Main picture on the cover is related to CEFIPRA project number 4705-1 titled “Development of Carbon Nanotube-Metal Hybrid Catalysts”
From the Director’s Desk

With the resolution of strengthening the core competency of CEFIPRA and expanding the mandate of the Centre to catalyse across the knowledge innovation chain, we present the activities of the year 2013-14, the first year of CEFIPRA's journey beyond its existence of 25 years. This year was especially important as we have stepped into the next phase of evolution of CEFIPRA's role from bilateral S&T funding to facilitator and enabler of the growing Indo-French S&T ecosystem.

In our continuing effort for the advancement of bilateral scientific competency in the cutting edge area of knowledge through collaboration, 13 new projects have been initiated, support for 63 projects have been continued and 15 projects have completed their duration. The outcomes have created global common goods in the forms of 115 research Publications in internationally peer reviewed journals and many products, designs and processes.

The knowledge to product pathways have been catalyzed by initiating 3 new and 5 continuing projects through academia-industry collaboration in the areas of bilateral industrial interests.

To carry out the expanded mandate of the Centre, the platform of CEFIPRA has brought value to the national S&T systems through initiation of targeted programmes in the areas of infectious diseases, engineering sciences, big data, cyber physical system and high performance computing. The bilateral experience of CEFIPRA has also been leveraged in attracting private sector partners to enrich the Indo-French ST&I ecosystem. The important supply chain of scientific human resources between the two nations has been sustained by launching new dedicated mobility support programmes for doctoral students.

CEFIPRA showcased its bilateral catalyst role over the last 25 years and beyond through its exhibition pavilion and interactive sessions in the highly successful Indo-French Technology Summit held on 23rd and 24th October 2013 at New Delhi. The summit attracted around 900 participants from India and France and was one of the largest confluences of minds between the two countries.

Our newsletter ENSEMBLE has emerged as an important tool for continuing dialogue with the expanding stakeholder community of CEFIPRA.
In continuation of the initiative of meeting the best minds, the second CEFIPRA Lecture was delivered by Dr.R.Chidambaram, Principal Scientific Adviser of the Government of India. We have also brought many new stakeholders from the public and private sectors to make them aware about the Indo-French innovation systems.

The systemic facilitator role of CEFIPRA was highlighted by launching the Region to Region cooperation programme for harnessing the regional synergy in knowledge and business domains.

The best recognition of CEFIPRA as a model of bilateral S&T cooperation came when it was considered as a candidate of a feasibility study for establishing an India-EU joint house for science and innovation.

The experience of the first year towards the next 25 years of CEFIPRA has provided us the necessary confidence to better position the Centre for the service of our existing stakeholders and to welcome many new stakeholders to the family of CEFIPRA.

Dr. Debapriya Dutta
Director, CEFIPRA
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Overview
During the year, CEFIPRA, India’s first and France’s only bilateral organization to support collaborative research in the advance areas of S&T has emerged as an enabler & facilitator of Indo-French S&T cooperation with a programme profile across the knowledge innovation chain. The year has been the time for scientific cooperation, interactions and newer initiatives by CEFIPRA. The completion of 25 years of existence has put a new surge in the centre’s commitment towards providing newer services to the scientific communities of India and France. In an effort to meet the greater challenges of a changing global S&T environment, CEFIPRA has expanded its arms by incorporating newer programmes into its portfolio which will have a broader impact across the knowledge innovation chain. With much appreciated efforts and steady support of its Scientific Council, Industrial Research Committee and the Governing Body, CEFIPRA has made successful interventions to rope in new scientific stakeholders from India and France, and foster collaborations.

Progress

As a bilateral organisation mandated to promote shared research efforts between diverse categories of stakeholders in India and France, CEFIPRA’s support for joint Indo-French scientific R&D initiatives lies at its core.

As per the directives of the Governing Body, the Centre expanded its mandate by launching programmes across the knowledge innovation chain during the year.

Collaborative Scientific Research Program

As the flagship offering of CEFIPRA, the Collaborative Research Programme kept pace with the emerging requirements of research in frontier areas of science and technology. During the year 13 new projects were initiated in diverse areas of science & technology including Genetics, Molecular biology, Condense Matter Physics, Neurobiology and Catalytic Studies. As on 31 March 2014, sixty three projects were ongoing in different Indian and French research institutions and 15 projects completed. The summary of these projects are available from page 37 to 111. As many as 115 papers based on work done under CEFIPRA supported projects were published in reputed, peer reviewed, high impact factor international scientific journals such as Nature Materials (av. IF-36.425), Ang. Chemie International Div (av. IF-11.336), Trends in Pharmacological Science (av. IF-10.390), Kidney International (av. IF-8.520), PLOS Genetics (av. IF-8.167), Journal of Molecular Cell Biology (av. IF-8.432), Chemistry of Materials (av. IF-8.535), etc. Research Publications from CEFIPRA projects continue to receive large number of citations reflecting the high quality of research being pursued under these projects.

As it has been done over the years, this year too CEFIPRA brought out a compilation of all research papers coming out of CEFIPRA supported collaborative projects for dissemination amongst various members of the scientific community and various stakeholders of CEFIPRA. The 21st volume of compilation of research papers, pertaining to the year 2014, emanating out of CEFIPRA supported projects has been brought out along with this report.

Industrial Research Programme

Launched in the year 2002, Industrial Research Programme of CEFIPRA has been successfully engaging the industry in pursuit of science for maximising global common goods. Five ongoing projects under the programme continued to catalyse the knowledge product pathway in diverse areas like ceramics, catalysis, financial inclusion platforms, air-pollution monitoring, colorectal cancer diagnosis and genetics. In the year 2013-14, the portfolio of Industrial Research Programme was further enriched by way of three new projects aimed at a) finding solutions for the inspection of bond quality in aerospace composite joints, b) for enhancement/modifications of sensing algorithms for existing wireless networks and c) to design and performance evaluation for Device-to Device communications for Advanced Cellular networks. Outline of projects under the Industrial Research Programme has been detailed in a dedicated section in this report (pg 131-136).

Fostering Dialogue : Seminars/ Workshops/Training Schools

CEFIPRA continued to support seminars/workshops/ training schools in cutting edge areas of science to foster dialogue, enhance knowledge oriented networking and identify new opportunities for S&T collaboration in the areas of mutual interest to India and France.

As many as 11 seminars/workshops were supported involving more than 300 top level Indian and French experts, in addition to a large number of students and other stakeholders from relevant areas of scientific endeavour.
Targeted Programs

Targeted programs of CEFIPRA provide a platform to the research funding agencies of both the nations to support collaborative research in specific thematic areas. The project on “Adaptation of Irrigated Agriculture to Climate Change” is being implemented under DST-INRA programme. Under DST-ANR programme, projects are implemented in the areas of Infectious diseases and Engineering Sciences. DST-Inria-CNRS programme has been initiated to support projects in the areas of Big Data, Cyber Physical Systems (including Embedded systems) and High Performance Computing. Additionally, CEFIPRA also facilitated implementation of Indo-French Centre for Applied Mathematics (IFCAM) established by DST and Centre National de la Recherche Scientifique (CNRS).

Dedicated Mobility Support to Students

CEFIPRA recognises the need to nurture the students of today and encourage/facilitate them in a manner that they become aspirant and capable of assuming leadership positions in scientific research and technology application in the years to come.

The Centre had joined hands with Université Joseph Fourier in Grenoble, France to open up an opportunity for Indian students to participate in European School on Nanosciences and Nanotechnologies (ESONN) and interact with the best talent in the field. Participation of 6 Indian doctoral students in the ESONN Training Programme-Session 2013 was supported by CEFIPRA.

Continuing its focus on students and to provide opportunities for young Indian and French researchers to interact with their peers in India and France CEFIPRA has supported 11 Indian and 5 French doctoral students under its Raman-Charpak Fellowship programme to have useful stints in R&D institutions of India and France.

Innovation Programme

In its expanded mandate across the knowledge innovation chain, CEFIPRA has further strengthened the research partnership between India and France towards creating global common goods, through public private partnership mode. As a step towards further strengthening the research partnership between India and France towards global common goods, CEFIPRA has launched Innovation Programme through Public Private Partnership mode. Following an MoU signed with Saint-Gobain Research India (SGRI), a subsidiary of French company Saint Gobain, a programme was launched on ‘Sustainable habitat for hot and/or humid climates’. Similarly, an MoU was signed between Biotechnology Industrial Research Assistance Council (BIRAC) and CEFIPRA for improving competitiveness of BIRAC supported Indian Industries through French collaboration. Under this initiative, the Biotechnology Industry Research Assistance Council (BIRAC) and the Service for Science and Technology at the French Embassy in India, Ministry of Foreign Affairs, Government of France launched an Indo-French Challenge oriented programme in the area of Red Biotechnology. In addition to this an Expression of Interest was signed between EADS, a world leader in Aeronautics, Space, Defense and related services and CEFIPRA, to launch a new innovation programme in Aerospace.

CEFIPRA Annual Lecture Series

Dr. R Chidambaram, the Principal Scientific Advisor to Government of India delivered the 2nd CEFIPRA Lecture on 2nd December, 2013 in CEA, Saclay, France. He talked about increasing international collaboration in science and technology, nuclear energy, climate change and National Knowledge Network in India.

Outreach

The Indo-French Technology Summit 2013 was held at New Delhi during 23-24 October, 2013. Given its premier role in promoting and facilitating S & T collaboration between India and France, CEFIPRA actively participated in the Technology Summit. A pavilion showcased CEFIPRA’s initiatives, achievements and interventions across the Knowledge Innovation Chain to raise awareness among the Indian and French stakeholders about the role of CEFIPRA as a unique bilateral organisation. CEFIPRA also organized three focused discussion sessions during the Tech Summit to get inputs from attending delegates from academia, industry and the government on the contemporary topics of Design Research, Aerospace Research and knowledge forward chaining of outputs of CEFIPRA - supported projects.

Exposing Indian SMEs to French Industrial Ecosystem

A meeting of stakeholders in the Small and Medium Enterprises (SMEs) was organised on 23rd August 2013 at the India International Center, New Delhi. The meeting was aimed at eliciting inputs and insights from professional/entrepreneurs from the SME sector in India on the S&T challenges confronted by the Indian SME sector and also to identify areas where
collaboration between Indian and French SMEs can be facilitated by CEFIPRA.

Brainstorming Seminar on “CEFIPRA - Beyond 25 Years”

In the course of its journey it is important for an agency to take stock and refine its approach for the future. To realise this objective and to also enlist various outputs emerging from CEFIPRA supported projects, a meeting of PIs of various projects was organised at New Delhi on August 21, 2013.

Other Initiatives

On the initiative of CEFIPRA, an MoU was signed between Technology Development Board (TDB), India and bpifrance on February 14, 2013 to foster exchanges and innovative collaborations between companies, organizations and institutions of France and India.

Region to Region Cooperation Program

Recognizing the scope and benefits of regional synergy across the knowledge-innovation chain, CEFIPRA has launched a regional cooperation programme including the State of Karnataka, India and the region of Aquitaine, France since both the regions have relatively better developed ST & I Ecosystems in terms of presence of Knowledge institutions and innovative enterprises in various domains.

The programme has two distinct but closely linked pathways of Knowledge Cooperation & Business Cooperation. The Knowledge Cooperation pathway aims to link the knowledge institutions of both the regions through the initiatives like Mobility Support, Scientific Collaborative Research Programme and Industrial Research Programme. Business Cooperation pathway aims to connect SMEs from both the region in the areas of Aerospace & Biotechnology to develop a B-2-B collaboration through various mechanisms.

India-EU Joint House for Science & Innovation

CEFIPRA was part of a feasibility study for establishing an INDIA-EU JOINT HOUSE FOR SCIENCE & INNOVATION (INDIA SI HOUSE) commissioned by the European Commission. CEFIPRA was entrusted with the responsibility of recommending a legal framework and suggest scientific priorities. CEFIPRA presented its initial results and findings to Executive Advisory Board (EAB), held at New Delhi on 5-7 June 2013. It submitted its final Report in February, 2014 with the Project Coordinator OST, Paris and participated in the final meeting held in Paris in March 2014.

CEFIPRA WELCOMES Mme. ANNE GRILLO

Mme. Anne Grillo, Directrice, Direction de la Coopération culturelle, universitaire et de la recherché, Ministère des Affaires Etrangères of France took charge as the new Co-Chairperson of the Governing Body from the French side.

Mme Grillo joined the Ministry of Infrastructure Transport & Housing, Govt. of France in 1993 where she headed its Legal Affairs Department. In her long and distinguished career so far she has served in several important positions within France as well as represented her country in diplomatic positions across the world.
Guidance of the Governing Body

The 27th meeting of the Governing Body of CEFIPRA took place in New Delhi, India on 6th March, 2014. Appreciating the expanded mandate of CEFIPRA, the Governing Body emphasized that innovation through PPP mode of cooperation should form the focus of enhancing the activities of CEFIPRA across the knowledge innovation chain while retaining its core strength for promoting collaborative research in advanced areas of science and technology. The network of scientists established between the two nations through CEFIPRA could be further mobilized in the coming years for expanding the centre’s core activities. Initiatives should also be taken into the fold of CEFIPRA at systemic level for enhancing the benefit of CEFIPRA’s intervention.

CEFIPRA should align its programmes based on the commonality of challenges in India and France with research priority in global societal challenges, such as water, climate, life & health sciences and innovation and interdisciplinary initiatives. Evolution of CEFIPRA as a single window for Indo-French bilateral S&T Cooperation was emphasized during the meeting.

The time is ripe for linking successful groups of the two countries to evolve a structured mechanism and the funding strategy. It desired that efforts should be taken to bring major Indian consortia into the fold of the Public Private Partnership initiatives of CEFIPRA. The already initiated efforts to bring the national funding agencies of both the countries, through targeted programs, in finding science based solutions to the problems of bilateral relevance were appreciated during the meeting. The requirement for structured procedure for evaluating proposals, with clear criteria was suggested by the Governing body for improving the Industrial Research Programme. The GB desired that the approach being adopted by the Industrial Research Committee of CEFIPRA should be more industry oriented.

The two co-chairs of CEFIPRA came together to release the Publications titled “CEFIPRA 25 Years” during the meeting. The Publications highlights the various achievements of CEFIPRA since its inception till the completion of 25 years.
The 51st meeting of the Scientific Council was held in Autrans and Grenoble, France from May 10 to 14, 2013. During the meeting the following activities took place:

- Final review of ten completed projects took place, one was graded Excellent and three were graded Very Good.
- Mid-term review of thirteen ongoing projects took place.
- Out of the seven seminar proposals considered, six were recommended for support by the scientific council in the areas of Health Problems, Acoustics, Nanotechnology, Network Models, etc.

The 52nd meeting of the Scientific Council was held during November 16 -19, 2013 in Kodaikanal and Madurai, India. The following activities took place during the meeting:

- Out of the total thirty seven project proposals considered, fourteen projects were recommended in the areas of Computer Science, Life and Health Science, Pure and Applied Physics, Pure and Applied Chemistry, Environmental Sciences, Material Science and Information Technology.
- Final review of eleven completed projects had been carried out. Four were graded Excellent and Six were graded Very Good.
- Mid-term reviews of ten ongoing projects were carried out.
- Out of the four seminar proposals, two proposals were recommended in the topics of Organic semiconductor gas sensors and Advanced Materials.
The 22nd and 23rd meetings of the Industrial Research Committee were held during the year in Grenoble, France on May 15, 2013 and Madurai, India on November 20, 2013 respectively. During the year 2013-14, seven projects were on-going and one project was completed titled ‘Acylation to 2, 4-dichloro-5-fluoroacetophenone (DCFA) for the efficient manufacture of Ciprofloxacin’, involving Neuland labs, an Indian industry and the research partners, IICT, Hyderabad and Université de Bordeaux.

During the year a new project also started titled “Tilling in cucurbits: a non-transgenic reverse genetic approach for muskmelon crop improvement”, involving Bench Bio Pvt. Ltd and Namdhari Seeds Ltd and a French Research Laboratory L’Unité de Recherche en Génomique Végétale (URGV), INRA, Évry.

In response to the special call for proposals in the areas of automotive, aerospace and ancillary industries, a total of twelve concept proposals were received. Three Proposals were recommended for support, out of which one was in the area of Material Science and two were from Information technology. The Committee also recommended a seminar on “Challenges in Machining of Aerospace Materials”.

As a part of the expanded mandate of CEFIPRA to engage new stakeholders, CEFIPRA initiated its new Public Private Partnership Programme. Saint Gobain Research India was the first Private Company to show keen interest in this newly launched programme of CEFIPRA and signed an MoU with CEFIPRA during the Indo-French Technology Summit 2013 to launch a programme on ‘Sustainable Habitat for Hot and/or Humid Climates’. A call for proposals was launched under the programme on 15th November, 2013.

In order to further strengthen the PPP Programme, CEFIPRA has also signed a Letter of Intent with Airbus and Astrium for possible future activities.
Outreach
CEFIPRA Lecture Series - 2nd Lecture by Dr. R. Chidambaram

CEFIPRA Annual Lecture Series was initiated by CEFIPRA in the Year 2012. The 2nd CEFIPRA Lecture was delivered by Dr. R. Chidambaram, then Principal Scientific Advisor to Govt. of India on 2nd December, 2013 at CEA (Commissariat à l’énergie atomique, or the French Atomic Energy Commission) in Saclay, France. The lecture was attended by more than 200 scientists and researchers from diverse institutions comprising the French S&T ecosystem.

In his lecture, Dr. Chidambaram highlighted the role of S&T in development of nations and the role a knowledge economy plays in making this development “sustainable”. He noted the increasingly international character of pursuit of science and international collaboration that has made possible creation of mega size facilities like the Large Hadron Collider (Cern) and International Thermonuclear Experimental Reactor (Cadarache). He also pointed towards the role of India and Indian scientists in creating and running these facilities.

Dr. Chidambaram underlined the efforts to create world-class research facilities in India like the Centre for Excellence in Nano-electronics, and, National Knowledge Network that can be accessed by multiple users like universities and laboratories to pursue their diverse research goals. Such facilities, he noted, encourage international collaboration, and at the same time, attract young Indian faculty from abroad back to India.

Touched upon the energy scenario in India, Dr. Chidambaram explained the emerging trends in electricity consumption in India that makes nuclear energy critical to meet the needs of a rapidly growing large economy. The unfolding phenomenon of climate change only adds more urgency to the whole issue making nuclear technology an important part of the mitigation strategy. However, for nuclear energy to be a “sustainable” mitigation technology, the nuclear fuel cycle has to be closed, as India is planning to do, with important lessons learnt from the Fukushima accident.

Dr. Chidambaram underscored that Nuclear Energy is not just about power, but has numerous other applications in areas like health care, agriculture, desalination, aquifer recharge to name a few. Extensive knowledge of thermal engineering, materials and computational fluid dynamics associated with nuclear power can also be useful in other energy sectors ranging from renewable energy to design of advanced ultra super-critical thermal plants.●
A seminar for France based stakeholders of CEFIPRA was organised on May 17, 2013 at Paris, France. The objective of the seminar was to provide a platform to CEFIPRA's stakeholders to articulate their experiences of working with CEFIPRA, and its mechanisms to foster S&T collaboration between India and France. Another purpose was to elicit their views as to how CEFIPRA can best service its expanded mandate while also ensuring an inclusive and equitable participation of various constituent of its targeted community.

The then, French Co-Chair of CEFIPRA, Mme. Helene Duchene was present at the inaugural session, along with representatives of various French agencies like the Ministry of Higher Education and Research, CNRS, Ministry of Industry, OSEO, INSERM, ANR, INRA etc.

The deliberations at the seminar were divided into two sessions. The first session saw presentations by PIs of ten CEFIPRA supported projects that have been considered successful in various reviews. The PI's were encouraged to share their candid views on strengths and weaknesses of various aspects of collaborative mechanisms of CEFIPRA. The presentations were well received and set the tone and pace for subsequent discussions.

The second session "Fostering Indo-French innovative ecosystems through CEFIPRA" brought forth the practices followed by various French agencies having role in enhancing cooperation between research and industry. The session saw the participation of AGRENIUM, OSEO, SYSTEMATIC, INPI, MEDICEM & Cap-Digital. While OSEO emphasised upon various avenues that it has made available for connecting with small and medium companies in France, the industry representatives emphasised on the need to utilise organisational leverage offered by various agencies to reach out to industrial organisations. In this context, several of them highlighted that they are already in touch with CEFIPRA to pursue similar objectives.

The meeting concluded with the consensus that the core strengths of CEFIPRA should be maintained while trying to be proactive in some specific domains that are of current and immediate relevance to academic and industrial stakeholders.

CEFIPRA has evaluated over 1050 projects and has supported the setting up of over 380 scientific collaborations since its inception.

In the course of its journey it is important for an agency to take stock and refine its approach for the future. To realise this objective and also to evaluate various knowledge outputs that has emerged from CEFIPRA supported projects, a meeting of PIs of various projects was organised at New Delhi on August 21, 2013. The primary aim of the meeting was to use the inputs received to further fine tune CEFIPRA's mechanisms for knowledge generation. Twenty eight participants attended the meeting including experts, successful PIs and dignitaries from various backgrounds. This included Prof. R. C. Budhani (Director, National Physics Laboratory, New Delhi) and Prof. C. S. Dey (School of Biological Sciences, Indian Institute of Technology, Delhi).

After presentations and panel discussion, following opportunities were identified for further interventions:

- Need to build a “Think Tank” consisting of successful PIs from diversified domain of expertise to get periodic feedback.
Department of Science and Technology, Government of India, in partnership with the Confederation of Indian Industry, has been organizing the annual flagship event “Technology Summit and Technology Platform” with an objective to promote technology tie-ups, joint ventures and investments to and from the “Partner Countries”. In Tech Summit 2013 France was the partner country and CEFIPRA was one of the co-organiser of the event.

The Technology Summit 2013 was held at New Delhi on 23-24th October 2013. CEFIPRA also made a robust presence at the event to showcase its contribution to Indo-French S&T cooperation and also engage with the participants for ideas and feedback.

Given its premier role in promoting and facilitating S&T collaboration between India and France, CEFIPRA participated actively in the Tech Summit. Pavilion set up by CEFIPRA in the exhibition area showcased CEFIPRA’s initiatives, achievements and interventions across the Knowledge Innovation Chain over the past 25 years. The main purpose behind setting up the pavilion was to raise awareness among the Indian and French stakeholders about CEFIPRA’s role as a unique linkage platform. CEFIPRA’s contribution to Indian and French Scientific landscape was highlighted through displays on knowledge generated through basic science research, translational research in applied sciences and innovations coming out of projects supported by CEFIPRA. Several Indian and French scientists who are also Principal Investigators of CEFIPRA supported projects gave a live demo of their projects at the pavilion.

CEFIPRA’s pavilion attracted a large footfall and visitors included Hon’ble Minister of Science and Technology, Dr. Jaipal Reddy; French Ambassador to India, Mr. François Richier. This was in addition to large number of senior dignitaries from Indian and French governments, R&D institutions and business enterprises. A large number of scientists and industry professionals also spent time in CEFIPRA’s pavilion gathering information about

- Need to venture into unexplored but promising areas in terms of greater societal relevance and identify major thrust areas of research of mutual interest to both the countries.
- Need to enhance the degree of networking among the groups of scientists and S&T institutions through improved mode of communication channels viz. invitation letters, periodic newsletter, blogs etc.
- Need to provide funding to a group of scientists instead of funding to individual scientist by setting up virtual centres.
- Need to provide French language tutorials to Indian students working in French laboratories to overcome the language and societal barrier.
- Need for a long term funding for young researchers to enhance the level of cooperation and collaboration between the Indian and the French institutions.
- Need to create a database of Indian students residing in France to form an Indian Student Association to ensure necessary logistical/moral support to the new comers.
- Need to devise a mechanism to reach out to the vast untapped talent pool of Indian biologists having expertise in the areas of drug discovery, disease model and pharmaceuticals. The areas of intervention can be diabetes, cancer, cardiovascular, metabolic, photonics biology (laser operated medico-surgery) and infectious diseases etc.

The meeting was concluded by proposing to show case promising technologies which were patented but do not have suitable industrial partners for commercialization during the Indo-French Technology Summit for wider dissemination.

Indo-French Technology Summit
New Delhi
23-24 October 2013
various initiatives of CEFIPRA in support of Indo-French bilateral S&T relations.

In addition to setting up the pavilion, CEFIPRA also organized three focused discussion sessions during the Tech Summit to get inputs from attending delegates from academia, industry and the government on key S&T issues. These sessions were on following contemporary topics: a) Design Research b) Aerospace Research c) Knowledge Forward Chain

The sessions evoked an enthusiastic response and gave CEFIPRA very useful feedback and guidance which will surely help in shaping some of its initiatives in the future.

Indo-French Aerospace Collaboration: Policies & Technologies

India and France have significant strengths in the field of Aerospace Engineering and are well positioned to complement efforts of each other for advancement in this important field. A roundtable session “Indo-French Aerospace Collaborations: Policies & Technologies” was organised by CEFIPRA at the Indo-French Tech Summit on 24th October 2014 to discuss issues and challenges in this domain that are of mutual interest to India and France.

Dr. Cédric Post, Deputy Director for International affairs, GIFAS (French Aerospace Industries Association) represented France while Indian SMEs were represented by Dr. Rajiv Chawla, Chairman of IamSME, an association of Indian SMEs. Other participants were from Indian and French Aerospace industries in private as well as the public sector (Thales, Astrium, Antrix...).

The purpose of the roundtable session was to take stock of existing collaborations between France and India in the aerospace field and get a first hand account of the experiences of stakeholders in the course of collaborative Aerospace Engineering projects.

Indo-French Design collaboration: Emerging Opportunities

A round table discussion “Indo-French Collaboration and Emerging Opportunities” was organised by CEPIFRA at the Tech Summit 2013 on 24th October 2013.
The agenda of the roundtable session was to discuss the possibility of collaboration between Indian & French academic and industrial organisations in cross-cutting disciplines of Design and Engineering.

Professionals from a large number of academic and industrial organisations from both countries participated in the discussions and presented their views on the steps needed for enhancing collaboration between institutions of the two countries in the field of Design Engineering.

Modalities of CEFIPRA support to promote joint collaboration in this important yet under emphasised area of S&T endeavour were also discussed. The outcome of the discussions were summarised as under:

- Joint collaborative projects between academia and/or industry from India and France can be submitted for support from CEFIPRA.
- Language barrier needs to be overcome.
- Lack of a common platform where opportunities and collaborative interests could be identified.

Knowledge Forward Chain

The session on Knowledge Forward Chain brought out the catalytic role of CEFIPRA in the evolutionary Indo-French S&T ecosystem through selected case studies in each segment of the Knowledge Innovation chain.

Feasibility Studies: India-EU Joint House for Science & Innovation

Collaboration of European Member States & associated countries with India over the last decade has pointed towards the need for a single window mechanism for processing collaborative projects between EU and India. In order to assess the feasibility of such a mechanism, European Commission commissioned a feasibility study for establishing an INDIA-EU JOINT HOUSE FOR SCIENCE & INNOVATION (INDIA SI HOUSE). A consortium of nine institutions from India and EU Member States was formed for this purpose. Being one of the partners, CEFIPRA was entrusted the responsibility of recommending a legal framework and suggest scientific priorities as a part of this study.

CEFIPRA completed the assigned task successfully and submitted its report with OST, Paris, France. CEFIPRA also participated in the final meeting held in Paris in March 2014.

ENSEMBLE: The newsletter of CEFIPRA

During the year 5 issues of ENSEMBLE, the newsletter of CEFIPRA, were published showcasing the activities of the centre to reach out to its stakeholders.
New Initiatives
Exposing Indian SMEs to French Industrial Ecosystem

Small and Medium Enterprises (SMEs) are driving force behind large proportion of S&T innovations that are critical for a country’s economy for their contribution in terms of employment creation, new investments and enhanced exports.

In the backdrop of the critical role of SMEs in the development of a nation, a meeting of stakeholders in the SME space was organised at the India International Center, New Delhi on 23rd August, 2013. The purpose of the meeting was to elicit inputs and insights from professional/entrepreneurs engaged in the SME sector in India on the S&T challenges confronted by the Indian SME sector and identify areas where collaboration with French SMEs can be facilitated by CEFIPRA for obtaining the required results.

The broad scenario of growth and development of SMEs in India was discussed during the meeting.

Selected companies will be asked to identify their problems and outline the support they wish to have from their French counterparts. CEFIPRA, in this context, will provide support via exposure visits and facilitate to link those companies with the French counterparts.

First Meeting of Region-to-Region Cooperation
Karnataka, India and Aquitaine, France

Recognizing the scope and benefits of regional synergy across the knowledge-innovation chain, CEFIPRA has launched a regional cooperation programme including the State of Karnataka, India and the region of Aquitaine, France. Both the regions have relatively better developed ST&I ecosystems in terms of presence of knowledge institutions and innovative enterprises in various domains.

As part of this initiative, CEFIPRA arranged for a delegation representing government, industry and academia from the State of Karnataka to visit the Aquitaine region and interact with counter part stakeholders.

During the two day visit the delegates discussed knowledge cooperation opportunities between Karnataka and Aquitaine including their R & D strengths and possibilities of knowledge cooperation focused on the knowledge pathway.

The debriefing session was held at the Bordeaux Polytechnic Institute.
CEFIPRA - Airbus Group Letter of Intent

As a step towards further strengthening the research partnership between India and France, Airbus Group signed a Letter of Intent (LoI) with CEFIPRA for creating a new innovation initiative called the 'Airbus Group - CEFIPRA Aerospace Programme.'

Signed at the India-France Technology Summit 2013, the LoI envisages support to research projects proposed by Indian universities and institutions as a means to foster research in India in the field of aerospace. This is particularly in sub-domains like avionics, composite materials, high performance computing, nanotechnology and applied mathematics.

CEFIPRA - Saint Gobain Research India Ltd. MoU

CEFIPRA and SAINT GOBAIN RESEARCH INDIA Ltd. (SGRI) signed a Memorandum of Understanding to work together to promote research on "Sustainable habitat for hot and/or humid climates".

SGRI is a cross functional R&D center of Saint Gobain based in Chennai. Its aim is to develop solutions for sustainable habitat in hot and/or humid climates specifically related to building energy optimization, sustainable and affordable building materials/solutions. SGRI is a subsidiary of Saint Gobain, SA France.

Each selected project shall be funded for a period of 12 to 18 months (such as for feasibility study and concept validation) with options for extensions of up to additional 18 months, up to a maximum cumulative duration of 36 months.

In addition to the above mentioned support for R&D projects, a Postdoctoral fellowship will be launched by SGRI. The scheme will allow French scientists to work at an appropriate research facility in India.
CEFIPRA received 66 new proposals during the year, which were reviewed by the Scientific Council in its 51st and 52nd meetings. The thrust area wise distribution of the proposals received and recommended for support during the year 2013-2014 is given in figures 1a & 1b. From the chart it is prominent that the areas of life and Health Sciences, Pure & Applied Physics and Pure & Applied Chemistry continue to have a higher share of the proposals received and accepted.

**New Projects Initiated:** 13 new projects were initiated during the year. Figure 2 depicts the thrust area-wise distribution of the projects commenced and the figure 3 depicts the same in sub-areas. Summary of these projects are available in page no. 113-129. The geographical distribution of the projects commenced during the year and their thematic distribution in India and France are depicted in Figures 9 & 12 and Figures 13 & 16 respectively.

**On-going Projects:** As on 31st March 2014, Sixty three projects were under implementation in different Indian and French research institutes. Summary of these projects are available in page No 57 to 111, whereas the geographical distribution of the on-going projects during the year and their thematic distribution in India and France are depicted in Figures 9 & 11 and Figures 13 & 15 respectively.

**Completed Projects:** 15 projects were completed during the year and five were rated as Excellent in the areas of Genetics, Catalysis, Applied Mathematics, Organic Chemistry whereas seven were rated as Very Good in the areas of Hydrology, Atmospheric Modelling, Device Modelling, Genetics, Materials for Energy, Applied Mathematics, etc. The summary of these projects are available in page No 37 to 56 The major thrust area-wise distribution of the completed projects is given in Figure 4.

31 Human Resources (17 in India & 14 in France) were supported through training comprising of Doctoral and Post-Doctoral students and mobility of 61 scientists and students (37 from India to France and 24 from France to India) were supported. (Figure 5)
85 Publications resulted from the completed projects received 384 citations (source: web of science). The areas of Pure and Applied Mathematics, Pure applied Chemistry and Environmental Sciences (Figure 6) having the higher share of Publications. These Publications have been in reputed peer-reviewed journals; significant of them are BMC Genomics, Journal of Cell Biology, European Journal of Organometallic chemistry, etc. The areas of Pure applied Chemistry and Environmental Sciences have received the highest share of citations (Figure 7).

The geographical distribution of the projects completed during the year and their thematic distribution in India and France are depicted in Figures 9 & 10 and Figures 13 & 14 respectively.

Some of the significant knowledge products developed from the 15 completed projects are in the areas of pure and applied Chemistry, Environmental Sciences, Information and Communication Technology.

**Significant Processes Developed**
- Process to find Different pol III-transcribed genes in different locations within the nucleus.
- Root Bracketing Method based algorithm for efficient calculation of surface-potential of IDG MOSFET.
- Developed a “Green” route for the synthesis of gold nano-particles using CMG-g-PEPO as both reducing and capping agent for drug delivery applications.
- Code developed to calculate rock properties including porosity, pore size distribution, density correlation function, specific surface area, connectedness of pores and lacunarity.

**Significant Design Developed**
- Design and synthesis of a neural interface using CMT composites.

**Significant Products Developed**
- Software packages for linear and non-linear integral equations.
- Langmuir-Blodgett (LB) films from fullerene derivatives
- Nafion Composite Membrane prepared with Fullerene derivatives.
Major linkages established between the R&D institutions were

- Hydrogels prepared from tamarind kernel powder (TKP) and ethyl hydroxyl ethyl cellulose (EHEC).

In order to analyse the value of CEFIPRA support based on the completed projects a volume Vs. Value analysis has been done.

The Volume vs Value Index was constructed to understand the relationship of input provided to and the output produced in 15 research projects across 9 thrust areas. The Volume is defined as the Input (Total expenditure and per project investment in a particular thrust area) and the value (RoI) is the output obtained in the thrust areas in relation to the input. The technological output is measured by taking into account the processes, patents, designs, instruments and products generated from these projects in each thrust area (jth).

Technological output = \[(\text{Patj} / \text{NPat}) + (\text{Prodj} / \text{NProd}) + (\text{Proj} / \text{NProj}) + (\text{Desj} / \text{NDes}) + (\text{Insj} / \text{NIns})\]/5

The value (V) signifies the weighted value of the output measured in terms of technological outputs, research Publications, citations received by these Publications and human resource developed out of the CEFIPRA funded projects.

The weights are decided based on the activities of CEFIPRA. CEFIPRA is an organization for scientific research and thus a higher weight is given to scientific Publications as compared to technological output and human resource developed. The value of (V) is calculated as below:

\[ V = \text{Technological output} \times 0.3 + (\text{Pubj} / \text{NPub}) \times 0.25 + (\text{Sum of Avg. Citation of jth thrust area/Total Avg. Citation}) \times 0.25 + 0.2 \times (\text{HRj} / \text{NHR}) \]

The efficiency of CEFIPRA supported projects is depicted in Figure 8:

- The per capita expenditure (average project cost) is high for Pure and Applied Mathematics (Maths), Information and Communication Technology (ICT) and Water with low rate of return (weighted output).
- Examining both the Total expenditure of a Thrust area (by size of bubble) and average project cost (by

<table>
<thead>
<tr>
<th>Major linkages established between the R&amp;D institutions were</th>
</tr>
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<tbody>
<tr>
<td>CSIR- National Geophysical Research Institute, Hyderabad</td>
</tr>
<tr>
<td>IIT-Bombay</td>
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<tr>
<td>Centre for Cellular &amp; Molecular Biology, Hyderabad</td>
</tr>
<tr>
<td>IIT Delhi</td>
</tr>
<tr>
<td>University of Mysore</td>
</tr>
<tr>
<td>IIT-Madras</td>
</tr>
</tbody>
</table>
horizontal axis), it shows along with Environmental Sciences (ES), Pure and Applied Chemistry (CHEM) & Life and Health Sciences (LHS) have performed considerably well with and yielded highest rate of return.

Figure 8: Efficiency of CEFIPRA supported projects. (Volume Vs. Value Analysis)
Geographical Distribution of Projects in India

Figure 9
The maps capture the spatial heterogeneity of CEFIPRA supported projects with Indian institutions in the context of various themes.

Project Domains

- Maths
- Physics
- Chemistry
- Life
- Earth
- IT
- Material
- Biotech
- Computer
- Water
- Environment
Geographical Distribution of Projects in France

Figure 13
The maps capture the spatial heterogeneity of CEFIPRA supported projects with French institutions in the context of various themes.

**Project Domains**

- **Maths**
- **Physics**
- **Chemistry**
- **Life**
- **Earth**
- **IT**
- **Material**
- **Biotech**
- **Computer**
- **Water**
- **Environment**
The map depicts the geographical co-location of projects complete by CEFIPRA over the year and poles the compétitivités in France, signifying the contribution of CEFIPRA supported projects in strengthening the French S&T ecosystem.
Nurturing Knowledge

Completed Projects
Basic Sciences
Role of Chromatin Architecture in Cellular Senescence

Background

The project involved studying cellular senescence, or study of aging at cellular level. One hallmark of senescent cells is a prominent reorganization of chromatin structure. However, virtually nothing is known about the epigenetic changes in senescent cells and how higher-order chromatin organization is important for the execution as well as maintenance of the senescence phenotype. The main objective of the proposed work was to obtain a deeper understanding of how epigenetic changes are important for the establishment and maintenance of the senescence phenotype and how an aberrant higher-order chromatin organization could provide an environment conducive for tumorigenesis. Genomic occupancy profile of SATB1 and histone modifications in replicating as well as senescent cells provided insights into the chromatin organization of these two phenotypes of fibroblasts.

Objectives

- Isolation and identification of genomic regions in open and closed chromatin in senescent cells.
- Histone modification status of open and closed chromatin domains.
- Generation of primary fibroblast silenced for SATB1 expression; Preparation of RNA samples and transcriptional profile of SATB1-silenced cells.
- Involvement of SATB1 in tumorigenesis.
- Identification of gene targets of SATB1 in senescent and tumor cells and genomic map of SATB1-binding sites.
- Stable knock-down and silencing of identified gene targets; transformation potential of identified targets.

Knowledge Products Developed

- Generation of primary fibroblast stably silenced for SATB1 expression, and, transcriptional profile of SATB1-silenced cells
- SATB1 expression profile in tumorcelllines and primarytumorsamples
- Expression of SATB1 and SATB2 in primary and senescentfibroblastsat RNA andproteinlevel;
- Expression of repressive histone modification mark H3K27(me)3 in primary and senescentcells
- ChIP (Chromatin Immunoprecipitation) analysis of primary and senescentcells for occupancy of SATB family proteins

Publications

SCI Journal Publications : 1
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators-3
France to India : Collaborators -1
Completed Projects

Pure and Applied Mathematics

Numerical Treatment of Integral Operators with Non-smooth Kernels

Project No.: 4101-1  Sept. 2009 - Aug. 2013

Background

Many important physical phenomena are governed by differential and integral operators. With the advent of computer, it is possible to find sufficiently accurate solutions for integral equations of the second kind and for eigenvalue problems associated with differential or integral operators. There is a need for efficient algorithms that are iterative, have optimal rates of convergence, are stable and cost-efficient. Such algorithms are available for spectral approximation and approximation of operator equations associated with unidimensional integral operators with smooth kernels. It is not the same for integral operators with non-smooth kernels.

Objectives

• The focus of this project is on integral operators with non-smooth kernels such as Green’s function type kernels and weakly singular kernels. In the Nystrom method, a continuous finite rank operator approximation is obtained by replacing the integral by a composite numerical quadrature formula. In the case of Green’s function type kernels, a careful choice of the subintervals in the composite numerical quadrature is needed in order to retain the order of convergence. If the right hand side has logarithmic singularities, then a graded mesh may be needed. We intend to investigate these issues and validate the theoretical results by numerical experiments.

• We also seek to compare the singularity subtraction and product integration techniques for numerical solutions of weakly singular integral equations, examine eigenvalue problems for non-smooth kernels and to consider approximate solutions of multi-variable integral equations over planar regions, or more generally, over surfaces.

Knowledge Products Developed

• Asymptotic series expansions for approximate solutions of second kind Fredholm integral equations and for approximate eigen elements in the case of a kernel of the type of Green’s function.

• Proof of the non commutativity of linearization and discretization of non-linear integral equations for some discretization schemes and preference for beginning by linearization.

• Modified Projection Method for non-linear integral equations.

• Introduction of a condition number of a basis of a finite dimensional normed space to measure the possibility of its `near linear dependence’ as well as of overflow/underflow.

• Preparation of software packages for linear and non-linear integral equations.

Publications

SCI Journal Publications : 6
Paper Presented in Conferences : 7

Mobility Support

India to France : 4
France to India : 4
Epigenetics of Transcription by RNA polymerase III

Background
In eukaryotes, genes are transcribed by three nuclear RNA polymerases (pols), each transcribing a specific subset of genes. Pol I synthesises the precursor of large ribosomal RNA, pol II transcribes all protein-coding genes and many non-coding (nc) RNAs. Pol III is specialized in expression of small ncRNAs generally involved in translation. Recent studies have established the central role of pol III in the expression of many nc-RNAs but their transcriptional regulation is still unknown. Packing of DNA as chromatin generates gene-specific architectures that are instrumental in poising genes for/against immediate or eventual expression. Chromatin is generally repressive for transcription, but this can be overcome by epigenetic mechanisms like Chromatin remodelling, histone modifications, histone variant incorporation and gene positioning inside the nuclear space.

Objectives
- To investigate the link between local chromatin structure and expression level of the genes transcribed by the yeast RNA polymerase III at global scale.
- To characterize epigenetic regulation of local chromatin structure, under different conditions affecting pol III transcription.
- To explore the role of local chromatin structure and transcription activity in determining the gene locations in the nuclear space.

Knowledge Products Developed
- A unique arrangement of nucleosomes is found near the yeast pol III-transcribed genes. The genes reside in a nucleosome-free region (NFR), bordered by positioned nucleosomes.
- These nucleosomes change positions under repressed state, pre-dominantly at 3’-ends of the genes. Expression of different genes shows different response to nutrient starvation.
- Different pol III-transcribed genes were found in different locations within the nucleus.
- Nuclear location of different genes shows different response to nutrient deprivation.
- However, gene expression does not show correlation with location in nuclear space.

Principal Collaborators
- Purnima Bhargava
  Centre for Cellular and Molecular Biology
  Hyderabad
- Olivier Gadal
  Université Paul-Sabatier
  Toulouse

Publications
SCI Journal Publications: 3
Papers Presented in Conferences: 5

Mobility Support
India to France: Collaborators-2
France to India: 1
Objectives

The objective of this project is to develop a non hydrostatic general circulation model for climate simulations as well as weather forecast using finite volume methods on icosahedral hexagonal grid.

Knowledge Products Developed

- A dynamical core equipped with MPI capability of parallel execution is developed.
- A second order monotonic and positive advection scheme is developed and implemented in the dynamical core.
- The dynamical core participated in Dynamical Core Model-Intercomparison Project (DCMIP 2012) under the name DYNAMICO and tested with various proposed. Results of dynamico were found consistent with other well-established models participated in DCMIP 2012.
- Dynamical core is tested with Held-Suarez test case and coupled with simplified dry physical package.
- Dynamical core is coupled with physics package of LMDZ5, a well-established French climate model. Aqua planet simulations are carried out with this setup.

Background

Icosahedral-hexagonal grids are quasi-uniform as well as free of the polar singularity of latitude-longitude grids. These grids have opened the way to massively parallel execution of general circulation models (GCM). Our goal is to develop an icosahedral hexagonal version of the LMD-Z (GCM). However numerical schemes of LMD-Z relying on the Cartesian grid must be replaced. Exact mass conservation, an essential requirement for climate models is achieved by finite-volume scheme.

Knowledge Products Developed

- A dynamical core equipped with MPI capability of parallel execution is developed.
- A second order monotonic and positive advection scheme is developed and implemented in the dynamical core.
- The dynamical core participated in Dynamical Core Model-Intercomparison Project (DCMIP 2012) under the name DYNAMICO and tested with various proposed. Results of dynamico were found consistent with other well-established models participated in DCMIP 2012.
- Dynamical core is tested with Held-Suarez test case and coupled with simplified dry physical package.
- Dynamical core is coupled with physics package of LMDZ5, a well-established French climate model. Aqua planet simulations are carried out with this setup.

Publications

SCI Journal Publications : 2
Papers Presented in Conferences : 3

Mobility Support

India to France : Collaborators-1
France to India : Collaborators-3
Background
The project seeks to isolate and study low molecular weight mononuclear iron(II/III) coordination complexes as structural and functional models for the peroxide regulator (PerR) zinc-iron proteins that sense hydrogen peroxide in prokaryotes and release the expression of defence enzymes. Mononuclear iron(II)/(III) complexes and manganese analogues of suitable tetra- and pentadentate ligands containing biomimetic donors will be isolated for the first time as models for the PerR protein. X-ray structure determination of suitable single-crystals of these complexes will also be undertaken to ascertain the coordination environments of the models. The ability of the mononuclear iron(II)/(III) complexes to activate a variety of substrates will be studied using GC, HPLC and GC-MS techniques. The catalytic activity of the iron and manganese complexes towards oxidation of histidine imidazole moieties and other oxotransfer reactions will be studied.

Objectives
This project aims at probing PerR mechanism at the molecular level by combining chemical (model studies), biochemical (protein chemistry) and biophysical (molecular spectroscopy) approaches. In addition it will address the question of the reversibility of the histidine oxygenation to find whether PerR is a sacrificial sensor or can be regenerated in the cell. An important benefit of these studies will be to open the way to new biomimetic catalytic processes based on H2O2 since PerR functions does not rely on reductive dioxygen activation.

Knowledge Products Developed
- Several 5N, 4N, 2N2O ligands proposed have been isolated and characterised successfully.
- Fe(II) and Mn(II) complexes of those ligands have been isolated and characterised by using X-ray crystallography and other spectroscopic techniques.
- Catalytic activity of the isolated Fe(II) and Mn(II) complexes towards the oxidation of various imidazoles were done.
- The crystal structure of the active PerR protein has been solved
- A single mutation within the regulatory site of PerR abolishes its interaction with H2O2
- PerR regulatory site is oxidized in a physiologically meaningful manner which suggests that PerR may have an unanticipated function as oxygen sensor

Publications
SCI Journal Publications : 20
Papers Presented in Conferences : 3

Mobility Support
India to France : Collaborators-3
France to India : Collaborators-1
Kleinian Groups: Geometrical and Analytical Aspects

Background
Kleinian groups are discrete subgroup of the group of automorphisms of the Riemann sphere. Their study leads to questions in analysis, geometry, group theory, topology, etc. Our project contains 3 themes. Theme 1 is centred around Cannon-Thurston maps. We will use them to obtain a topological picture of the limit set. We will also study the analytical, metric/measure theoretic properties of these maps. With theme 1, we intend to make progress on an old question: does the bending of the boundary of the Nielsen core allow one to recover the hyperbolic metric on the manifold? Theme 3 is devoted to "symmetric patterns" and rigidity.

Objectives
• Describe the Cannon-Thurston map in terms of the ending laminations
• Consider Cannon-Thurston maps in terms of their analytical properties.
• When \((M, P)\) is the product of a surface \(S\) with boundary by an interval, the set of the closed geodesics for an hyperbolic on \((M, P)\) which are shorter than the Margulis constant form a link (that we suppose infinite) in \(M\).
• To study this link and try to relate it to the end invariants. Cannon-Thurston maps for higher rank symmetric spaces. Existence of combinations theorems.
• Study the lines of minima of Steven Kerckhoff
• Extend the Theorem of Bonahon on the Quasi-Fuchsian space to the space of metrics on an acylindrical hyperbolic manifold \(M\).

Knowledge Products Developed
• Described the structure of Cannon-Thurston maps in details in terms of the ending laminations
• Proved the existence of combinations theorems.
• Studied the lines of minima of Steven Kerckhoff.
• Extended the Theorem of Bonahon on the Quasi-Fuchsian.
• Pattern Rigidity theorems for Hyperbolic groups, Pattern rigidity in lattices in Real Hyperbolic Space

Publications
SCI Journal Publications : 14
Papers Presented in Conferences : Nil

Mobility Support
Indian to France : Collaborators-4
France to India : Collaborators-2
Objectives

One of the main goals of observational cosmology is to find answers to questions such as how star-formation proceeds, what is the resultant metal production, how it is related to the physical and chemical state of the interstellar medium (ISM) and what is the mode of transport of metals from galaxies to the intergalactic medium (IGM). Absorption lines seen in the spectra of high-redshift quasars are very sensitive and luminosity unbiased tracers of the gas located in dense regions like disks of galaxies as well as in the diffuse intergalactic medium. Observation of quasars allows one to probe the evolution of our universe over a large look back time. We wish to study (i) the molecular and dusty interstellar medium of distant galaxies, (ii) the multiphase structure of the neutral gas probed by 21-cm absorption, (iii) the metal enrichment of the IGM and its connection to outflows from galaxies and quasars and (iv) the time variations of different dimensionless fundamental constants of Physics.

Knowledge Products Developed

- Completing the systematic survey of 21-cm absorption in a sample of Mg II absorbers in the redshift range 0.5<z<1.5 using GMRT, GBT and VLA.
- Strongest constraints on the combination of fundamental constants using four 21-cm absorbers detected in GMRT survey together with VLT observations specifically obtained for the project with attached calibrations.
- We report the discovery of a double hump Lyman-alpha emission line from a high redshift damped Lyman-alpha system using X-shooter observations.
- We reported the first case of variable Fe fine-structure absorption in a low ionization BAL QSO.
- We also reported the first detection of Diffuse Interstellar Bands (DIBs) from a low-z QSO galaxy pair.

Publications

SCI Journal Publications : 8
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators - 2
France to India : Collaborators - 3
Background

Our research encompasses the synthesis and characterization of new inorganic species as well as a study of their electronic structures and reactivity in the domain of inorganic chemistry. An experimental plus modern electronic structural computational approach is proposed. Young coworkers participating in this research receive a broad training in modern inorganic chemistry and gain a range of skills that permits valuable versatility in their future careers. Our work takes Ph.D. students and research associates to one frontier of inorganic chemistry where they encounter unusual structures with new types of bonding and reactivities. The international dimension provided by this joint proposal will enhance these educational activities providing Indian co-workers with significant exposure to modern inorganic chemistry in a prominent French laboratory and the reciprocal for the French colleagues.

Knowledge Products Developed

- Synthesis and theoretical study of new hypoelectronic metallaboranes of formula \((\text{Cp}^*\text{TaX})_2\text{B}_5\text{H}_{11} (X = \text{F, Cl, Br, I})\) and \((\text{Cp}^*\text{Ta})_2\text{B}_4\text{H}_8\text{I}(\mu-\text{BH}_4)\).
- Synthesis of first open-cage hypoelectronic 11-vertex tantalaborane that possesses a nido geometry based on icosahedron geometry and hypoelectronic eleven vertex molybdaborane clusters that possesses close geometry based on bicapped square antiprism geometry were done.
- A new synthetic route to metalla-heteroborane cluster was established.
- Synthesis of two simple triazole-based, easy-to-synthesize, and multisignaling chemosensors and that selectively bind with the Hg\(^{2+}\) cation.

Publications

SCI Journal Publications: 18
Papers Presented in Conferences: 2

Mobility Support

India to France: Collaborators - 2, Student - 1
France to India: Collaborators - 2
Mineral-Fluid Interaction Model for CO\textsuperscript{2} Sequestration

Objectives

- Characterize mass transfers heterogeneity triggered by flow field and rock-forming mineral heterogeneity where diffusion is not dominant at pore scale.
- Test different modeling approaches, based on advanced random walk techniques, at pore scale using both high-resolution three-dimensional images taken before and after dissolution/precipitation experiments, and generated statistically equivalent porous media.
- Explore genetic models based on compaction and diagenesis.
- Investigate the role of the interface contact area versus reactive surface area, reactants spreading and mixing and advection versus diffusion.
- Extension towards the modeling of variable viscosity fluids will be investigated.
- Up-scale these processes in order to produce operational models at Darcy’s scale using the continuous medium approach.
- Darcy’s scale properties, will be directly computed from mass and momentum balance equations.

Background

Fluid-rock mass transfer processes play an important role in a number of geosciences applications. We propose to study a more recent application that concerns the underground storage of CO\textsubscript{2} (now considered necessary to mitigate global warming). Quantifying the long-lasting presence of huge volumes of CO2 in reservoirs requires addressing the essential issue of the pore structure and the hydrodynamic properties of the reservoir induced by the chemical reactions. In this case, the thermal, chemical and hydro dynamical forcing of the reservoirs may induce important and sustainable mass transfers that can change irreversibly the hydromechanical properties of the reservoir and of the surrounding rocks. Modelling these processes is therefore essential to evaluate the feasibility and the integrity of long-term confinement of the storage.

Knowledge Products Developed

- Algorithms have been developed by to study microgeometry of pore and rock phase
- A simulation platform based on Time Domain Random Walk and Kinetic Monte Carlo was developed.
- Partial validation of the Stokes solver.
- The calculation of the time evolution of bulk diffusivity of the porous media has been implemented.
- The behaviour of the dissolution pattern at different values of the Peclet and Damkohler numbers was analysed for different geometries (fractures and porous media).

Publications

SCI Journal Publications : 4
Papers Presented in Conferences : 6

Mobility Support

India to France : Collaborators -3
France to India : Nil
Hydrology and Water Resources from Space over the Indian Continent

Background
The knowledge of water storage in different forms—surface water, snow, moisture, groundwater—and their variability on different spatial and temporal scale is important at scientific as well as at policy levels. This especially is true for a vast country like India with a rapidly growing economy and resultant rise in living standards.

Space borne measurements have exceptionally improved our understanding of the Earth’s global water storage variability and also able to provide information on the regional scale. New space-based observation tools particularly GRACE gravity and satellite altimetry are providing critical information for monitoring of total and surface water storage variations.

Knowledge Products Developed
- Inundations and volumes of floods in two river basins namely Ganga and Indus are estimated
- A large volume of satellite altimetry data are processed to provide river water levels at numerous locations of Ganges, Brahmaputra, Krishna and Godavari rivers.
- Annual runoff and draft of Ganga-Brahmaputra to the Bay of Bengal are estimated based on River level data.
- Spatio-temporal variation of water storage variation over the Ganga, Krishna, Indus, Brahmaputra and Godavari river basins are inferred from satellite gravimetry

Objectives
The objective of this project is to monitor land water storage of the Indian continent using space gravimetry and satellite altimetry data. Observations of the GRACE space gravimetry mission will be used to provide soil and groundwater volume time series over the main river basins of India since mid-2002 at ~ 10-day interval. Altimetry data from Topex/Poseidon, Jason-1, ERS-2 and Envisat satellites will provide surface water time series since early 1993, in particular over the main Indian rivers as well as over man-made reservoirs. Altimetry data combined with visible and radar satellite imagery will allow determination of surface water volumes over flooded areas during flood season. Combination of surface water volumes with GRACE-based total water storage will permit determination of the groundwater component. The space-based hydrological products will be compared to land surface model outputs as well as with in situ data when available.

Publications
SCI Journal Publications: 4
Papers Presented in Conferences: 8

Mobility Support
India to France: Collaborators - 4
France to India: Collaborators - 1

Principal Collaborators

V.M. Tiwari
National Geophysical Research Institute, Hyderabad

Jean François Cretaux
Laboratoire d’Etudes en Géophysique et Océanographie Spatiales, Toulouse
Completed Projects

Pure and Applied Chemistry

Bimetallic Catalysis Involving Ruthenium and Palladium: C-H Bond Activation/Functionalization and Beyond

Project No. : 4205-1
Feb. 2010 - Sep. 2013

Background

Dipalladium and diruthenium systems, in which two metal ions are in close proximity, will be synthesized and their potential utilities as catalysts will be examined. The carbene (NHC) and 1,8-naphthyridine (NP) based ligands and their chiral versions will be synthesized. The [RuI-RuI], [RuII=RuII], [PdI...PdI] and [PdII...PdII] dimetal precursors will be subjected to complexation reactions with newly synthesized ligands. Detailed theoretical calculations will be undertaken to understand the superiority of dimetal catalysts compared to their mono-metal congeners. In the emerging field of cooperative bimetallic catalysis, a project proposal of this type is expected to provide guidelines that will enable to design tomorrow’s catalysts having higher reactivity and better selectivity.

Objectives

The central theme of the project is cooperative bimetallic catalysis, utilizing bimetallic compounds in organic transformations.

- Design and synthesis of multidenate ligands to stabilize a dimetal core.
- The synthesis of diruthenium and dipalladium precursors.
- Systematic collaborative studies on the interaction of C-H bond with dimetal core, stoichiometric organometallic reactions at the dimetal platform, organometallic catalysis employing diruthenium and dipalladium complexes for a variety of reactions including cross-coupling reaction: Suzuki, Sonogashira, Negishi, Heck reaction.
- Special attention will be given to C-H bond activation/functionalization reactions of hetero-aromatics, which are important building blocks in organic synthesis.

Knowledge Products Developed

- A diruthenium(I) compound has been shown to catalyse aldehyde olefination reactions effectively.
- A set of diruthenium(I) compound with NHC ligands are shown to catalyse carbene-transfer reactions.
- Palladium-catalyzed direct arylation of thiophenes or arenes bearing SO2R substituents have been demonstrated.
- Dipalladium(II) compounds bridged by proline-based chiral ligand have been synthesized.
- Non-classical carbene compound of Ru(II) have been synthesized.

Publications

SCI Journal Publications : 15
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators - 3
France to India : Collaborators - 2

Principal Collaborators

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Indian Institute of Technology-Kanpur
Kanpur

Henri Doucet
UMR 6226 CNRS
Université de Rennes
Rennes

Indo-French Centre for the Promotion of Advanced Research
Background
The practical implementation of alternative energy storage systems is becoming increasingly important. Fuel cells will most likely be the energy source of the future. However, there are issues to be addressed before such devices can become economically viable and technically sure. Amongst the problems to be solved is the question of the separating membrane. The most common polymer based membranes currently used are sulfonated perfluoropolymers commonly known as Nafion. They need to be fully humidified because the proton conductivity of such membranes depends heavily on the water content in the membrane. Recently, tremendous efforts have been devoted to realize the dry operation of membrane and reduce the cost. The focus of this project is to develop fullerene based membranes as basic components for proton conducting materials.

Objectives
This project is directed towards the development of low-to-medium temperature (60-200°C) fuel cell proton conducting membrane electrolytes, and polar liquid crystalline materials. Here, we propose a different type of functionalization on fullerene by which one can control the properties of functionalized organic materials. For example: by increasing fullerene acidity, we expect to lower the barrier for proton hopping and thus achieve proton transport properties superior to that of Nafion. These studies will provide useful inputs for the generation of new, novel materials for energy devices. The focus of this project is to develop new materials for the next generation of energy devices. In particular towards the development of materials for organic devices such as solid electrolyte for lithium-ion (Li+) rechargeable batteries, and polar liquid crystalline materials.

Knowledge Products Developed
• Synthesis and Characterization of penta-adducts of fullerenes.
• Preparation of Nafion Composite Membrane with Fullerene derivatives.
• Measurement of conductivity and performance of the membrane.

Principal Collaborators
Satish Patil
Indian Institute of Science
Bangalore

Daniel Guillon
IPCMS, Groupe des Matériaux Organiques
Strasbourg

Publications
SCI Journal Publications : Nil
Papers Presented in Conferences : Nil

Mobility Support
India to France : Collaborators-1
France to India : Nil
Completed Projects

Information & Communication Technology

Compact Modeling of Asymmetric Double Gate Nano Scale Transistors

Objectives

Development of Compact Models for the Electrostatics of Asymmetric DG Transistors
- Explicit modeling of body potential as a function of Gate Voltage
- Modeling of threshold voltage, short channel effect, drain induced barrier lowering and sub-threshold slope
- Modeling of inversion charge
- Modeling of energy quantization effects
- Development of Compact Models for the Electrodynamics of Asymmetric DG Transistors
- Closed form drain current model
- Modeling of large signal parameters
- Modeling of small signal parameters

Knowledge Products Developed

- A simple charge model for common double gate MOSFET adapted to gate oxide thickness asymmetry
- Piece-wise linearization technique based charge model for independent double gate MOSFET
- Improved surface potential calculation technique for independent double gate MOSFET
- Analytical approximation of surface potentials for double gate MOSFET having gate oxide thickness asymmetry
- Verilog-A code for common and independent double gate MOSFET for immediate engineering applications (e.g. circuit simulation).

Background

Relentless focus on Moore’s Law transistor scaling has provided ever-increasing transistor performance and density. To continue the technology scaling beyond 22nm node bulk-MOSFET needs to be replaced by new device architectures, most promising being the Multiple-Gate MOSFETs (MuGFET). As like bulk-MOSFET, an accurate and physical compact model is important for MuGFET based circuit design. In nanoscale regime there will always be some asymmetry between the gate oxide thicknesses due to process variations and uncertainties. This can affect device performance significantly. At the same time, independently controlled DG (IDG) MOSFETs have gained tremendous attention owing to its ability to modulate threshold voltage and trans-conductance dynamically. Due to the asymmetric nature of the electrostatic, developing efficient compact models for asymmetric/independent DG MOSFET is a daunting task.

Project No. : 4300-IT-1
Aug. 2010 - July 2013

Publications

SCI Journal Publications : 3
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators-1 : Students - 2
France to India : Collaborators-2

Principal Collaborators

Santanu Mahapatra
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Costin Anghel
Institut Supérieure d’Electronique de Paris (ISEP), Paris

Publications

SCI Journal Publications : 3
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators-1 : Students - 2
France to India : Collaborators-2
Protection by New Arecoline Derivatives in Alzheimer’s Disease


Background
The discovery of cholinergic deficit in Alzheimer’s disease patient’s brain has triggered research efforts, using cholinomimetic approaches for their symptomatic and putatively neuro-protective efficacy in AD therapy. Cholinergic agents include muscarinic agonists, cholinesterase inhibitors and acetylcholine releasing agents. One of the muscarinic agonists tested in AD is arecoline, and its bioisosteres, widely explored as muscarinic receptor 1 agonists. This project focuses on design and synthesis of novel arecoline and heterocyclic derivatives, as selective M1 agonist for the treatment of AD. Newly synthesized molecules will be pharmacologically characterized. Potent and selective derivatives will be tested in an in vivonontransgenic model of AD, the central injection of Aβ25-35 peptide in mice. Their neuro-protective activity will be determined using a combined molecular, morphological and behavioural approach, by the French partner.

Objectives
- Design and synthesis of new M1 receptor selective, potent, bioavailable and receptor wash resistant non-ester analogs of Arecoline and similar heterocyclic derivatives as agonists.
- Synthesized derivatives will be checked for M1 receptor binding constant in vitro and determination of IC50 values.
- Based on the above binding studies the lead will be optimized by substituting different groups by QSAR studies.
- The screened molecules will be tested for prevention or reversion of Aβ25-35 induced learning and memory deficits (large dose response studies).
- Neuroprotective activity of the most effective doses and compounds will be assessed at the biochemical level (measures of oxidative stress, induction of pro-apoptotic caspases...).
- The neuro protective activity will be confirmed at the morphological level by an immunohistochemical analysis of the brain of treated mice with a panel of specific markers (cell death, neurons, glia and microglia, synapse...).

Knowledge Products Developed
- The in vivo neuroprotective activity of arecoline thiazolidinone (AT) and arecoline morpholine (MAT, MAA) derivatives and published molecules were screened using aggregated amyloid β25-35 peptide ICV injection in Swiss mice.
- The level of lipid peroxidation assayed in hippocampus extracts. The level of choline acetyl transferase activity was determined in frontal cortex extracts.
- AT and MAT showed a marked efficacy in preventing the Aβ25-35 deficits at 0.3 and 0.1 mg/kg. MAA appeared much less active.

Principal Collaborators
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Mysore

Tangui Maurice
CNRS Research Director, Head of team
2 of INSERM U. 710
University of Montpellier, Montpellier

Publications
SCI Journal Publications : 2
Papers Presented in Conferences : Nil

Mobility Support
India to France : Collaborators-1
France to India : Collaborators-1
**Completed Projects**

**Pure and Applied Chemistry**

**Self-Assembly in Novel Macromolecular Systems Based on Bioresource Materials: Synthesis, Characterization and Applications**

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**Background**

**Project No. : 4305-1**

**Oct. 2010 - Mar. 2014**

**Associating Polymers [APs]** have attracted increasing attention lately due to their unique property of self-assembly in aqueous media. These systems provide a rich background for designing novel formulations for a wide range of applications in cosmetics, pharmaceuticals, biomedicals, food, paints, oil recovery, paper, textile, etc. In the project we have worked on the design and synthesis of novel associating polymers and gels based on natural polymers. There is a great scope for these ‘environmentally friendly’, renewable resource materials and to prepare value added APs with applications in health care area.

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**Objectives**

- Utilization of bioresource materials as base polymers to synthesize novel APs.
- To prepare responsive and/or reactive graft copolymers and gels by chemical modification of polysaccharides such as Carboxymethyl Guar [CMG], Carboxymethyl Tamarind [CMT], hyaluronic acid [HA] and alginate [ALG].
- To elucidate the structure and properties by FT-IR, NMR, DSC, SANS, Rheometry, Dynamic Mechanical Analysis and Fluorescence spectroscopy.
- Application development for the obtained product in the area of industrial thickeners, tissue engineering and injectables in controlled release of drugs.

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**Knowledge Products Developed**

- New thermo-responsive polysaccharides were synthesized from carboxymethyl guar (CMG), carboxymethyl tamarind (CMT), Alginate and Hyaluronic acid.
- Alginate-g-PEPO was synthesized with tunable cold and hot gelation profile.
- Hydrogels were prepared from tamarind kernel powder (TKP) and ethyl hydroxy ethyl cellulose (EHEC).
- Developed a “Green” route for the synthesis of gold nano-particles using CMG-g-PEPO as both reducing and capping agent for drug delivery applications.
- Design and synthesis of a neural interface using CMT composites.

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**Principal Collaborators**

- **M. V. Badiger**
  National Chemical Laboratory
  Pune

- **Dominique Hourdet**
  ESPCI ParisTech/Sorbonne Universités
  CNRS UMR 7615
  Paris

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**Publications**

- SCI Journal Publications: 5
- Papers in Conferences: 2

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**Mobility Support**

- India to France : Collaborators - 3
- France to India : Collaborators - 3
Nurturing Knowledge

On-going Projects
Basic Sciences
Background

The molecular mechanisms responsible for emergence and progression of autoimmunity and inflammation, have remained obscure. We address the role of antibodies that are capable of hydrolysing the target antigen. Previously we documented the importance of antibodies with catalytic activity in hemophilia A and in sepsis. In the ongoing project, we pursue the characterization of factor VIII-hydrolyzing IgG (FHIg). We also extend our description of hydrolysing IgG to additional antigen targets. In particular, we are characterizing DNA hydrolysing IgG in patients with systemic lupus erythematosus, and investigate the presence of topoisomerase-hydrolyzing IgG in patients with scleroderma. We strongly believe that identifying the role of hydrolysing antibodies would help in better understanding the molecular pathogenesis and conceiving improved therapeutics.

Objectives

I. FVIII-hydrolyzing IgG
   • Prevalence FVIII-hydrolyzing IgG in patients with acquired hemophilia and follow-up during disease progression
   • Follow-up of FVIII-hydrolyzing IgG in patients with congenital hemophilia A who have developed FVIII inhibitors and are under protocols of ‘immune tolerance induction’
   • Generate monoclonal anti-FVIII antibodies with proteolytic activity to FVIII

II. DNA-hydrolyzing IgG in patients with systemic lupus erythematosus
   • Longitudinal follow-up of DNA-hydrolyzing IgG in patients with SLE
   • To generate murine monoclonal anti-DNA antibodies with hydrolytic activity to DNA
   • Topoisomerase I-hydrolyzing IgG in patients with scleroderma
   • To investigate the presence of topoisomerase I-hydrolyzing IgG in patients with scleroderma

Knowledge Products Developed

• Detection of factor IX-hydrolyzing IgG in the plasma of patients with acquired and congenital hemophilia.
• Discovery of factor IX-hydrolyzing IgG in the plasma of patients with acquired hemophilia A
• FVIII-hydrolyzing IgG in patients with congenital hemophilia A who have developed FVIII inhibitors and are under protocols of ‘immune tolerance induction’
• Identification and description of DNA-hydrolysing antibodies in patients with SLE and in patients with scleroderma

Publications

SCI Journal Publications : 8
No. of Papers Presented in Conferences : 5

Mobility Support

India to France : Collaborators - 2
France to India : Collaborators - 3
On-going Projects

Life and Health Sciences

Collective Migration in the Fly Nervous System

Background
Metastasis is the prime cause of deaths in most of the cancer patients. Cell migration is one of the most important aspects of cancer cells during metastasis. To invade, cancer cells interact with the surrounding healthy cells and migrate along the body. Because of its occurrence deep inside the body of a patient, it can be very difficult to study this issue. What scientists already know is that cancer cells migrate to metastasize but how does this process take place and what can be done to prevent still makes the object of intense investigation. Using a simple model organism to study cell migration we are trying to decipher some of the salient aspects of cancer metastasis, with a focus on molecular and cellular mechanisms of cancer invasion and collective migration.

Objectives
Collective cell migration plays a key role in several physiological processes, from development to homeostasis. It requires a higher degree of complexity than single-cell migration as cells must coordinate their movements to maintain their reciprocal positions in order to reach their final destination. Initially, the project aimed at characterizing the molecular cascade involved in collective glial migration using the Drosophila model system. We have been able to show that Glide/GCM plays a key role in glia migration, a rather unexpected finding for an early factor that is involved in fate determination. Data indicates that this determinant must accumulate at threshold levels to ensure proper migration. The current project aims at understanding how is the stability of Glide/Gcm controlled and which are the direct targets that regulate glial migration.

Knowledge Products Developed
- The glial chain in a developing Drosophila wing provides an excellent tool for study of the molecular pathway underlying collective migration.
- Role played by a transiently expressed fate determinant Glide/Gcm in collective glial migration. gcm is the early determinant that acts as a binary switch between neurons and glia, its role is indispensable for gliogenesis.
- GCM acts on collective glial migration through its direct downstream target Frazzled, a Netrin receptor. Integration of autonomous/chemo-regulatory pathways ensures that glial migration occurs in an efficient manner. Data shows the deterministic role of an early transcription factor on a late and collective behavior.

Principal Collaborators

<table>
<thead>
<tr>
<th>K. VijayRaghavan</th>
<th>Angela Giangrande</th>
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<tbody>
<tr>
<td>National Centre for Biological Sciences, Bangalore</td>
<td>Institut de Génétique et de Biologie Moléculaire et Cellulaire, Strasbourg</td>
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Publications
SCI Journal Publications: 1
Paper presented in conference: 1

Mobility Support
India to France: Collaborators - 1
France to India: Collaborators - 1
Non-Adiabatic Quantum Reactive Scattering Dynamics on Multi-Sheeted Potential Energy Surfaces

Background
Relative scattering dynamics of prototypical exoergic insertion reactions on multi-sheeted coupled electronic potential energy surfaces (PESSs) will be investigated with the aid of time-independent and time-dependent quantum mechanical methods. The findings will be compared with the crossed molecular beam results. As a prerequisite of quantum dynamical studies, extensive ab initio quantum chemistry calculations will be carried out and the relevant PESs will be constructed by fitting the ab initio data. The adiabatic PESs will be diabatized and the diabatic coupling surfaces will be established. The French team will develop the time independent method in body-frame hyperspherical coordinate system. The Indian team will develop the time-dependent method in body-fixed Jacobi coordinate system to treat the nonadiabatic reactive dynamics. The Besancon team will be involved in PES calculations.

Objectives
Theoretical studies of reactive chemical dynamics beyond Born-Oppenheimer approximation,
Development of electronic potential energy surfaces,
Investigation of nuclear dynamics by quasi-classical trajectory,
Time-independent and time dependent quantum mechanical methods.

Knowledge Products Developed
- Salient features of the potential energy surfaces of the electronic ground state of S + OH and electronic excited state of the C + OH reactive systems are examined in detail.
- Optimal grid in the reagent Jacobi coordinates is established.
- Time-dependent wave packet propagation is being carried out to calculate reaction probability, integral cross section and thermal rate constant.
- Quantum dynamics of the H+ + H2 reaction at low temperatures is studied using two different potential energy surfaces.
- Huge quantum symmetry effects are observed in the O + O2 exchange reaction.

Principal Collaborators

<table>
<thead>
<tr>
<th>Susanta Mahapatra</th>
<th>Pascal Honvault</th>
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<td>Univ. of Hyderabad</td>
<td>Univ. de Bourgogne</td>
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<td>Hyderabad</td>
<td>Dijon</td>
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Publications
SCI Journal Publications : 3
Papers Presented in Conferences : 1

Mobility Support
India to France : Collaborators - 2
France to India : Collaborators - 3
On-going Projects

Knowledge Products Developed

Methods currently used to analyze anisotropic flow in relativistic heavy-ion collisions were devised before the importance of event-to-event flow fluctuations was recognized. We argue that flow fluctuations can be obtained directly from data by fully exploiting the information contained in the two-particle correlation matrix. Our new method, based on the Principal Component Analysis, uses the eigenmodes and eigenvalues of the two-particle correlation matrix. It can be used to extract information on the pseudorapidity- and transverse momentum-dependence of multiplicity and flow fluctuations. We test the applicability of this method with Monte-Carlo simulations using the transport model AMPT, as well as the ALICE data.

Objectives

The LHC collider at CERN started accelerating beams of lead nuclei in 2010, at energies 30 times larger than the collider RHIC at Brookhaven. These collisions have produced a phase of matter named the quark-gluon plasma. This project is devoted to theoretical studies in close relation with this experimental programme. The first aspect of the project is to compute the production of particles in these collisions from first principles, using recent developments in perturbative Quantum Chromodynamics (QCD). The second aspect is to study specific signatures of the quark-gluon plasma using QCD at finite temperature, namely the production of charmonium, and of particles with high transverse momenta. The third aspect of the project investigates the expansion of the quark-gluon plasma and its decay into particles using relativistic hydrodynamics.

Background

This project is in the area of Theoretical High-Energy Nuclear Physics being pursued experimentally at the Large Hadron Collider (LHC) at CERN. The experiments aim to test non-perturbative aspects of QCD. We aim to characterize the initial state formed in nucleus-nucleus collisions, the knowledge of which is crucial to extract the properties of QGP. To that end, we have presented several new correlation observables. We have proposed a simple model to understand the anisotropy generated by initial-state fluctuations. We have also studied event-plane correlators which have the potential to throw additional light on the initial-state phenomena. Using Principal Component Analysis, we have developed a new method to study event-by-event fluctuations in nucleus-nucleus collisions.

Publications

SCI Journal Publications : 3
Papers Presented in Conferences : 1

Mobility Support

India to France : Collaborators - 6
France to India : Collaborators - 4

Extreme QCD in the LHC Era

Project No. : 4404-2

Principal Collaborators

Rajeev S. Bhalerao
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Publications

SCI Journal Publications : 3
Papers Presented in Conferences : 1

Mobility Support

India to France : Collaborators - 6
France to India : Collaborators - 4

Indo-French Centre for the Promotion of Advanced Research
On-going Projects

Distant Obscured Galaxies from GMRT and Herschel

Project No. : 4404-3
April 2011 - Mar. 2015

Objectives

- Identify and characterise a large sample of candidate high redshift radio galaxies. A detailed study has been carried out by combining our deep GMRT radio observations with optical, infrared and high frequency radio data.
- To use image stacking techniques in the radio, mid- and far- infrared to study the radio-FIR correlation in normal Milky way type galaxies upto a redshift of 1.
- To carry out a detailed study of a new giant radio galaxy discovered by us, an incredible 9 billion light years away. Such objects are extremely rare and we have carried out a complete analysis of this galaxy by combining GMRT radio data with X-ray, optical, near infrared, mid-infrared and high-frequency radio observations.

Background

This project falls in the broad area of galaxy evolution, where statistical changes in galaxy populations over cosmic time are studied and compared to the predictions of theoretical and numerical models and then placed in the larger cosmological context. There are a number of challenges here - the epoch of peak star formation is extremely distant and most star formation occurs in extremely dusty star forming regions. This makes optical observations nearly useless and sensitive radio and far-infrared observations which are more transparent to dust are required. This early epoch also witnesses peak activity in active galactic nuclei. With our new radio data, and extensive archival observations in optical, near/mid/far infrared and high frequency radio bands, a number of problems related to the radio-infrared correlation, AGN activity and distant radio galaxies will be explored.

Knowledge Products Developed

- Observation of the radio-far infrared (FIR) correlation
- Spectral Energy distribution (SED) modelling
- Identification and segregation of obscured galaxies and AGNs

Publications

SCI Journal Publications : 3
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators - 2
France to India : Collaborators - 2

Principal Collaborators

Yogesh Wadadekar
National Centre for Radio Astrophysics
Pune

Alexandre Beelen
Institut d’Astrophysique Spatiale
Orsay

By using image stacking techniques, it becomes possible to study extremely faint radio emission from star-forming galaxies detected in the Herschel-HerMES survey. This radio stack at the positions of about 1200 far-infrared sources shows radio emission at the 400 micro Jansky/beam level.
**On-going Projects**

**Life and Health Sciences**

**Studying the Interactome of NAD-Dependent Deacetylase Sirt1 in the Testis**

**Background**

Sirtuins are NAD-dependent proteins that link metabolic inputs to cellular and organismal physiology. In mammals there are 7 sirtuins of which three are localized to the nucleus (Sirt1, Sirt6, Sirt7), three to the mitochondria (Sirt3, Sirt4, Sirt5) and one in the cytoplasm (Sirt2). Due to their ubiquitous expression and dependence on NAD they have been implicated to play a critical role in affecting normal and pathophysiology including age-related diseases such as cancer, obesity and diabetes. Despite several reports that have highlighted their cellular functions, upstream signals that mediate posttranslational modifications (PTMs) and interacting partners are largely unclear for several sirtuins. This project aims to uncover the molecular mechanisms of sirtuin functions by investigating modifications of Sirtuins (isoforms and PTMs of Sirt1) and their interacting partners (full length and short isoforms of Sirt1 and the evolutionarily conserved mitochondrial sirtuin Sirt4). Unless upstream and downstream modulators of sirtuins are studied, efforts at delineating their key roles in aging mechanisms will remain unknown.

**Objectives**

- Identification of the interactome of Sirt1
- Differential interactions of the Sirt1 splice variants
- Functional validation of the identified interactome
- PTMs (Glycosylation) of Sirt1
- Identification of proteins that interact with Sirt4

**Knowledge Products Developed**

- Cloning and expression of GST-exon2 fusion protein
- Generation of monoclonal antibodies for Sirt1 Exon-2
- Preliminary MS/MS analyses of Sirt1 IP from testis
- Differential interactions of the Sirt1 splice variants using tagged proteins
- Preliminary MS/MS analyses of Sirt4 immunopurified samples
- PTMs (Glycosylation) of Sirt1
- Identification of Sirt1 dependent Acetyl Proteome

**Principal Collaborators**

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Mumbai

**A. Gonzalez de Peredo**
CNRS
Institut de Pharmacologie et de Biologie Structurale Toulouse

**Publications**

SCI Journal Publications: Nil
Papers Presented in Conferences: Nil

**Mobility Support**

India to France: Collaborators - 1
France to India: Collaborators - Nil
Computational Studies of Frustrated Quantum Magnets

Project No. : 4504-1  June 2011 - Nov. 2014

Background
The field of quantum magnetism is at the heart of several important developments in fundamental and applied science, such as MRI, magnetic storage devices and spintronics. It has also provided a major impetus for the development of new theoretical tools and algorithms, as well as major conceptual advances and experimental techniques (NMR, polarized synchrotron, pulsed high magnetic fields). In spite of being a mature discipline, it remains a fertile area of research, as it provides many examples of unusual collective behaviour due to the strong correlations between particles and frustration effects. The projects mentioned above are positioned at the frontiers of current research developments in quantum magnetism and are mainly of fundamental nature (pure basic science). The main applications will involve better understanding and interpretation of experimental results in the area.

Objectives
We aim to investigate several open issues in quantum magnetism and other strongly correlated systems. The work proposed is of a theoretical nature and is well-motivated by connections to experimental systems.
Due to the intrinsic quantum nature of the problem, the complexity of strongly correlated problems grows exponentially with the physical system size. We aim to develop and use a mixture of analytical and computational techniques (including quantum Monte Carlo simulations) to tackle the following issues:
- Real-time dynamics of quantum magnets
- Improved mean-field theory for quantum anti ferromagnets
- Exotic deconfined quantum critical points in quantum spin systems
- Computational studies of quantum dimer and related valence-bond systems

Knowledge Products Developed
- Analytical and numerical understanding of the behavior of resonating valence bond (RVB) wave-functions: contrary to the prevailing ideas so far, RVB wave-functions on bipartite lattices are not all simple liquids, but rather critical liquids (in two dimensions) and antiferromagnets with unusual correlations (in three dimensions).
- New computational schemes for study of these wavefunctions provide more precise results on transitions between these phases.

Principal Collaborators
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Publications
SCI Journal Publications : 7
Papers Presented in Conferences : 3

Mobility Support
India to France : Collaborators 1, Student - 1
France to India : Collaborators-2
On-going Projects

Pure and Applied Chemistry

Development of fulvene-based Zr(II) and Ti(II) chemistry: organometallics, reactivity and applications in organic synthesis

Project No. : 4505-1
July 2011 - June 2014

Background
Pentafulvenes are readily accessible building blocks in organic synthesis. Their unique unsaturated system gives access to cycloaddition reactions in which the three double bonds of the fulvene system can react as a 2, 4 or 6π electron component. The Indian partner of the project has a wide expertise in the fulvene-based organic synthesis. Fulvenes offer the possibility of unexplored reactivities towards the organometallic reagents, particularly column IV transition metal complexes (Ti, Zr) are promising candidates. In fact, organometallic complexes of zirconium and titanium in the oxidation state +II are well-known to interact with alkenes and dienes, resulting in a large number of applications in organic synthesis. The interaction of these complexes with fulvenes may therefore reveal original transformations convenient for organic synthesis.

Objectives
The main objective of this project has been the introduction of fulvenes as substrates to the divalent chemistry of zirconium and titanium, opening up the way for new atom-economic transformations and efficient pathways for the synthesis of useful organic molecules. At first, an in-depth organometallic study has been planned to establish the reactivity between fulvenes and divalent zirconium and titanium species. Secondly, based on this organometallic study, some five-membered as well as polycyclic frameworks, typically found in molecules of biological interest would be efficiently accessed.

Knowledge Products Developed
Developed a number of efficient methodologies for the synthesis of a number of molecules with potential biological activity. Some of the cores developed are unique, having an indoline and pyraoles fused to the cyclopentene core.

- Synthesis and reactivity of first metalocene-fulvene complexes
- Titanium-catalysed hydroalumination of fulvenes leading to regio and stereoselective transformation of fulvenes at the C1 position
- Unprecedented C-F activation in benzofulvenes
- Stereoselective access to 3,4-disubstituted allylidene cyclopentenes
- Straightforward Lewis acid catalysed transformation of fulvenes to polycyclic compounds

Principal Collaborators

K. V. Radhakrishnan
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Thiruvananthapuram

Jan Szymoniak
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Reims

Publications
SCI Journal Publications : 4
Papers Presented in Conferences : 4

Mobility Support
India to France : Collaborators- 1; Students : 2
France to India : Collaborators- 2
Cometary Grains: Observations and Simulations

On-going Projects

Objectives

- To propose a complete numerical protocol to analyze observational data from the light scattered by cometary comae dust, in order to obtain definite information about physical properties of the dust particles ejected from a comet nucleus.
- Numerical protocol for light-scattering data analysis will be applied to the comet 103P/Hartley to supplement the direct observations obtained by the Deep Impact Extended Mission (DIXI/EPOXI) involved in spacecraft flyby over the comet in October 2010.
- The ultimate goal is to give to all scientists involved in comet rendezvous missions, a practical tool to get easy and reliable access to some parameters (particle size and morphology) crucial to foresee the interaction between a probe and the cometary dust particles.

Background

The dust tail is the most visually spectacular part of the comets we occasionally see in the night sky. Reaching typical lengths of tens of millions of kilometres, they are composed primarily of smoke-sized dust particles with an average diameter of around a micrometre, and are yellow in colour as they shine by reflected sunlight. Understanding the properties of cometary dust helps in a greater way to understand the formation and evolution of our solar system. Building phenomenological tools validated with both numerical and experimental simulations is extremely important in this context. Use of computers for numerical modelling of grains aggregates (composed of nanometer sized individual grains) is becoming an essential tool to interpret and understand observational data obtained from electromagnetic wave scattering.

Knowledge Products Developed

- Comet C/2009 P1 (Garradd) was observed by imaging polarimetry from 2 m telescope at IUCAA Girawali Observatory (IGO) in India and from the 0.8 m telescope at Haute-Provence Observatory (OHP), and this revealed various interesting dust and jet properties of the comet.
- Comet 78P/Gehrels was observed polarimetrically from India and France during October 2011 (IGO), January 2012 (OHP) and February 2012 (IGO), when its phase angle was between 15 and 28.3 degrees. These were the first polarimetric measurements of the dust properties of the comet Gehrels which resulted in various interesting properties of cometary dust.

Publications

SCI Journal Publications : 8
No. of Papers Presented in Conferences : 5

Mobility Support

India to France : Collaborators : 4
France to India : Collaborators : 3

Principal Collaborators

Asoke Kumar Sen
Assam University
Silchar

Robert Botet
Université Paris-Sud
CNRS UMR 8502
Paris
Objectives

The objective of the project is to fill that gap by using the Discontinuous Galerkin method. The literature review also shows that this method has been proven to be able to handle shock waves, complex geometries and nonlinear waves. However, no combination of these three advantages has ever been made. Hence, the project aims at developing a Discontinuous Galerkin method for the advanced numerical simulation of nonlinear shock waves in 2D complex geometries with applications to acoustical problems.

Knowledge Products Developed

- Developed discontinuous Galerkin (DG) method for 1D Burgers’ equation;
- Incorporated Gaussian artificial viscosity in the method for stabilization;
- Develop shock sensor algorithm has been and tested successfully in order optimally add the artificial viscosity;
- Developed a computer code and the solution is compared with exact solution in the case of Burgers’ equation for several test cases;
- The method has been updated to 1D Euler’s equation of motion where test cases confirm that the method successfully captures the shock and the rarefaction waves;
- The dimensionless form of the governing equation of the weakly nonlinear acoustic wave propagation has been derived (in 2D) along with the characteristic fields.

Background

Weak shock waves are one of the most intense and spectacular features of nonlinearities in acoustics. They are characterized by sudden pressure variations, separating smooth parts of the waveform. Acoustical shock waves can be observed in various domains of acoustics, with either applications to geophysics (sound produced by the thunder), engineering (as the sonic boom produced by supersonic aircrafts) or medicine (as the shock waves produced by a trauma on a skull). A numerical solver would be a useful tool to understand and discriminate physical mechanisms responsible for these phenomena. To obtain high fidelity simulations, one has to reproduce the physical mechanisms involved in nonlinear acoustics such as the harmonics generation and the generation of shock waves and their interactions, and to reproduce these phenomena in situations where the mesh is adapted to complex geometries.

Publications

SCI Journal Publications : Nil
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators- Nil
France to India : Collaborators- 1
The central theme of the project is number theory. Understanding the L-functions of automorphic forms is a big challenge. In this project, our contribution to this challenge is the specific case of spinor zeta functions of Siegel-Hecke forms of degree 2. We obtained quantitative results on the sign changes of the coefficients of these functions. In particular, we have shown that on the average half of the nonzero coefficients of the spinor zeta function of a Siegel-Hecke cuspform of degree 2 are positive and half are negative. We have also calculated the Rankin-Selberg convolution of a Siegel-Hecke cuspform of degree 2 with itself.

Knowledge Products Developed
Quantitative results on the sign changes of the coefficient of the spinor zeta function.

Principal Collaborators

<table>
<thead>
<tr>
<th>J. Sengupta</th>
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</tr>
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<tbody>
<tr>
<td>Tata Institute of Fundamental Research Mumbai</td>
<td>University Henri Poincare Vandeuvre Nancy</td>
</tr>
</tbody>
</table>

Publications
SCI Journal Publications: Nil
Papers Presented in Conferences: Nil

Mobility Support
India to France: Collaborators -4
France to India: Collaborators -7
On-going Projects

Life and Health Sciences

Dynamics of Serotonin1A Receptors by Single Particle Tracking


Background
The serotonin1A receptor is an important member of the G protein-coupled receptor (GPCR) super family and is implicated in depression and anxiety. Deciphering membrane organization and dynamics of the receptor will be crucial in the future development of better therapeutics. The project synergies complimenting expertise of project partners [analysis of organization, dynamics and function of the serotonin1A receptor (India) and single molecule diffusion analysis of GPCRs (France)] to address this important issue. We will compare the effects of chronic vs. acute membrane cholesterol depletion, which induce distinct pharmacological responses, on receptor dynamics. We will also analyze the role of actincytoskeleton in the functional dynamics of the receptor. The results are likely to provide novel in sights on GPCR signaling and dynamics, and help in designing better therapeutics.

Objectives
Although ~50% genes in higher eukaryotes code for membrane proteins, progress in understanding membrane protein function has been slow. This is partly due to the enormous difficulty in the crystallization of membrane proteins. In addition, it is becoming increasingly clear that for deciphering membrane protein function, it is important to appreciate and understand characteristic membrane dynamics since a static structure alone is not enough for a comprehensive understanding of membrane protein function. It is in this overall backdrop that measurements of live cell membrane dynamics with a goal of correlating with cellular function assume relevance. Measurement of membrane dynamics is often challenging due to intrinsic noise associated with cellular systems.

The overall objective of the proposed project is to understand the interplay between membrane organization (dynamics) and function of the human serotonin1A receptor by single molecule analysis of its diffusion (single particle tracking) in live cells. In addition, we plan to explore the role of membrane cholesterol and the actincytoskeleton on dynamics and function of the receptor.

Knowledge Products Developed
- Performance of single particle tracking in live cells.
- Performance of Single particle tracking (SPT) experiments with transfer in receptors as a control of non-raft marker protein, since the serotonin1A receptor could reside in cholesterol and sphingolipid rich regions of the membrane also known as “lipid raft”.
- An important result from single particle tracking approach that labelling with primary or secondary antibodies gave similar diffusion coefficient and radii of confinement.

Publications
SCI Journal Publications : Nil
Paper presented in conference: Nil

Mobility Support
India to France : Collaborators: 3
France to India : Nil

Principal Collaborators

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Control: HEK-293 cell lines expressing His-Myc-5-HT1A
Probing Dense Matter and Strong Gravity

Project No. : 4604-1

Background

A fundamental problem of particle physics is to understand the nature of supernuclear degenerate matter of neutron star cores. One cannot solve this problem by doing experiments in terrestrial laboratories. Possibly the only way to solve this problem is to measure the structural parameters of neutron stars. Another fundamental problem of physics is to probe the strong gravity regime. Strongest gravitational field exist around neutron stars and stellar mass black holes. KHz QPOs are believed to originate from within a few Schwarzchild radii of neutron stars, and hence can be useful to measure the neutron star parameters and to probe the strong gravity region. However, the actual origin of this timing feature is not yet known making it unreliable as a tool yet. In this project, we plan to study kHz QPOs in order to establish this feature as a tool.

Objectives

Analysis and modelling of kilohertz quasi-periodic oscillation (kHz QPO) data of RXTE archive to understand the origin of this timing feature, which could be very useful to constrain neutron star parameters and to probe the strong gravity. More specifically, the French collaborator and his colleagues at IRAP have developed innovative analysis tools to measure energy-dependent phase-lag, covariance spectra, and associated spectral decomposition. These tools are applied to the low mass X-ray binary, 4U1728-34, which shows both lower and upper kHz QPOs. The models of the fractional amplitude vs. energy and energy-dependent phase-lag for kHz QPOs are being calculated by the Indian collaborator, and these models will be compared to the data analyzed by the French collaborator. This will be very useful to probe the degree and nature of the contribution of each spectral component to the origin of kHz QPO. But, since there are many free parameters, the task is extremely challenging, and one has to first identify the small subset of parameters, the fluctuations of which can give rise to the observed fractional amplitude vs. energy and energy-dependent phase-lag.

Knowledge Products Developed

- Precise controlled unit cell growth of epitaxial LAO/STO and Cr doped LAO/STO using pulsed laser deposition technique with in-situ RHEED.
- Successfully grown ultra thin (6uc) films and probed the interface with X-ray photo emission spectroscopy (XPS) in order to understand the metal to insulator transition with Cr doping.

Principal Collaborators

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Publications

SCI Journal Publications : Nil
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators - 2
France to India : Collaborators - 1
On-going Projects

Pure and Applied Physics

Slow Highly Charged Ion Molecule Collisions

Objectives
The basic objective of the project is to study and understand the interaction of very slow highly charged ions with atoms and molecules. The interaction of highly charged ions with matter, in the form of atoms, molecules, clusters and bulk matter is a region of much contemporary interest.

The collaborators propose to study the interaction of the highly charged ions at very low velocities (a few eV/q), such that the interaction times are large, and the target electrons can react to the incoming and outgoing projectile’s electric field. The collisions would not be adiabatic, and a sort of “chemical reaction” would occur with a breakdown of the Born-Oppenheimer approximation.

The availability of slow highly charged ions at both the partner institutes is the main inspiration for the project. It is proposed to do complimentary experiments at the two institutes to address the various aspects of slow highly charged ion molecule collisions.

Background
The project aim is to generate the ability to study extremely slow ion-molecule collisions. This information is of fundamental interest to atomic and molecular physicists, to study processes where the kinetic energies involved in the collision are much smaller than the potential energy carried by the projectile. Such interactions would test the commonly used “Oppenheimer approximation” to calculate potential energy curves.

Such approximations are commonly made in all ion molecule scattering calculations which are ubiquitously done to explain ion atom and ion molecule collisions in plasmas, both man made and naturally occurring.

Knowledge Products Developed
Determined the requirements for pulsing of ion beams and pulsed extractions. The feasibility of producing slow multiple charged ions has been definitively demonstrated in Caen, with ion beams with energy 80qeV achieved. Knowhow on the use of delay line detectors has been exchanged.

Theoretical simulations on the possibility of decoding the kinetic energy releases in ion molecule collisions show that extraction delays of about 50ns are acceptable for the experiments that are being planned.

Publications
SCI Journal Publications : Nil
Papers Presented in Conferences : Nil

Mobility Support
India to France : Collaborators-1, Student 1
France to India : Collaborators-3

Principal Collaborators
C P Safvan
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New Delhi

Amine Cassimi
Centre de Recherche sur les Ions
Caen
Effect of the Correlations in the Statics and Dynamics of Extended Systems

Background
This project aims to investigate the role of strong correlations in the statics and dynamics of extended systems. An example of such a system is a polymer chain (or an assembly of chains) moving in a complex medium which may be pure or disordered. Our research will focus on four aspects of such a correlated system: (i) to investigate the statistics of rare and extreme events (ii) to investigate the first-passage properties associated with the dynamics (iii) to study the avalanche dynamics when the chain moves in a quenched disordered medium and find possible mappings to sandpile models.

Objectives
To understand the static and the dynamical properties of an extended object, with strong correlations between its different parts, is an important challenge in theoretical physics. In addition, recent experiments on a single DNA molecule have raised important new questions regarding the role of correlations in such systems. The main aim of this project is to study the role of correlations in an extended system such as a polymer chain, via theoretical analysis of solvable models as well as extensive numerical simulations. The collaborators plan to study four different aspects of such extended systems: phases and phase transitions, extreme value statistics, first-passage properties and avalanche dynamics. Each of these aspects requires developing new theoretical and numerical tools which is the main objective. Subsequently, it is expected to use the results in various applications.

Knowledge Products Developed
- Analytical results for universal order and record statistics of random walks have been obtained.
- The spatial extent of animal epidemics has been characterized both analytically and numerically using connections to the extreme statistics of branching Brownian motion.
- Analytical results for work fluctuations for a Brownian particle harmonic trap has been obtained.

Publications
SCI Journal Publications : 13
Papers Presented in Conferences : Nil

Mobility Support
India to France : Collaborators -3
France to India : Collaborators -4, Students - 1
On-going Projects

Pure and Applied Chemistry

Studies of Iron Complexes of N/O-Functionalized N-Heterocyclic Carbenes in Homogeneous Catalysis

Background

Initially, the main focus of the project was the development of iron organometallic chemistry of the N–heterocyclic carbene (NHC) ligands, from the specific perspective of their utility in homogeneous reduction catalysis. Similar exploration was also undertaken for the nickel complexes of the N–heterocyclic carbene ligands. In particular, the project involved the preparation of new and innovative N,O-functionalized N–heterocyclic carbene ligands for the stabilization of their iron-NHC and nickel-NHC complexes. The potential catalytic utility of these complexes were then explored in selected organic transformations namely, the hydrosilylation of aldehyde and ketone substrates and the borylation of aryl bromide derivatives. The project demonstrated valuable catalytic potential in the emerging fields of the iron-NHC and the nickel-NHC complexes.

Objectives

The primary objectives of the proposal were:

- the design and the synthesis of original N,O-functionalized N–heterocyclic carbene (NHC) ligands.
- the preparation of the corresponding iron-NHC and nickel-NHC complexes.
- the use of these iron-NHC and the nickel-NHC complexes in homogeneous catalysis as these transition metals are considered inexpensive and abundant.

Knowledge Products Developed

- The generation of new knowledge in the areas of the synthesis and the utility of the iron-NHC and nickel-NHC complexes in the field of the homogeneous catalysis.
- Succeeded to prepare two series of iron complexes and one of nickel complexes. Many of the synthesized compounds are fully characterized, in particular by X-ray analysis.
- In chiral version, the first results gave racemic alcohols.

Principal Collaborators

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Mumbai

Christophe Darcel  
Université de Rennes1  
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Publications

SCI Journal Publications : Nil  
Papers Presented in Conferences : 1

Mobility Support

India to France : Nil  
France to India : Collaborators: 1
On-going Projects

Environmental Sciences

Nutrient Sensing in Plants


Background

Understanding the interaction between Na+ and nitrate have been chosen for several reasons. First they are of extreme importance at both a cognitive level and at the agricultural level, because as stated above, Na+ is the #1 cause of salinity in watered soil and NO3- is the main Nitrogen (N) source for the vast majority of plants and for crops. Second, this couple (NO3-/Na+) is known to interact at the physiological level (Zolla et al., 2010).

We will develop a project integrating 2 approaches: i) candidate gene studies as well as ii) a machine learning approach using the power of systems biology to discover new regulatory signalling network. Since roots are the unique interface between the plant and both studied ions (NO3- and Na+), we will pay special attention to root responses.

Objectives

Food production should increase by 40% by 2050 to cope with the growing population. Two restrictions of increasing production yield have been studied: (i) the presence of salt in at least 20% of irrigated land worldwide, which impairs crop production and (ii) the effect of nitrate on both plant growth and development. The basis of this project is supported by the interaction between nutrition and stress tolerance and specifically the role of nitrate in such mechanisms. The signal transduction pathways involving the CIPK, a family of kinase interacting with a calcium sensor (CBLs) will be studied in Arabidopsis.

The aim of the presented project is to understand the mechanisms by which plants sense the concentration of sodium and nitrate in the media and integrate downstream signalling pathway to adapt their developmental processes. We will have special attention to root developmental responses.

Knowledge Products Developed

- Corona Green based sodium localization study identified CBL9 and CIPK23 as putative salinity sensitive mutants because their root accumulates higher sodium.
- Nitrate modifies the sodium sensitivity of plants.
- NPF5.5 is expressed in the embryo and is involved in nitrogen accumulation

Publications

SCI Journal Publications : Nil
Paper presented in conference: Nil

Mobility Support

India to France : Collaborators: 2
France to India : Collaborators: 2
On-going Projects

Computer Sciences

Arithmetic Circuits Computing Polynomials

Project No. : 4702-1
May 2012 - April 2016

Background

In the field of “computational complexity” the most important issue is to show that some given problem is difficult. This information, apart from its theoretical value, is useful for someone interested in practical applications, because once a problem is shown to be “hard” in some sense then research can turn towards alternative strategies. Two of the three objectives of this project are clearly linked to this issue, as proving lower bounds or establishing completeness are two ways to show that a problem is “hard” in some specific sense. The third objective is the establishment of a framework for showing hardness result (notions of reduction and completeness) in a class of questions which have not been very well studied yet (enumeration) but which have practical importance.

Objectives

- The aim of this project is to better understand arithmetic circuit computations of polynomials and related counting and enumeration complexity questions, organised along three main axes:
- Proving lower bounds for restricted models of computations (multilinear branching programs), with a particular focus on the computation of the determinant.
- Finding new natural complete polynomials for the classes in the general theory defined by Valiant, in particular for the class of feasible computations VP, and understanding the role of the characteristic in results of VNP completeness.
- Defining or refining notions of reduction, completeness, parallel complexity, space bounded complexity for enumeration and studying enumeration questions related to polynomials computed by circuits.

Knowledge Products Developed

- Major contributions to a recent flurry of exciting results in lower bounds for restricted models (depth 4), with the perspective of proving general lower bounds,
- Similar lower bounds for restricted models computing the elementary symmetric polynomials proved
- Obtaining the best non-commutative lower bounds since Nisan’s paper from 1991
- Obtaining the first natural example of a complete polynomial for the class VP of “tractable” polynomials

Principal Collaborators

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Guillaume Malod
Université Paris Diderot - Paris

Publications

SCI Journal Publications : 2
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators -6
France to India : Collaborators -6
Two-Dimensional Electron Gas Physics in Oxide Heterostructures

Project No. : 4704-1
May 2012 - April 2015

Background

Conducting quasi two-dimensional electron gas (q2-DEG) is formed at the interface between the two insulating, dielectric perovskites, LaAlO$_3$ and SrTiO$_3$. Despite numerous investigations, there are still a lot of open questions. The pioneer work of Okamoto et al introducing the concept of “electronic surface reconstruction” to explain the origin of the free charges at the interface is still under debate, and their prediction of a rich phase diagram for ultra-thin LaTiO$_3$ layers on SrTiO$_3$. Related to more general context is of making new devices and functions with oxides heterostructures, the goal of this project is to make and study epitaxial oxides heterostructures of pure and magnetic impurity doped LaTiO$_3$/SrTiO$_3$ and LaAlO$_3$/SrTiO$_3$ systems, where various kind of phenomena like superconductivity, ferromagnetism etc has been discovered.

Objectives

The original aim is to study the physics of the two dimensional electron gas which takes place at the LaTiO$_3$/SrTiO$_3$ interface with three main objectives:

- Phase diagram of the superconducting 2DEG in LaTiO$_3$/SrTiO$_3$ interfaces
- Doping LaTiO$_3$/SrTiO$_3$ structures with Mn or Co.

Knowledge Products Developed

- Optimization of the growth parameters for pure and doped LAO/STO.
- Precise controlled unit cell growth with in-situ RHEED.
- Achieved epitaxial growth of LAO/STO and few doped LAO/STO.
- Measurements of Mn delta doped LAO/STO heterostructures.

Principal Collaborators

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Jérôme Lesueur
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Paris

Publications

SCI Journal Publications : Nil
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators - 1
France to India : Collaborators - Nil
Objectives

The objectives of the project are:

- To study non-equilibrium quantum phenomena in strongly-correlated nanoscale systems like for instance interacting quantum dots in the Kondo regime.
- Examine other ways of achieving non-equilibrium by applying a time-dependent bias or gate voltage. The photo-assisted charge- and spin-noise will be computed for an ac modulation of the external field.
- Address the questions related to charge and spin dynamics after a fast switching (step pulse) of the gate voltage.

Knowledge Products Developed

- An Equation-of-Motion approach (EOM) for the generalized Anderson model in non-equilibrium situation including spin-flip tunneling processes resulting from Rashba interactions.
- A Non-Equilibrium Green Function (NEGF) technique for the calculation of the non-symmetrized current noise at zero and finite frequencies for the Anderson model treated by the Equation-of-Motion approach.
- Spin-polarized current through a quantum dot in the presence of spin-preserving tunneling processes dependent on spin.
- Spin-polarized current through a Rashba quantum dot in the presence of spin-flip tunneling processes.
- Current noise at finite frequency through a quantum dot in the presence of spin-preserving tunneling and eventually additional spin-flip tunneling for Rashba quantum dots.
On-going Projects

Rotating and Curved Boundary Layer Instabilities


Background
Shear flows display a wide range of instabilities and undergo transition to turbulence by vastly different routes. The dynamics of wall-bounded shear flows determines global flow quantities of such friction coefficients and heat transfer rates. In many practical configurations of interest, fluid flows around objects that are curved and rotating. Curvature and rotation both have a major role in stability and transition to turbulence, but the combination has not been studied very much. The combination is likely to display different behaviour from merely the sum of its parts.

Objectives
The proposed research is a blend of theoretical analyser and numerical simulation, in close interaction. Objectives of the project include:

- computation of the unperturbed flow fields;
- linear stability analysis of these flows;
- derivation of fully nonlinear wavetrains;
- secondary stability analysis of these finite-amplitude solutions;
- characterization of the fully developed global flow dynamics.

Knowledge Products Developed
- It is shown that curvature and rotation can work together to significantly modify stability of shear flows.
- Rotating cylinder, axial flow: Base flow computed, linear stability analysis done
- Rotating channel: Linear stability analysis done, transient growth analysis conducted, nonlinear computations ongoing.

Principal Collaborators

Rama Govindarajan
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Hyderabad

Benoit Pier
Ecole Central de Lyon, CNRS
Ecully

Publications
SCI Journal Publications: Nil
Papers Presented in Conferences: 1

Mobility Support
India to France: Collaborators - Nil
France to India: Collaborators - 1
On-going Projects

Pure and Applied Chemistry

Correlated Studies of Response Properties of Open-Shell Molecules in the Relativistic Framework

Project No. : 4705-3
May 2012 - April 2015

Background
The overall objective is to develop computational tools for the study of reactivity and properties of molecules containing heavy elements. Such complexes often display complicated electronic structure. Actinides in particular have several features such as numerous energetically close orbitals and significant relativistic effects making them a challenge for theoretical chemists. We propose to address these challenges by consolidated and successive developments of high level of correlation theory combined with relativistic corrections.

Objectives
The overall objective of project 4705-3 is to develop computational tools for the study of reactivity and properties of molecules containing heavy elements. More precisely, we aim at developing state of the art electron correlation methods (coupled-cluster) providing highly accurate results for molecules displaying relativistic effects, on par with what has been achieved for light elements. It is essential to bring together the complementary expertise of the Indian side in formulating the necessary high-level multi-reference electron correlation theories and that of the French side in implementing them in a highly efficient manner amenable to application in medium-large molecules of spectroscopic and chemical interest.

Knowledge Products Developed
- Overcoming computational bottlenecks in the relativistic coupled cluster code in DIRAC
- Developing a theory for electron correlation which we believe will be able to handle medium heavy elements in a multi-reference manner and be amenable to relativistic corrections.

Publications
SCI Journal Publications : 2
Papers Presented in Conferences : 2

Mobility Support
India to France : Collaborators -2, Student - 2
France to India : Collaborators -1
On-going Projects

Deep Structure of the Indian Continent

Project No.: 4707-1
May 2012 - April 2015

Background

Thickness of the lithosphere has a prominent role in shielding the mantle attrition processes vital for the stability factor of the Precambrian crust making its precise determination important. Additionally, imprints of major tectonic events are manifested as alterations in deep lithospheric architecture. Present day configuration of the Indian tectonic plate is a consequence of its breakup from the Gondwana super continent. Paleomagnetic data demonstrates that the Indian continent moved northwards at exceptionally high speeds (explained by an unusually thin Indian lithosphere). Thermo-barometric estimates in Central India suggest an approximately 175 km thick lithosphere. An analysis of heat flow data and P-T estimates on mantle xenoliths indicate a thick lithosphere beneath south India. To solve this apparent contradiction, we investigate the lithospheric and asthenospheric structure underneath the Indian cratons and the Indian plate and trace its evolution through time.

Objectives

The specific objectives are:

- To assemble teleseismic data registered at all the Indian broadband seismological stations & to constrain the thermal structure of the Indian shield lithosphere and, to characterize the seismic structure and deformation through application of recent methodologies.
- To obtain the crustal structure at high resolution using ambient noise and a 3-D anisotropic, heterogeneous mantle model of the Indian continent and surrounding oceans and, to map lateral variations in the lithosphere-asthenosphere boundary and to calculate synthetic seismograms at the regional scale by spectral element method
- To derive a consistent evolutionary model of the Indian continent by synthesizing the seismic results and constraints from heat flux, petrological and paleomagnetic data.

Knowledge Products Developed

- Collation of the teleseismic data registered at all the Indian broadband seismological stations.
- Determination of phase velocity maps of Rayleigh and Love waves in the period range 35-175s for the fundamental modes and the first overtones. Preliminary tomographic 3D-anisotropic model of the Indian continent.
- Characterization of the Lithosphere Asthenosphere boundary beneath India & 3D P and S wave velocity structure of India from teleseismic travel time tomography. Deformation of the Indian plate by investigating splitting of SK(R)S waveforms from all seismic stations.

Principal Collaborators

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Hyderabad

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Paris

Publications

SCI Journal Publications: 3
Papers Presented in Conferences: Nil

Mobility Support

India to France: Collaborators -2
France to India: Collaborators -4
Objectives

The objectives of the project are to explore, at the gene level, the functional biodiversity of soil eukaryotic microbial communities living in stressful polluted soil environments. This will allow us to characterize genes implicated in adaptation to these stressful conditions such as: heavy metal resistance mechanisms but also genes implicated in basic processes such as organic matter degradation under stressful conditions.

Knowledge Products Developed

- The primary screening of soil cDNA libraries for heavy metal resistance genes.
- The phenotypic validation of heavy metal resistant yeast transformants
- The sequencing of most of the selected genes
- The initial characterization of the selected genes for cross heavy metal resistance
- The characterization of the studied soil eukaryotic biodiversity by means of high throughput sequencing of 18S rRNA genes by the functional complementation of metal sensitive yeast mutants
- The preliminary characterization of several of metal resistant clones
- The survey of the molecular diversity of the soil eukaryotes in the studied sites through high-throughput sequencing of ribosomal RNA

Background

Soil is a reservoir of biodiversity and contains large number of yet to be discovered microorganisms expressing new unidentified genes. This gene reservoir can yield new eukaryotic genes implicated in heavy metal resistance or in organic matter degradation by using “functional meta-transcriptomics” approach, as we do in this project.

Similar but distinct to metagenomics, this approach is a recent culture-independent method in microbial ecology which gives a direct and simultaneous access to the genes expressed by all the eukaryotic microbial species, cultivable or not, living in a common environment. It also has a strong potential in environmental biotechnology to discover novel genes of interest.

Publications

SCI Journal Publications : Nil
Papers Presented in Conferences : 4

Mobility Support

India to France : Collaborators -1
France to India : Collaborators -2
Molecular Mechanisms of Immune Evasion by *M. Tuberculosis*

**Project No. : 4803-1**  
**Project Duration:** Oct. 2012 - Sept. 2015

**Background**
Mycobacterium tuberculosis, an etiologic agent of tuberculosis, is a major cause of morbidity and mortality worldwide. The interaction of *M. tuberculosis* and immune system is of dynamic process and implicates several cellular and molecular partners. The central theme of our proposal concerns molecular dissection of immune evasion mechanisms of *M. tuberculosis* and designing tools for the conception of novel vaccines. Overall, our proposal addresses both basic and medical sciences and is expected to deliver preventive and therapeutic tools to combat tuberculosis.

**Objectives**
- To study differential microRNA (miRNA) profile of tuberculosis patients and to correlate its relevance to disease progression.
- To explore the role of innate pattern recognition receptors (PRRs) and intracellular signaling dynamics in the modulation of miRNA expression by virulent antigens of *M. tuberculosis*.
- To decipher the role of candidate miRNA in the pathogenesis/protection against tuberculosis in vivo.
- To dissect molecular immuno regulatory function of Haemoxygenase-1 (HO-1) and \( \text{CD}_4^+ \text{CD}_{25}^+ \text{Foxp}_3^+ \) regulatory T cells (Tregs), the two major regulators of immune response to an antigen/pathogen, in the pathogenesis of tuberculosis.
- To study the impact of Tregs on miRNA expression pattern and HO-1-mediated immune regulation towards *M. tuberculosis* and to conceive novel vaccine and adjuvant candidate.

**Knowledge processes/products developed out of the project**
The identified molecular regulators that orchestrate immune evasion mechanisms of *M. tuberculosis*.

* **Biomarkers:** In terms of biomarkers, we have identified several miRNA signatures such as miR-155, miR-31, miR-150 and miR-146a which regulate significant evasion strategies. These miRNAs including identified the host signaling pathways can be analysed for host directed therapies (HDT) of tuberculosis.

* **Therapeutic molecules:** We have identified few immunogenic antigens of *M. tuberculosis* like PE, PGRS 17 (Rv0978c), PE, PGRS 11 (Rv0754), Rv1917c (PPE34) and PE, PGRS 62 (Rv3812). They could be utilized as novel vaccine antigens which can be combined with currently used BCG vaccines to boost the vaccine efficacy or can be used as a subunit vaccine.

**Publications**
- SCI Journal Publications : 6
- Papers Presented in Conferences : Nil

**Mobility Support**
- India to France : Collaborators -1, Student - 1
- France to India : Collaborators -1
On-going Projects

Life and Health Sciences

Mechanisms of Lysine Acetyltransferase (Kat/Hat) Activation by Small Molecule Activators and Use Thereof in Memory

Objectives
In the present project:
- Use small molecule activator(s) of histone acetyltransferase conjugated with a glucose derived cell permeable self fluorescent carbon nanosphere as a tool to induce histone hyperacetylation in mice brain.
- Elucidate the mechanisms of induction of the acetylation and its downstream effect gene expression in the neural tissue.
- Study the role of histone acetylation in development of newly-generated neurons and in spatial memory formation. Understand the therapeutic potential of HAT activator(s) in the treatment of neurodegenerative disorders.

Background
There is credible evidence that chromatin modifying machinery has a role in CNS disorders. The CREB-Binding Protein (CBP) plays a crucial role in neuronal survival, as well as in memory formation. Previous work has shown that CBP function is altered in neurodegenerative diseases. As it becomes clear that chromatin is dynamic and is subjected to extensive experience- and age-associated remodeling, it was quickly realized that a pharmacological tool, able to modulate histone acetylation, could represent a good therapeutic option. So far inhibitors of histone deacetylases enzymes have been used, thanks to cancer research. However, HAT activation based therapeutic strategy, and specifically that of CBP, could prove efficient to treat memory disorders found in neurodegenerative diseases.

Knowledge Products Developed
- In vivo activation of HAT (CBP/p300) function after systemic injection achieved for the first time (adult mouse).
- Distribution of the CSP-driven HAT activator (CSP-TTK21) molecule within the organism (mice) following intraperitoneal injection.
- Mechanism of activation of HAT in mice brain especially in the context of autoacetylation 4- Pharmacological activation of the acetyltransferase CBP/p300 enzyme (CSPTTK21 treatment) favors adult neurogenesis (maturation) and improves longterm memory retention in young adult mice.
- CSPTTK21 treatment improves long-term memory retention in a mouse model of Alzheimer’s disease bearing Neurofibrillary Tangles

Principal Collaborators

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Publications
SCI Journal Publications : 3
Papers Presented in Conferences : 3

Mobility Support
India to France : Collaborators -Nil
France to India : Collaborators -Nil
Supra-Molecular Approach to Composite Materials for Advanced Technologies

**Background**
Materials with functionality controlled by molecular composition and order can revolutionise soft solvated materials or optical nanostructured materials. Bottom-up approaches using self-assembly are the most appropriate routes for the synthesis of gel-phase soft materials, copying the advantages of biological systems but exploiting synthetic accessibility and robustness. Nano- and micro-structures controlled in size, shape, order, stiffness, optical stability and tunability are challenges that can individually be overcome but seldom achieved simultaneously. We will combine the 'best of both worlds' to design and develop original molecular systems that induce a synergy between organic and inorganic building blocks. We expect developing functional materials with novel emergent properties for high-tech applications, for example in photonics.

**Objectives**
Composite and hybrid materials result from two worlds with complementary properties. The combination of organic and inorganic components, or two different families of molecules, is a challenge that is addressed using supramolecular interactions. Novel gelators, chelating and bridging ligands are specifically designed for intimate intermixing and structuring into gels of organic self-assembled nanofibers, inorganic nanoparticles and/or lanthanide salts. Besides the synthetic effort performed both at the IISc-Bangalore and at the ISM-Bordeaux, original solvent processing techniques using supercritical fluids are developed at the ICMCB-Bordeaux to form desolvated aerogels and nanoparticles. The interaction of the material with light, revealed at the nanoscale by confocal fluorescence microscopy (ISM), serves as a handle for the understanding of supramolecular interactions and could result in potential applications in photonics.

**Knowledge Products Developed**
- Hybrid cholate/Pd hydrogels were used for Catalysis
- Hybrid cholate/Cd2+ metalogels were combined to luminescent CdSe nanoparticles
- Luminescent anisotropic core/shell NPs were prepared to form composite organogels
- Novel and improved CdSe NPs were obtained in supercritical fluids
- First studies of single NPs by coupled AFM/confocal fluorescence microscopy

**Publications**
SCI Journal Publications : 1
Papers Presented in Conferences : Nil

**Mobility Support**
India to France : Collaborators- 4
France to India : Collaborators- 1, Student - 1

**Principal Collaborators**
- **Uday Maitra**
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On-going Projects

Material Sciences

High Anisotropy Molecular Magnets Synthesis & Modelling

Project No. : 4808-1  
Sep. 2012 - Aug. 2015

Background
This proposal is an off-shoot of the previous IFCPAR project that the PIs had earlier. The motivation for the earlier proposal was our collaboration with late Professor Olivier Kahn who first initiated the project on molecular magnetism between India with Dr. J.V. Yakhmi and Indian PI as his Indian collaborators. During the period, the Indian collaborator of 4808-1 had interacted with Professor Sutter scientifically. After the untimely demise of Professor Kahn, Sutter moved to Toulouse and our collaboration continued since it was complimentary. Dr. Sutter was synthesizing molecular magnets and the theoretical inputs for understanding their behaviour and for tweaking the magnetic properties was provided by my group. Since, this was quite successful, the collaborators continued and under the framework of IFCPAR, formalized it again, facilitating close personal interactions between the two groups which is highly required for this to be fruitful.

Objectives
In this project, on the experimental front, synthesis of some high spin organic-inorganic hybrid magnetic chains involving transition metal ions, rare earth and organic radicals have been synthesized. They have been modelled using a Heisenberg Hamiltonian solved by novel VB technique that has been developed by us. We are also currently studying role of single ion magnetic anisotropy in determining the anisotropy of a magnetic chain.

Knowledge Products Developed

- Synthesis of heptacoordinated Ni(II) and Fe(II) complexes in D5h surrounding.
- Demonstration of their substantial magnetic anisotropy, and effect of ligands on it.
- Preparation of heterometallic compounds with these Ni and Fe building units.
- Novel hetero-trispin (2p-3d-4f) chain compounds.
- Modeling of the magnetic behaviours by novel VB technique.

Publications

SCI Journal Publications : 4  
Papers Presented in Conferences : 3

Mobility Support

India to France : Collaborators - 1, Student - 1  
France to India : Collaborators - 1
On-going Projects

Life and Health Sciences

Control of Melanosomal Biogenesis by Small GTPases

Background

Melanosomes are cell type-specific organelles within retinal pigment epithelial cells and epidermal melanocytes in which melanin pigments are synthesized and stored. They are "lysosome-related organelles" but, as first shown in our group, they coexist with late endosomes and lysosomes. Over the past years we and others have performed studies to decorticate several aspects of early and late melanogenesis. Stage I premelanosomes correspond to early endosomal vacuoles that serve as intermediates for cargo bound both for lysosomes and melanosomes at different stages. Using High Pressure Freezing (HPF) and electron tomography we have shown that premelanosome fibrils form in association with intraluminal endosomal membranes and that fibrils assemble into fibrillar sheets upon which melanin deposits. Melanin synthesis during late melanogenesis requires delivery of melanogenic enzymes from yet still distinct endosomal domains.

Objectives

- Investigate the role of small GTPasesRab in endosomal trafficking in melanocytes and in the production of functional melanosomes. Endosomes are required intermediates in trafficking to the melanosome. Aim to unravel the mechanisms involved in maintenance and specialization of the endosomal domains and in the establishment of the dialogue between endosomes and melanosomes.
- Investigate the function of GTPases of the Arl family in the formation of melanosomes.
- Investigate how trafficking in melanocytes controlled by these proteins and melanocyte biogenesis/transfer is influenced by interactions with keratinocytes.

Knowledge Products Developed

- Identified several endosomal Rab GTPases that regulates different protein trafficking pathways in melanosome biogenesis.
- Unraveled a previously unknown post Golgi-melanosome pathway required for melanocyte pigmentation and controlled by Rab6AA' GTPases.
- Identified an Arf-like GTPase (ARL4A), which regulates melanosome biogenesis by controlling AP-3 dependent cargo transport to melanosomes.

Publications

SCI Journal Publications: 3
Papers Presented in Conferences: 5

Principal Collaborators

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Mobility Support

India to France: Nil
France to India: Nil
On-going Projects

Life and Health Sciences

Study of Neural Development in hiPS Models of Microcephaly

Objectives

- To generate human induced pluripotent stem (hiPS) cell lines from normal human fibroblasts and patients fibroblasts mutated in MCPH1.
- To differentiate normal and patient hiPS cell lines into neural progenitors and differentiated cortical neurons.
- To study cell cycle and proliferation of neural progenitors from normal and patient hiPS lines.
- To study cortical neurons specification (layer markers and connexions).
- To study mode of cell division and centrosome composition in neuronal progenitors derived from hiPS cell lines.

Background

Human Primary Microcephaly is an autosomal recessive genetic disorder manifested in a reduction of cortical outgrowth causing congenital microcephaly and mental retardation. Study of neural development in vertebrates and notably to use mouse and human embryonic stem (ES) cells to understand key steps of neuronal differentiation and model human diseases is important, as the project aims to do. We have been able to describe the contribution of extrinsic and intrinsic factors on the differentiation of ES cells into mature granule neurons, a means to better control the fate of neural progenitors in vitro. The project aims to differentiate human ES cells into cortical neurons and use dermal fibroblasts from patients carrying mutations in genes involved in brain growth to model human microcephaly, using the hiPS reprogramming strategy.

Knowledge Products Developed

- Fibroblast reprogramming
- Preliminary experiments on SHSY5Y
- Cloning of upregulation vector for STIL

Sagittal section from an adult mouse cerebellum labelled in green with the neuron-specific beta-tubulin antibody and showing successfully engrafted cerebellar progenitors labelled with red tracer (DsRED). This picture has been selected to appear as the cover page of the April issue of the STEM CELLS journal (AlphaMed press)

Principal Collaborators

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Publications

SCI Journal Publications : 1
Papers Presented in Conferences : 2

Mobility Support

India to France : Collaborators- 1
France to India : Collaborators- Nil
Reversals of a Large Scale Field on a Turbulent Background


Background

According to geophysical observations, the magnetic field of the Earth is known to have reversed with random time interval. The solar magnetic field however reverses approximately every eleven years. A recent laboratory experiment using a von Karman flow of liquid sodium (VKS experiment) exhibits similar features for different parameter regimes. The above field reversals bear certain similarity with the reversals of the large scale velocity field in turbulent convection, as well as in Kolmogorov flows. The recent experimental observations of magnetic fields generated by turbulent flow have prompted new interest in the studies of magneto hydrodynamic (MHD) flows in liquid metals and plasmas. Such flows raise both fundamental problems, as well as find applications in geophysics, astrophysics, and various industrial processes.

Objectives

The objectives of the project are:

• To explore quasi two-dimensional turbulence with Kolmogorov-like forcing and study the behaviour of large-scale modes of the flow.
• To use numerical simulations and theoretical models to understand experimental results as well as observations related to a striking phenomenon: the dynamics of large scale fields on a turbulent background.
• To determine why a small number of large-scale modes accurately capture the dynamics of the reversals although these systems are strongly turbulent.
• To study how reversals are triggered and determine their correlation with the fluctuations of the energy flux that drives the large scale modes.

Knowledge Products Developed

• Flow reversals and condensate states in Kolmogorov flow in two-dimensional geometry. Observed an excellent agreement between the simulations and experiments.
• Numerical study of energy transfers during reversals of the magnetic field. It has been shown that the power of the Lorentz force decreases before reversals.
• Flow reversals in free-slip RBC in two dimensions for large Prandtl number convection.
• Symmetries of the flow reversals identified as Z2xZ2 group.

Publications

SCI Journal Publications : Nil
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators- 1
France to India : Collaborators- Nil
Background

In the quest for making functional devices smaller, the thickness of polymer films has reached values even smaller than the diameter of the unperturbed molecule. However, despite enormous efforts, our understanding of the origin of some puzzling properties of such thin films is still not satisfactory. In our project we bring together two complementary groups for studying confined polymer films in order to find out how and why properties of polymers in thin films differ from their behaviour while in bulk. Aiming at unveiling the origin for such “mysterious” behaviour, we will relate structural properties as determined by reflectometry techniques with the dynamics of polymer chains in thin films determined via dewetting experiments. The ultimate goal is to propose a general concept relating molecular aspects and the properties of thin polymer films.

Objectives

- Prepare a uniform, smooth and continuous ultra-thinnest polymeric film, which has anti-corrosion and hydrophobic properties, on semiconductor surface. This study is not only important from the technological point of view but also it has fundamental importance in understanding the origin of strong interaction between solid surfaces with the extremely confined polymer chains.
- Understanding the role of concentration in determining the ultimate structure of the triblock copolymer films on Si surface. Role of their initial structures in swelling behaviour under humid environment.

Knowledge Products Developed

- Preparation of ultra-thinnest films (≤ 2nm) of PS by spin-coating followed by toluene rinsing.
- Characterization of the films by x-ray reflectivity and Atomic force microscope.
- Ultra-thinnest film of PS shows anti-corrosion and strong hydrophobic characteristics.
- Structure of PEO-PPO-PEO triblock copolymer ultra-thin films is greatly influenced by the concentration of polymeric solution used for the film preparation.
- A compact, continuous and uniform film begins to form at 4.5 g/l concentration. Below this concentration the films are incomplete and discrete.

Publications

SCI Journal Publications : 5
Papers Presented in Conferences : 5

Mobility Support

India to France : Collaborators -5
France to India : Collaborators -4
On-going Projects

Objectives

- Development of in-depth understanding of intrinsic properties of a Time Projection Chamber (TPC) based on Micromegas detectors.
- Optimize design/operational parameters of the TPC device.
- To study the effect of such power pulsing in a given magnet field.
- Detailed detector simulation of the Micromegas-based TPC.
- Train young students to design and work with the Micromegas detector.
- Exploration and initiation of work in socially relevant areas like medical imaging or industrial imaging, homeland security using Micromegas.
- Possibility of low cost production of Micromegas in local industries.

Background

Accelerator based High Energy Physics (HEP) research requires very precise tracking detectors that are capable of handling high luminosity, are stable and less expensive. TPCs based on the Micromegas detectors can be a very strong candidate in this context. There can be good utilization of the Micromegas detectors in various other fields, as well. These include low or medium energy nuclear physics, astro-particle physics, medical or industrial imaging, homeland security. To achieve this we need to develop a thorough understanding of various characteristics of the Micromegas detectors under different environments. These characteristics are determined through complex physical processes occurring inside the detector. It is towards this development of understanding that this project is oriented.

Knowledge Products Developed

- Design and fabrication of two small and simple TPCs have been completed. A well-equipped test bench set up to carry out off-line experiments with test boxes and TPCs has been completed.
- Two-phase CO2 cooling has been used to dissipate heat on the end-plates and the complete process carefully simulated.
- In-beam experimental data has been analyzed to illustrate the effect of electrostatic distortion on the Micromegas based end-plates.
- Detailed numerical simulation has been carried out to interpret the experimental observations.

Publications

- SCI Journal Publications: 3
- Papers Presented in Conferences: 3

Mobility Support

- India to France: Collaborators - 3: Students - 2
- France to India: 1
Thermo-Hydrodynamics of Phase-Change Induced Oscillating Taylor Bubble Flows

Project No. : 4408-1

Objectives
The objectives of the project are to study thermo-hydrodynamics of phase-change induced oscillating Taylor bubble flows in mini-micro channels under various boundary conditions namely: Mini-Micro Channels (typical hydraulic diameter 500 µm to 3 mm); Adiabatic as well as diabatic conditions; Controlled/uncontrolled oscillations of Taylor bubbles and Various fluid/solid combinations (most important being transparent material for a proper observation of the thermo-hydrodynamic phenomenon). We plan to employ Particle Image Velocimetry (PIV), Infra Red Thermography (IRT) and High Speed Videography (HSV) to achieve this aim. The results will have direct implications on design and understanding pulsating heat pipes, compact phase change electronics cooling modules, micro-fluidic devices and micro-biochemical reactors and mass transfer systems.

Background
The project is focused on bubble dynamics and associated heat transfer during two-phase flows in mini/micro/capillary pipe geometries. This configuration and these phenomena are of high importance in a variety of situations of practical engineering problems of various fields, from thermal control (heat pipes) to microfluidic devices, MEMS, etc.

Knowledge Products Developed
• Establishment of a self-sustained and autonomous, thermally driven oscillating two-phase system,
• Discerning the complex operating thermo-physics of this unique system and role of wetting dynamics on the overall pressure drop and local heat transfer is another achievement.
• Improved, next generation mathematical model of a pulsating heat pipe device.
• Valuable inputs for the fundamental process of evaporation during motion of Taylor slugs inside capillary tubes, both under steady and oscillatory motion.
• The results are specifically useful for the development of comprehensive models for Pulsating Heat Pipe and understanding the flow in the condenser sub-section of Loop Heat Pipes.

Principal Collaborators
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Kanpur
Jocelyn Bonjour
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Publications
SCI Journal Publications : 13
Papers Presented in Conferences : 18

Mobility Support
India to France : Collaborators - 2
France to India : Collaborators - 2
On-going Projects

Water

The Kosi River Alluvial Dynamics

Objectives

The objective of the project is to study the dynamics of an alluvial fan building and evolution with a special emphasis on avulsion dynamics. The specific objectives are:

• To understand the historical-scale dynamics of the Kosi alluvial fan through numerical modeling and flume experiments,
• To estimate the modern sediment flux in the Kosi river and relate this to morphological changes e.g. Channel aggradation and flooding,
• To understand the alluvial architecture and long-term (pre-historic) avulsion history of the Kosi river through geophysical surveys and shallow coring.
• To estimate pre-historic sediment flux in the Kosi fan using geochemical (isotopic) methods and to understand the forcing functions (climate-tectonics coupling).
• To develop long-term strategy for river management in this region based on process-response system.

Background

The objective of the project is to study the dynamics of an alluvial fan building and evolution with a special emphasis on avulsion dynamics. The project site is located in north Bihar India and is looking at the Kosi river which has built the largest alluvial fan in the world and is also know for raid and frequent avulsion. The project is making use of physical models and cellular automatas of alluvial fans and braided streams and their application on the field to the study of the dynamics of the Kosi fan system in north Bihar, India. Two physical models are being developed and analyzed, one on the braided channel dynamics, and one alluvial fan building. A cellular model of fan dynamics will also be developed. Together with field surveys the models will help understand the stability of a stream on its fan and will also make recommendations on best engineering practices on such dynamic rivers such as Kosi for designing a sustainable management strategy.

Knowledge Products Developed

• Alluvial stratigraphy of the Kosi megafan
• Sediment Transport and Channel Morphology of the Kosi River, India
• 1D theoretical and experimental fan

Principal Collaborators

Rajiv Sinha
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Publications

SCI Journal Publications : 1
Papers Presented in Conferences: Nil

Mobility Support

India to France : Collaborators - 3
France to India : Collaborators - 3
On-going Projects

Computer Science

Constraint-based Design of Controllers and Prefilters


Background

The task of designing and implementing a controller or a control strategy on any industrial or laboratory plants is a tough and complex exercise. Uncertainty in a system comes from modeling errors of the plant, or diversity of exogenous disturbance. We often hope classical controller would satisfy the performance objectives for a large range of parameter variations in control system design. However, in reality, classical controllers usually achieve the desired performance in a limited range of disturbances and parameter variation. Thus, it is necessary to design robust controller which a priori takes into account the uncertainties in the plant model parameters and disturbance. Quantitative Feedback Theory (QFT) is a well-known approach for designing robust control system. However, the manual approach is often tedious and time taking, and usually leads to considerable over designs.

Objectives

Many applications in science and engineering require automatic control of several variables that strongly interact with each other. To effectively handle variations in the system parameters and cope with external disturbances, a robust control system is desired. Robust controller and prefilter synthesis of system is of great practical interest, and their automation is a key concern in control system design.

Specific objectives of the project are:

- To develop an ICST-based procedure for automated design of QFT controllers for multivariable systems;
- To develop an ICST-based procedure for automated design of QFT prefilters for multivariable systems;
- To develop computer code for the proposed procedures, and to integrate it into industrial strength MATLAB toolboxes;
- To test and validate the computer codes through extensive computer simulations;
- To test the efficacy of the developed procedures and codes, via real-time experiments performed on a magnetic levitation system in the laboratory.

Knowledge Products Developed

- Designed controllers and pre-filters are tested on the complex uncertain plants like the industrial plant and the magnetic levitation plant

Publications

SCI Journal Publications : 3
Papers Presented in Conferences : Nil

Mobility Support

India to France : Nil
France to India : Collaborators - 3

Principal Collaborators

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**On-going Projects**

**Life and Health Sciences**

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**Evaluation of Cellular and Immune Response in Mice and Patients with Acute Promyelocytic Leukemia Treated with Arsenic Trioxide**

**Project No. : 4503-2**  **July 2011 - June 2014**

**Background**

Acute promyelocytic leukemia (APML, APL) is a subtype of acute myelogenous leukemia (AML), a cancer of the white blood cells. In APL, there is an abnormal accumulation of immature granulocytes called promyelocytes. The disease is characterized by a chromosomal translocation involving the retinoic acid receptor alpha (RAR) gene and is distinguished from other forms of AML by its responsiveness to all-trans retinoic acid therapy. APL was first characterized in 1957 by French and Norwegian physicians as a hyperacute fatal illness. Currently it is one of the most treatable forms of leukemia with a 12-year progression-free survival rate estimated to be approximately 70%. But several patients still suffer a relapse. Efforts to improve clinical outcomes in this group are ongoing.

Kaplan-Meier survival curves showing that the combination of ATRA+ATO+pVAX14 is the best in rescuing the APL mice.

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**Objectives**

The overall goal of this collaboration is to study the effects of novel agents used in the treatment of acute promyelocytic leukemic on the immune response through preclinical studies in mice models and ongoing clinical trials in patients. In specific:

- Study antibody responses to acute promyelocytic leukemia (APL) in mouse model of acute promyelocytic leukemia and in APL patients with newly diagnosed and relapsed acute promyelocytic leukemia treated with an arsenic trioxide based regimen.
- Study immune reconstitution and cellular response to APL in patients with newly diagnosed and relapsed acute promyelocytic leukemia treated with an arsenic trioxide based regimen.
- Study safety and efficacy of PML-RARα targeted DNA vaccine as an adjunct to arsenic trioxide in the treatment of a mouse model of acute promyelocytic leukemia mice with and without all-trans retinoic acid.

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**Knowledge Products Developed**

- Transfer of transplantable mouse model of acute promyelocytic leukemia (APL) to India. Established and validation done of the pre-clinical mouse model for evaluation of the vaccine strategy under evaluation.
- The DNA plasmid vaccine was evaluated and validated in the mouse model. Combined data from both laboratories established the superiority of ATRA+ATO+pVAX14 vaccine over all other combinations in long term survival.
- Technology for the in-house preparation of RARA proteins was established.

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**Principal Collaborators**

- Vikram Mathews  
  Chistion Medical College  
  Vellore

- Christine Chomienne  
  Institute of Universitaire Hématologie  
  Paris

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**Publications**

- SCI Journal Publications : 1
- Papers Presented in Conferences : Nil

**Mobility Support**

- India to France : Collaborators- 2
- France to India : Collaborators- 3
Mechanisms of New Long-Lasting Luminescence Biomarkers

**Background**
A biomarker, or biological marker, generally refers to a measured characteristic which may be used as an indicator of some biological state or condition. In medicine, a biomarker can be a traceable substance that is introduced into an organism as a means to examine organ function or other aspects of health.

The project aims at developing novel biomarkers emitting red Long-Lasting Phosphorescence (LLP) for in vivo small animal optical imaging. The biomarkers are first excited by ultraviolet light for a couple of minutes outside the animal body, then injected to the animal, where they emit red/infrared light detectable for several hours after the injection.

**Objectives**
- Development of Long Lasting Luminescence Materials
- Study of Structural and Optical Properties
- Identification of Defects participating in LLP mechanism

**Knowledge Products Developed**
New long-lasting phosphorescence (LLP) materials, ZnGa$_2$O$_4$:Cr and MgGa$_2$O$_4$:Cr were prepared and characterized by several techniques like electron paramagnetic resonance (EPR) spectroscopy, thermally stimulated luminescence (TSL) and X-ray absorption fine structure (XAFS) spectroscopy to identify defects responsible for LLP property. The materials developed show excellent LLP properties for UV or X-ray excitation. Furthermore, LLP is also observed using relatively less harmful visible light as excitation source. This has a great implication in bio-imaging as the biomarker can now be re-excited from within the animal body thereby enhancing the detection time. Our results indicate that the mechanism of LLP induced by visible light excitation is entirely localized around Cr$^3+$ ion with an antisite defect in its first cationic neighbour (CrN2).

**Principal Collaborators**
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**Publications**
SCI Journal Publications : 8
Papers Presented in Conferences : 9

**Mobility Support**
India to France : Collaborators -2; Students -2
France to India : Collaborators -4
On-going Projects

Environmental Sciences

Controlling for Upscaling Uncertainty in Assessment of Forest Aboveground Biomass

Project No.: 4509-1

Background
The goal of the project is to assess uncertainty in evaluation of forest aboveground biomass at critical steps of the upscaling process from local forest data to regional extrapolations, in order to improve large-scale biomass and carbon stock assessments. It focuses on the humid forests of the Western Ghats of India, for which field data, satellite images and detailed vegetation maps are available. This project is an accompanying research of the National Carbon Project (NCP) led by the Indian Principal Collaborator. It is also part of a research programme of the French Principal Collaborator, which searches for a pertinent integration of the allometric theory of plants with 3D simulations of forest stand dynamics and canopy texture analysis in order to predict properties of forest stands at multiple spatial scales. The project has great potential applications within the framework of NCP and more generally within the REDD+ mechanism on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries. Following its approval in the beginning of 2013, a kickoff meeting was held in April 2013 in Pondicherry.

Significant knowledge products developed out of the project
- Evaluation of plot-level allometric AGB models
- HR Satellite data acquisition and analysis
- Forest-type classification using various resolution satellite data and vegetation maps
- Field data collection and analysis
- 3D simulations of stand structure variations

Publications
- SCI Journal Publications: 2
- Papers Presented in Conferences: 2

Mobility Support
- India to France: Collaborators: 1, Students: 1
- France to India: Collaborators: 5

Principal Collaborators

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Indian Institute of Remote Sensing
Dehradun

Pierre Couteron
Botanique et bioinformatique
de l'Architecture des Plantes,
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Objective
The main objective of the project is to assess uncertainty in evaluation of forest aboveground biomass (AGB) at critical steps of the upscaling process from local forest data to regional extrapolations, in order to improve large-scale biomass and carbon stock assessments.

The project will focus on the humid forests of the Western Ghats (WG) of India, for which field data from forest sample plots, satellite images at various spatial and spectral resolutions, as well as detailed vegetation maps are available. This project can be seen as an accompanying research programme of the Indian National Carbon Project of ISRO-Geosphere Biosphere Programme. The specific goals are:
- Conversion of tree measurements into plot-level AGB estimates: as a first task we propose to conduct
- Prediction of nominal forest-type AGB densities
- Landscape-scale extrapolation of AGB estimates

Environmental Sciences
On-going Projects

Life and Health Sciences

Genome-wide Recruitment Profiling of BLM after DNA Damage

Project No. : 4603-1  Nov. 2011 - Oct. 2015

Background
Mutation in the BLM helicase results in Bloom syndrome (BS), an autosomal recessive disorder. Patients with BS exhibit hyper-recombination and are prone to almost all forms of cancer. Although previous research has clearly implicated the BLM protein in the DNA Double Strand Breaks (DSB) response and repair, its exact role in these pathways still remains to be fully deciphered. We have recently developed a new system capable of generating sequence-specific and annotated DSBs across the genome. This technology can be used to profile DSB repair proteins around multiple breaks at high resolution, when coupled to high throughput technologies like ChIP-chip and ChIP-seq. Using this system, we propose to generate the first comprehensive recruitment map of BLM on the human genome, before and after DSB induction. This will be a major step towards characterizing how BLM accumulates at DSB sites, and reveal the factors that contribute to its recruitment.

Objectives
The specific aims of the original project were:

- ChIP-chip profiling of BLM at DSBs generated by AsiSi-ER, in asynchronous cells
- Profiling of BLM at DSBs generated by AsiSi-ER, in synchronized cells
- Investigate the determinants that control BLM accumulation at DSBs

Knowledge Products Developed

- First high resolution map of BLM around more than a hundred DSB
- Correlation with RAD51 distribution at DSB
- Correlation with resection
- Requirement of BLM for resection

Publications
SCI Journal Publications : Nil
Papers Presented in Conferences : 6

Mobility Support
India to France : Collaborators-NIL
France to India : Collaborators-NIL
**On-going Projects**

**Pure and Applied Physics**

**Real-time Imaging Through Fog Over Long Distances (RITFOLD)**

**Background**

The problem of imaging through turbid media has elicited great interest in the optics community. This may be attributed to fundamental aspects of light propagation through diffusive media on the one hand, and the large potential for application for augmented-vision through diffusive atmosphere for navigation and transportation safety. Several techniques have been developed either using time-consuming image reconstruction strategies (inversion algorithms) or cost-prohibitive time-gating techniques which employ a pulsed light source and a time-gated ultra-fast camera to detect ballistic photons. Development of affordable and user friendly systems that could be implemented on small aircrafts, and introduced on small airports that are not equipped with radio-frequency Instrument Landing Systems.

**Objectives**

The project aims to devise a method of real-time imaging through fog over long distances. When light travels through such inhomogeneous media, recurrent strong random scattering causes light trajectories to be largely diffusive. We seek to separate the few ballistic photons from the large number of diffusive photons (1:10⁶), so as to form images. The novelty of the project is that it attempts imaging in the field, in natural fog, and aims at creating real-time images, so that the technique may have practical applications in navigation.

**Significant knowledge products developed out of the project**

- Light transmitter in field and receiver in lab. Setup. Remote control facility setup, enabled control of emitter atop tower, and camera in lab in France. These may be accessed by users anywhere in the world, by cell phone.
- Extensive data acquisition and analysis in the field under various weather conditions. Polarisation based imaging performed in natural foggy conditions over distance of 1.3km.
- Different polarimetric estimators found suited under different weather conditions.
- Different filtering techniques evaluated for full-field real-time amplitude demodulation.
- Tabletop experiments carried out using subsampling of a modulated signal with intensified camera.

**Principal Collaborators**

- Hema Ramachandran
  Raman Research Institute
  Bangalore

- Mehdi Alouini
  Université de Rennes
  Rennes

**Publications**

- SCI Journal Publications : 2
- Papers Presented in Conferences : Nil

**Mobility Support**

- India to France : Collaborators - 2
- France to India : 2
On-going Projects

Material Sciences

Developing Design Guidance for Rammed Earth Construction

Project No. : 4608-1
Nov. 2011 - Oct. 2015

Background
Buildings sector contributes >40% of GHG emissions globally. Primary energy consumption in the building sector is attributable to embodied energy of materials and building systems. There is a need for evolving low embodied carbon construction materials in order to reduce GHG emissions. Rammed earth is a low embodied carbon and eco-friendly construction material, which utilises local soil resources. There is a lack of standardised testing procedures for assessing the strength of rammed earth walls. Currently available codes of practice on rammed earth lack proper design guidance. The novelty of the project is to standardise the testing procedure for evaluating the strength of rammed earth and to develop design guidance. The outcome of the project will help the professionals involved in promotion of rammed earth constructions.

Objectives
Rammed earth can be categorised into stabilised rammed earth (SRE) and unstabilised rammed earth (USRE). These two types have distinctly different characteristics in terms of strength, stiffness and elastic properties. The project focuses on the following aspects of USRE and Cement stabilised rammed earth (CSRE.) :

- Standardising specimen size for assessing the characteristic compressive strength. Variables: Soil grading, density and cement content
- Establishing stress strain relationships and elastic constants (modulus, Poisson's ratio, etc) considering soil grading, density and cement content as variables
- Examining compressive strength of CSRE and USRE with different slenderness ratios and load eccentricities, for deriving stress reduction factors.
- Examining behaviour of rammed earth elements under lateral loads in order to assess the behaviour under seismic or wind loads.

Knowledge Products Developed
- State-of-the-art computer controlled, Servo-hydraulic Structural Test System with ability for bi-directional loading with two actuators has been designed and installed. The structural system has a horizontal clearance of 1500 mm and a vertical daylight of 4300mm. The system has 2000 kN vertical actuator and 500 kN actuator for horizontal loading with pressure transducers & digitally controlled system with host computer.

Publications
SCI Journal Publications : 1
Papers Presented in Conferences : Nil

Mobility Support
India to France : Collaborators : 1
France to India : Collaborators : 1

Principal Collaborators

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J. C. Morel
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Vaulx en Velin
Research of New Layered Oxides for Energy Storage and Conversion

Objectives
The collaborators propose to explore the synthesis and characterization of new layered phases potentially attractive as electrode materials for secondary lithium batteries and/or thermoelectrics. The research will be focused on transition metal oxides. The mixed valences of these materials obtained by low temperature synthesis or electrochemistry will allow to adjust physical properties. Structural-chemical bond properties relationships will be studied and the possibility to use these materials as materials for electrodes for power generation systems.

Knowledge Products Developed
- Study of (Cu, Li)xTiOPO₄
- Exploration of Fe-S/P-O system
- Synthesis and electrochemical characterizations of Fe₃(PO₄)_,OH₂ NaFe₃(SO₄)₂(OH)₆ and Fe₂O(SO₄)₂
- Exploration of A-V-P-O system
- Synthesis and electrochemical characterizations of Na₂VO(HPO₄)₂

Principal Collaborators

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Valerie Pralong
Laboratoire CRISMAT, ENSICAEN
CAEN

Background
Electronic devices are highly dependent on the properties of their power sources which involve layered transition metal oxides. Environmental concerns have encouraged the development of research of new materials. The key of the majority of the physical properties, the most important parameters remain to be the duality between electronic and ionic conductivity which could be generated by the electrochemical-driven redox reaction. Tuning the electronic-ionic allows researchers to control the transition metal valences and then the electronic properties which are the basement for a majority of today’s applications. The most relevant example could be the lamellar cobaltite compound LixCoCO₂ commercially used in Li-ion batteries while the isotypic phase NaxCoO₂ is actually intensively as a new thermoelectric material without forgetting the hydrated phase NaxCoO₂·yH₂O which presents superconductivity.
Multilingual Word Spotting for Degraded Documents

Project No. : 4700-IT-1  
May 2012 - April 2015

Background
In India and France (but not only) there are huge scanned documents some of which are historical documents. Most of them are with noisy background and broken foreground, handwritten, with graphics etc. For retrieval of relevant documents from this huge database and for their categorization, OCR are not usable. That is the reason why word-spotting received an increasing interest during the past few years since it allows querying using image comparison and does not rely on any transcription/annotation. Even if some pieces of work on word spotting have been done, it remains a challenging issue, especially considering multi-lingual aspect, robustness to partial degradations of words, multi-oriented text. The project will be mainly dedicated to printed modern and historical documents (but extension to handwritten documents could be considered) written in main Indian languages like Bangla, Devnagari and Telugu, along with English and French languages for the benefit of the two collaborative countries.

Objectives
The objective of the project is to develop a word spotting method which is an interesting alternative to OCR for document indexation and retrieval of specific documents (degraded, historical, graphics, handwritten etc.). The main goals that need further research are to be able to:

• retrieve candidates not exactly similar to the query;
• search inside graphical parts with multi-oriented text;
• search with multilingual abilities;
• integrate user feedback to improve the ranking of the retrieval.

Significant knowledge products developed out of the project

• The Flexible Sequence Matching (FSM) approach based on Dynamic Time Warping algorithm and its variants has been improved. In case of word spotting, it is configured to allow to skip elements in target lines at beginning/end and to skip local degradations or variations, allowing robust matching between a query image and variations of it.
• The developed two-stage approach for word spotting in graphical documents has been improved to handle Latin as well as Indian scripts. The text/graphic separation part has also been improved using components extraction and filtering or alternatively, using Gabor filters.

Principal Collaborators

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Publications

SCI Journal Publications : Nil  
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators - 2, Students - 1  
France to India : Collaborators - 3
On-going Projects

Life and Health Sciences

Anti-factor H Autoantibody Associated Hemolytic Uremic Syndrome

Project No. : 4703-1
Sept. 2012 - Aug. 2015

Background

Hemolytic uremic syndrome (HUS), characterized by hemolytic anemia and thrombocytopenia, is a chief causes of acute renal failure in children. There is increasing recognition of the role of the complement regulatory pathway in its pathogenesis. Autoimmune HUS, associated with autoantibodies to complement factor H, accounts for a significant proportion of patients across the world and even more in India. The centers in Paris & New Delhi, that have collaborated for more than 8-yr in studying the magnitude, clinical profile, genetics, pathogenesis and therapies for this unique disorder, have consolidated their work through CEFIPRA support.

Objectives

- Validate anti-factor H antibody assay in India and establish a normal threshold
- Insights into mechanisms of autoimmunity against factor H by examining: (i) MHC haplotype; (ii) deficiency of CFHR1 in patients, relatives, controls
- Screen for mutations in genes implicated in susceptibility to HUS
- Study anti-factor H cellular immune response, through constitution of a peripheral blood mononuclear cell & plasma samples bank of patients
- Microbial triggers associated with the disease: (i) collection of clinical data, (ii) parasitological & bacterial exam of stools, (iii) serological identity of infections

Significant knowledge products developed out of the project

- Establishing and validating anti-factor H antibody assay; defining normal levels; offered to patients from across the country
- Setting up of large clinical database on atypical HUS
- Setting up ELISPOT assay for study of cellular immune response against factor H, using cultured PBMC stimulated with factor H
- Validation of multiplex approach for detecting 16 microbial pathogens (including genes for shigatoxins) in stools from patients in France & India
- Characterization of anti-CFH antibodies: isotyping, binding specificity; estimating immune complexes; sheep red cell lysis
- Flow cytometry for expression of membrane cofactor protein (CD46); genetic sequencing of CD46

Principal Collaborators

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Publications

SCI Journal Publications : 3
Papers Presented in Conferences : 6

Mobility Support

India to France : Collaborators - 2, Students - 1
France to India : Collaborators - 1
Development of Carbon Nanotube-Metal Hybrid Catalysts

Project No. : 4705-1  May 2012 - Oct. 2015

Background
Construction of highly efficient and recyclable heterogeneous catalysts applicable in a variety of organic transformations with high degree of selectivity is an important objective from academic and industrial perspectives. For these novel catalytic systems, carbon nanotubes (CNT) were chosen as support due to their low cost, stability, high surface area, inertness, tunable topography, and their ability to stabilize transient higher oxidation states of supported metals. Although CNT-supported noble metal catalysts have been employed in selected organic transformations, due to poor distribution of metal nanoparticles along the nanotube, their performance was unpredictable. It is possible to overcome this problem by uniformly embedding metal nanoparticles on functionalized nanorings around CNT. A catalyst on these lines can be robust and exhibit superior catalytic efficiencies in various organic reactions.

Objectives
Design and construction of metal catalysts supported on carbon nanotubes (CNT): Proposed to be carried out via self-assembly of surfactants that form supramolecular nanorings around the CNTs and anchoring of metal nanoparticles on the CNT-nanorings resulting in supramolecular structures that would function as highly efficient and recyclable heterogeneous catalysts in various organic reactions.

Nanohybrids as catalysts in organic transformations: The study of gold (Au), palladium (Pd) and platinum (Pt) embedded on the CNT-nanorings was proposed as these metals are known to be excellent catalysts for diverse organic reactions: For instance, (a) Au-CNT hybrids should be efficient for chemoselective hydrogenation, stereo-and regioselective cyclization and regioselective ring opening; (b) Pd-CNT hybrids for hydrogenation and various coupling reactions such as Heck, Suzuki, Sonogashira, and Tsuji-Trost; (c) Pt-CNT hybrids for sequential hydrogenation-oxidation, intramolecular Diels-Alder reaction-ring opening etc; (d) Mixed metal (e.g. Pd-Au) hybrids for alcohol oxidation and sequential reactions, e.g. coupling hydroamination.

Knowledge Products Developed
- The use of CNT-supported Pd nanoparticles for Suzuki couplings.
- Excellent results for the first example of room-temperature reactions with unreactive chlorinated aromatics

Principal Collaborators
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Publications
SCI Journal Publications : 5
Papers Presented in Conferences : Nil

Mobility Support
India to France : Collaborators - 1
France to India : Collaborators - 2
On-going Projects

Pure and Applied Chemistry

All Polymer Flexible Gas Sensors (Flexi-Sensors)

Project No.: 4705-2
May 2012 - April 2015

Background

Chemi-resistive sensors based on metal oxide semiconductors have been extensively studied for detection of various toxic gases because of their reasonably good sensitivity, stability, and convenience of operation. Nanostructured oxide-semiconductors though exhibit better sensitivity to different gases, their potential for the commercial sensors is hampered by high operating temperatures and lack of selectivity. Conducting polymers have also been used as gas sensors because their electrical conductivity changes when they come in the contact of analyte gases and have distinct advantages. However, similar to their inorganic counterparts they, too, suffer from lack of specificity, in addition to sluggish response and recovery. To overcome these problems, we worked on a new concept of organic/inorganic hybrid films so that the best of the two worlds namely, metal-oxides and polymers, could be utilized to obtain highly selective gas sensor.

Objectives

This project aims at providing simple and versatile strategies for the fabrication of new generation “all polymer flexible sensors”, which would not only be highly selective, room temperature operating, and low cost but also provide portability. In this project, the key issues that will be investigated are:

- Covalent grafting of PPy layer on BOPET sheets for perfect adhesion;
- Selectivity enhancement of target gases (i.e. H2S, NH3, Cl2, CO, NO2 etc.) by tuning the conductivity of sensing layer through embedding of nanostructures (e.g. ZnO, CNTs, metal nanoparticles, graphene etc.);
- Long term stability enhancement of the flexi-sensors by modifying the nature of sensing layer to hydrophobic.

Knowledge Products Developed

- Highly selective H2S gas detection by polyaniline-silver (PPy-Ag) nanocomposite films by UV induced polymerization on the silane modified BOPET sheets.
- Reproducible modification of the flexible ITO coated PEN substrates by diazonium coupling agent for covalent grafting of polypyrrole-silver (PPy-Ag) nanocomposite films.
- Demonstration of highly selective chemi-resistive gas sensing properties of H2S using flexible gold modified CoPc films.

Principal Collaborators

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Publications

SCI Journal Publications: 5
Papers Presented in Conferences: Nil

Mobility Support

India to France: Collaborators- 3
France to India: Collaborators- 3
Objectives

The objective of the proposal is to create a new class of DNA-quantum dot complexes where non-blinking quantum dots are interfaced to DNA surface chemistry. These easily bio-functionalizable QDs will be used for cutting edge bio-imaging applications. Thus first non-blinking quantum dots will be realized. Then they will be interfaced with DNA through optimal bioconjugation routes using appropriate chemistry. These molecularly precise DNA-quantum dots will then be functionalized with biological tags and used for targeting in-vivo long duration bioimaging.

Knowledge Products Developed

- QDs were successfully encapsulated inside DNA icosahedra to give IQDs
- Achieved Generalization– i.e., QDs between 4-12 nm in size could all be successfully encapsulated inside DNA icosahedra
- Preliminary data that establishes to functionalize IQDs on the DNA shell with a folate bio-tag with a stoichiometry of one tag to one IQD.
- Preliminary results that the folate functionalized IQDs are compatible to image endosomes.
On-going Projects

Life and Health Sciences

Novel Nanotechnological Approaches for Treatment of Leishmaniasis Using 2-Propylquinoline

Project No. : 4803-4

Objectives

This project aims to design novel nanoformulations of 2-propylquinoline (2-PQ), an emerging drug with potential for the treatment of leishmaniasis in humans. These formulations will allow this lipophilic drug to be administered intravenously in a safe and reliable manner, in order to treat both visceral and disseminated leishmaniasis. Furthermore, since in-vitro combination of 2-PQ and Amphotericin B (AmB) did not exhibit any antagonism in either promastigotes or in tramacrophageamastigote. donovani (unpublished data) we propose combining them in a formulation in an attempt to prevent the emergence of drug resistance.

Background

Visceral leishmaniasis is a parasitic disease that affects humans in India and South Europe. Classical drugs are toxic and generate resistance. The chemical series of 2-substituted quinolines is in pre-clinical development for the treatment of visceral leishmaniasis. One molecule, propyl-2-quinoline (2-PQ), shows qualities which justify its further development. Although 2-PQ is active by the oral route, an intravenous formulation that could be used in cases of advanced disease is necessary. Therefore, we plan to develop several formulations that could be used to treat either visceral or disseminated leishmaniasis. Furthermore, in order to prevent drug resistance, we propose to combine 2-PQ with Amphotericin B (AmB), an important drug in the treatment of leishmaniasises. All these formulations will be low-cost and they will be studied for their stability, their ability to release the drugs, their bioavailability, their antileishmanial activity in vivo and their toxicity.

Knowledge Products Developed

- Preparation and characterization of a 2-PQ liposomal formulation
- In vivo antileishmanial activity of the 2-PQ liposomal formulation
- Preparation of a 2-PQ polymer for oral administration

Publications

SCI Journal Publications : Nil
Papers Presented in Conferences : Nil

Mobility Support

India to France : Collaborators- 1
France to India : Collaborators- 3
On-going Projects

Pure and Applied Chemistry

Kinetics and Spectroscopy in Extreme Environments: Applications to Astrophysics and Astrochemistry

Project No. : 4905-1

Background
Radioastronomy has been extensively used for identifying the chemical species in stellar and interstellar environments. Infrared spectroscopic measurements are currently used to study the atmospheric composition of several transiting exoplanets characterized by surface temperatures comprised between 500 and 2000 K (hot Neptunes and hot Jupiters). The discovery of such exoplanets has revived questions about other habitable planets in our universe and also the question of life beyond earth. Fundamental understanding of interstellar dust on the one hand and diesel engine soot on the other hand, require extensive spectroscopic and kinetic data of relevant chemical species, that include radicals, molecules and weakly bound complexes. All the experimental and theoretical work planned in this project will be addressing these issues.

Objectives
The objectives of the present project are centred on the acquisition of some fundamental data relevant to Astrophysics and Astrochemistry. During our previous project, following the numerous visits and discussions, a novel high temperature source was designed and developed. This could be used for spectroscopic and kinetics studies at high temperatures, typically in the range of 800 – 2000 K. It opened up new avenues that were not envisaged at the beginning of our project. In the current project, we would like to use this source for production of materials (simulating hot astrophysical atmospheres) and kinetics and spectroscopic studies at high temperatures. In parallel, the existing facilities at Rennes and Bangalore will be used to complement these experiments. In particular, shock tube studies on propargyl alcohol pyrolysis and combustion, C atom reactions with small hydrocarbons, FTMW investigations propargyl alcohol and its complexes will be carried out in Bangalore. Theoretical and modelling work will also be carried out in Bangalore to provide additional insights.

Knowledge Products Developed
- Emission infrared spectra of methane (CH4) have been recorded around 7 microns at very high temperatures, comprised between 700 and 1400 K
- The second result is connected to the out-of-equilibrium infrared absorption spectroscopy of some selected polyatomic molecules (mainly small hydrocarbons). The above mentioned HES has been coupled to a vacuum chamber to accelerate, at hypersonic velocities, a gas previously heated at 2000 K.
- Microwave spectrum of propargyl alcohol dimer has been assigned.

Publications
SCI Journal Publications : 3
Papers Presented in Conferences : Nil

Mobility Support
India to France : Collaborators - 2
France to India : Collaborators - 3
Nurturing Knowledge

New Projects
Basic Sciences
Integrating Hox and Chromatin Mediated Transcriptional Regulation

Project No. : 4703-2  |  Jun 2013 - May 2016

Background
How only a handful of highly specific transcription factors, the Hox proteins, accomplish rich functional diversity in establishing the anterior-posterior body axis in all animals, still remains poorly understood. Previous approaches on understanding their mode of action have focused mainly on studying how protein partners of the PBC and Meis family of sequence specific transcription factors influence Hox target gene recognition. As chromatin and not naked DNA is the in vivo template for Hox proteins, it is proposed to investigate how chromatin regulators mediate Hox protein function.

Objectives
The goal of this project is to understand how chromatin regulators impact on Hox proteins that are transcription factors with key functions in development and disease. The objectives are as follows:

- To explore if homeotic response elements (HREs) and chromatin regulator response elements (CREs) overlap.
- To explore if chromatin regulators directly interact with Hox proteins, and if posttranslational modifications regulate these interactions.
- To explore the specific crosstalk between Hox proteins and chromatin regulators in chromatin context and its functional validation.

Principal Collaborators

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Yacine Graba  
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New Projects

Life and Health Sciences

Global Transcriptomics of Sex-specific Splicing

Project No. : 4903-4
May 2013 - April 2016

Background
Sex determination, a phenomenon observed in sexually reproducing organisms, generates distinct sexes. Manipulation of sex determination genes has resulted in producing sterile males through sex conversion, which are released into the field for controlling insect pests. Varying molecular mechanisms orchestrate sex determination. Insights obtained from Drosophila melanogaster (male heterogametic sex chromosome system) revealed sex specific splicing of pre-mRNAs and autoregulation of genes involved in sex determination. We are studying the role of sex-specific transcripts in sex determination in D. melanogaster and domesticated silkworm Bombyx mori through comparative transcriptomic analysis.

Objectives
The project aims at identifying loci playing conserved roles in sex determination in heterogametic B. mori females, with commercial applications in lepidopterans; a group with large number of agricultural pests. Identifying molecular players involved in sex determination and differentiation in B. mori and D. melanogaster is underway with a broad objective of developing unisex breeds to be used in sericulture and sterile insect technology based pest control.

The primary objectives of the project are:

- To characterize and compare the sex specific splicing of pre-mRNAs via high-throughput sequencing of cDNAs (RNA-Seq), in two insect species, a male heterogametic system (D. melanogaster) and a female heterogametic system (B. mori).
- To analyze the novel molecular players involved in sex determination in these two insect model systems.

Principal Collaborators

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Centre de Neurosciences de Paris Sud
Orsay
New Projects

Pure and Applied Physics

Studies of Spin Ladder and Heavy Fermion Systems in Extreme Conditions of Hydrostatic or Uniaxial Pressure and Low Temperature

Objectives

- To gain further understanding of the novel and competing orders that exist in two families of strongly correlated electron systems, namely spin ladder and heavy fermion systems, and improve the expertise of the 2 groups through a sharing of technology.

- The correlation of uniaxial and hydrostatic pressure experiments will bring new insights into the complex phase diagrams, and lead to common Publications and conference presentations of a high international level.

Background

Discovering and understanding the new states of matter found in the rich phase diagrams and competing ground states of strongly correlated electron systems represent some of the most challenging problems in condensed matter physics. Research in this field relies strongly on the use of high pressure and magnetic fields to explore the complex landscape of phenomena but also to manipulate the delicate balance between the various phases in order to study the quantum phase transitions between them. This research is essentially fundamental, aiming to better understand the rich physics of the field. However the implications of this research extend to a much wider area of physics and even to some of the applications of tomorrow.

Principal Collaborators

- S. Arumugam
  Bharathidasan University
  Tiruchirappalli

- Daniel Braithwaite
  CEA
  Institut Nanosciences et Cryogénie
  Grenoble

Diamond anvil cell for resistivity designed and constructed in Grenoble for Bharathidasan University
New Projects

Earth and Planetary Sciences

Tropical Cyclones in the Bay of Bengal: Oceanic Response and Air-Sea Interactions

Background
Tropical cyclones (TCs) are one of the deadliest natural hazards in coastal areas, causing huge lives and property losses. The Indian sub-continent is one of the most badly affected regions in the world. Cyclone track and intensity prediction is hence an important part of hazard mitigation programs. One of the significant constraints on TCs intensity predictions is the lack of knowledge about the ocean response to the storm forcing. TCs induce intense upper ocean mixing resulting in a surface cooling and a chlorophyll bloom. While the chlorophyll bloom may lead to enhanced fish catches, the resulting sea surface cooling feedbacks negatively on the TC intensity by reducing the enthalpy flux provided to the cyclone. The Bay of Bengal is unique amongst TC generation regions for its very strong salinity stratification after the monsoon. The magnitude of the TC-induced surface response may hence strongly depend on the pre-cyclone saline stratification.

Objectives
- To Quantify the oceanic control on tropical cyclones-induced surface temperature response in the Bay of Bengal, with an emphasis on the role of salinity stratification on the amplitude of TCs-induced chlorophyll blooms and surface cooling using a forced ocean model.
- To Understand how this surface cooling retroacts onto the TC characteristics in this region by using a regional coupled ocean-atmosphere model.
- To Develop statistical prediction schemes in this region in order to quantify the skill improvement brought by accounting for ocean-atmosphere interactions under TCs.

Principal Collaborators
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LOCEAN, UPMC-Expansion
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Model Sea Surface Salinity climatology before (left) and after (right) the southwest monsoon. The model rainfall distribution during the monsoon is quite good and the model reproduces the post-monsoon “river in the sea” along the east coast of India.
Hypergeometric Functions: Harmonic Analysis and Representation Theory

Project No.: 5001-1 Mar. 2014 - Feb. 2017

Background
The hypergeometric functions associated with root systems are representation-theoretical motivated multivariate hypergeometric functions. They originated in the work of Heckman and Opdam (with further contributions by Cherednik) and may be seen as a natural extension of the spherical functions, due to Harish-Chandra, for semisimple Lie groups and Riemannian symmetric spaces. The study of hypergeometric functions associated to root systems is nowadays a central theme in many areas of mathematics, such as harmonic analysis, representation theory, combinatorics and probability.

Objectives
The specific objectives of the project are:

• To develop the Heckman-Opdam theory of hypergeometric functions in several directions.
• To continue the study of hypergeometric functions associated to root systems in a systematic manner and thus develop an Lp harmonic analysis.

Principal Collaborators

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Angela Pasquale
University of Lorraine
Metz
New Projects

Earth and Planetary Sciences

Cenozoic Denudation of South India

**Objectives**

The objective of the project is to evaluate the relative influence of epeirogeny and climate change on the denudation and maintenance of the high elevation escarpment of the passive continental margin of Peninsular India (Western Ghats) over the last 60 Ma. An integrated approach combines the detection and dating of erosional paleolandsurfaces and quantification of the chemical and mechanical surface mass transfers linked to the topographic evolution of the continental margin. The main tasks of the project consist of (1) mapping of relict paleolandsurfaces, and (2) geochemical, mineralogical and 39Ar/40Ar geochronological analyses of the laterites carried by these paleolandsurfaces. Ultimately, one expects to quantify the sediment budget from continent to offshore basins and test the influence of the quantified mass transfers on vertical lithospheric movements.

**Background**

High elevation (i.e., escarpment bearing) divergent continental margins result from continental break-up and may have delivered significant sediment fluxes to offshore basins. Constraining the denudation history of passive margins is crucial to decipher their post-rift topographic evolution that has major implications for source-to-sink systems. Current evolution models of passive margins topography predict contrasted denudation patterns across the escarpments but generally fail in providing precise denudation rates histories mostly because of the lack of absolute dating of well-characterized geomorphic markers. In the tropical belt, the passive margin upwarps and adjoining platforms bear planation lateritic paleo land surfaces. Our project aims at defining the nature, age, distribution and elevation of such lateritic paleoland surfaces on either side of the Western Ghats escarpment to evaluate the relative contributions of epeirogenic uplift and climate change (or their interference) in the post break-up evolution of Peninsular India over the Cenozoic.

**Principal Collaborators**

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Centre of Earth and Space Sciences, University of Hyderabad, Hyderabad

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Nurturing Knowledge

New Projects
Applied Sciences
Catecholestrogens in fish reproductive endocrinology

Objectives

- Synthesis and functional role of catecholestrogens in catfish and rainbow trout oocyte maturation
  - Catfish total RNA extraction and sequencing using next generation sequencing technologies, Assembly and annotation of deduced sequences, production of an estimated 44,000 sequences homologous nucleotide array, CE effects on the transcriptome of catfish postvitellogenic ovarian follicles and expression of enzymes involved in CE synthesis during gonadotropin-induced oocyte maturation.
  - Measurement of ovarian catecholestrogens and hydroxylase activities during oocyte maturation in trout, expression of genes involved in CEs synthesis, CE effects on the transcriptome of trout postvitellogenic ovarian follicles
  - Functional role of catecholestrogens in rainbow trout sex differentiation
  - Exploration of a potential synthesis of CE in embryonic gonads during sex differentiation in rainbow trout and analysis of CE effects on embryonic gonads.
  - Building a new model of endocrine regulation of ovarian differentiation and oocyte maturation involving CEs.

Background

The importance of estrogens in vertebrate female reproduction is well known but little is known about the role of estrogen metabolites (catecholestrogens), which have been considered as metabolic wastes. The project aims to decipher the synthesis and function of catecholestrogens (CE) during two important phases of fish reproductive biology which are known to involve strong estrogen regulation and action, i.e. gonad sex differentiation, and final oocyte maturation (FOM). Two complementary models will be used, the Indian catfish and the rainbow trout. In the first part of the project, Next Generation Sequencing technologies will be used to acquire a genomic data base for catfish, such a data base being already available in rainbow trout. Using these data, oligonucleotide microarrays will be setup to study the effect of CE on embryonic gonadal transcriptome in trout, and ovarian transcriptome in trout and catfish. Attention will be paid to the potential role of CE on the expression of genes involved in steroidogenic regulation Besides, the expression of enzymes involved in CE synthesis will be investigated using quantitative PCR in both species.

Principal Collaborators

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Ovarian follicles (left) and isolated granulosa cells (right) have been cultured in vitro to screen the effect of catechol on rainbow trout, Oncorhynchus mykiss, ovarian steroidogenesis
**Objectives**

*Ralstonia solanacearum* causes a lethal bacterial wilt disease in more than 200 different plant species around the world. The bacterium lives in soil as a saprophyte and lives inside the plants as a parasite. Different transcription regulators in this bacterium are responsible for tight regulation of its virulence and pathogenicity functions during the infection to host plant. *R. solanacearum* has two genes encoding for the alternative sigma factor, $\sigma^{54}$: rpoN1, located in the chromosome and rpoN2, located in a distinct ‘megaplasmid’ replicon. These two genes are conserved across all *R. solanacearum* strains sequenced so far. The aim is to characterize the regulon of both the rpoN genes using transcriptomics and molecular genetics approaches in this bacterium.

**Background**

In order to determine the extent of functional overlap between the rpoN genes, individual mutants as well as a double mutant of rpoN were created in *R. solanacearum* strain GM1000. Inoculation on plants revealed that rpoN1 was required for virulence whereas rpoN2 is not. In addition rpoN1 controls other important functions, unlike rpoN2. The rpoN1 and rpoN2 genes have different expression patterns. Moreover, the expression of rpoN2 is dependent upon rpoN1. Our work reveals that the two rpoN genes are not functionally redundant in *R. solanacearum* as multiple traits are under the control of these regulators. Based on these findings, we provide a model describing the functional connection between RpoN1 and the PehR pathogenicity regulator and their dual role in the control of several *R. solanacearum* virulence determinants.

**Principal Collaborators**

- S. K Ray  
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The aim of this study is to gain insights into molecular mechanisms that are associated with response to corticosteroids by using gene- and exon-expression profiling and metabolomics profiling.

- To identify baseline molecular mechanisms that predict the subsequent response or non-response to corticosteroids. For this, gene/exon-expression profiling in the liver and peripheral blood mononuclear cells (PBMCs) as well as metabolomic profiling of liver, plasma and urine will be performed at baseline (i.e., day 0, before starting corticosteroids).

- To identify molecular mechanisms associated with the response to corticosteroid therapy. For this, gene/exon-expression profiling in PBMCs and metabolomics profiling of plasma and urine will be performed at day 3 and day 7 of corticosteroid therapy. Results will be compared between responders and nonresponders to treatment.

Background

In India and France, patients with severe alcoholic hepatitis are treated with corticosteroids. However, only 40% of patients respond to corticosteroids and non-responders are at high risk of short-term death. To date, there is no established alternative or additive treatment to corticosteroids. Moreover, there are no identified predictors of the response to corticosteroid therapy.

Objectives

Principal Collaborators

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Background

Mammalian skeletal muscle can regenerate effectively after damage, due to persistence of muscle progenitor cells called satellite cells (SC) in the adult. In normal muscle, SC are quiescent mononucleated cells juxtaposed between the basal lamina and the plasma membrane of multinucleated myofibers. In regenerating muscle, the molecular events in activated SC diverge to generate both new SC and new myofibers. This is a tightly controlled and multifaceted regulatory system. Selenoprotein N, a redox associated factor, (SelN; encoded by the SEPN1 gene) is the only selenoprotein associated to a human monogenic disease, SEPN1-related myopathy (SEPN1-RM), which is typified by severe weakness and wasting of neck & trunk muscles. In the absence of Selenoprotein N, there is an increase in the amount of cells that make new fibers and a reduction in the number that make new SC. As a result, over time, there is a serial loss in the muscle SC population.

Objectives

- To delineate the role of SelN as a novel key actor in the molecular control of self-renewal, activation or differentiation in muscle progenitors.
- To define the link between SelN, oxidative stress and epigenetic regulation of muscle progenitor cell fate.
New Projects


Project No. : 5005-1

Background
The goal of catalysis is to replace certain stoichiometric reactions by very selective catalytic ones, but an important secondary goal is “atom economy”, to limit waste products resulting from chemical reactions. Homogeneous catalysts allow reactions to take place, in most cases, at lower temperatures and pressures than those required for the stoichiometric reaction. Globally, a homogeneous catalytic process significantly reduces energetic demands. It should be noted that the selectivity of a homogeneous catalyst is critically dependant on the ligands linked to the metal that is carrying out the transformation. The project aims at the discovery of new catalyst types, all based on the presence of a container or capsule hosting the catalytic centre. This topic is very challenging. Being conceptually new, the targeted catalysts are anticipated to result in new selectivities.

Objectives
The project aimed at producing catalytic reactions taking place inside a molecular cavity. Four types of ligands based on the resorcin[4]arene platform will be considered, all having either pyridine moieties or phosphorus atoms connected to the larger rim of a conical resorcinarene backbone. The presence of a cavity able to host the catalytic centre is mainly expected to favour substrate or product discrimination. Moreover, the confinement of the catalytic center should introduce a high regioselectivity of the formed products. The resorcinarenyl-complexes will be assessed in carbon-carbon bond forming reactions, hydride transfer and addition of TMSCN to aldehyde. Recycling of the catalysts will be also studied, notably by preparing polymeric derivatives. The present research is a fundamental contribution to the discovery of homogeneous catalysts operating in a confined environment.

Principal Collaborators

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It is proposed to design and develop new classes of C1 symmetric ligands or organocatalysts based on a biaryl backbone and to evaluate their catalytic efficiency for various catalytic reactions. To begin with ortho,ortho’-dibromobiaryls, ligands will be synthesized and further attempts will be made for the atropodiestereoselective functionalization towards enantiopure ligands. It is planned to synthesize C1-symmetric ligands such as O,O-, N,N-, or P,N-ligands as well as phosphate and phosphoramidite ligands. The compounds prepared in this way as free ligands or their metal complexes will be screened for their catalytic activities and enantioselectivities. The catalytic reactions to be studied involve asymmetric aldol reaction, multi-component C-C bond forming reaction, asymmetric conjugate addition, asymmetric hydrogenation and hydroboration, propargylation and Petasis reactions. The yield and ee will be compared with known methods.

Background

Asymmetric catalysis is the method of choice for the synthesis of chiral substances on laboratory stage as well as on industrial scale. Indeed, several processes are applied on industrial scale for the preparation of compounds with agrochemical, flavor or pharmaceutically relevant properties. In general, the chiral catalysts are formed by complexation of a phosphorus ligand with a transition metal. Chiral organophosphorus derivatives having an axial chirality, a planar chirality or chirality due to a cycle are the most popular ones due to their versatility and stereoselective performance. Additionally, axially chiral biaryls in general are privileged structures in asymmetric synthesis or catalysis.

The preparation of new enantiopure ligands, which offer chiral environment to coordinated metal atoms, is one of the most straightforward challenges for organic chemists and corresponds to the social challenges for industrial renewal.

Objectives

Principal Collaborators

Pradeep Kumar
Organic Chemistry Division
National Chemical Laboratory
Pune

Frédéric Leroux
CNRS UMR 7509
University of Strasbourg
Strasbourg
Objectives

First objective of the project is to find efficient computational methods for centrality measures. This encompasses fast algorithms for estimating betweenness centrality, spectral measures for ranking motivated by dynamic phenomena concerning evolving networks or dynamic phenomena on static networks (such as computation on networks). This will combine techniques from computational linear algebra, MCMC and quasi-MCMC, learning algorithms, in particular reinforcement learning algorithms.

Second objective is to study decentralised algorithms on networks. This encompasses decentralised search (for e.g., an address, a piece of data, or information) based on random walks for realistic network models, decentralised or distributed computing of spectral ranking measures, multiarmed bandit-based online learning algorithms and ant-colony-optimisation algorithms for learning routes, decentralised computing of localised centrality measures based on quasi-invariance and metastability.

Principal Collaborators

Vivek S. Borkar
Indian Institute of Technology
Mumbai

K. Avrachenkov
INRIA
Sophia Antipolis
Shaping of Durable, Thermal Shock Resistant High Volume Ceramic Containers

Background
The centre for Ceramic Processing at International Advanced Research Centre for Power Metallurgy and New Materials (ARCI) have their expertise in formulating ceramic compositions for engineered properties. M/S Pierre Arquie Ceramique Technique (P.A.C.T) have their capacity for shaping high volume ceramic containers. Considering the huge commercial potential of durable ceramic crucibles, M/S Ceradecor India Limited, Noida (UP) agreed to develop durable, thermal shock resistant high volume ceramic containers for industrial applications. With the above background, it was proposed to collaborate in the area of their respective expertise to optimize the established slip casting process develop at P.A.C.T extending to a wide range of thermal resistant formulations developed at ARCI into various configurations such as large crucibles, Nozzles and other ceramic articles looking at various applications.

Objectives
To develop a process for casting high volume, thermal shock resistant ceramic containers with improved life time.

Outcome
- Thermal shock resistant formulations
- Optimization of the Slip properties suitable for casting.
- Sintering schedule to obtain thermal shock resistant containers of approx. dimensions, Ø 210 x H170 x th 20 mm
Objectives

To test for the presence of K-RAS and B-RAF mutations in Colo-rectal tumors of Indian patients and to develop methodology to isolate and concentrate circulating nucleic acids from urine and also from plasma.

Outcome

- A total of 27 clinical samples (tumor DNAs) and 6 plasma samples obtained from Asian Health Care Foundation, Hyderabad were analysed. Out of these, 16 samples tumor DNAs were found to be positive for G12V mutations and 11 were negative. One specimen has a novel A11A (silent) mutation. All the plasma samples analyzed were negative for K-Ras mutations.

- A methodology for isolation of nucleic acids from urine has also been developed at CCMB. Presently this method is standardized to optimize the yield of nucleic acids that can be used for screening K-Ras and B-Raf mutations.
Selective oxidations with Hydrogen Peroxide: Development of New Catalyst & Process conditions

Background
Hydrogen peroxide is a well-known green oxidant that produces water and oxygen as byproducts. It is therefore a very interesting oxidant for environmentally friendly industrial processes. CSIR-NCL has good knowledge of activation catalysts for hydrogen peroxide. ARKEMA skills oxidation reactions are widely recognized as it is a producer and distributor of H₂O₂. UCCS is renowned for its competences in catalysis and spectroscopic characterization of catalysts. It works on the oxidation of organic molecules. Considering this, the activation of the green oxidant hydrogen peroxide and its use as a reagent in reactions with biomass has been proposed. Different selective oxidations with hydrogen peroxide will be studied based on the various molybdenum complexes developed by the NCL.

Objectives
Development of new catalysts and process conditions for selective oxidation with hydrogen peroxide
Promotion of oxidation processes using the green oxidant hydrogen peroxide, accessible to a large number of end-users

Outcome
- 14 catalysts samples prepared
- Oxidation of veratryl alcohol as model reaction was set-up and all catalysts were tested
- Improved procedure was developed for delignification
- Laboratory scale delignification tests under improved procedure show promising performance in terms of kappa number and degree of polymerisation
- Structural characterisation of most active catalysts made progress

Project Partners

Research Partner (India)  Industry Partner  Research Partner (France)

Shubhangi B. Umbarkar  Markus Brandhors  Edmond Payen
CSIR-NCL, Pune, India  Arkema Lyon, France  UCCS, Lille, France
Financial-Inclusion based upon Rural Mobiquitous Services Technological Platform

Background
The “First” was conceived and proposed in which TCS, University of Nice, France, Gemalto, France and IISc, Bangalore formed a consortium to evaluate the technologies like NFC and mobile phones to addresses the existing problems faced by the Rural initiatives in India including FI, RSBY, NAREGA etc.

Objectives
The main objective of FIRST project is to enable India and other emerging countries (Morocco, Tunisia, Haiti, Vietnam, Nigeria, Russia, Brazil ...) to achieve their vision regarding FI and RI scenario (like PDS, NREGA, RSBY in India etc) by offering/creating a sustainable ECOSYSTEM involving a viable business model with low cost, secured generic and symmetric NFC platform, open equally both to banks, Mobile Network Operators and others who are focusing rural initiatives.

Strategically, it involves the following

- Financial Inclusion represents the first ICT (Information and Communication Technology) step for Rural Inclusion (RI) issues in India and many emerging countries.
- Cell phones (and smart phones) should naturally be the base to deliver financial and rural services to unbanked people.
- The solutions built around cell phones (Mobility) should be studied in depth around technology and standards (like NFC - Near Field Communication) and generic open source platforms

Outcome
- FI has been digitized but PDS is not digitized. NFC in France-Technology has some taking. Some innovation idea has to be tested. TCS is involved in the test case.

Project Partners
TILLING in cucurbits: a non-transgenic reverse genetic approach for muskmelon crop improvement

Background
In melon, sex determination is genetically governed by the genes andromonoecious (a) and gynoeicous (g), and the interplay of these two genes result in a range of sexual flower types. The A and G genes have been recently cloned by Dr Bendahmane’s group at the URGV-INRA lab and manipulating these has been shown to increase yield in melons. Furthermore, the lab has also created Long Shelf Life (LSL) muskmelon by TILLING muskmelon orthologs of tomato LSL gene. A novel non-transgenic reverse genetic tool, TILLING (Targeting Induced Local Lesions IN Genomes), developed and patented at URGV-INRA lab provides an alternative way to manipulate endogenous genes for the improvement of crops. This TILLING technology has been licensed by BenchBio Pvt Ltd., and brought to India for improvement of crops. The aim of this proposal is to apply TILLING technology to Indian muskmelon varieties of Namdhari Seeds Pvt. Ltd (NSL), as starting point with the aim of generating lines with new and improved traits for Indian and worldwide markets. The ultimate goal of this project is to produce stable melon plant prototypes carrying novel traits such as LSL and female flower only producing plants (gynoeicous) for hybrid seed production, to test them for agronomic importance and finally develop commercial products.

Objectives
- To apply "TILLING technology" developed and patented by URGV-INRA lab, France to Indian muskmelon varieties belonging to NSL for generating mutant lines with new traits.
- To select mutant varieties with novel traits towards crop improvement (gynoeicous) and enhanced shelf-life (LSL)
- To perform selective crossing and to develop improved, stable melon plant prototypes with enhanced shelf-life and gynoeicous trait.
- To assess their agronomic importance and to develop a final commercial cultivars for Indian and worldwide markets.

Outcome
- Bioinformatic analysis has been done and the sequence of the LSL gene controlling Long Shelf Life (LSL) and the sequence of the G gene that controls female flower formation (gynoeicous) in muskmelon has been completed.
- Completed Ethyl Methane Sulfonate (EMS) treatment on the NSL muskmelon seeds by BenchBio at pilot scale and determined optimum dose of EMS mutagen for generating mutant population.
- Large scale EMS treatment of melon seeds completed by BenchBio for generation of mutant population. Seed treatment on around 20000 muskmelon lines has been completed at NSL premises following BenchBio’s highly efficient EMS protocol.
- EMS treated seeds has been planted in the nursery followed by transplanting in the field by NSL. Some novel plant phenotypes have been observed indicating that the EMS treatment has worked efficiently.
- Management including field trials/testing of the mutant population has been made in the field on a regular basis by NSL.
- Harvesting of second generation mutant (M2) seeds from first variety (LSL trait) and seed sent for mutation screening.
- LSL mutants have been obtained and seeds are being bulked for transferring to NSL for evaluation and product development.
- Screening for gynoeicous trait is ongoing.

Project Partners

Industry Partner (India)-Scientific R&D
- Dr. Manash Chatterjee
  Bench Bio Pvt Ltd
  Valsad, Gujarat, India

Industry Partner (India)- Commercial
- Mr. Uday Singh
  Namdhari Seeds Pvt. Ltd.
  Bangalore, India

Knowledge Partner (France)
- Dr. Abdelhafid Bendahmane
  Unité de Recherche Génomique Végétale - INRA, Évry, France
Fostering Dialogue

Seminars & Workshops
The first Indo-French School on Materials for the Future was held on April 15-19, 2013 in Poitiers, France. The school aimed at being a first step towards new Indo-French actions of formations and research in the area of materials for the future, between Pprime Institute (CNRS – Poitiers University – ISAE-ENSMA) on the French side, and Indian Institute of Science – Bangalore and Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore on the Indian side.

The school included an enriched poster session dedicated to PhD students, post-doctoral fellows and young researchers in addition to research talks and a visit to the Pprime Institute.

The school covered a wide range of topics in material science and engineering. Courses and research talks dealt mainly with subjects like nanomaterials, composite materials, polymers, metallurgy and biomaterials. Experimental and theoretical investigations were also equally represented. While the discussions were quite advanced in the area of nanomaterials, new dialogue were initiated on subjects like metallurgy and composite materials.

The poster session allowed participants to discuss topics of their interest with experts from both countries. It has to be noted that this formation has been recognised as part of Pprime Institute PhD Students diploma.

The Scientific Council of CEFIPRA had felt that Proteomics was an important area where the expertise instituted in the two countries should be utilised for nucleating collaborations between expert groups of the two countries. Accordingly, a seminar on “Recent trends in Proteomics” was supported at Bangalore, India. Six distinct groups from France were represented by nine French scientists while twelve Indian groups were represented by 21 scientists.

The presentations by French and Indian scientists covered various aspects of the sector. In particular, discussions on subjects like the proteomic approach for understanding cancer, stress tolerance in plants, enzymatic mechanisms in the proteome, functional proteomic studies, advanced tools and techniques for proteomic R&D were highlights of the seminar.

The meeting started with a brief inauguration with introductory remarks from Drs. Kumar Somasundaram, Genome Garin, K. Dharmalingam and Mr. V.V. Rao from CEFIPRA. There was a discussion with inputs from Prof. K Dharmalingam, member of Scientific Council of CEFIPRA, which identified and prioritised possibilities of working together based with complementarity in expertise available in Indian and French Institutions.
Some of the potential areas identified during the deliberation for collaborative work were: cancer, diabetes, infectious diseases, model organisms, metabolomics, post-translational modifications and training workshops.

**Challenges in Overcoming Complexity**
**From Big Data to Cyber-Physical Systems**

The India-France Workshop in ICST “Challenges in Overcoming Complexity: From Big Data to Cyber-Physical Systems” was held on 4-5 April, 2013 at New Delhi. Jointly organized by CEFIPRA, INRIA, CNRS and Khosla School of Information Technology (IIT Delhi), the workshop brought together Indian and French researchers to explore the possibilities of collaborative work in the field of ICST by Indian and French institutions.

The programme of the workshop included two invited talks. One was by Prof. Vijay Chandru of Strand Genomics, Bangalore on the topic Genomic Medicine: New paradigms of knowledge curation and decision-support”. The other talk was by Prof. Gerard Huet of INRIA on “Cultural heritage in the digital age: Challenges and research problems”. In addition there were 17 technical presentations, selected from submitted white papers and expressions of intent to collaborate.

Scientists, researchers and industry professionals agreed on importance and prospects of collaborative R&D and expressed a strong desire to convert possibilities into real activity on the ground. The topics that were mentioned as possible candidates for joint R&D included algorithmics; machine learning; analysis of the semantic web, computational geometry, social networks; formal methods; embedded systems and architecture; cyber-physical systems; sensor networks and distributed systems. There were also two invited talks that elaborated upon the research being done in INRIA in the areas of high-performance computing (Dr. Jean Roman) and Cyber-physical systems (Dr. Alain Girault).

The workshop concluded on following points of agreement:

- Researchers with collaborative arrangements should be encouraged to submit proposals to CEFIPRA.
- Initiate a targeted call for fresh collaborations in the field of computing and informatics (ICST), aimed at (a) encouraging young researchers, and (b) for incubating collaborations in new areas and on new topics.
• Future workshops can focus on areas of common interest to both nations such as a) Embedded Systems and Reconfigurable Computing, and b) High-Performance Computing.

• Most participants felt that brainstorming workshops such as the one under discussion should be held more frequently.

Dynamics of Earth and Planetary Cores

The workshop on DYNAMICS OF EARTH AND PLANETARY CORES organized by Centre for Earth Sciences, Indian Institute of Science, Bangalore (23-26 September 2013) brought to the fore the most recent developments in the modeling of planetary dynamos, and the need to improve field measurements from satellites.

The workshop provided an opportunity to Indian doctoral students to showcase their research before the international community. Review lectures, pitched at the graduate student level, on challenges in planetary dynamo modeling were complimented by 30-minute research presentations made by scientists working on fringe areas of the subject. In the final session, PhD students from both India and France were made aware of postdoctoral opportunities in Deep Earth research.

In addition to the above projects, collaboration in solar/astrophysical dynamos between IISc and French Universities was discussed. A compact disk containing all the talks given at this workshop was also released.

Indo-French Design Conclave

CEFIPRA partnered with the National Institute of Design (NID), Ahmedabad to organise an inter-disciplinary seminar involving design and engineering professionals from various institutions in India and France.

The goal of the seminar was to explore the possibility of Indo-French collaborations in the interface zone of engineering and design disciplines through a variety of mechanisms including:
• Scientific research
• Design and Technology collaborative research
• Student mobility

Most participants expressed an earnest wish to link-up with CEFIPRA by way of joint projects. They also felt that CEFIPRA's support for mobility will be very useful to foster more interactions between professionals that are a must for identifying research priorities and for developing joint R&D proposals for funding support.

Suggestions that came through during the course of the deliberations for improving Indo-French collaborative R&D in the field of design were:
• Development of common directory of design professionals in India and France
• Conducting a joint workshop to identify priorities and potential partners.
• Focused training sessions to dilute cultural and language barriers.

Indo-French Brainstorming Seminar on Atmospheric Sciences

A brainstorming seminar on Atmospheric Sciences was organised jointly by Ministry of Earth Sciences, Govt. of India and CEFIPRA. The purpose of the seminar was to discuss the Monsoon Mission initiated by the Govt. of India and to explore the scope for Indo-French collaboration in the same.

The Indian participants were drawn from research groups involved in gathering data and developing models and carrying out in the domain of Atmospheric Science. The French participants included representatives from premier institutions like Institut Pierre Simon Lapalce (IPSL), Le Laboratoire de Météorologie Dynamique (LMD) and Meteo-France.

Technical sessions covered five broad areas:
• Monsoon and Tropical Modelling
• Ocean and Monsoon/Tropical Climate/atmospheric ocean coupling
• Multi-scale Monsoon Modelling
• Modelling and Model Initialisation
• Parameterization of physical Processes, Initialisation and Modelling

Speakers emphasised on the need for comprehensive and wider Indo-French collaborations in the area of weather forecasting and modeling. In the plenary session, the Director, IPSL gave an overview of IPSL, which is a federation of six laboratories. Prof J Srinivasan of Indian
Institute of Science (IISc) explained the challenges in understanding and predicting the Monsoons.

As many as 30 speakers representing diverse institutions from India and France presented their insights and identified challenge areas for future focus. These included: (a) Climate modeling; (b) Seasonal forecast at smaller spatial scales; (c) Fine-scale physical processes in the ocean and atmosphere boundary layers, and their role in basin-scale air-sea interactions; (d) Satellite data assimilation; (e) Teleconnections for Indian monsoon prediction and Design of future modelling systems.

Four major technical areas of Indo-French collaborations in the field of Atmospheric science were identified:

- Modeling, Data Assimilation and understanding
- Aerosols & Atmospheric coupling

Seminar concluded with a panel discussion moderated by Prof. Herve Le Treut and Prof. J. Srinivasan.

CEFIPRA organized an Indo-French seminar on Bio-inorganic Approaches to Current Health Problems in association with Pondicherry University during March 24-28, 2014. The Seminar was attended by ten French, one Austrian, one German and around 50 Indian scientists.

A number of presentations by the younger faculty members and research scholars revealed that most of them are interested in designing metal (Cu, Zn, Ru) and organometallic Ru complexes, metal-curcumins and cyclophosphoramides as drugs for cancer treatment, their interaction with DNA and its cleavage. A number of presentations by the younger faculty members and research scholars revealed that most of them are interested in designing metal (Cu, Zn, Ru) and organometallic Ru complexes, metal-curcumins and cyclophosphoramides as drugs for cancer treatment, their interaction with DNA and its cleavage.

The seminar ended with an analysis of the thrusts made in treating diseases with metallo drugs, mainly cancer. Focus was made on the importance of bioinorganic chemistry in bioimaging and other non-cancerous diseases. One of the new ideas generated from this seminar is targeting telomerase enzyme, which is responsible for cell growth and is over expressed in Cu-85% in cancer cell using Pt(II) and Ru(II) metal complexes. Interaction with many Senior Indian and French Scientists gave new exposure to young researchers.

It is now well established that communication networks are amenable to mathematical modelling using a variety of tools, depending on the questions being asked. This was amply demonstrated in the workshop on New Avenues from Network Models organised with support from CEFIPRA at Department of Electrical Communication Engineering, IISc Bangalore from 13-15 January, 2014.

The primary aim of the workshop was to highlight that networks occur in several domains of human activity, and that a variety of mathematical techniques can be used to model these networks, so as to understand their performance, and derive insights into how to manage them.

Comprising of three tutorials and 12 seminars spread over three days, the workshop brought together several researchers from India and France, whose work had been funded by CEFIPRA over the past 8-9 years, and several other researchers from the two countries, who work in related areas. Some of the new ideas discussed at the workshop included:

- Enforcement of fairness in the exchange of file fragments in a peer-to-peer network.
- The use of piecewise deterministic Markov processes to model the level of influence of the content on a user’s social network timeline.
- A possible interpretation of the trial-and-error dynamics as a learning strategy that explores the strategy space according to the action functional predicted by the Freidlin-Wentzell theory, with the global minima of the action functional at pure strategy Nash equilibria.

Hosted by Aravind Medical Research Foundation (AMRC) which has significant expertise in the study of ophthalmic fungal infections, the workshop focused on an in depth analysis of the biology and pathogenesis of Aspergillus – the most ubiquitous fungal pathogen and the host response to fungal infection in the immuno-
competent as well as in the immuno-compromised individuals. With 12 French and 19 Indian scientists participated in the workshop participants the workshop. The themes included a) the "Omics" approaches to understand Aspergillus pathogenesis, b) understanding the fungal biology, host-fungal interaction and host responses, c) in developing a model system to study Aspergillus pathogenesis and d) treatments to these fungal infections.

From the clinical side, complications of Aspergillus infection in haematopoietic stem cell/solid organ transplant recipients and patients with long-term corticoid therapy, usage of combination of antifungal drug therapy and the need for the early diagnosis and treatment to prevent the occurrence of complications due to Aspergillus were discussed.

AMRC highlighted to the participants the corneal infection due to Aspergillus and Fusarium spores, which is a cause of blindness of around 340000 Indian populations annually. Ineffectiveness of anti-fungal therapy in fungal keratitis patients causing loss of vision was discussed to underscore the need for early and effective intervention methods.

### Functional metal-organics: Applications in materials and catalysis

The Indo-French Seminar on “Functional Metal-Organics: Applications in Materials and Catalysis”, was held at the National Institute of Science Education and Research, Bhubaneswar, Odisha. About 80 participants drawn from India and France attended the Seminar.

The seminar covered advances and future trends in functional metal-organics and gathered scientists from France and India working in diverse areas. The presentations on various aspects of Functional Metal Organics included Molecular Magnetism, Photochemistry, Optical Materials, Organometallics and Catalysis.

The proposal to launch a spring/winter School in India on development of new molecular materials for energy related applications was discussed.

The participants suggested short research stays funded by Charpak-Raman fellowships. Spring/Winter Schools in India should be organized – on subjects like development of new molecular materials for energy related applications: photocatalysis, solar cell and photovoltaics, photo activations of molecules, material and optical properties etc.

In view of the overwhelming success of this meeting it was suggested that a future meeting on this theme be held in India/France in about 2 years time. It was also suggested that another seminar should be planned and organized at the interface of molecules and materials.

### Indo-French Physics Conference

CEFIPRA, in association with Centre national de la recherche scientifique (CNRS), organized an Indo-French Physics conference at IISc, Bangalore during March 18 - 21, 2014.

The objective of the conference is to foster collaboration between experts groups of two countries i.e. India & France in the important areas of physics. The conference was organized for four days in the areas of Optics, Nano-Sciences, Cold Atoms & Synchrotrons. 28 French scientists from different institutes of France
and 80 Indian scientists from leading institutes of India attended. During the four day programme there were 35 invited talks by the experts from both the countries followed by round table discussions. The presentation by French and Indian scientists covered various aspect of subject domains. There was an opportunity for Indian researchers to showcase their research before international community through poster session. Got the opportunity for French Researchers to visit Indian laboratories / Indian Institutes working in the areas of Physics.

Three definite collaborations are expected to emerge from this under the network programme of CEFIPRA. The conference concluded that researcher should be encouraged to submit proposals to CEFIPRA under its regular call for proposal.
Providing a Platform

Targeted Programs
Adaptation of Irrigated Agriculture to Climate Change
DST-INRA Targeted Programme

Likely impact of climate change on agriculture and water resources is of great significance. The problem of excessive groundwater extraction has resulted in declining groundwater levels, water quality deterioration, rise in extraction costs, depletion of well yield and failure of wells in peninsular India. To address this problem requires an understanding of the interactions between all the components of the system, including hydrology, economics and agronomy. Attempts for integrative assessment using coupled economic and agro-hydrogeological models for optimizing the economic benefits of agriculture and sustainable groundwater levels are few. Adaption of innovation in agriculture has been studied in India rather extensively, the impact of climate change on local agricultural producers has been addressed in some cases, there is inadequate integration between water management, the agronomic aspects, and the prospect of climate change.

Objectives
The project aims to:
• To develop an integrated model (in agronomy, hydrogeology and economics) and scenarios of evolution of agricultural systems and water management policies, which will be tested both at the farm scale and the watershed scale in the case of an experimental watershed in Peninsular India.
• To combine both economic impacts on the crop production and hydrogeological regime and hydro-economic feedbacks on the future land use and productivity.
• Farmer decision model will be developed to investigate the farming system adaptability to changing climate or economic context.

Knowledge Products Developed
• Calibration of the model Stics for main crops
• Inverse modelling for soil parameter retrieval from satellite (radar)
• First versions of the coupled model 1D/2D for crop/groundwater
• Reconstitution of land use-land cover change for the period 1973-2012
• Agricultural practices and farm typology from farm survey.

Principal Collaborators

Sekhar Muddu
Indian Institute of Science
Bangalore

Laurent Ruiz
Institut National de la Recherche Agronomique
Rennes-Buirmpé

Publications
SCI Journal Publications : 3
Papers Presented in Conferences : 9

Mobility Support
India to France : Collaborators - 2
France to India : Collaborators - 1

Illustration of the data acquisition in the South Gundal watershed: stream drainage and depth to groundwater levels.
The DST-INRIA programme could be put in place with the kind assistance from DST and INRIA during the year 2013. The agreement was signed after the ICST seminar held in April 2013. After the agreement, a call for proposals was launched. A total of 18 proposals were received under this call. A joint selection committee selected the following 6 project proposals.

<table>
<thead>
<tr>
<th>Title</th>
<th>Indian PI</th>
<th>French PI</th>
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<tbody>
<tr>
<td>Personalized Mobility Services for Urban Travelers</td>
<td>Pushpendra Singh</td>
<td>Animesh Pathak</td>
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<tr>
<td></td>
<td>Indraprastha Institute of Information Technology, Delhi</td>
<td>Inria Paris Rocquencourt</td>
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<tr>
<td>Basal Ganglia At Large</td>
<td>B.R Surampudi</td>
<td>Frederic Alexandre</td>
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<td></td>
<td>Univ. of Hyderabad, Hyderabad</td>
<td>LaBRI, INRIA</td>
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<tr>
<td>Algorithmic Verification of Real-Time Systems</td>
<td>Krishna S</td>
<td>Frederic Herbreteau</td>
</tr>
<tr>
<td></td>
<td>IIT-Bombay</td>
<td>Institut Polytechnique de Bordeaux</td>
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<tr>
<th>Title</th>
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<th>French PI</th>
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<tr>
<td>Optimal inference in Complex and Turbulent data</td>
<td>D. Singh</td>
<td>Hussein Yahia</td>
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<td></td>
<td>IIT-Roorkee</td>
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<tr>
<td>Evolving Communities and Information Spreading</td>
<td>Bivas Mitra</td>
<td>Jean-Loup Guillaume</td>
</tr>
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<td>IIT-Kharagpur</td>
<td>Université Pierre et Marie Curie</td>
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<tr>
<td>Evolving Communities and Information Spreading</td>
<td>Uttama Lahiri</td>
<td>Anirban Dutta</td>
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<td></td>
<td>IIT, Gandhinagar</td>
<td>DEMAR, INRIA -Sophia Antipolis</td>
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Call for proposals for first targeted programme between Department of Science and Technology (DST), Government of India and Agence Nationale de la Recherche (ANR) was launched in October 2012. Against the call, 46 common project proposals were received in the areas of Infectious Diseases and Engineering Sciences. The following four projects from the domains of infectious diseases and engineering sciences were selected for support.

<table>
<thead>
<tr>
<th>Infectious Diseases</th>
<th>Indian Coordinator</th>
<th>French Coordinator</th>
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</thead>
<tbody>
<tr>
<td>Soluble mediators of the immune system against <em>Aspergillus fumigatus</em></td>
<td>Dr. Arun Sahu National Centre for Cell Science Pune</td>
<td>Dr. Vishukumar Aimananda Unité des Aspergillus Institut Pasteur Paris</td>
</tr>
<tr>
<td>Unravelling new functions for the H-NS family of proteins in Gram-negative bacterial pathogens</td>
<td>Dr. J. Gowrishankar Centre for DNA Fingerprinting and Diagnostics Hyderabad</td>
<td>Dr. Sylvie Rimsky Ecole Nationale Superieure (ENS) Cachan</td>
</tr>
</tbody>
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<tr>
<th>Engineering Sciences</th>
<th>Indian Coordinator</th>
<th>French Coordinator</th>
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<tbody>
<tr>
<td>Complex oxide nanocrystalline systems for chemical sensors</td>
<td>Dr. N. Venkataramani Indian Institute of Technology-Bombay</td>
<td>Dr. Antoine Barnabe Université Paul Sabatier Institut, Carnot Toulouse</td>
</tr>
<tr>
<td>Dense particulate systems</td>
<td>Prof. Prabhu R Nott Indian Institute of Science Bangalore</td>
<td>Dr. Elisabeth Guazzelli Aix Marseille University Marseille</td>
</tr>
</tbody>
</table>
Strengthening the Supply - Chain
European School on Nano-sciences and Nano-technologies (ESONN) is held every year in Grenoble, France during the months of August and September. This prestigious school is aimed at providing training for doctoral students, postdoctoral and junior scientists from universities and laboratories from all around the world in the field of Nanosciences and Nanotechnologies covering aspects such as the elaboration, characterization and functionalities of nano-objects. The program emphasizes on the role of laboratory courses and structured to highlight the fundamental and technological advances in Quantum Nanoelectronics and the interface between Physics and Biology.

Understanding the importance of nanotechnology in future, CEFIPRA has joined hands with a French university, Université Joseph Fourier to support the participation of Indian doctoral students in this European school (ESONN).

The 10th session of ESONN 2013 was a three-week course held during August 25th - September 14th, 2013 and CEFIPRA supported the participation of 6 Indian Doctoral Students. Through the feedback taken from CEFIPRA-ESONN fellows, it has been observed that the practical work and theory classes have been indeed beneficial for the candidates in terms of learning challenges in the field of nanotechnology.

<table>
<thead>
<tr>
<th>Name &amp; Institute</th>
<th>Name &amp; Institute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neha Sharan</td>
<td>Mr. Shammy Verma</td>
</tr>
<tr>
<td>Indian Institute of Science</td>
<td>Inter University Accelerator Centre, New Delhi</td>
</tr>
<tr>
<td>Bangalore, Karnataka.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mr. C. Jayaseelan</td>
</tr>
<tr>
<td></td>
<td>C. Abdul Hakeem College, Tamil Nadu</td>
</tr>
<tr>
<td></td>
<td>Mr. Tanay Roy</td>
</tr>
<tr>
<td></td>
<td>Tata Institute of Fundamental Research, Mumbai</td>
</tr>
<tr>
<td></td>
<td>Ms. Nandini Bhandaru</td>
</tr>
<tr>
<td></td>
<td>Indian Institute of Technology, Kharagpur</td>
</tr>
<tr>
<td></td>
<td>Mr. Harshad Harde</td>
</tr>
<tr>
<td></td>
<td>National Institute of Pharmaceutical Education and Research, Mohali</td>
</tr>
</tbody>
</table>

CEFIPRA-ESONN 2013 Fellowship
The Raman–Charpak Fellowship program is in honour of two Nobel Laureates in Physics, Prof C.V. Raman, Indian Nobel Laureate, 1930 and Prof Georges Charpak, French Nobel Laureate, 1992. The Fellowship was launched during the State visit of the President of France, Mr. Francois Hollande, to India on February 14-15th 2013. The aim is to facilitate the exchange of doctoral students between the two countries, in order to broaden the scope and depth of future engagements in science, technology and innovation.

The Raman-Charpak Fellowship is the only Indo-French bilateral Fellowship programme jointly funded by the Department of Science and Technology (DST), Government of India and the Science & Technology Department of the French Embassy in India, Ministry of Foreign Affairs, Government of France.

The Indo French Centre for Promotion of Advanced Research (CEFIPRA) implements this fellowship programme with a goal to improve the doctoral skills of students by providing them an opportunity to carry out part of their research work in a University / Research Institute based in France or India. The scheme provides an exposure and experience about the current research methods and trends in France/India, while discovering another cultural context. The fellowship covers 8 Fields of research like Atmospheric and Earth Sciences, Life Sciences, Medical Sciences, Chemistry, Material Sciences, Engineering Sciences, Mathematical and Computational Sciences & Physical Sciences. During the year, a total of 308 candidates applied for this fellowship and out of them 11 Indian and 5 French candidates were awarded the Raman-Charpak Fellowship 2013.

### Raman-Charpak Fellowship 2013

<table>
<thead>
<tr>
<th>Domain</th>
<th>Name &amp; Institute</th>
<th>Institute Visited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>Sreekuttan M. Unni</td>
<td>Institut de Chimie des Milieux et Matériaux de Poitiers, UMR-CNRS 7285, Université de Poitiers</td>
</tr>
<tr>
<td>Life Sciences</td>
<td>Dharmendra Tomar</td>
<td>Neuro Centre magendie, INSERM U862, Université Bordeaux II, Bordeaux</td>
</tr>
<tr>
<td></td>
<td>Shubhra Singh</td>
<td>Dynamique des Interactions Membranaires Normales et Patholigiques, Université Montpellier</td>
</tr>
<tr>
<td></td>
<td>Shubhra Singh</td>
<td>Institute of Life Science, Bhubaneswar &amp; Tata Institute of Fundamental Research, Mumbai</td>
</tr>
<tr>
<td></td>
<td>Esther Dalko</td>
<td>Institut de Génétique de Biologie Moléculaire et Cellulaire Illkirch</td>
</tr>
</tbody>
</table>

### Raman-Charapk Fellowship

<table>
<thead>
<tr>
<th>Domain</th>
<th>Name &amp; Institute</th>
<th>Institute Visited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Sciences</td>
<td>Vivek Reddy Palicharla</td>
<td>Institut de Génétique de Biologie Moléculaire et Cellulaire Illkirch</td>
</tr>
<tr>
<td>Mathematical Sciences</td>
<td>Bapan Ghosh</td>
<td>INRIA Sophia Antipolis Méditerranée</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Bengal Engineering and Science University, Shibpur, Howrah</td>
<td>Sophia Antipolis</td>
</tr>
<tr>
<td>Chemical Sciences</td>
<td>Kasireddy H. Vardhan Reddy</td>
<td>Laboratoire de Chimie Thérapeutique, BioCIS-CNRS</td>
</tr>
<tr>
<td></td>
<td>Indian Institute of Chemical Technology, Hyderabad</td>
<td>UMR Châtenay-Malabry</td>
</tr>
<tr>
<td>Konkala Karnakar</td>
<td>Laboratoire des Glucides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indian Institute of Chemical Technology, Hyderabad</td>
<td>UMR 6219 CNRS Amiens</td>
</tr>
<tr>
<td>Atmospheric Sciences</td>
<td>Sneha Chandrakant Sagarkar</td>
<td>INRA, UMR 1347</td>
</tr>
<tr>
<td></td>
<td>Nagpur</td>
<td>Agroecology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dijon</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>Purushottam Jha</td>
<td>Université Paris Diderot-Paris</td>
</tr>
<tr>
<td></td>
<td>Bhabha Atomic Research Centre Mumbai</td>
<td>7 CNRS UMR 7086</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paris</td>
</tr>
<tr>
<td></td>
<td>Joel Genet Marthelot</td>
<td>TIFR Centre for Interdisciplinary Sciences, Hyderabad</td>
</tr>
<tr>
<td></td>
<td>Université Pierre et Marie Curie</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jonathan Anthony Freundlich</td>
<td>Indian Institute of Science</td>
</tr>
<tr>
<td></td>
<td>Université Pierre et Marie Curie</td>
<td>Bangalore</td>
</tr>
<tr>
<td>Atmospheric and Earth Sciences</td>
<td>Kabilan Mani</td>
<td>Laboratorio Microorganisms</td>
</tr>
<tr>
<td></td>
<td>BITS Pilani K K Birla Goa Campus, Goa</td>
<td>Genome et Environment, France</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>Karan Nathwani</td>
<td>Signal &amp; Image processing</td>
</tr>
<tr>
<td></td>
<td>Dept. of Electrical Engineering</td>
<td>Department, Institut Mines-Telecom, Paris, France</td>
</tr>
<tr>
<td></td>
<td>Indian Institute of Technology, Kanpur</td>
<td></td>
</tr>
<tr>
<td>Chemical Sciences</td>
<td>Simon Donck</td>
<td>Indian Institute of Technology-Bombay, Mumbai</td>
</tr>
<tr>
<td></td>
<td>Université Paris Sud</td>
<td></td>
</tr>
<tr>
<td>Life Sciences</td>
<td>Ghania Ramdani</td>
<td>Department of Physics</td>
</tr>
<tr>
<td></td>
<td>Paris Descartes University,</td>
<td>Indian Institute of Science</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>Bangalore, India</td>
</tr>
</tbody>
</table>
CEFIPRA receives grants-in-aid from the Government of France and Government of India annually. The nodal agency on the Indian side is the Ministry of Science and Technology and on the French side is the Ministry of Foreign Affairs. The grants-in-aid are released based on the budgetary projections made by the Centre and duly approved by the Governing Body of the Centre. The grants-in-aid are directed towards expenditure on the following Core programmes of the Centre:

1. Scientific Research Programmes
2. Industrial Research Programme and
3. Seminar/workshops
4. Mobility support for Indian students to participate in the ESONN Training Programme
5. Any other activity approved by the Governing Body on case to case basis

During the year 2013-14, Rs.110.00 million and Rs. 100.84 million grant in aids were received from Government of India & Government of France respectively for the core programmes. The details of fund position for the last three years under the core programmes are given in the Table 1.

An amount of Rs. 165.84 million was spent on the Scientific Research Programme during the financial year. During the year 2013-14, sixty six new scientific research proposals were received and 22 proposals were recommended at an estimated cost of Rs. 236.79 million for support in the areas of Computer Science, Life and Health Science, Pure and Applied Physics, Pure and Applied Chemistry, Earth and Planetary Science, Material Science, Information and Communication Technology. The areas of Life and Health Sciences, Pure and Applied Physics and Pure and Applied Chemistry continue to have a higher share of the proposals received and accepted. The consistent effort made by the Centre in terms of expenditure towards collaborative scientific research projects has remained more or less study between 65 & 70 %. The number of project proposals considered and approved for the last five years are given in Figure 18.

As on March 31, 2014, 63 projects were under implementation. These include 13 new projects which

### Table 1

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Grant-in-aid received from Govt. of India C/F from Last year</th>
<th>Grant received during the year</th>
<th>Grant-in-aid received from Govt. of France C/F from Last year</th>
<th>Grant received during the year</th>
<th>Total Fund available (million Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>12.60</td>
<td>110.00</td>
<td>56.39</td>
<td>100.84</td>
<td>279.83</td>
</tr>
<tr>
<td>2012-13</td>
<td>38.46</td>
<td>82.73</td>
<td>52.21</td>
<td>112.76</td>
<td>286.16</td>
</tr>
<tr>
<td>2011-12</td>
<td>11.94</td>
<td>97.84</td>
<td>31.84</td>
<td>91.70</td>
<td>233.32</td>
</tr>
</tbody>
</table>

### Figure 18

Number of Project Proposals Considered and Approved

![Bar chart showing the number of proposals considered and accepted from 2009-10 to 2013-14](chart.png)
were started during the financial year. The disciplines in which the new projects where supported are in the areas of Life and Health Sciences, Pure and Applied Physics, Pure and Applied Chemistry, Earth Science, Material Science and Information Technology.

Among the 50 ongoing projects, 23 projects underwent mid-term review by the Scientific Council in its two meetings held during the year. The Council had deliberated on each of the projects and had suggested appropriate corrective measures so as to ensure successful outcome from these projects.

During the year there were 15 projects which were reviewed by the Scientific Council after their completion. Five of them were rated excellent and seven as Very Good. These projects ranged from domains of Water Resources, Material Sciences, Genetics, Applied Mathematics, Atmospheric Sciences, Catalysis etc. A total of 85 Publications have emanated from these projects which got 384 citations 5 new products, 30 processes and 7 designs resulted out of the projects. In terms of human resource development, 31 young scientists were trained including post-docs and doctoral students. Out of these 14 were trained in France and 17 students in India. There were total 37 visits from India to France and 24 were from France to India including students. The volume value analysis provided in the subsequent pages is indicative of the performance of this programme. Significant outcomes from these projects are in place and being followed up for further forward chaining.

Rs. 10.30 million was spent on the Industrial Research Programme during the financial year. Six projects are on-going under the programme in the areas of ceramic engineering, air pollution monitoring, information technology, catalysis, cancer and agriculture. The programme has continued to grow with two new projects being supported during the year in the areas of aerospace and wireless network. The Industrial Research Committee, with the help of CEFIPRA has strived to have an outreach to the small and medium industries of two countries who could benefit under this programme. Efforts were made to reach out in particular in the aerospace and IT sector industries of the two countries.

Seminars and workshops have always been used as a platform for enabling interactions between the scientific communities of the two countries. During the year 14 seminars/workshops were supported by the Centre at a cost of Rs. 22.61 million in the areas of Proteomics, Atmospheric Sciences, Design Conclave, Network Models, Filamentous Fungal Pathogens, Metal Organics and Optics, Nanosciences, Cold Atoms & Synchrotron facilities.

The details of the expenditure incurred by the Centre during the Financial Year for the core programme, under various budget heads are given in Table 2. A comparison with the previous two years has also been provided. Figure 19 depicts the expenditure pattern under various heads over the last five years.

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expenditure incurred for the core programme during the financial years</strong></td>
</tr>
<tr>
<td><strong>Budgetary Components</strong></td>
</tr>
<tr>
<td>1. Scientific Research Projects</td>
</tr>
<tr>
<td>2. Industrial Research projects</td>
</tr>
<tr>
<td>3. Seminars &amp; Workshops</td>
</tr>
<tr>
<td>4. General Scientific Expenses (activities like Publications of research papers, short visits of scientists other than project visits etc.)</td>
</tr>
<tr>
<td>5. Governing Body &amp; Scientific Council Expenses</td>
</tr>
</tbody>
</table>
CEFIPRA has been directed to diversify its activities over the last 3 years to cater to the requirements across the knowledge innovation chain. In this context, CEFIPRA had initiated programmes which took support from the National Funding Agencies of the two countries for facilitating their requirements and are considered as non-core programmes.

Targeted programmes generated through CEFIPRA is such a non-core programme through which the national funding agencies are provided a platform to support specific areas of bilateral interest. Significant among them are:

**Targeted Programmes**

**DST-INRA**

INRA had expressed a desire to have specific contact with homologous institutions in India to pursue a common research programme in water related research for agriculture. The first project in this area is between Ashoka Trust for Research in Ecology and the Environment & Indian Institute of Science, Bangalore and INRA

In this context it is necessary to understand that CEFIPRA is in the process of reviving the INRA-ICAR agreement so that a longstanding relationship could be sustained through the platform afforded by CEFIPRA.

**DST-ANR**

Recognising the pivotal role played by ANR in France, the Centre had requested DST to help nurture a collaborative programme. After an agreement between the two agencies, a first call for proposals was launched in mutually agreed areas of Infectious Diseases and Engineering Science. Against this call 56 proposals had been received. An expert committee from both the sides had evaluated these proposals and had recommended four of them for support. The Indian side is being funded entirely by DST through CEFIPRA. The French side is being financed by ANR directly.

The expenditure related to the Indian side implemented through CEFIPRA is Rs. 8.80 million during the year.

**DST-INRIA**

The Centre had been approached by INRIA & CNRS France requiring Centre's help in establishing direct linkages with the scientific communities involved in the IT sector in India. Towards this end, the Centre had
organized a Seminar in April, 2013 bringing together the communities in big data of the two countries.

Subsequent to this meeting INRIA had expressed desire to provide dedicated funding for this programme and DST had agreed to provide matching fund. Accordingly a call was launched during the financial year to invite proposals under DST-INRIA programme during the year.

### Mobility Programmes

The other dimension of the diversification of the activities of CEFIPRA is in terms of addressing the need of strengthening the supply chain of scientific manpower of the next generation of the two countries by supporting their mobility to expose them to the scientific landscape of the other nation.

In this context, Rs. 81.70 lakhs has been spent towards a dedicated mobility programme, Raman-Charpak Fellowship was launched during the State visit of Honorable President of France, H.E. Mr. François Hollande in India, in February 2013. The programme has supported visits of 11 Indian students to France and 5 students from France to India.

At the same time, CEFIPRA worked towards providing access to Indian doctoral student to the prestigious ESONN programme being implemented by the University of Joseph Fourier, Grenoble. CEFIPRA funded the students’ travel, stay and other incidental expenses for the period of the ESONN programme. During the financial year, seven Indian students benefited from this programme. The benefit of such support is enormous where these students, with their exposure will become future S&T ambassadors between India and France. This programme is supported from the fund received from the core programmes.

The details of fund position and expenditure incurred for the non core programmes during the financial year are given in the Figure 20 and Table 3.

### Others

#### DST-CNRS (IFCAM)

The Centre continues to manage the administrative and financial aspects related to the Indo French Centre for the Pure and Applied Mathematics (IFCAM), as approved by the Governing Body.

The programme started during the financial year 2012-13 and an amount of Rs. 7.80 million was available from Indian side (DST). Rs. 2.92 million was received from CNRS during the financial year and eight projects are under implementation.

### Centre’s premises

While the annual maintenance of the Centre continue to be met out of the accumulated funds resulting from bank interest etc., the Centre had taken an approval from the Governing Body for utilizing some of these funds for its renovation. The renovation processes are expected to end towards the end of 2014 and will be duly presented and reflected in the statement of accounts for the financial year 2014-2015.

### Financial Audit

The statutory audit of the accounts of the Centre was carried out by M/s. SSAS & Associates, Chartered Accountants. The Auditors’ Report with its attachments viz. Receipt & Payment Account, Income & Expenditure
## Table 3:
Non-core Programmes: Fund Position & Expenditure incurred

<table>
<thead>
<tr>
<th>Fund Available</th>
<th>Indian Side</th>
<th>French Side</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C/F balance</td>
<td>Received during the year</td>
<td>C/F balance</td>
</tr>
<tr>
<td>RAMAN-CHARPAK</td>
<td>7.44</td>
<td>0.30</td>
<td>-</td>
</tr>
<tr>
<td>FELLOWSHIP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DST-INRA PROJECTS</td>
<td>(0.29)</td>
<td>0.02</td>
<td>0.62</td>
</tr>
<tr>
<td>DST-ANR PROJECTS</td>
<td>-</td>
<td>9.00</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL RECEIPTS</td>
<td>7.5</td>
<td>9.32</td>
<td>0.62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPENDITURE</th>
<th>Indian Side</th>
<th>French Side</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAMAN-CHARPAK</td>
<td>4.49</td>
<td>3.68</td>
<td>8.17</td>
</tr>
<tr>
<td>FELLOWSHIP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DST-INRA PROJECTS</td>
<td>0.46</td>
<td>0.09</td>
<td>0.55</td>
</tr>
<tr>
<td>DST-ANR PROJECTS</td>
<td>8.83</td>
<td>-</td>
<td>8.83</td>
</tr>
<tr>
<td>TOTAL EXPENDITURE</td>
<td>13.78</td>
<td>3.77</td>
<td>17.55</td>
</tr>
</tbody>
</table>

Account and Balance Sheet are given. These accounts, as certified by the Auditors, show all transactions in Rupees after converting the transactions in Euro into Rupees. However, as required by the Bye-laws, the Euro versions of all these accounts was also prepared and certified by the Auditors.

The rate prescribed by the Reserve Bank of India on the last working day of the year, i.e. 31st March 2013 has been adopted for conversion of the transactions in Euro into Rupee and vice versa during the year 2013-14 in pursuanace of the decision of the Governing Body of the Centre. While, the accounts of the earlier year 2012-13 was based on exchange rate in relation to Rupee and Euro of Rs. 68.3403, the rate adopted during 2013-14 is Rs. 69.5438.
The Volume vs. Value index was constructed area wise. There are 15 completed projects of year 2013 across 9 thrust areas. The Volume is defined as the input provided for the thrust areas and the value is the output obtained in the thrust areas in relation to the input. The Volume vs. Value Index was constructed to understand the relationship of input to the output produced. The definition of input and output is considered as follows:

1. **Input in each thrust area**: Total expenditure from all the projects in a particular thrust area.
2. **Output in each thrust area** is defined as the Value Index (Refer Table 1)

**Steps followed for defining Value Index:**

Calculate

\[ \text{Value Index} (V) = \text{Tech 2} \times 0.3 + \frac{(\text{Pub} / \text{N_{pub}}) \times 0.25 + (\text{Avg. Citation} / \text{Total Avg. Citation}) \times 0.25 + 0.2 \times \left( \frac{\text{HRj}}{\text{N_{HR}}} \right)}{5} \]

The technological index for each thrust area is defined as

\[ \text{Tech 2} = \left[ \frac{(\text{Pat}_j / \text{N_{Pat}}) + (\text{Prod}_j / \text{N_{Prod}}) + (\text{Proj}_j / \text{N_{Proj}}) + (\text{Des}_j / \text{N_{Des}}) + (\text{Ins}_j / \text{N_{Ins}})}{5} \right] \]

**Calculation Table:**

<table>
<thead>
<tr>
<th>No. of Projects</th>
<th>Expenditure (Crore `)</th>
<th>Per Capita Expenditure (Crore `)</th>
<th>Patents Filed (Pat)</th>
<th>Product Filed (Prod)</th>
<th>Process Filed (Proj)</th>
<th>Design Filed (Des)</th>
<th>Instrument Filed (Ins)</th>
<th>Papers Filed (Papers)</th>
<th>Pub/N_{PUB}</th>
<th>Citations of Publications</th>
<th>Avg. Citation</th>
<th>Avg. Cit/ Total Avg Citation</th>
<th>Human Resource (HR)</th>
<th>HR/N_{HR}</th>
<th>Tech 2*</th>
<th>Value Index (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Sciences</td>
<td>1</td>
<td>0.418</td>
<td>0.418</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0.12</td>
<td>0.096</td>
</tr>
<tr>
<td>Life &amp; health Sciences</td>
<td>3</td>
<td>1.595</td>
<td>0.531</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0.058</td>
<td>18</td>
<td>3.6</td>
<td>0.122</td>
<td>7</td>
<td>0.22</td>
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<tr>
<td>Pure &amp; Applied Chemistry</td>
<td>3</td>
<td>2.085</td>
<td>0.695</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>19</td>
<td>352</td>
<td>199</td>
<td>6.65</td>
<td>0.225</td>
<td>7</td>
<td>0.22</td>
</tr>
<tr>
<td>Pure &amp; Applied Physics</td>
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<td>0.315</td>
<td>0.315</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>0.094</td>
<td>31</td>
<td>3.87</td>
<td>0.13</td>
<td>2</td>
<td>0.06</td>
</tr>
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<td>Earth and Planetary Sciences</td>
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<td>0.449</td>
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<td>2</td>
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<td>Environmental Sciences</td>
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<td>0</td>
<td>5</td>
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<td>0</td>
<td>18</td>
<td>0.231</td>
<td>101</td>
<td>5.61</td>
<td>0.190</td>
<td>4</td>
<td>0.12</td>
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<tr>
<td>Information &amp; Communication Technology (ICT)</td>
<td>1</td>
<td>0.524</td>
<td>0.524</td>
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<td>0</td>
<td>1</td>
<td>3</td>
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<td>0</td>
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<td>0.079</td>
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<td>Water</td>
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<td>0.708</td>
<td>0.708</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0.047</td>
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<td>2.25</td>
<td>0.076</td>
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<td>0.06</td>
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<tr>
<td>Pure and Applied Mathematics</td>
<td>2</td>
<td>0.96</td>
<td>0.48</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>0.17</td>
<td>10</td>
<td>0.66</td>
<td>0.022</td>
<td>2</td>
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<td>15</td>
<td>0</td>
<td>5</td>
<td>30</td>
<td>7</td>
<td>0</td>
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</tbody>
</table>

The Value Index for each thrust area is defined as:

\[ V = \text{Tech 2} \times 0.3 + \left( \frac{\text{Pub}}{\text{N_{pub}}} \times 0.25 + \left( \frac{\text{Avg. Citation}}{\text{Total Avg. Citation}} \times 0.25 + 0.2 \times \left( \frac{\text{HRj}}{\text{N_{HR}}} \right) \right) \right) \]
more of scientific research and thus a higher weight is given to scientific research as compared to technological output and human resource.

To understand the relationship between input and output we plot the following:

- x-axis – Per project cost in each thrust area (per capita expenditure for projects in each thrust areas)
- y-axis – Rate of return measured as the value index
- bubble size : the absolute value of expenditure for each thrust area.

Figure 1: Gives the relationship between the three variables.

**Per thrust area Investment**

**Note:** Life and Health Sciences (LHS); Pure and Applied Chemistry (CHEM); Environmental Sciences (ES); Pure and Applied Physics (PHY); Material Sciences (MS); Information and Communication Technology (ICT); Instrumentation (Inst.); Pure and Applied Mathematics (Maths); Water

The per capita expenditure (average project cost) is high for Pure and Applied Mathematics (Maths), Information and Communication Technology (ICT) and Water with low rate of return (weighted output).

Examining both the Total expenditure of a Thrust area (by size of bubble) and average project cost (by horizontal axis), it shows along with Environmental Sciences (ES), Pure and Applied Chemistry (CHEM) & Life and Health Sciences (LHS) have performed well with and yielded highest rate of return.

**Figure 1: Per thrust area Investment vs. Rate of Return**
The Auditors’s Report comprises the following:

- Balance Sheet as at 31st March, 2014 (Rupee version)
- Income & Expenditure Account for the year ended on 31.03.2014 (Rupee version)
- Receipt & Payment Account for the year ended on 31.03.2014 (Rupee version)
- Balance Sheet as at 31st March, 2014 (Euro version)
- Income & Expenditure Account for the year ended on 31.03.2014 (Euro version)
- Receipt & Payment Account for the year ended on 31.03.2014 (Euro version)
- Receipt & Payment Account for the year ended on 31.03.2014 (in respective currencies i.e.- Rupee/Euro)
- Accounting Policies and Notes on Accounts to Balance Sheet & Income and Expenditure Account.
- Receipt & Payment Account in respect of IFCPAR Gratuity Fund for the year ended on 31.03.2014
- Receipt & Payment Account in respect of IFCPAR General Provident Fund for the year ended on 31.03.2014

This is based on the accounting practices of India, and has taken into consideration, the requirements of the Government of India & Government of France as per the norms of IFCPAR/CEFIPRA.
Auditors' Report

To the Members of Governing Body of The Indo French Centre for the Promotion of Advanced Research, New Delhi

We have audited attached Balance sheet of the Indo French Centre for the Promotion of Advanced Research, New Delhi ("the Society") registered under Societies Registration Act, 1860 as at 31st March 2014 and the Income and Expenditure account and Receipt and Payment Account of the Society for the year ended, annexed thereto. These financial statements are the responsibility of the Society Management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with auditing standards generally accepted in India. Those Standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis of our opinion.

We report that:

(a) we have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit;

(b) in our opinion, proper books of accounts have been kept by the Society so far as appears from our examination of those books;

(c) the balance sheet and income and expenditure account dealt with by this report are in agreement with the books of accounts;

(d) as there are presently no authoritatively established accounting principles for the specialised aspects related to societies not having any commercial activity, these statements have been prepared on the basis of accounting policies referred to in the Note a. to the financial statements. On this basis, in our opinion and to the best of our information, and according to the explanations given to us, the said accounts give a true and fair view:

(i) in the case of the balance sheet, of the state of affairs of the Society as at 31st March 2014; and

(ii) in the case of the Receipt and Payment Account together with Income and expenditure Accounts, of the Surplus of income over expenditure for the accounting year ending 31st March 2014.

for SSAS and Associates,
Chartered Accountants
Firm Registration No.: 08550N

[Signature]
ALPANA SAXENA
Partner
Membership No. 095837

Head Office – U 52/62, DLF Phase III, Gurgaon, Haryana
# INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI

## BALANCE SHEET AS AT 31ST MARCH 2014

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Amount as at March 31, 2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liabilities</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Reserve Fund</td>
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<tr>
<td>Brought Forward Balance</td>
<td>120,762,549.15</td>
<td>145,519,438.06</td>
<td></td>
</tr>
<tr>
<td>Add: Surplus/(Deficit) of income over expenditure</td>
<td>(31,752,586.28)</td>
<td>98,036,632.37</td>
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<tr>
<td><strong>Reserves Commited for Specific Programmes</strong></td>
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<tr>
<td>IFCA Projects</td>
<td>4,249,103.00</td>
<td>7,809,040.00</td>
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<tr>
<td>DST-INRA Projects</td>
<td>167,954.00</td>
<td>273,247.00</td>
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</tr>
<tr>
<td>DST-ANR Projects</td>
<td>3,259,135.14</td>
<td>7,440,020.00</td>
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</tr>
<tr>
<td>Raman Charpuk Fellowship</td>
<td>2,016,491.04</td>
<td>2,276,732.04</td>
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</tr>
<tr>
<td>Economic Diplomacy R&amp;D Programmes</td>
<td>2,757,776.19</td>
<td>1,719,646.97</td>
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</tr>
<tr>
<td>Project with IF Rajasthan</td>
<td>12,600.01</td>
<td>1,335,983.00</td>
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</tr>
<tr>
<td>India-France Technology Summit</td>
<td>6,954,380.00</td>
<td>932,419.00</td>
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</tr>
<tr>
<td>Challenges in Health</td>
<td>1,003,691.06</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Water Network</td>
<td>1,351,232.21</td>
<td>1,351,232.21</td>
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</tr>
<tr>
<td>French Season in India</td>
<td>273,420.21</td>
<td>92,419.03</td>
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<tr>
<td>Indo-India Science &amp; Innovation House Project</td>
<td>41,277.03</td>
<td>21,641,419.72</td>
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<tr>
<td>Overseas from Specific Programmes</td>
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<tr>
<td><strong>Amount to be refunded to DST</strong></td>
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<tr>
<td>SC/IR Special Meeting</td>
<td>55,248.00</td>
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<tr>
<td><strong>TOTAL</strong></td>
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<td>151,561,577.89</td>
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<td><strong>Assets</strong></td>
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<td>Fixed Assets</td>
<td>A</td>
<td>5,427,224.61</td>
<td>6,085,696.61</td>
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<tr>
<td>Less: Depreciation</td>
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<td>887,765.00</td>
<td>968,310.00</td>
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<td><strong>Net Block</strong></td>
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<td>4,539,459.61</td>
<td>5,117,386.61</td>
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<tr>
<td>Work in Progress/Office</td>
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<td>1,663,230.00</td>
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<tr>
<td><strong>Cash &amp; Cash Equivalents</strong></td>
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<tr>
<td>In Indian Rupees Saving Bank Accounts</td>
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<td>Union Bank of India</td>
<td>11,693,848.95</td>
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<tr>
<td>State Bank of Hyderabad</td>
<td>27,696,068.59</td>
<td>25,120,317.49</td>
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<td>Axis Bank</td>
<td>675,735.00</td>
<td>747,665.00</td>
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<td>State Bank of Hyderabad (Gratuity Fund)</td>
<td>2,174,965.47</td>
<td>2,563,116.47</td>
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<td>In Euro Account</td>
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<td>Credit Industriel et Commercial, Paris</td>
<td>64,675,062.62</td>
<td>109,025,720.54</td>
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<td><strong>Sendry Deposits</strong></td>
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<td>With Indian Habitat Centre</td>
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<td>Rent</td>
<td>180,000.00</td>
<td>180,000.00</td>
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<td>Cellular Connection</td>
<td>20,120.00</td>
<td>205,220.00</td>
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<tr>
<td>Income Tax and TDS-Recoverable</td>
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<td><strong>TOTAL</strong></td>
<td>4,293,913.44</td>
<td>4,293,913.44</td>
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<td><strong>Accounting policies and notes on accounts</strong></td>
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</tr>
<tr>
<td>As per our report of each date.</td>
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<tr>
<td>For SSAS AND ASSOCIATES</td>
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<tr>
<td>Firm Registration No. 08559N</td>
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<tr>
<td>Chartered Accountants</td>
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<tr>
<td>Alpaka Saxena</td>
<td></td>
<td></td>
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<tr>
<td>Membership No. 095837</td>
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<td>Place : New Delhi</td>
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<td>Date : 27-3-2014</td>
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Ruppee Version

[Conversion Factor 1 Euro = Rs. 69.5430]

[Conversion Factor 1 Euro = Rs. 66.3403 for the year 2012-13]
# INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2014

## INCOME

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Amount as at March 31, 2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grant-in-aid</strong></td>
<td></td>
<td></td>
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<tr>
<td>Contribution from Department of Science and</td>
<td>110,000.00</td>
<td>82,727,465.00</td>
<td>93,820,075.00</td>
</tr>
<tr>
<td>Contribution from Govt. of France</td>
<td>110,000.00</td>
<td>82,727,465.00</td>
<td>93,820,075.00</td>
</tr>
<tr>
<td><strong>Noncore Programmes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFSCAM Projects</td>
<td>2,920,039.00</td>
<td>1,515,000.00</td>
<td>4,435,039.00</td>
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<tr>
<td>DST-INRA Projects</td>
<td>6,667,015.00</td>
<td>6,667,015.00</td>
<td>6,667,015.00</td>
</tr>
<tr>
<td>DST-ANR Projects</td>
<td>3,831,745.00</td>
<td>3,831,745.00</td>
<td>3,831,745.00</td>
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<tr>
<td>Raman Charpak Fellowship</td>
<td>3,665,821.40</td>
<td>7,500,300.00</td>
<td>11,166,121.40</td>
</tr>
<tr>
<td><strong>Extramural Activities</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Economic Diplomacy R&amp;D Programmes</td>
<td>2,434,032.00</td>
<td>2,354,665.04</td>
<td>4,788,697.04</td>
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<tr>
<td>Project with IT R &amp; Rajasthan</td>
<td>7,214,370.01</td>
<td>1,719,646.97</td>
<td>9,933,016.98</td>
</tr>
<tr>
<td>India-France Technology Summit</td>
<td>6,954,380.00</td>
<td>6,954,380.00</td>
<td>6,954,380.00</td>
</tr>
<tr>
<td>Challenges in Health</td>
<td>2,781,752.80</td>
<td>2,781,752.80</td>
<td>2,781,752.80</td>
</tr>
<tr>
<td>Water Network</td>
<td>19,784,345.79</td>
<td>19,784,345.79</td>
<td>19,784,345.79</td>
</tr>
<tr>
<td>French Season in India</td>
<td>399,810.78</td>
<td>5,907,867.08</td>
<td>6,307,677.85</td>
</tr>
<tr>
<td>India Science &amp; Innovation House Project</td>
<td>19,784,345.79</td>
<td>19,784,345.79</td>
<td>19,784,345.79</td>
</tr>
<tr>
<td><strong>SC/IRC Special Meetings</strong></td>
<td>300,000.00</td>
<td>5,907,867.08</td>
<td>6,207,867.08</td>
</tr>
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<td>Misc Income</td>
<td>106,677.80</td>
<td>106,677.80</td>
<td>106,677.80</td>
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<tr>
<td><strong>Interest from Bank Accounts</strong></td>
<td>2,659,354.80</td>
<td>3,125,765.00</td>
<td>5,785,119.80</td>
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<td>Core Programmes</td>
<td>824,496.00</td>
<td>135,209.00</td>
<td>959,705.00</td>
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<tr>
<td>Non-Core Programme</td>
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<td>160,722.00</td>
<td>160,722.00</td>
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<tr>
<td><strong>Retirement Fund</strong></td>
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<td>3,584,572.00</td>
<td>3,584,572.00</td>
</tr>
<tr>
<td>Interest received from income Tax</td>
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<td>3,844,574.00</td>
<td>3,844,574.00</td>
</tr>
<tr>
<td><strong>Net on Exchange Rate Fluctuation</strong></td>
<td>2,659,109.80</td>
<td>4,034,335.48</td>
<td>6,693,445.28</td>
</tr>
<tr>
<td>In conversion of opening balance of CIC, Paris</td>
<td>1,344,229.40</td>
<td>1,344,229.40</td>
<td>1,344,229.40</td>
</tr>
<tr>
<td>In repatriation of funds from France</td>
<td>2,659,109.80</td>
<td>4,034,335.48</td>
<td>6,693,445.28</td>
</tr>
<tr>
<td><strong>Brought Forward from Accumulated Reserves for Specific Programmes</strong></td>
<td>21,778,628.74</td>
<td>246,636,486.32</td>
<td>246,636,486.32</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>285,914,794.38</td>
<td>285,914,794.38</td>
<td>285,914,794.38</td>
</tr>
</tbody>
</table>

## PAYMENTS

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Amount as at March 31, 2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Expenses of the Centre</td>
<td>207,690,695.92</td>
<td>184,567,752.55</td>
<td>392,258,448.47</td>
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<tr>
<td>Governing Body/ Scientific Council Expenses</td>
<td>12,820,024.01</td>
<td>13,193,335.65</td>
<td>26,013,359.66</td>
</tr>
<tr>
<td>Travelling Expenses</td>
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<td>2,038,358.48</td>
<td>4,328,950.26</td>
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<tr>
<td>Office Expenses - Shareable</td>
<td>4,696,468.18</td>
<td>3,981,936.40</td>
<td>8,678,404.58</td>
</tr>
<tr>
<td>Salaries</td>
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<td>13,387,593.00</td>
<td>26,775,186.00</td>
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<td>Office Expenses - Non-shareable</td>
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<td>3,672,158.00</td>
<td>10,610,304.07</td>
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<tr>
<td>Targeted Scientific Programmes</td>
<td>24,332,630.07</td>
<td>13,168,767.30</td>
<td>37,501,397.37</td>
</tr>
<tr>
<td>Extramural Activities</td>
<td>12,121,256.55</td>
<td>9,799,092.37</td>
<td>21,920,348.92</td>
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<tr>
<td>Gratuity Fund</td>
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<td>305,150.00</td>
<td>803,803.00</td>
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<td>H. SC/IRC Special Meeting</td>
<td>244,752.00</td>
<td>244,752.00</td>
<td>244,752.00</td>
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<tr>
<td>Depreciation on Fixed Assets</td>
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<td>968,331.00</td>
<td>1,866,114.00</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>285,914,794.38</td>
<td>285,914,794.38</td>
<td>285,914,794.38</td>
</tr>
<tr>
<td>Balance of Surplus Funds</td>
<td>10,035,510.56</td>
<td>4,606,156.20</td>
<td>14,641,666.76</td>
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</tbody>
</table>
Less: Appropriation of Unutilised Funds for Targeted/Extramural Programmes

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFCAM Projects</td>
<td>4,245,183.88</td>
</tr>
<tr>
<td>DST-INRA Projects</td>
<td>-</td>
</tr>
<tr>
<td>DST-ANR Projects</td>
<td>167,954.94</td>
</tr>
<tr>
<td>Raman Charpak Fellowship</td>
<td>3,259,135.14</td>
</tr>
<tr>
<td>Economic Diplomacy R&amp;D Programmes</td>
<td>2,016,491.04</td>
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<tr>
<td>Project with IIT Rajasthan</td>
<td>2,737,776.19</td>
</tr>
<tr>
<td>India-France Technology Summit</td>
<td>122,680.00</td>
</tr>
<tr>
<td>Challenges in Health</td>
<td>-</td>
</tr>
<tr>
<td>Water Network</td>
<td>6,954,380.00</td>
</tr>
<tr>
<td>French Season in India</td>
<td>1,083,691.36</td>
</tr>
<tr>
<td>SC/JRC Special Meeting</td>
<td>735,231.21</td>
</tr>
<tr>
<td>India Science &amp; Innovation House Project</td>
<td>55,248.00</td>
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<tr>
<td>Overheads from Specific Programmes</td>
<td>273,620.22</td>
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<td>41,277.03</td>
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<td>21,696,667.72</td>
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<td>1,799,646.07</td>
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<td>2,776,732.04</td>
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<tr>
<td></td>
<td>7,440,000.00</td>
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<td>7,800,000.00</td>
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<tr>
<td></td>
<td>273,247.70</td>
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<tr>
<td>Surplus/(Deficit) of Income over expenditure carried over to Balance Sheet</td>
<td>(31,752,586.28)</td>
</tr>
<tr>
<td></td>
<td>(15,835,086.91)</td>
</tr>
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</table>

Accounting policies and notes on accounts

L

As per our report of even date.

For SSAS AND ASSOCIATES
Firm Registration No. 06550N
Chartered Accountants
ALPANA SAXENA
Partner
Membership No. 095837

Place: New Delhi
Date: 27/09/2014

Walken
MATHEW JOSEPH
ACCOUNTS OFFICER

DR. DEBAPRITA DUTTA
DIRECTOR
### INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI

**Receipt and Payment Account for the Year Ended on 31st March, 2014**

**Conversion Factor (Euro = Rs. 68.3403 for the year 2012-13)**

**Rupee Version**

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Amount as at March 31, 2013</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Brought Forward Balance</strong></td>
<td></td>
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<tr>
<td><strong>Cash &amp; Cash Equivalents:</strong></td>
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<td><strong>In Indian Rupees Saving Bank Account</strong></td>
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<tr>
<td>Union Bank of India</td>
<td>8,054,715.95</td>
<td>222,219.95</td>
<td>10,276,935.85</td>
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<tr>
<td>State Bank of Hyderabad</td>
<td>53,120,317.49</td>
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<td>128,706,781.60</td>
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<td>747,665.00</td>
<td>718,492.00</td>
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<td>2,733,045.47</td>
<td>5,296,161.94</td>
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<td>State Bank of Hyderabad (Gratuity Fund)</td>
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<td></td>
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<tr>
<td><strong>In Euro Account</strong></td>
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<td>Credit Industriel et Commercial, Paris, France</td>
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<td>46,804,226.72</td>
<td>124,271,490.64</td>
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</table>

| **B. Receipts** | | | |  |
| **Grant-in-aid** | | | |  |
| **For Core Programmes** | | | |  |
| Contribution from Dept. of Science and Technology, Govt. of India | 110,036,600.00 | 210,838,510.00 | 320,875,110.00 |
| Contribution from Govt. of France | 100,036,510.00 | 112,761,495.00 | 212,798,005.00 |
| **For Non-core Programmes** | | | |  |
| IFICAM Projects | 2,920,839.00 | 14,515,006.00 | 17,435,845.00 |
| DST IRSA Projects | - | 6,667,015.00 | 6,667,015.00 |
| DST-ANR Projects | 8,311,745.00 | - | 8,311,745.00 |
| Raman Charpak Fellowship | 3,485,124.40 | 15,438,406.00 | 18,923,526.40 |
| **For Extramural Activities** | | | |  |
| Economic Diplomacy R & D Programmes | 2,434,833.00 | 1,719,646.97 | 4,154,479.97 |
| Project with IT Rajastran | - | - | - |
| India-France Technology Summit | 7,214,370.01 | - | 7,214,370.01 |
| Challenges in Health | 6,354,380.00 | - | 6,354,380.00 |
| Water Network | 2,781,752.03 | - | 2,781,752.03 |
| French Season in India | - | - | - |
| India Science & Innovation House Project | 791,510.78 | 19,784,345.79 | 20,575,856.57 |
| SC/IRC Special meetings | 100,000.00 | 100,000.00 | 200,000.00 |
| Misc Income | 100,000.00 | 100,000.00 | 200,000.00 |

| **Interest from Bank Accounts** | | | |  |
| Core Programmes | 2,659,354.00 | 3,125,765.00 | 5,785,119.00 |
| Non-Core Programmes | 824,496.00 | 3,564,572.00 | 4,389,068.00 |
| Gratuity Fund | 100,722.00 | 135,209.00 | 235,931.00 |

| **Interest received from Income Tax** | | | |  |
| **Refund of Income Tax/TDS** | | | |  |

**Gain on Exchange Rate Fluctuation**

| Conversion of opening balance of CIG, Paris | 1,364,228.48 | 4,054,335.48 | 5,418,563.96 |
| In repatriation of funds from France | 2,690,196.00 | - | 2,690,196.00 |

| **Amount deducted from Salaries** | | | |  |
| Tax Deducted at Source | 1,196,976.00 | 1,499,314.00 | 2,696,290.00 |
| Group Insurance Premium | 9,360.00 | 9,360.00 | 18,720.00 |
| Contributory Provident Fund | 1,446,225.00 | 2,654,561.00 | 4,100,786.00 |

| TDS deducted-Bills/Contractors etc. | 690,171.00 | 340,074.00 | 1,030,245.00 |

| Amount recovered on behalf of CLRI, Chennai | 43,940.00 | 110,520.00 | 154,460.00 |

| Amount recovered on behalf of DST | 221,940.00 | 384,193,567.47 | 384,415,507.47 |
### Receipt and Payment Account for the Year Ended on 31st March, 2014

*(Conversion Factor: 1 Euro = Rs. 69.5418)*

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Amount as at March 31, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><strong>March 31, 2013</strong></td>
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<tr>
<td><strong>C. Shareable Expenses</strong></td>
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<td></td>
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<tr>
<td>Scientific expenses of the Centre</td>
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<td>184,567,752.55</td>
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<tr>
<td>Governing Body/Scientific Council Expenses</td>
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<td>13,191,335.63</td>
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<tr>
<td>Travelling Expenses</td>
<td>D 2,209,591.78</td>
<td>2,099,338.45</td>
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<tr>
<td>Office Expenses - Shareable</td>
<td>E 4,089,448.19</td>
<td>3,981,936.49</td>
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<tr>
<td>Salaries</td>
<td>F 13,387,593.00</td>
<td>13,155,543.00</td>
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<tr>
<td>Purchase of Office Equipment</td>
<td>209,086.00</td>
<td>51,927.61</td>
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<tr>
<td>Purchase of Furniture &amp; Fixtures</td>
<td>18,050.00</td>
<td>167,182.00</td>
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<tr>
<td>Purchase of Computer System</td>
<td>62,000.00</td>
<td>62,000.00</td>
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<tr>
<td>Security Deposit refundable</td>
<td>5,000.00</td>
<td>5,000.00</td>
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<td>Security Deposit-Director’s residence</td>
<td>-</td>
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<tr>
<td>Security Deposit-Cellphone</td>
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<td>720.00</td>
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<tr>
<td>Sale of Old Staff Car</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Furniture &amp; Fixture (Sold)</td>
<td>-</td>
<td>(23,764.00)</td>
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<tr>
<td>Office Equipment (Sold)</td>
<td>-</td>
<td>(21,149.00)</td>
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<tr>
<td>Advance paid to suppliers</td>
<td>-</td>
<td>241,213,228.91</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>241,213,228.91</strong></td>
<td><strong>217,167,657.66</strong></td>
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<tr>
<td><strong>D. Non-shareable Expenses</strong></td>
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<tr>
<td>Office Expenses - Non-shareable</td>
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<td>Computer System</td>
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<tr>
<td>Computer System (Sold)</td>
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<td>-</td>
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<tr>
<td>Renovation Expenses</td>
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<td>4,169,680.00</td>
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<td><strong>Total</strong></td>
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<td><strong>4,199,680.00</strong></td>
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<td><strong>E. Targeted Scientific Programmes</strong></td>
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<td><strong>F. Extramural Activities</strong></td>
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<td><strong>G. Gratuity Fund</strong></td>
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<td>265,156.00</td>
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<td><strong>H. SC/JRC Special Meeting</strong></td>
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<td><strong>I. Miscellaneous Payments</strong></td>
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<td><strong>Total</strong></td>
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<td><strong>J. Closing Balance</strong></td>
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<tr>
<td>Bank Balances</td>
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<tr>
<td>In Indian Rupees</td>
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</tr>
<tr>
<td>Saving Bank Account</td>
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</tr>
<tr>
<td>Union Bank of India</td>
<td>11,803,084.95</td>
<td>8,654,715.95</td>
</tr>
<tr>
<td>State Bank of Hyderabad</td>
<td>27,466,028.00</td>
<td>51,120,217.49</td>
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<td>Axis Bank</td>
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<td>747,665.00</td>
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<tr>
<td>State Bank of Hyderabad (Gratuity Fund)</td>
<td>2,174,985.47</td>
<td>2,563,116.47</td>
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<tr>
<td>In Euro</td>
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<tr>
<td>Credit Industriel et Commercial, Paris, France</td>
<td>66,575,062.62</td>
<td>109,025,720.54</td>
</tr>
<tr>
<td><strong>TOTAL (C+D+E+F+G+H+I)</strong></td>
<td>359,627,697.92</td>
<td>384,193,567.47</td>
</tr>
<tr>
<td>Accounting policies and notes on accounts</td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>

As per our report of even date.

For SSAS AND ASSOCIATES
Firm Registration No. 08550N
Chartered Accountants

Mathew Joseph
Accounts Officer

Dr. Debapriya Dutta
Director

Alpana Saxena
Partner
Membership No. 095837

Place: New Delhi
Date: 27.09.2014
<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Amount as at March 31, 2013</th>
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<tbody>
<tr>
<td><strong>Liabilities</strong></td>
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<td>(12,864.76)</td>
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<td>114,134.70</td>
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<td>DST-RRIE Projects</td>
<td>2,415.08</td>
<td>-</td>
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<td>160,866.95</td>
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<td>Economic Diplomacy R &amp; D Programmes</td>
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<td>33,313.63</td>
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<tr>
<td>Project with IIT-Jodhpur</td>
<td>40,367.65</td>
<td>25,943.00</td>
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<tr>
<td>India France Technology Summit</td>
<td>1,264.67</td>
<td>-</td>
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<tr>
<td>Challenges in Health</td>
<td>100,000.00</td>
<td>-</td>
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<tr>
<td>Water Network</td>
<td>15,292.00</td>
<td>19,515.98</td>
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<tr>
<td>French Season in India</td>
<td>10,572.20</td>
<td>19,515.98</td>
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<tr>
<td>India Science &amp; Innovation Board Project</td>
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<td>13,693.70</td>
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<tr>
<td>Overheads from Specific Programmes</td>
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<td>311,191.22</td>
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<td><strong>Amount to be refunded to DST</strong></td>
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<td><strong>Cash &amp; Cash Equivalents:</strong></td>
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<td>Union Bank of India</td>
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<td>Axis Bank</td>
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<tr>
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<td>37,685.29</td>
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<td>Crédit Industriel et Commercial, Paris</td>
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<td><strong>Sunrise Deposits</strong></td>
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<td><strong>Income Tax and TDS- Recoverable</strong></td>
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<td><strong>TOTAL</strong></td>
<td>61,744.02</td>
<td>62,831.35</td>
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</tbody>
</table>

Accounting policies and notes on accounts
As per our report of even date.

For SAS AND ASSOCIATES
Chartered Accountants
Partnership No. 068507
Membership No. 069563
Place: New Delhi
Date: 27/09/2014

[Signature]

MATHIEU JOSEPH
ACCOUNTS OFFICER
DR. DEEPRAGA DUTTA
DIRECTOR
<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Total</th>
<th>Amount as at March 31, 2013</th>
<th>Total</th>
</tr>
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</tr>
<tr>
<td>Grant-in-aid</td>
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<td>Contribution from Department of Science and Technology, Govt. of India</td>
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<td>Contribution from Govt. of France</td>
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<td>-</td>
<td>-</td>
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<td>410,644.91</td>
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<td>Economic Diplomacy R&amp;D Programmes</td>
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<td>34,455.00</td>
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<td>Project with IIT Rajasthan</td>
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<td>25,163.00</td>
<td>-</td>
<td>-</td>
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<tr>
<td>India-France Technology Summit</td>
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<td>26,828.90</td>
<td>86,446.90</td>
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<td>Challenges in Health</td>
<td>100,000.00</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>Water Network</td>
<td>40,000.00</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>French Season in India</td>
<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>India Science &amp; Innovation House Project</td>
<td>5,749.05</td>
<td>264,407.56</td>
<td>26,828.90</td>
<td>86,446.90</td>
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<tr>
<td>SC/IRC Special meetings</td>
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<td>-</td>
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<tr>
<td>Misc Income</td>
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<tr>
<td>Interest from Bank Accounts</td>
<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Interest received from Income Tax</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Gain on Exchange Rate Fluctuation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>In conversion of opening balance of CIC, Paris</td>
<td>19,615.04</td>
<td>50,314.22</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>In repatriation of funds from France</td>
<td>36,602.18</td>
<td>50,314.22</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Brought Forward from Accumulated Reserves for Specific Programmes</td>
<td>313,155.57</td>
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<tr>
<td>TOTAL</td>
<td>3,967,092.29</td>
<td>-</td>
<td>3,521,150.59</td>
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</table>

PAYMENTS

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Total</th>
<th>Amount as at March 31, 2013</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Scientific Expenses of the Centre</td>
<td>B</td>
<td>2,985,179.07</td>
<td>2,708,716.15</td>
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<tr>
<td>Governing Body/Scientific Council Expenses</td>
<td>C</td>
<td>184,344.60</td>
<td>193,063.52</td>
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<tr>
<td>Travelling Expenses</td>
<td>D</td>
<td>31,643.25</td>
<td>29,826.30</td>
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<tr>
<td>Office Expenses - Shareable</td>
<td>E</td>
<td>70,264.61</td>
<td>58,466.30</td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td>F</td>
<td>152,505.92</td>
<td>192,560.52</td>
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</tr>
<tr>
<td>Office Expenses - Non-shareable</td>
<td>G</td>
<td>90,766.57</td>
<td>53,733.42</td>
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<tr>
<td>Targeted Scientific Programmes</td>
<td>H</td>
<td>350,320.67</td>
<td>192,694.03</td>
<td></td>
</tr>
<tr>
<td>Extramural Activities</td>
<td>I</td>
<td>174,395.24</td>
<td>14,325.51</td>
<td></td>
</tr>
<tr>
<td>Gratuity Fund</td>
<td>J</td>
<td>7,029.43</td>
<td>4,465.27</td>
<td></td>
</tr>
<tr>
<td>H. SC/IRC Special Meeting</td>
<td>-</td>
<td>3,519.39</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Depreciation on Fixed Assets</td>
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<td>12,765.02</td>
<td>14,169.27</td>
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<tr>
<td>TOTAL</td>
<td>4,131,692.57</td>
<td>-</td>
<td>3,452,720.29</td>
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</tbody>
</table>

Balance of Surplus Funds

(144,598.37) | 67,460.30 |
**Less: Appropriation of Unutilised Funds for Targetted/Extramural Programmes**

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFCAM Projects</td>
<td>61,100.83</td>
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<tr>
<td>DST-INRA Projects</td>
<td>-</td>
</tr>
<tr>
<td>DST-ANR Projects</td>
<td>2,415.08</td>
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<tr>
<td>Raman Charpak Fellowship</td>
<td>46,854.50</td>
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<tr>
<td>Economic Diplomacy R &amp; D Programmes</td>
<td>20,995.99</td>
</tr>
<tr>
<td>Project with IIT Raipur</td>
<td>39,367.65</td>
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<tr>
<td>India Frace Technology Summit</td>
<td>1,704.07</td>
</tr>
<tr>
<td>Challenges in Health</td>
<td>100,000.00</td>
</tr>
<tr>
<td>Water Network</td>
<td>15,582.86</td>
</tr>
<tr>
<td>French Season in India</td>
<td>10,572.20</td>
</tr>
<tr>
<td>SC/IRC Special Meeting</td>
<td>794.42</td>
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<tr>
<td>India Science &amp; Innovation House Project</td>
<td>3,934.50</td>
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<tr>
<td>Overhead Charges to Cofepsra</td>
<td>593.54</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>311,905.65</strong></td>
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<tr>
<td><strong>Surplus/(Deficit) of Income over expenditure carried over to Balance Sheet</strong></td>
<td></td>
</tr>
<tr>
<td><strong>(456,504.02)</strong></td>
<td><strong>(231,721.08)</strong></td>
</tr>
</tbody>
</table>

Accounting policies and notes on accounts

As per our report of even date.

For SSAS AND ASSOCIATES
Firm Registration No. 08550N
Chartered Accountants

ALPANA SAXENA
Partner
Membership No. 995837

Place: New Delhi
Date: 27.09.2014

Mathew Joseph
Accounts Officer

Debapriya Dutta
Director
# Receipt and Payment Account for the Year Ended on 31st March, 2014

## Euro Version

(Conversion Factor 1 Euro = Rs. 69.5433)

(Conversion Factor 1 Euro = Rs. 68.3403 for the year 2012-13)

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount as at March 31, 2014</th>
<th>Amount as at March 31, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Brought Forward Balance</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Cash &amp; Cash Equivalents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Indian Rupees Saving Bank Account</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Union Bank of India</td>
<td>115,822.70</td>
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<tr>
<td>State Bank of Hyderabad</td>
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<td>1,076,766.97</td>
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<tr>
<td>Axis Bank</td>
<td>10,750.99</td>
<td>10,513.44</td>
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<tr>
<td>Bank of Tokyo Mitsubishi Ltd.</td>
<td>36,056.15</td>
<td>39,992.00</td>
</tr>
<tr>
<td>State Bank of Hyderabad (Grainity Fund)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Euro Account</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit Industrial et Commercial, Paris, France</td>
<td>811,334.67</td>
<td>2,041,203.94</td>
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<tr>
<td></td>
<td></td>
<td>625,339.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,756,655.52</td>
</tr>
<tr>
<td><strong>B. Receipts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grants-in-Aid</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Core Programmes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribution from Dept. of Science and Technology, Govt. of India</td>
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<td>1,210,522.42</td>
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<tr>
<td>Contribution from Govt. of France</td>
<td>1,450,036.60</td>
<td>3,031,736.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,650,860.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,860,522.42</td>
</tr>
<tr>
<td>For Noncore Programmes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFNAM Projects</td>
<td>42,030.00</td>
<td>212,392.98</td>
</tr>
<tr>
<td>DST-ANR Projects</td>
<td>97,556.13</td>
<td>97,556.13</td>
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<tr>
<td>DST-ANR Projects</td>
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<td>126,995.43</td>
</tr>
<tr>
<td>Raman Charan Fellowship</td>
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<td>53,030.00</td>
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<tr>
<td></td>
<td></td>
<td>221,995.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>107,744.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td>419,744.02</td>
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<tr>
<td>For Extramural Activities</td>
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<td></td>
</tr>
<tr>
<td>Economic Diplomacy R&amp;D Programmes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project with IIT Rajasthan</td>
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<td>34,425.00</td>
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<tr>
<td>India-France Technology Summit</td>
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<td>25,163.00</td>
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<tr>
<td>Challenges in Health</td>
<td>100,000.00</td>
<td></td>
</tr>
<tr>
<td>Water Network</td>
<td>40,030.00</td>
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</tr>
<tr>
<td>French Season in India</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India Science &amp; Innovation House Project</td>
<td>5,745,456.51</td>
<td>284,497,56</td>
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<tr>
<td>SC/IRC Special meeting</td>
<td>4,313.33</td>
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</tr>
<tr>
<td>Misc. Income</td>
<td>1,562.72</td>
<td></td>
</tr>
<tr>
<td>Transfer of Funds</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interest from Bank Accounts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Programmes</td>
<td>38,239.99</td>
<td>45,738.24</td>
</tr>
<tr>
<td>Non-Core Programme</td>
<td>11,055.76</td>
<td></td>
</tr>
<tr>
<td>Grainity Fund</td>
<td>1,448.92</td>
<td>51,544.09</td>
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<tr>
<td></td>
<td></td>
<td>1,970.47</td>
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<td></td>
<td></td>
<td>47,716.71</td>
</tr>
<tr>
<td><strong>Interest received from Income Tax</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>56,256.32</td>
</tr>
<tr>
<td><strong>Refund of Income Tax / TDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>300,512.27</td>
</tr>
<tr>
<td><strong>Gain on Exchange Rate Fluctuation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In conversion of opening balance of CIC, Paris in reparation of funds from France</td>
<td>19,616.84</td>
<td>58,314.22</td>
</tr>
<tr>
<td></td>
<td>38,682.18</td>
<td>58,299.02</td>
</tr>
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<td></td>
<td></td>
<td>50,514.22</td>
</tr>
<tr>
<td><strong>Amount deducted from Salaries</strong></td>
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</tr>
<tr>
<td>Tax Deducted at Source</td>
<td>17,211.88</td>
<td>14,627.54</td>
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<td>Group Insurance Premium</td>
<td>134.59</td>
<td>136.95</td>
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<td>Contributory Provident Fund</td>
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<td>38,171.07</td>
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<td></td>
<td></td>
<td>21,211.89</td>
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<td></td>
<td></td>
<td>35,966.20</td>
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<tr>
<td>TDS deducted from Contractors etc.</td>
<td>9,924.26</td>
<td>4,987.89</td>
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<tr>
<td>Amount recovered on behalf of CLRI, Chennai</td>
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<td>642.96</td>
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<tr>
<td>Amount recovered on behalf of DST</td>
<td>3,176.43</td>
<td>1,617.20</td>
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<tr>
<td></td>
<td></td>
<td>5,393,017.34</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5,746,417.34</td>
<td>5,691,771.73</td>
</tr>
</tbody>
</table>
## RECEIPT AND PAYMENT ACCOUNT FOR THE YEAR ENDED ON 31ST MARCH, 2014

### Conversion Factor 1 Euro = Rs. 69.5438

### (Conversion Factor 1 Euro = Rs. 60.3403 for the year 2012-13)

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount for the year ended March 31, 2014</th>
<th>Amount for the year ended March 31, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C. Shareable Expenses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific Expenses of the Centre</td>
<td>B</td>
<td>2,985,179.07</td>
</tr>
<tr>
<td>Governing Body/Scientific Council Expenses</td>
<td>C</td>
<td>184,544.60</td>
</tr>
<tr>
<td>Travelling Expenses</td>
<td>D</td>
<td>31,643.25</td>
</tr>
<tr>
<td>Office Expenses - Shareable</td>
<td>E</td>
<td>70,264.61</td>
</tr>
<tr>
<td>Salaries</td>
<td>F</td>
<td>192,505.92</td>
</tr>
<tr>
<td>Purchase of Office Equipment</td>
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<td>1,605.39</td>
</tr>
<tr>
<td>Purchase of Furniture &amp; Fixture</td>
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<td>259.55</td>
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<td>Purchase of Computer System</td>
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<td>1,190.62</td>
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<td>Security Deposit Refundable</td>
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<td>Security Deposit-Cellphone</td>
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<td>45.14</td>
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<tr>
<td>Sale of Old Staff Car</td>
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<tr>
<td>Furniture &amp; Fixture (Sold)</td>
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<td></td>
</tr>
<tr>
<td>Office Equipment (Sold)</td>
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<td></td>
</tr>
<tr>
<td>Transfer of Funds</td>
<td></td>
<td>3,468,508.03</td>
</tr>
<tr>
<td><strong>D. Non-shareable Expenses</strong></td>
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</tr>
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<td>Office Expenses - Non-shareable</td>
<td>G</td>
<td>99,766.57</td>
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<tr>
<td>Computer System</td>
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<td></td>
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<tr>
<td>Computer System (Sold)</td>
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<td></td>
</tr>
<tr>
<td>Renovation Expenses</td>
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<td>23,917.85</td>
</tr>
<tr>
<td><strong>E. Targetted Scientific Programmes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>359,120.07</td>
<td>192,694.03</td>
</tr>
<tr>
<td><strong>F. Extramural Activities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>171,354.24</td>
<td>14,125.51</td>
</tr>
<tr>
<td><strong>G. Gratuity Fund</strong></td>
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<td></td>
</tr>
<tr>
<td>I</td>
<td>7,929.43</td>
<td>4,465.27</td>
</tr>
<tr>
<td><strong>H. SC/IRG Special Meeting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>3,193.39</td>
<td></td>
</tr>
<tr>
<td><strong>I. Miscellaneous Payments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>51,273.76</td>
<td>93,749.79</td>
</tr>
<tr>
<td><strong>Total = (C+D+E+F+G+H+I)</strong></td>
<td></td>
<td>4,178,689.94</td>
</tr>
</tbody>
</table>

### J. Closing Balance

| Bank Balances | | |
| In Indian Rupees | Saving Bank Account | |
| Union Bank of India | 169,732.59 | 117,861.68 |
| Sate Bank of Hyderabad | 398,252.88 | 777,291.25 |
| Axis Bank | 97,616.88 | 10,946.32 |
| State Bank of Hyderabad (Gratuity Fund) | 31,275.04 | 57,535.20 |
| In Euro Account | | |
| Credit Industriel et Commercial, Paris, France | 458,749.20 | 1,567,727.40 |
| **TOTAL (C+D+E+F+G+H+I)** | | 5,746,417.34 | 5,624,771.73 |

Accounting policies and notes on accounts

At our report of even date.

For: SSAS AND ASSOCIATES
Firm Registration No. 09550N
Chartered Accountants

ALPANA SAXENA
Partner:
Membership No. 095837

Place: New Delhi
Date: 27.09.2014

---

MAHESWARI
ACCOUNTS OFFICER

DR. DEBAPIYA DUTTA
DIRECTOR
### INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI

#### RECEIPT AND PAYMENT ACCOUNT FOR THE YEAR ENDED ON 31ST MARCH, 2014

*Conversion Factor 1 Euro = Rs. 69.5436*
*Conversion Factor 1 Euro = Rs. 68.3493 for the year 2012-13*

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount for the year ended March 31, 2014</th>
<th>Amount for the year ended March 31, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transaction in Rs.</td>
<td>Euro</td>
</tr>
<tr>
<td>A. Opening balance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash &amp; Cash Equivalents:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Indian Rupee S B Account</td>
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<td></td>
</tr>
<tr>
<td>Union Bank of India</td>
<td>8054.71595</td>
<td>-</td>
</tr>
<tr>
<td>State Bank of Hyderabad</td>
<td>53128.31749</td>
<td>-</td>
</tr>
<tr>
<td>Axis Bank</td>
<td>747665.00</td>
<td>-</td>
</tr>
<tr>
<td>Bank of Tokyo Mitsubishi Ltd.</td>
<td>2553116.47</td>
<td>-</td>
</tr>
<tr>
<td>State Bank of Hyderabad (Gratuity Fund)</td>
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<td></td>
</tr>
<tr>
<td>In Euro Account</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit Industriel et Commercial, Paris, France</td>
<td>1133551.71</td>
<td>676853.67</td>
</tr>
<tr>
<td>Total (A)</td>
<td>64485814.91</td>
<td>1133551.71</td>
</tr>
<tr>
<td>B. Receipts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grant-in-aid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Core Programmes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribution from Dept. of Science and Technology, Govt. of India</td>
<td>110000.00</td>
<td>-</td>
</tr>
<tr>
<td>Contribution from Govt. of France</td>
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</tr>
<tr>
<td>For Targeted Programmes</td>
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<td></td>
</tr>
<tr>
<td>IFGM Projects</td>
<td>42000.00</td>
<td>-</td>
</tr>
<tr>
<td>DST-INRA Projects</td>
<td>325000.00</td>
<td>-</td>
</tr>
<tr>
<td>DST-ANR Projects</td>
<td>8831745.00</td>
<td>-</td>
</tr>
<tr>
<td>Raman Charpak Fellowship</td>
<td>530000.00</td>
<td>-</td>
</tr>
<tr>
<td>For Extramural Activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic Diplomacy R &amp; D Programmes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project with RT Rajasat</td>
<td>35000.00</td>
<td>-</td>
</tr>
<tr>
<td>India-France Technology Summit</td>
<td>2346304.01</td>
<td>70000.00</td>
</tr>
<tr>
<td>Challenges in Health</td>
<td>100000.00</td>
<td>-</td>
</tr>
<tr>
<td>Water Network</td>
<td>460000.00</td>
<td>-</td>
</tr>
<tr>
<td>French Season in India</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India Science &amp; Innovation House Projects</td>
<td>5749.05</td>
<td>-</td>
</tr>
<tr>
<td>SC/RC Special meeting</td>
<td>303000.00</td>
<td>-</td>
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<tr>
<td>Misc Income</td>
<td>391394.00</td>
<td>100000.00</td>
</tr>
<tr>
<td>Transfer of Funds</td>
<td>16599886.00</td>
<td>-</td>
</tr>
<tr>
<td>Interest from Bank Accounts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Programmes</td>
<td>2659354.00</td>
<td>-</td>
</tr>
<tr>
<td>Non-Core Programme</td>
<td>824496.00</td>
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<tr>
<td>Gratuity Fund</td>
<td>103722.00</td>
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<tr>
<td>Interest received from income Tax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refund of Income Tax / TDS</td>
<td></td>
<td></td>
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<tr>
<td>Amount deducted from Salaries</td>
<td></td>
<td></td>
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<tr>
<td>Tax Deducted at Source</td>
<td>1196376.00</td>
<td>-</td>
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<tr>
<td>Group Insurance Premium</td>
<td>3600.00</td>
<td>-</td>
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<tr>
<td>Contributory Provident Fund</td>
<td>1449225.00</td>
<td>-</td>
</tr>
<tr>
<td>TDS deducted Bills/Contractors etc.</td>
<td>600171.00</td>
<td>-</td>
</tr>
<tr>
<td>Amount recovered on behalf of CBRI, Chennai</td>
<td>43940.00</td>
<td>-</td>
</tr>
<tr>
<td>Amount recovered on behalf of DST</td>
<td>221040.00</td>
<td>-</td>
</tr>
<tr>
<td>Total (B)</td>
<td>1452563593.01</td>
<td>17567495.00</td>
</tr>
<tr>
<td>Total (A+B)</td>
<td>209792367.92</td>
<td>2930300.76</td>
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</table>
# RECEIPT AND PAYMENT ACCOUNT FOR THE YEAR ENDED ON 31ST MARCH, 2014

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Amount for the year ended March 31, 2014</th>
<th>Amount for the year ended March 31, 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transaction in Rs</td>
<td>Transaction in Euro</td>
</tr>
<tr>
<td><strong>PAYMENTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Shareable Expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific Expenses of the Centre</td>
<td>18,36,806.00</td>
<td>1,83,59,60.00</td>
</tr>
<tr>
<td>Governing Body/ Scientific Council Expenses</td>
<td>6,27,86,710.00</td>
<td>47,79,51.00</td>
</tr>
<tr>
<td>Travelling Expenses</td>
<td>1,88,91,460.00</td>
<td>1,46,80.00</td>
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<tr>
<td>Office Expenses - Shareable</td>
<td>4,74,79,790.00</td>
<td>2,06,60.00</td>
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<tr>
<td>Salaries</td>
<td>13,30,97,593.00</td>
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<tr>
<td>Purchase of Office Equipment</td>
<td>299,80,00.00</td>
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</tr>
<tr>
<td>Purchase of Furniture &amp; Fixtures</td>
<td>1,85,00.00</td>
<td>-</td>
</tr>
<tr>
<td>Purchase of Computer System</td>
<td>8,00,00.00</td>
<td>-</td>
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<tr>
<td>Security Deposit refundable</td>
<td>5,00,00.00</td>
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</tr>
<tr>
<td>Security Deposit-Director’s residence</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Security Deposit-Cellphone</td>
<td>3,00,00.00</td>
<td>-</td>
</tr>
<tr>
<td>Sale of Old Staff Car</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Furniture &amp; Fixture (Sold)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Office Equipment (Sold)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total (C)</td>
<td>128,67,737.00</td>
<td>1,618,201.65</td>
</tr>
<tr>
<td>D. Non-shareable Expenses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office Expenses - Non-shareable</td>
<td>5,05,1,815.00</td>
<td>27,12,34.36</td>
</tr>
<tr>
<td>Computer System</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Computer System (Sold)</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Renovation Expenses</td>
<td>3,66,3,330.00</td>
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</tr>
<tr>
<td>Total (D)</td>
<td>6,715,153.00</td>
<td>27,12,34.36</td>
</tr>
<tr>
<td>E. NSOScore Scientific Programmes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Extramural Activities</td>
<td>16,54,737.00</td>
<td>1,12,393.31</td>
</tr>
<tr>
<td>G. Gratitude Fund</td>
<td>1,11,36,310.00</td>
<td>13,83,27.24</td>
</tr>
<tr>
<td>H. SC/IR Special Meeting</td>
<td>489,353.00</td>
<td>-</td>
</tr>
<tr>
<td>I. Miscellaneous Payments</td>
<td>244,752.00</td>
<td>-</td>
</tr>
<tr>
<td>Total (E+D+F+G+H+I)</td>
<td>167,48,1,550.00</td>
<td>1,77,1,551.56</td>
</tr>
<tr>
<td>J. Transfer of Funds</td>
<td>-</td>
<td>200,000.00</td>
</tr>
<tr>
<td>K. Balance carried Forward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash &amp; Cash Equivalents:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Indian Rupees Saving Bank Account</td>
<td>11,803,848.95</td>
<td>-</td>
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<tr>
<td>Union Bank of India</td>
<td>27,68,088.50</td>
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<tr>
<td>State Bank of Hyderabad</td>
<td>675,735.00</td>
<td>-</td>
</tr>
<tr>
<td>Axis Bank</td>
<td>2,174,985.47</td>
<td>-</td>
</tr>
<tr>
<td>In Euro Account</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Credit Industriel et Commercial, Paris, France</td>
<td>(958,749.20)</td>
<td>-</td>
</tr>
<tr>
<td>Total (J)</td>
<td>42,359,657.92</td>
<td>958,749.20</td>
</tr>
<tr>
<td>TOTAL (C+D+E+F+G+H+I+J+K)</td>
<td>209,73,2,307.92</td>
<td>2,930,309.76</td>
</tr>
</tbody>
</table>

Accounting policies and notes on accounts

As per our report of even date.

For SSAS AND ASSOCIATES
Firm Registration No. 045301
Chartered Accountants

ALPANA SAXENA
Partner
Membership No. 095837
Place: New Delhi
Date: 27-05-2014

Mathew Joseph
Accounts Officer
Debapriya Dutta
Director
### Fixed Assets

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars</th>
<th>Rate of Depn</th>
<th>Balance as on 01.04.2012</th>
<th>Additions during the Year</th>
<th>Total during the year</th>
<th>Depreciation For the Year</th>
<th>Balance as on 31.03.2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Land &amp; Building</td>
<td>10%</td>
<td>2,213,965.00</td>
<td></td>
<td>2,213,965.00</td>
<td>2,213,965.00</td>
<td>1,992,568.00</td>
</tr>
<tr>
<td>2</td>
<td>Computer</td>
<td>60%</td>
<td>475,766.00</td>
<td>92,800.00</td>
<td>568,566.00</td>
<td>558,566.00</td>
<td>221,426.00</td>
</tr>
<tr>
<td>3</td>
<td>Office Equipment</td>
<td>15%</td>
<td>284,297.61</td>
<td>184,397.00</td>
<td>468,694.61</td>
<td>453,993.61</td>
<td>24,700.00</td>
</tr>
<tr>
<td>4</td>
<td>Photocopyer</td>
<td>15%</td>
<td>184,313.00</td>
<td></td>
<td>184,313.00</td>
<td>174,758.00</td>
<td>9,555.00</td>
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<tr>
<td>5</td>
<td>Telephone system</td>
<td>15%</td>
<td>164,475.00</td>
<td></td>
<td>164,475.00</td>
<td>154,475.00</td>
<td>10,000.00</td>
</tr>
<tr>
<td>6</td>
<td>Furniture &amp; Fixtures</td>
<td>10%</td>
<td>1,281,238.00</td>
<td>18,850.00</td>
<td>1,299,880.00</td>
<td>1,299,880.00</td>
<td>1,169,359.00</td>
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<tr>
<td>7</td>
<td>Car</td>
<td>15%</td>
<td>513,213.00</td>
<td></td>
<td>513,213.00</td>
<td>513,213.00</td>
<td>43,631.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>5,117,365.61</td>
<td>281,107.00</td>
<td>5,398,472.61</td>
<td>5,117,365.61</td>
<td>4,539,338.61</td>
</tr>
<tr>
<td><strong>Previous Year</strong></td>
<td></td>
<td></td>
<td>5,302,143.00</td>
<td>296,712.00</td>
<td>5,598,855.00</td>
<td>5,117,365.61</td>
<td>4,539,338.61</td>
</tr>
</tbody>
</table>
### Schedule 'B'

**Scientific Expenses of the Centre**

<table>
<thead>
<tr>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Projects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Research Projects</td>
<td>72,762,812.00</td>
<td>1,338,172.03</td>
<td>165,044,309.02</td>
</tr>
<tr>
<td>Seminars &amp; Workshops</td>
<td>4,473,034.00</td>
<td>83,604.40</td>
<td>10,301,110.43</td>
</tr>
<tr>
<td>Professional &amp; Other Scientific Expenses</td>
<td>16,605,074.00</td>
<td>309,744.52</td>
<td>22,606,215.34</td>
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<tr>
<td>Expenses on Outreach</td>
<td>81,089.00</td>
<td>-</td>
<td>81,089.00</td>
</tr>
<tr>
<td>Publication Etc</td>
<td>2,503,264.00</td>
<td>-</td>
<td>2,503,264.00</td>
</tr>
<tr>
<td>Expenses on Patents</td>
<td>2,585,023.00</td>
<td>-</td>
<td>2,585,023.00</td>
</tr>
<tr>
<td>Expenses in Connection with ESNN Programme</td>
<td>157,529.00</td>
<td>3,150.00</td>
<td>157,529.00</td>
</tr>
<tr>
<td>Electronic project Proposal Mgt Syntaem</td>
<td>773,691.00</td>
<td>12,500.00</td>
<td>1,642,988.50</td>
</tr>
<tr>
<td>Cefpra Lecture Series</td>
<td>1,116,296.00</td>
<td>-</td>
<td>1,116,296.00</td>
</tr>
<tr>
<td>Water Network</td>
<td>192,579.00</td>
<td>4,151.31</td>
<td>481,276.87</td>
</tr>
<tr>
<td>-</td>
<td>267,624.00</td>
<td>290.00</td>
<td>281,532.75</td>
</tr>
<tr>
<td>-</td>
<td>101,618,036.00</td>
<td>1,523,970.36</td>
<td>267,608,695.92</td>
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</tbody>
</table>

### Schedule 'C'

**Governing Body/ SC/IRC Meeting Expenses**

<table>
<thead>
<tr>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governing Body</td>
<td>916,060.00</td>
<td>21,303.20</td>
<td>2,397,565.48</td>
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<tr>
<td>Scientific Council</td>
<td>4,409,399.00</td>
<td>57,196.57</td>
<td>6,307,064.02</td>
</tr>
<tr>
<td>Industrial Research Expenses</td>
<td>1,395,218.00</td>
<td>9,205.30</td>
<td>2,303,393.71</td>
</tr>
<tr>
<td>-</td>
<td>6,720,676.00</td>
<td>87,705.13</td>
<td>12,820,242.04</td>
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</table>

### Schedule 'D'

**Travelling Expenses**

<table>
<thead>
<tr>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>737,114.00</td>
<td>-</td>
<td>737,114.00</td>
</tr>
<tr>
<td>International</td>
<td>1,153,302.00</td>
<td>4,460.15</td>
<td>1,463,477.79</td>
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<tr>
<td>-</td>
<td>1,800,416.00</td>
<td>4,460.15</td>
<td>2,260,591.79</td>
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</tbody>
</table>

### Schedule 'E'

**Office Expenses - Shareable**

<table>
<thead>
<tr>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Hire Charges</td>
<td>147,927.00</td>
<td>-</td>
<td>147,927.00</td>
</tr>
<tr>
<td>Conveyance Expenses</td>
<td>85,192.00</td>
<td>-</td>
<td>85,192.00</td>
</tr>
<tr>
<td>Staff Car Expenses</td>
<td>157,801.00</td>
<td>-</td>
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</tr>
<tr>
<td>Office Equipment-Maintenance/Consumables</td>
<td>785,210.00</td>
<td>-</td>
<td>785,210.00</td>
</tr>
<tr>
<td>Telephone &amp; Internet expenses</td>
<td>756,176.00</td>
<td>50.00</td>
<td>756,653.19</td>
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<tr>
<td>Repair &amp; Maintenance</td>
<td>290,331.00</td>
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<td>290,331.00</td>
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<tr>
<td>Stationery</td>
<td>210,532.00</td>
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<td>210,532.00</td>
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<tr>
<td>Newspapers and Periodicals</td>
<td>25,468.00</td>
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<td>25,468.00</td>
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<tr>
<td>Books - Others</td>
<td>254,968.00</td>
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<td>254,968.00</td>
</tr>
<tr>
<td>Postage and Courier Expenses</td>
<td>240,457.00</td>
<td>-</td>
<td>240,457.00</td>
</tr>
<tr>
<td>Miscellaneous Office Expenses</td>
<td>232,938.00</td>
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<td>232,938.00</td>
</tr>
<tr>
<td>Security Charges</td>
<td>756,173.00</td>
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<td>756,173.00</td>
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<tr>
<td>Rent</td>
<td>44,487.00</td>
<td>142.50</td>
<td>54,939.99</td>
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<tr>
<td>Libreries</td>
<td>19,271.00</td>
<td>-</td>
<td>19,271.00</td>
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<tr>
<td>Other Establishment Charges</td>
<td>243,422.00</td>
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<td>243,422.00</td>
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<tr>
<td>Aud &amp; Fee</td>
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<td>77,920.00</td>
</tr>
<tr>
<td>Bank Charges</td>
<td>4,730.00</td>
<td>1,083.51</td>
<td>135,029.00</td>
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<tr>
<td>Electricity Charges</td>
<td>255,058.00</td>
<td>-</td>
<td>255,058.00</td>
</tr>
<tr>
<td>Professional Service Charges</td>
<td>401,126.00</td>
<td>-</td>
<td>401,126.00</td>
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<tr>
<td>Interest &amp; Penalty on TDS</td>
<td>940.00</td>
<td>-</td>
<td>940.00</td>
</tr>
<tr>
<td>Less: Office Expenses for Non Core Programmes</td>
<td>(245,945.00)</td>
<td>(245,945.00)</td>
<td>(3,536.55)</td>
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</table>

### Schedule 'F'

**Salaries**

<table>
<thead>
<tr>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
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<td>13,387,593.00</td>
<td>-</td>
<td>13,387,593.00</td>
<td>192,505.92</td>
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</tbody>
</table>
## SCHEDULE FORMING PART OF THE INCOME & EXPENDITURE ACCOUNT AND RECEIPT & PAYMENT ACCOUNT FOR THE YEAR ENDED ON 31ST MARCH 2014

*Amount for the year ended March 31, 2014*

(Conversion Factor 1 Euro = Rs. 68.3403)

<table>
<thead>
<tr>
<th>Schedule ‘G’</th>
<th>skins</th>
<th>skins</th>
<th>skins</th>
<th>skins</th>
<th>skins</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Office Expenses - Non-shareable</strong></td>
<td>skins</td>
<td>skins</td>
<td>skins</td>
<td>skins</td>
<td>skins</td>
</tr>
<tr>
<td>Maintenance Charges to INC</td>
<td>602,532.00</td>
<td>-</td>
<td>602,532.00</td>
<td>-</td>
<td>9,814.42</td>
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<tr>
<td>Maintenance – Office Premises</td>
<td>235,943.00</td>
<td>-</td>
<td>235,943.00</td>
<td>-</td>
<td>3,392.73</td>
</tr>
<tr>
<td>Municipal Tax</td>
<td>209,093.00</td>
<td>-</td>
<td>209,093.00</td>
<td>-</td>
<td>3,006.64</td>
</tr>
<tr>
<td>Renovation Expenses</td>
<td>228,011.00</td>
<td>-</td>
<td>228,011.00</td>
<td>-</td>
<td>3,278.57</td>
</tr>
<tr>
<td>Region to Region Meeting</td>
<td>3,439,811.00</td>
<td>27,124.36</td>
<td>5,326,142.07</td>
<td>-</td>
<td>76,586.87</td>
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<tr>
<td>25th Anniversary Expenses</td>
<td>256,425.00</td>
<td>-</td>
<td>256,425.00</td>
<td>-</td>
<td>3,667.24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5,051,815.00</td>
<td>27,124.36</td>
<td>6,938,146.07</td>
<td>-</td>
<td>99,766.57</td>
</tr>
</tbody>
</table>

| Schedule ‘H’ | skins| skins| skins| skins| skins|
| **Non-core Scientific Programmes** | skins| skins| skins| skins| skins|
| IPCAM Projects | 4,276,594.00 | 36,403.50 | 6,688,231.72 | - | 97,899.47 |
| DST-INRA Projects | 457,045.00 | 1,361.04 | 551,696.89 | - | 7,933.79 |
| DST-ANR Projects | 8,031,747.00 | - | 8,031,747.00 | - | 125,995.46 |
| Raman Charpak Fellowship | 2,580,987.00 | 74,628.77 | 8,170,955.26 | - | 117,493.56 |
| **Total** | 16,546,373.00 | 112,393.31 | 24,362,630.87 | - | 350,320.68 |

| Schedule ‘I’ | skins| skins| skins| skins| skins|
| **Extramural Activities** | skins| skins| skins| skins| skins|
| Economic Diplomacy R & D Programmes | 260,241.00 | - | 260,241.00 | - | 3,742.12 |
| Project with IIT, Rajanstan | 504,880.00 | 13,100.00 | 1,415,992.79 | - | 20,359.09 |
| India-France Technology Summit | 7,091,690.00 | - | 7,091,690.00 | - | 101,974.44 |
| Challenges in Health | - | - | - | - | - |
| Water Network | 1,698,061.00 | - | 1,698,061.00 | - | 24,417.14 |
| French Season in India | 939,370.00 | 107.44 | 600,751.79 | - | 8,638.47 |
| India Science and Innovation House Project | 1,015,158.00 | 624.00 | 1,036,580.97 | - | 15,222.19 |
| **Total** | 11,163,310.00 | 13,832.24 | 12,125,526.54 | - | 174,354.25 |

| Schedule ‘J’ | skins| skins| skins| skins| skins|
| **Gratuity Fund** | skins| skins| skins| skins| skins|
| Paid to LIC for maintaining the Gratuity Fund | 488,853.00 | - | 488,853.00 | - | 7,029.43 |
| **Total** | 488,853.00 | - | 488,853.00 | - | 7,029.43 |

| Schedule ‘K’ | skins| skins| skins| skins| skins|
| **Other Payments** | skins| skins| skins| skins| skins|
| TDS deposited - Salaries | 1,196,976.00 | - | 1,196,976.00 | - | 17,211.83 |
| TDS deposited - Bills / Contractors etc | 690,171.00 | - | 690,171.00 | - | 9,924.04 |
| Group Insurance - Paid to LIC | 9,360.00 | - | 9,360.00 | - | 134.59 |
| C.P. Fund - Transferred to CPF | 1,440,225.00 | - | 1,440,225.00 | - | 20,624.65 |
| Income Tax Demand and TDS | - | - | - | - | - |
| IFCPAR CP Fund | - | - | - | - | - |
| Amount paid to CINI, Chennai | - | - | - | - | - |
| Income Tax Demand | - | - | - | - | - |
| Amount paid to DST | 221,040.00 | - | 221,040.00 | - | 3,178.43 |
| **Total** | 3,565,772.00 | - | 3,565,772.00 | - | 51,273.76 |
## Schedule B
### Scientific Expenses of the Centre

<table>
<thead>
<tr>
<th>Description</th>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Projects</td>
<td>86,365,373.34</td>
<td>933,951.79</td>
<td>144,195,918.85</td>
<td>2,109,969.06</td>
</tr>
<tr>
<td>Industrial Research Projects</td>
<td>6,323,256.00</td>
<td>179,211.01</td>
<td>18,570,590.19</td>
<td>271,737.03</td>
</tr>
<tr>
<td>Seminars &amp; Workshops</td>
<td>16,450,732.00</td>
<td>109,174.36</td>
<td>17,911,740.51</td>
<td>262,095.31</td>
</tr>
<tr>
<td>Professional &amp; Other Scientific Expenses</td>
<td>191,649.00</td>
<td>-</td>
<td>191,649.00</td>
<td>2,795.55</td>
</tr>
<tr>
<td>Expenses on Outreach</td>
<td>2,053,747.28</td>
<td>1,060.00</td>
<td>2,106,188.00</td>
<td>30,819.12</td>
</tr>
<tr>
<td>Publication Etc.</td>
<td>1,516,416.00</td>
<td>-</td>
<td>1,516,416.00</td>
<td>22,189.19</td>
</tr>
<tr>
<td>Expenses on Patents</td>
<td>75,850.00</td>
<td>-</td>
<td>75,850.00</td>
<td>1,109.89</td>
</tr>
</tbody>
</table>

**Total:**

106,960,423.62 | 1,223,397.16 | 110,567,752.55 | 2,700,716.15

## Schedule C
### Governing Body/Scientific Council Expenses

<table>
<thead>
<tr>
<th>Description</th>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governing Body</td>
<td>2,984,195.00</td>
<td>7,170.10</td>
<td>3,474,768.51</td>
<td>50,044.79</td>
</tr>
<tr>
<td>Scientific Council</td>
<td>6,228,733.00</td>
<td>51,065.83</td>
<td>9,718,597.14</td>
<td>142,209.73</td>
</tr>
</tbody>
</table>

**Total:**

9,212,928.00 | 58,242.93 | 13,193,335.65 | 193,053.52

## Schedule D
### Travelling Expenses

<table>
<thead>
<tr>
<th>Description</th>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel in India</td>
<td>740,612.00</td>
<td>-</td>
<td>740,612.00</td>
<td>10,837.12</td>
</tr>
<tr>
<td>Travel Abroad</td>
<td>977,138.00</td>
<td>4,691.06</td>
<td>1,247,756.54</td>
<td>18,989.18</td>
</tr>
</tbody>
</table>

**Total:**

1,717,750.00 | 4,691.06 | 2,038,338.45 | 29,826.30

## Schedule E
### Office Expenses - Shareable

<table>
<thead>
<tr>
<th>Description</th>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Hire Charges</td>
<td>169,953.00</td>
<td>-</td>
<td>169,953.00</td>
<td>2,486.86</td>
</tr>
<tr>
<td>Conveyance Expenses</td>
<td>98,890.00</td>
<td>-</td>
<td>98,890.00</td>
<td>1,447.02</td>
</tr>
<tr>
<td>Staff Car Expenses</td>
<td>162,182.00</td>
<td>-</td>
<td>162,182.00</td>
<td>2,373.15</td>
</tr>
<tr>
<td>Office Equipment-Maintenance Consumables</td>
<td>672,886.00</td>
<td>-</td>
<td>672,886.00</td>
<td>9,485.02</td>
</tr>
<tr>
<td>Telephones &amp; Internet expenses</td>
<td>356,391.00</td>
<td>-</td>
<td>356,391.00</td>
<td>5,214.95</td>
</tr>
<tr>
<td>Stationery</td>
<td>201,534.00</td>
<td>-</td>
<td>201,534.00</td>
<td>2,948.98</td>
</tr>
<tr>
<td>Newspapers and Periodicals</td>
<td>19,314.00</td>
<td>-</td>
<td>19,314.00</td>
<td>285.54</td>
</tr>
<tr>
<td>Books - Others</td>
<td>6,600.00</td>
<td>-</td>
<td>6,600.00</td>
<td>96.58</td>
</tr>
<tr>
<td>Postage and Courier Expenses</td>
<td>307,880.00</td>
<td>-</td>
<td>307,880.00</td>
<td>4,505.10</td>
</tr>
<tr>
<td>Miscellaneous Office Expenses</td>
<td>204,796.00</td>
<td>-</td>
<td>204,796.00</td>
<td>2,996.71</td>
</tr>
<tr>
<td>Security Charges</td>
<td>314,895.00</td>
<td>-</td>
<td>314,895.00</td>
<td>4,607.75</td>
</tr>
<tr>
<td>Rent</td>
<td>721,250.00</td>
<td>-</td>
<td>721,250.00</td>
<td>10,553.60</td>
</tr>
<tr>
<td>Entertainment Expenses</td>
<td>18,782.00</td>
<td>403.70</td>
<td>43,972.00</td>
<td>670.55</td>
</tr>
<tr>
<td>Liveries</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other Establishment Charges</td>
<td>54,098.00</td>
<td>-</td>
<td>54,098.00</td>
<td>797.52</td>
</tr>
<tr>
<td>Audit Fee</td>
<td>44,944.00</td>
<td>-</td>
<td>44,944.00</td>
<td>657.65</td>
</tr>
<tr>
<td>Bank Charges</td>
<td>6,150.00</td>
<td>1,613.11</td>
<td>11,763.42</td>
<td>1,703.10</td>
</tr>
<tr>
<td>Electricity Charges</td>
<td>193,142.00</td>
<td>-</td>
<td>193,142.00</td>
<td>2,902.67</td>
</tr>
<tr>
<td>Professional Service Charges</td>
<td>278,654.00</td>
<td>-</td>
<td>278,654.00</td>
<td>4,077.45</td>
</tr>
<tr>
<td>Interest on Late payment of TDS</td>
<td>1,585.00</td>
<td>-</td>
<td>1,585.00</td>
<td>23.19</td>
</tr>
</tbody>
</table>

**Total:**

3,844,107.00 | 2,016.81 | 3,981,936.40 | 58,266.30

## Schedule F
### Salaries

<table>
<thead>
<tr>
<th>Description</th>
<th>Transaction in Rs</th>
<th>Transaction in Euro</th>
<th>Total Transaction converted in Rs</th>
<th>Total Transaction converted in Rs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>13,155,543.00</td>
<td>-</td>
<td>13,155,543.00</td>
<td>192,550.52</td>
</tr>
</tbody>
</table>

**Total:**

13,155,543.00 | - | 13,155,543.00 | 192,550.52

Conversion Factor 1 Euro = Rs. 68.3403
## Schedule 'G'

**Office Expenses - Non-shareable**
- Maintenance Charges to IHC: 634,902.00
- Maintenance - Office Premises: 273,027.00
- Municipal Tax: 209,093.00
- 25th Anniversary Expenses: 2,555,136.00

**Total**
- 3,672,158.00

## Schedule 'H'

**Targetted Scientific Programmes**
- IFCAM Projects: 6,715,006.00
- DST-INRA Projects: 3,591,815.00
- Raman Charpak Fellowship: 60,000.00

**Total**
- 10,366,815.00

## Schedule 'I'

**Extranural Activities**
- Economic Diplomacy R&D Programmes: 77,933.00
- Project with IIT Rajarhtan: 884,675.00

**Total**
- 962,608.00

## Schedule 'I'

**Gratuity Fund**
- Paid to LIC for maintaining the Gratuity Fund: 305,158.00

**Total**
- 305,158.00

## Schedule 'K'

**Other Payments**
- TDS deposited/Salaries: 1,000,334.00
- TDS deposited/Bills/Contractors etc.: 340,874.00
- Group Insurance - Paid to LIC: 9,360.00
- C.F. Fund-Transferred to CPF: 1,449,621.00
- Income Tax Demand and TDS: -
- IPCFAR CF Fund: -
- Amount paid to CLRI, Chennai: 43,940.00
- Income Tax Demand: 3,465,567.00
- Amount paid to DST: 110,520.00

**Total**
- 6,420,216.00

*Conversion Factor 1 Euro = Rs. 68.3403*
ACCOUNTING POLICIES AND NOTES ON ACCOUNTS

Organisation Overview

The Indo French Centre for the Promotion of Advanced Research (the Society) was registered on 16th day of April, 1986 under Societies Registration Act, 1860. The Society involves in the activities to (i) promote cooperation between India and France in advanced areas of fundamental and applied scientific research. (ii) develop cooperation by identifying scientist and scientific institutions of India and France. (iii) provide assistance in the form of grants and equipment as well as other appropriate means for the pursuit of advanced scientific research.

A. SIGNIFICANT ACCOUNTING POLICIES

1. **Accounting Period**: Financials are reported from 01st April of a year to 31st March of the following year for both Indian Rupees & Euro Transactions.

2. **Basis of preparation**: The financial statements are prepared under the historical cost convention and on cash basis.

3. Any surplus of Income over Expenditure carried forward to next year for utilization as per objectives of the Centre.

4. Grants released for various research projects have been shown under the head “Scientific Expenses” in the “Income & Expenditure Account” on the basis of disbursements made by the Centre. First year releases are made on the basis of the approved Budget. However, subsequent releases are made only on receipt of the statement of expenditure of the previous years from the institutions.

5. All the assets acquired for research projects remain with the institution where the research work is carried on. The Centre has however retained the right to transfer these assets to other institutions, if so required, on completion of the projects for which these assets were purchased. The expenditure on these assets has been accounted for in the Income and Expenditure Account under the head “Scientific Expenses”. Hence, these assets have not been taken in the Balance Sheet of the Centre.

6. **Reporting currency & Foreign Currency Transactions**:

   The accounting currency of the Society is Indian Rupee and Euro. Separate books of accounts are maintained for recording respective transactions occurring in Rupee and Euro currencies.

   In Euro version of the accounts the opening balances have been adjusted on the basis of the exchange rate adopted during the year. The difference arising from the restatement of monetary foreign currency assets (Bank Balance) is recognised as exchange fluctuation reserve in the Income and Expenditure Account. The difference arising from the restatement of other assets & liabilities are adjusted to Capital Fund in the Balance sheet.

   Euro accounts at the year end are being converted at the market rate of exchange obtained on the last working day of the previous financial year as prescribed by the Reserve Bank of India and vice versa. The rate adopted during the year 2012-13 is Euro 1 = Rs. 68.3403 and the consolidated statement of accounts in Rupee & Euro Versions are made on the basis of the above rate.

7. **Grants Awarded - Recognition**: Grants to an awardee are recognised on the recommendation of the Scientific Council, approval by the Governing Body and with the final approval of both Indian and French Governments. Based on the commitments made to awardees in a year, aggregate grants are recognised as expenditure to the extent of payment made to each awardee during the year.
8. **Income Recognition:**

Grants-in-aid: Grants received from Department of Science & Technology, Government of India and from Government of France are shown as Grant in Aid under the head Income in the Income and Expenditure Account.

9. **Fixed Assets:**

   a) Fixed assets are stated at cost less depreciation. The cost of an asset comprises of its purchase price and directly attributable costs of bringing the asset to working condition for its intended use.
   
   b) Depreciation on fixed assets has been provided at the rates and in the manner specified in Income Tax Rules, 1962.
   
   c) The office premise is owned by the Centre. However, the formalities in respect of the registration of the documents are pending on the part of Land & Development Office, Delhi.

10. **Renovation of Office Premise:** During the 26th meeting held in Paris on 7th February, 2013, the Governing Body of CEFIGRA directed to make a proposal for utilizing the fund accrued due to gain on exchange rate fluctuation and bank interest over the years. Accordingly proposals were submitted to the co-chairs, which included upgradation of physical infrastructure, IT infrastructure, video-conferencing and integrated communication system considering the operational deterioration of the physical infrastructure and improving the efficiency of the Centre.

    On approval of the proposal by the co-chairs, a committee was constituted by CEFIGRA. Limited tenders were invited for this purpose, based on the lowest quotation and technical competency the committee selected the following vendors for award:

   1) IT upgradation, maintenance and administration: M/S Sth Element Technologies at a cost of Rs. 150000/- per annum (inclusive of taxes).
   
   2) Physical and Infrastructure upgradation including office interiors: M/S Royal Inter-Arch Pvt. Ltd at a cost of Rs. 59.53 lakhs + Taxes
   
   3) Video-conferencing and integrated communication system: M/S Netcore Technologies Corporation at Rs. 31 lakhs.
   
   4) Appointment of an Architect firm: M/s. Eco Design Architects at a cost of Rs. 3.00 lakhs + taxes

Subsequently orders were issued to the selected vendors for the above upgradation works.

8. **NOTES TO ACCOUNTS:**

1. **Grants-in-Aid**

   a. IFCPAR has received a sum of Euro 1,450,000 from Government of France towards grants-in-aid for the financial year 2013-14 for normal activities of the Centre. A sum of Euro 100,000 was sanctioned by Government of France towards grants-in-aid for the financial year 2013-14 which remained to be received and was credited to the Centre’s bank account in April 2014. This amount has been taken in the receipt of the current financial year 2014-15. In addition, an amount of Euro 373,738.51 received during the year towards the Noncore/Extramural Scientific Programmes from Government of France.

   b. IFCPAR has received a sum of Rs. 11,00,00,000/- as Grants-in-aid from Government of India, Ministry of Science and Technology, Department of Science and Technology during the year for normal activities of the Centre. In addition, an amount of Rs. 88,31,745/- received during the year towards the Noncore/Extramural Scientific Programmes from Government of India.
2. **Income Tax**: The Centre was granted exemption under section 11(1)(c) of the Income Tax Act for the financial years 2004-05 to 2008-09.

Application for exemption under section 11(1)(c) of the IT Act for the financial years 2009-10 onwards is pending with CBDT. Two Income Tax demands have been raised against the Centre for the financial year 2009-10 & 2010-11 amounting to Rs. 7.31 crore Rs. 6.90 crore respectively. No provision has been made in this regard as the matter regarding legality of Income Tax liability of the Centre is being contested at appropriate forums.

3. **Employee Benefits**

   a. **Gratuity**: An amount of Rs. 488,535/- was paid to LIC of India towards annual premium for the Group Gratuity Cash Accumulation Scheme maintained with LIC of India.

   b. **Contributory Provident Fund & Super Annuation Scheme (Pension)**: Contribution collected from the Employees of the Centre used to be deposited in the approved IFCPAR Contributory Provident Fund. Since the year 2005-06, Centre has adopted a GP Fund (Pension-Superannuation Scheme) of LIC of India for its employees as approved by the Governing Body of the Centre. From 2005-06 onwards, the Centre has stopped making any contribution to the IFCPAR Contributory Provident Fund. Instead the GPF Contribution of the employees are deposited in GPF scheme, which is entitled for rebate under section 80C of the Income Tax Act, 1961. The Centre has been maintaining a Super Annuation Scheme with LIC of India for the Pension scheme for its employees. During the year an amount of Rs. 3,08,633/- was paid to LIC of India towards annual contribution for the Superannuation Scheme for the employees/ex-employees of the Centre, is debited to Income & Expenditure Account under the head “Salaries”.

4. All payments exceeding Rs. 20,000/- have been paid through cheques except in few cases. The management assured that in future, payments exceeding Rs. 20,000/- will be paid through any mode other than cash.

5. **Related parties Disclosures**: During the year no trust funds were utilized for the benefits of the trustees other than reimbursement of expenses incurred by them.

6. Previous years' figures are regrouped wherever necessary.

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For **SSAS AND ASSOCIATES**  
Firm Registration No. 08550N  
Chartered Accountants

**S.**

**Mathew Joseph**  
Accounts Officer

**S.**

**Dr. Debapriya Dutta**  
Director

**Alpana Saxena**  
Partner  
Membership No. 095637

Place: New Delhi  
Date: 27.09.2014
## INDO-FRENCH CENTRE
FOR THE PROMOTION OF ADVANCED RESEARCH
New Delhi

RECEIPT AND PAYMENT ACCOUNT IN RESPECT OF
IFCPAR GRATUITY FUND FOR THE YEAR ENDED 31ST MARCH, 2014

<table>
<thead>
<tr>
<th>RECEIPTS</th>
<th>AMOUNT (Rs.)</th>
<th>PAYMENTS</th>
<th>AMOUNT (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening balance Balance with State Bank of Hyderabad, IHC</td>
<td>2,563,116.47</td>
<td>Annual Contribution paid to LIC of India towards contribution to Gratuity Fund</td>
<td>488,853.00</td>
</tr>
<tr>
<td>Amount Receivable from IFCPAR towards TDS deducted by Bank on Interest</td>
<td>92,709.00</td>
<td>Closing balance State Bank of Hyderabad Savings Bank Account</td>
<td>2,174,985.47</td>
</tr>
<tr>
<td>Interest from Bank on Saving Bank</td>
<td>100,722.00</td>
<td>TDS deducted by Bank on interest</td>
<td>92,709.00</td>
</tr>
</tbody>
</table>

**TOTAL**                                      **2,756,547.47**   **TOTAL**                                      **2,756,547.47**

The above transactions/balances are included in the Receipt & Payment account of IFCPAR for the year 2013-14

Compiled from the books of accounts and records as produced before us

For **SSAS AND ASSOCIATES**  
Firm Registration No. 08550N  
Chartered Accountants

ALPASA SAXENA  
Partner  
Membership No. 095837  

Place : New Delhi  
Date : 27.09.2014

**MATHEW JOSEPH**  
ACCOUNTS OFFICER

**DR. DEBAPRIYA DUTTA**  
DIRECTOR
# INDO-FRENCH CENTRE

**FOR THE PROMOTION OF ADVANCED RESEARCH**

New Delhi

**RECEIPT AND PAYMENT ACCOUNT IN RESPECT OF**

IFCPAR General Provident Fund for the Year Ended 31st March, 2014

<table>
<thead>
<tr>
<th>RECEIPTS</th>
<th>Amount (Rs.)</th>
<th>PAYMENTS</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening Balance:</td>
<td></td>
<td>Advance paid to:</td>
<td></td>
</tr>
<tr>
<td>Balance with State Bank of Hyderabad, IHC</td>
<td>4,731,137.27</td>
<td>Mr. P. Mohansundaram</td>
<td>27,000.00</td>
</tr>
<tr>
<td>Special Deposit Scheme Account with Union Bank of India, Connaught Place</td>
<td>514,769.00</td>
<td>Mr. Deepankar Varua</td>
<td>80,500.00</td>
</tr>
<tr>
<td>PF contributions received from employees for the year 2012-2013</td>
<td>1,267,006.00</td>
<td>Mr. Mathew Joseph</td>
<td>180,000.00</td>
</tr>
<tr>
<td>Refund of advances by the employees</td>
<td>181,225.00</td>
<td>Mr. Jeewan Kumar</td>
<td>100,000.00</td>
</tr>
<tr>
<td>Interest earned by the fund on:</td>
<td></td>
<td>Final withdrawal by:</td>
<td></td>
</tr>
<tr>
<td>Special deposits with UBI</td>
<td>44,912.00</td>
<td>Mr. T. Nadarajan</td>
<td>200,000.00</td>
</tr>
<tr>
<td>Short-term deposits and SB deposits with SBI</td>
<td>196,860.00</td>
<td>Mr. R. Murali</td>
<td>195,200.00</td>
</tr>
<tr>
<td>Interest paid by the Centre on Employees contribution (after adjusting interest earned by IFCPAR CP Fund A/c)</td>
<td>241,772.00</td>
<td>Mr. P. Mohansundaram</td>
<td>230,000.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>7,169,147.27</td>
<td>CLOSING BALANCE:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Balance with State Bank of Hyderabad, IHC</td>
<td>5,641,678.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Special Deposit Scheme Account with Union Bank of India, Connaught Place</td>
<td>514,769.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>7,169,147.27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compiled from the books of accounts and records as produced before us

For SSAS AND ASSOCIATES
Firm Registration No. 08550N
Chartered Accountants

ALPANA SAXENA
Partner
Membership No. 095837
Place : New Delhi
Date : 27.05.2014

Signed: Mathew Joseph
ACCOUNTS OFFICER

Dr. Debapriya Dutta
DIRECTOR
Indo-French Centre for the Promotion of Advanced Research (CEFIPRA) is a model for international collaborative research in advanced areas of science and technology. The centre was established in 1987 with support from Department of Science & Technology, Government of India and the Ministry of Foreign Affairs, Government of France.