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**Building Indo-French Partnership in
Observational Astronomy**

Newsletter of the Indo-French Centre for the Promotion of Advanced Research

Editor's Note

Dear Readers,

CEFIPRA, as an Indo-French joint platform for S&T cooperation continues to build Indo-French partnership in diverse areas of Science Technology and Innovation (STI). CEFIPRA has contributed significantly to the STI partnerships between both countries. Indian and French stakeholders have a common vision to transform their societies in a sustainable manner.

To further evolve new models of STI partnerships in the coming years, CEFIPRA eagerly looks forward to the recommendations emanating from the second Knowledge Summit being held in Lyon during 17 -18 October, 2019. The interactive sessions at the summit will provide a fresh impetus in the priority areas namely Renewable Energy, Green Chemistry, Smart Cities, Agriculture, Marine Sciences, and Artificial Intelligence.

In this issue, continue our efforts, to showcase research achievements of CEFIPRA supported projects, in area of astronomy, urban transport, IoT etc.

"Ensemble" also carries a report on Indo-French Seminar on "Marine Sciences" and CEFIPRA's efforts to disseminate its activities to the scientific community.

Dr. Purnima Rupal
Director, CEFIPRA

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Radio Properties of Clusters and Galaxy Lenses

(By M. Pommier and B. Guiderdoni - CRAL, Lyon Observatory)

This report presents the achievements of a 3.5 years (2015-2018) of CEFIPRA supported Astronomy project (5204-2) on 'Radio properties of clusters and galaxy lenses' carried out between CRAL, Lyon- France, and IUCAA, Pune-India, We list below the major project outcomes, and their impact on the scientific world: showed that the X-ray mass concentration is higher in Cool Core Clusters (CC).

1 Discovery of rare diffuse emission in lensing cluster of galaxies and their dynamics

Non-thermal emission from the center of the Intra Cluster Medium (ICM) is known to trace the turbulent and shock regions in galaxy clusters. In recent years, low frequency (MHz-range) radio observations in combination with X-ray and optical data have enabled to characterize, with much higher accuracy the morphological, spectral and dynamical properties of galaxy clusters, via mapping these turbulent and shock regions. To improve the understanding on this subject, **Mamta Pommier, Bruno Guiderdoni, Johan Richard from CRAL, Lyon and Françoise Combes from LERMA, Paris, with Joydeep Bagchi from IUCAA, Pune, Joe Jacob from Newman College, Kerala** and collaborators envisaged a GMRT, IRAM large follow-up observation program aimed at characterizing a sample of 25 clusters in the $0.2 < z < 0.9$ redshift range.

As a direct result of this study, the researchers reported the first ever systematic survey of nonthermal emission at very low frequencies (< 610 MHz) from the ICM of lensing clusters. These results showed that **rare non-thermal emission in the ICM of 80% clusters in our sample was discovered with the GMRT**, thereby confirming the presence of excess of synchrotron emitting relativistic electrons gyrating in the magnetic fields of lensing clusters. Further, the non-thermal emission from the ICM of merging or Non-cool core clusters (NCC) hosts 'haloes' (central turbulent regions), 'relics' (peripheral shock regions) and a rare population of 'Ultra Steep Spectrum radio haloes (USSRH) with a spectral index < -1.4 , in a few cases. **The rare USSRHs discovered with the GMRT are very faint in nature, and await significant detection with the new International Mega Radio Astronomy project 'Square Kilometre Array (SKA)'** that will be operational in the near future between 50 MHz-12.5 GHz, at arcsec scale resolution with micro-Jy level sensitivity. Both France and India are collaborating members in the SKA project. In the case of Cool core clusters (CC), 'mini-haloes' were detected indicating gas sloshing between the ICM and central Bright cluster galaxy (BCG). However, to disentangle the radio emission from the central BCG jet and the mini-halo emission, high resolution mapping observations with the SKA are required. Using a radio-X-ray luminosity scaling correlation study, the authors showed that turbulence generated in the ICM due to mergers is responsible for the acceleration of particles that

tend to produce emission at radio MHz range, and, when the strength of turbulence falls, the radio halo fades off rapidly, giving rise to USSRHs followed by non-detection in radio.

By combining the optical (HST/MUSE) and X-ray (Chandra) observations, authors investigated the Dark and Baryonic matter interaction in these clusters towards the ICM, and obtained a correlation between the mass concentration and shift in the centroid w.r.t. the cluster center. Their analysis showed that the X-ray mass concentration is higher in CC clusters w.r.t. NCC clusters, as well as in X-ray maps (baryonic matter) w.r.t. optical mass maps (Dark matter). These results confirmed that Dark matter is collision-less whereas baryonic matter is collisional in nature. Further, **IRAM observations on a sample of 17 clusters discovered cold gas in 47% clusters, with most of the detection from the central region of CC clusters.** These results suggest that the gas from in falling galaxies in the cluster environment is stripped off by ram pressure stripping feeding the disc of central BCG with a reservoir of cold gas. In the case of CC clusters, the cold gas signifies the cooling of accretion disc, with no on-going merger activities.

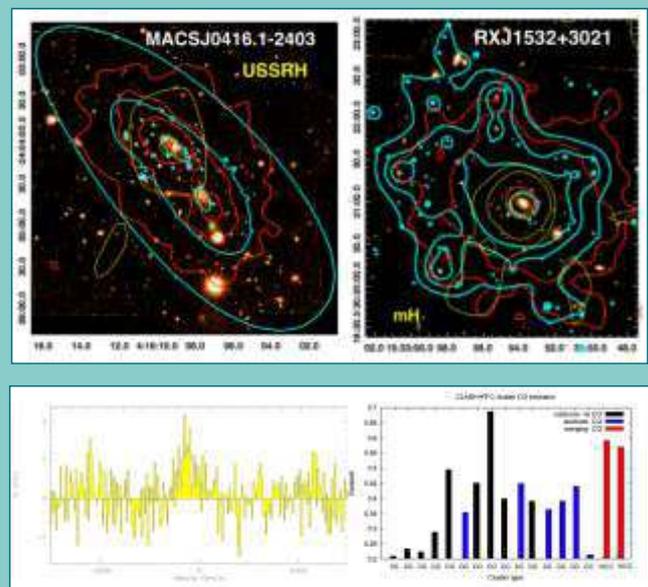


Fig. Dark and baryonic matter coupling in NCC (left panel) and CC (middle panel) clusters with X-ray (red), MUSE/HST total mass map (cyan) & GMRT (yellow) contours overlaid on the background HST map (M. Pommier et al. 2016, 2019). Right panel shows the detection of cold gas (CO emission) in cool core clusters.

Principal Collaborators



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Saint Genis Laval

With the above mentioned study, the authors have provided the current status of our understanding of non-thermal emission in galaxy clusters, and their interaction with the hot gas from the ICM. Pommier et al. have also showed that, as the merger activities fades off in the cluster environment, the discs in the BCGs of CC clusters start to show excess of cold molecular gas. Further, the authors conclude that high sensitivity and angular resolution imaging, spectral capabilities, and large field of view observations with the SKA in the next decade will help the improvement of the statistics, the understanding of the impact of mergers within the ICM of galaxy clusters, and the characterization of both their scaling relation and dynamical properties. *Pommier et al. have set-up a collaboration for the future with the SKA members in India and UK on the above mentioned projects.*

2 Discovery of a new supercluster of galaxies 'Saraswati'

Bagchi et al. reported the discovery of an extremely massive and large supercluster named 'Saraswati' (goddess of knowledge in ancient India mythology) using spectroscopic data in the Stripe-82 region of SDSS. This new supercluster is a major concentration of galaxies and galaxy clusters, forming a wall-like structure spanning at least 200 Mpc across at redshift $z \approx 0.3$. This enormous structure is surrounded by a network of galaxy filaments, clusters and large, $\approx 40 - 170$ Mpc diameter, voids. The main body of the supercluster comprises at least 43 massive galaxy clusters (mean $z = 0.28$) with a total mass of $\approx 2 \times 10^{16} M_{\odot}$. A spherical collapse model suggests that the central region of radius smaller than ≈ 20 Mpc and mass at least $4 \times 10^{15} M_{\odot}$ may be collapsing. This places it among the few largest and most massive superclusters known, comparable to the dominant and most massive 'Shapley Concentration' ($z \approx 0.046$) in the nearby universe. The Saraswati supercluster and its environment reveal that some extreme large scale, prominent matter density enhancements had formed ≈ 4 Gy in the past, when dark energy had just started to dominate structure formation. This galactic concentration sheds light on the role of dark energy and cosmological initial conditions in supercluster formation, and tests the competing cosmological models.

3 Discovery of Giant Radio Galaxies from the NVSS catalogue

*Dabhade et al. reported the discovery of a large number of an extremely rare kind of galaxies called the Giant Radio Galaxies (GRGs), using a nearly 20 year old NVSS VLA radio survey. These galaxies represent the end phase of the galaxy life cycle, and it is very important to understand their evolution in sparse and dense cluster environments, as well as their interaction with the Intra Galactic Medium (IGM). The results of the analysis suggested that the environment alone does not play a role in the size and evolution of the GRGs, and hints towards a powerful AGN at play, which produces energetic linear jets to the extent of > 700 kpc along, with kinks and lobes. Further, the outer lobes of GRGs tend to host emission with very steep radio spectral index ($\alpha -1.6$), pointing towards strong radiative losses in the lobe plasma. These **steep spectrum sources are a potential new population of sources to be discovered with the uGMRT, LOFAR, NenuFAR radio arrays currently operating at MHz range, and with the SKA array in the future.***

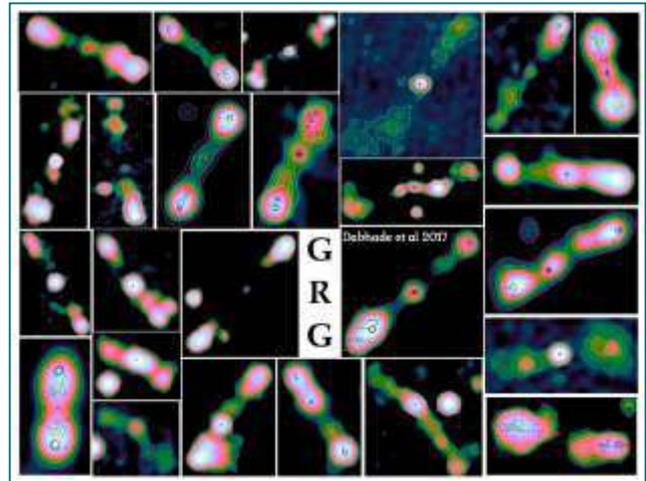


Fig. Montage showing Radio image from 1.4 GHz NVSS radio survey of all new GRGs reported by Dabhade et al 2017.

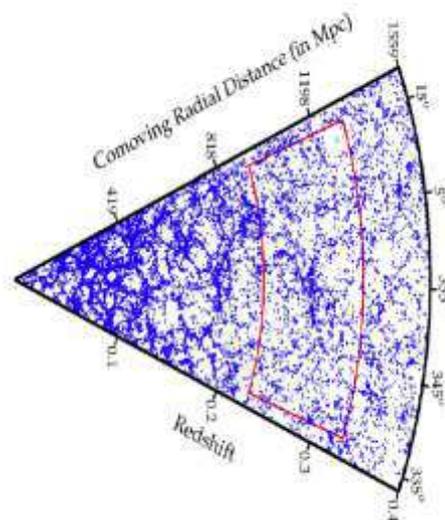


Fig. Redshift cone plot of SDSS galaxies, extending from redshift $z = 0$ to 0.4, and R.A. width 45° , declination width $2^\circ.5$, centered near Saraswati supercluster, the prominent large-scale structure within the red box. The small depth in the declination direction has been suppressed for clarity. (Bagchi et al. 2017)

4 Impact on career of young researchers and bilateral scientific collaboration

- A successful outcome of the project was the **training of the team to use the advanced facilities** like the European IRAM 30mt telescope and NOEMA, and the use of world-class GMRT in India. The CEFIPRA funding helped the **career of a graduate student**, Mr Pratik Dabhade, is preparing his thesis, and gave him opportunities to visit France, and get training on IRAM observations and data processing. Dr Mamta Pommier, who played a key role in the project and whose CNRS position was supported under the CEFIPRA project, is currently working on the French SKA-Pathfinder NenuFAR project at the Observatory of Paris. She is strongly involved in the European LOFAR, as well as in the International SKA telescope projects. She thanks CEFIPRA for **supporting women career in research**, and looks forward to build long term projects with the CEFIPRA to help the career of young women in research.
- The Franco-Indian schools “Indo-French Astronomy school on Optical Spectroscopy” - Nov, 23rd-28th 2015

and “From re-ionization to large scale structure - a multi-wavelength approach” Feb-11th-17th 2018 jointly organized at IUCAA, Pune, co-funded with the Laboratory of Excellence (LabEx) Lyon Institute of Origins (LIO), gave the collaborators a possibility to **introduce a large group of students and young researchers from both countries with cutting-edge topics**. Several **bilateral contacts** taken during the visit of the French collaborators during the schools, have resulted into **new proposals** (submitted and being prepared) for science programs under CEFIPRA to build long-term collaboration.

- CEFIPRA organization’s consistent **administrative support, flexibility and efficiency in handling this bilateral project** is the key factor for the success of this collaboration project and is highly appreciated.
- Finally, the success of our CEFIPRA project has fostered many **new opportunities of scientific collaboration** both in France and India, on several upcoming facilities like LOFAR/uGMRT/SKA (radio), MSE/MUSE (optical), ASTROSAT (X-ray) in the domain of astronomy, and provided **technical and manpower training, as well as exchange possibilities for the future**.

Reflection Aware ICC Analysis Framework for Android Apps

Smartphones are becoming a store of personal information and used in financial transactions. These have become attractive targets for malware writers. If not protected, malware disguised as a real app may enter the device and be used for stealing credentials without any knowledge of the user. A monetary or identity stealth threat may translate to the physical threat as well. It is imperative that security solutions for mobile systems handle all known/uncovered vulnerabilities.

The main objective of this project is to detect privacy/sensitive data leakage through one or more (colluding) Android apps that are reflection-aware as well as

Final outcomes of the project:

1. Supplements static analysis in Identification of privacy leaks through reflection/obfuscation by malicious apps.
2. An improved approach for inspecting malicious behaviour hidden through reflection and obfuscation of parameters of reflection APIs.
3. Improvements performed in terms of scalability, timely analysis, coverage of non-trivial paths, and handling of logic-bombs.
4. Supports state of the art static analysis approaches in analyzing otherwise missed leaks without modifying them and improves the recall.

Principal Collaborators



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equipped with anti-detection features employed for evading dynamic analysis. Reflection was introduced in Java for ensuring that version-compliant functions would be executed. So at run time depending on underlying hardware and JRE environment, appropriate library function is invoked. Same functionality can be used for invoking malicious functions at run-time bypassing static analysis. Apps employing reflection cannot be analysed by existing static methods alone. On the other hand solutions employing dynamic analysis are computationally expensive and 100% coverage is not assured.

In this project, Pls use dynamic analysis to identify the class/method being bound at runtime and use this information to instrument the app. This instrumentation is basically replacing reflection call with resolved class/method name, Instrumented app can be statically analyzed. Instrumentation is done at intermediate Jimple representation. To improve code coverage and impart efficiency to our method, Pls employed a hybrid approach. This approach consists of two phases. In phase one, static analysis of the input app is carried out. The main aim is to identify the code part that needs to be dynamically analyzed. Once such targets are identified, second phase i.e. dynamic analysis concentrates only on these parts, referred to as slices in program analysis terminology.

INDIRA-B

(INDICators of Reliability and Variability of Bus systems)

(By Neila BHOURI - IFSTTAR)

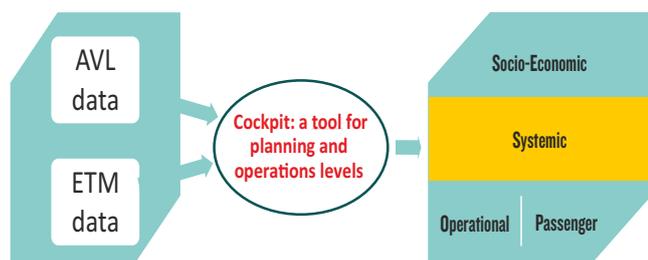
INDIRA-B (INDICators of Reliability and Variability of Bus systems) project is based on the need to integrate the urban bus systems with existing city roads and the larger public transport network. The scope of the project is to analyse performance-related indicators and patterns of the bus system.

This project includes major interventions at two levels- product and process. The product involves use of Intelligent Transportation Systems (ITS) technology for developing performance indicators for bus systems. At the process level, the aim is to improve the operation of buses by means of branching modules, dealing with new indicators in an existing management system, exploiting an existing real time data acquisition system.

The objective is to assess existing well known quality-of-service indicators, and to develop new ones. The main outcome of this project is a research tool, consisting of different modules, for analysis and diagnosis of the quality of service of bus routes in different operational use.

Main Results

The originality of the approach lies in four points:



1. Inclusion of vehicles and passengers data on the same model repository

Buses are localized by AVL: (Automatic Vehicle Location) and passengers in and out buses by ETM (Electronic Ticketing Machine). Based on the original generic multimodal data model of the Claire-SITI platform (a research tool developed in the Grettia laboratory since 2000), both data are joined in the same database which allows to follow up and take decision with the consideration of passenger demand.

Project Partners



TRIPP (Academic partner – India)

Transportation Research and Injury Prevention Programme (TRIPP) at the Indian Institute of Technology (IIT) Delhi, is an interdisciplinary programme. TRIPP focuses on the reduction of adverse health effects of road transport. Introduction of bus rapid transit projects in India was initiated by TRIPP members as advisor to Delhi government.



IFSTTAR (Academic partner – France)

GRETTIA is a research laboratory on Transport Network and Advanced Software Engineering in the department COSYS (Components and Systems) at IFSTTAR. IFSTTAR is the French Institute of Science and Technology for transport, spatial planning, development and networks.



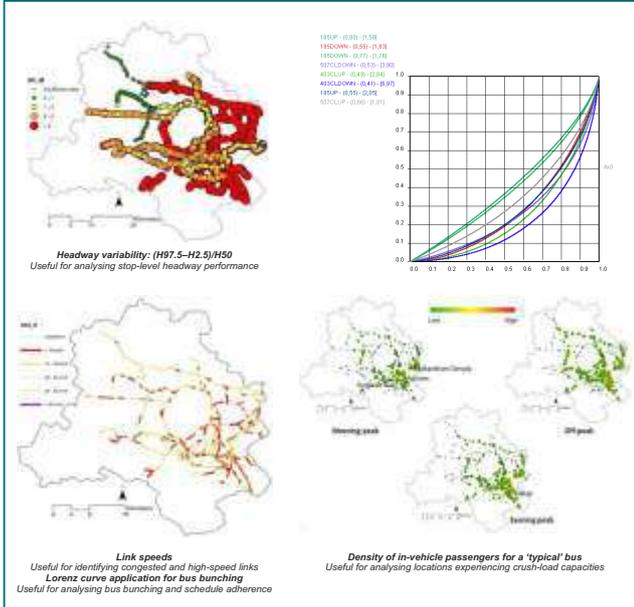
DIMTS (Industrial partner – India)

Delhi Integrated Multimodal Transit System Ltd. (DIMTS) is a 50:50 joint venture between Government of Delhi and Infrastructure Development and Finance Company (IDFC). DIMTS has rich experience in public transport operations, intelligent transport systems technology, transport planning and modelling, project management, in particular.

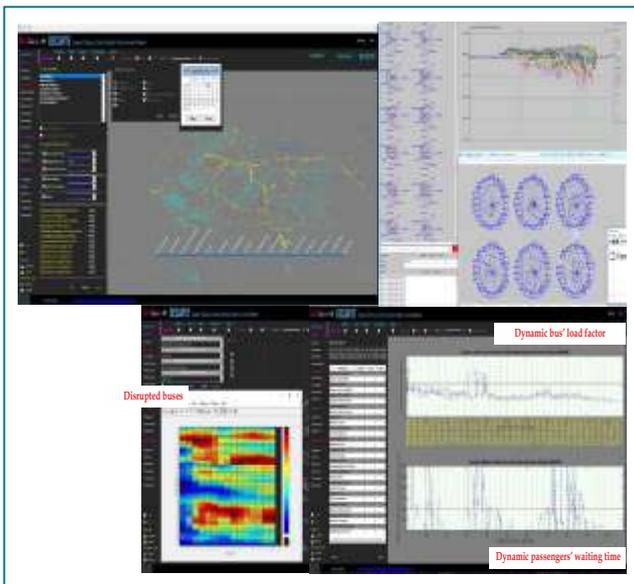


2 Performance indicators developed

A coherent set of indicators related to efficiency of the bus system for the different actors: bus operator, passengers and public authorities. Already existing and new performance indicators are tested on the 25 routes of the New-Delhi network operated by DIMTS. All proposed indicators are clear, easily understandable and useful to the audience.



3 Software allowing visualization of the bus conditions and a multi-criteria analysis of the quality of service



We are thankful to CEFIPRA for facilitating the recruitment of the doctoral student and the Post-Doc. A good synergy between the partners, happy to work together. The group is keen to carry forward their work on bus control and performances.

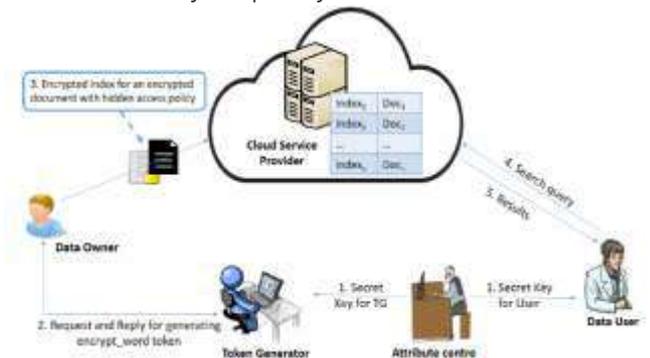
Study of Privacy, Accountability and Ownership in IoT



Dr. Manik Lal Das - DA-IICT, Gandhinagar and Dr. Pascal Lafourcade - University of Claremont

Internet of Things (IoT) is an innovative Internet infrastructure that can interrogate and integrate information between the real world and the virtual world. As IoT applications require integration of several complementary technologies for interacting to a tiny sensing device from a powerful cloud server, security and privacy are real challenges in IoT applications. The objective of this project is aimed at conducting extensive research in the security and privacy issues in IoT applications through collaborative research between French researchers and Indian researchers.

One of the main goals of the project is to develop secure protocols. Over the three years, Indian and French researchers had numerous meetings for making progress and fulfilling this important goal of the project. We have devised a new primitive, Private Polynomial Evaluation, and validated the primitive with a formal security model, termed as Indistinguishable Chosen-Function Attack, which is a novel contribution to the scientific community by this project. In addition, PIs have contributed towards privacy-preserving aspects of data processing and node-capture scenario in IoT applications. Data de-duplication and ownership issues in IoT applications have also been explored substantially. The technical merits of the research works have been anticipated in the form of publications appeared in referred journals (e.g. IEEE Transactions on Cloud Computing, IEEE Sensors Journal and Wireless Personal Communications-Springer) and in peer-reviewed conferences (e.g. ProvSec, ICISS) in the area of security and privacy.



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PRIYA
PhD Student
RCF - 2018

**Experience as Raman Charpak Fellow at
C2N-CNRS Université Paris-Saclay -
Université Paris Sud, France**

I am Priya, a PhD student in the Department of Physics at the Indian Institute of Technology Ropar. I worked at the Laboratory for Nano-scale optics and Metamaterials (LaNOM) under the supervision of Dr. Rajesh V. Nair, Assistant Professor in the Dept. of Physics, IIT Ropar. Recently, I have been awarded the prestigious Raman-Charpak Fellowship 2018 in Physical Sciences for two-months (April-May) to work in the renowned group of Prof. Pascale Senellart at the Centre for Nanosciences and Nanotechnology, CNRS – Université Paris-Saclay - Université Paris Sud, France.

I take this opportunity to share my magnificent learning experience as a Raman-Charpak Fellow in the city of Paris, France. To begin with, I would like to thank the Indo French Centre for Promotion of Advanced Research (IFCPAR/CEFIPRA) for providing me with this global platform to discuss my ideas and earn a hands-on experience on the high-end research facilities in the laboratory of Prof. Senellart at C2N-CNRS. The group comprises of students from different countries and hence nurtures a diversified and culturally rich environment. Speaking of the work culture, the group works vigorously towards their goals and always mark an impact with their writing in different peer-reviewed journals. My colleagues also helped me in exploring the exotic French cuisine including Crapes and wines at the famous Place de la Bastille, Paris. The one-day excursion trip with the group members to the royal residence of France’s King, the Palace of Versailles, Paris acquainted me with the unique art collections and architecture which signifies the timeless asset of France. Overall it was an incredible experience to work in a different culture along with distinct people that helped me to enhance my skills, thanks again to the CEFIPRA for embracing me this wonderful opportunity.



Dr. VYAS
Senior Modeling
Engineer
Danfoss, Lyon



**Loop Heat Pipes for Avionics
and Terrestrial Application**

PIs: Prof. Jocelyn Bonjour, Prof. Frederic Lefèvre, CETHIL Laboratory, INSA Lyon, France and Prof. Sameer Khandekar, IIT Kanpur, India.

I write this testimonial with earnest gratitude to share my experience so far, as a Post-Doctoral researcher at CETHIL Laboratory, INSA Lyon. My post-doctoral research at INSA officially began from the 01 October 2018, right after my PhD completion in August 2018. I am indebted to CEFIPRA in facilitating me with such a rapid and smooth transition from India to France. I am fortunate to be part of a dynamic and vibrant collaboration, sponsored by the Industrial Research Programme of CEFIPRA. The ongoing research collaboration encompasses four major participants, namely, Prof. Sameer Khandekar (IIT Kanpur), Prof. Jocelyn Bonjour (CETHIL, INSA Lyon), Mr. Siddharth Paraliker (Golden Star Ltd., Pune, India) and Mr. Claude Sarno (THALES, Valence, France).

In this project, we intend to develop a novel thermal management system called the Loop Heat Pipe, intended for 100 W, typically to be integrated with different avionic systems of THALES. While the industrial specification is provided by THALES, my Post-Doctoral research focuses on the “Convective condensation phenomena inside a Loop Heat Pipe”.

The primary requirement of such a study stems from the lack of data base on the thermo-hydrodynamics of low mass flux 5 kg/m²s to 100 kg/m²s condensation that occurs inside a capillary tube (of typically 1 mm to 2 mm diameter). Under such conditions, where the surface tension effects are dominant, the condensation pattern and hence the ensuing heat transfer coefficient can be drastically different than condensation occurring in macro-channels. Further, system level coupling between the various components of a LHP also remains to be investigated. As a matter of fact, some recent dynamic models of LHP were used to highlight a variety of complex



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Marine Biodiversity, Ecosystem Dynamics and Conservation

Observatoire Océanologique de Banyuls, Banyuls sur Mer, France on Date - 8-10 July, 2019



This successful workshop included presentation by six institutional presentations, as well as twenty one scientific presentations involving ten Indian presenters, nine French presenters. Two round tables were held, one dedicated to sharing knowledge about funding opportunities to support Indo-French collaboration and the other to share the ongoing projects of each participants.

As an outcome of the second round table, it was decided that we will create a list of internship opportunities for the coming years to circulate to students and on-going PhD projects in both Countries.

A scientific speed dating was also organized to further develop ideas about hands-on collaborations between participants. India, with its tropical climate, vast coastline, island territories and diverse marine ecosystems of coral reefs, seagrass meadows, mangroves and open ocean is unique in its exceptional richness of marine biodiversity. Marine biodiversity is a multidimensional concept, considered at many different levels, ranging from genetic variability among individuals and populations, to diversity of species, assemblages, habitats, landscapes and biogeographical provinces.

Despite this tremendous diversity, marine organisms remain largely unexplored by fundamental or applied research in India. Ocean productivity is controlled by both the diversity and identity of marine species forming functional communities. Human modifications to the collective biodiversity of the ocean can alter ecological functions and life support services that are ultimately essential to the well-being of human societies. Substantial local losses of biodiversity have already occurred in the ocean in response to overfishing, habitat destruction, pollution or non-indigenous species introduction. Climate change has also started to modify species assemblages at larger scales, due to profound modification of the ocean physics and chemistry.

The biodiversity in the EEZ of India including coastal and deep-sea habitats and its functional role is largely unexplored. Yet, climate change is expected to significantly impact this part of the ocean. Thus, investigations of Indian marine biodiversity should be intensified.

Through the seminar, the idea of testing ecological concepts shaping species distribution across terrestrial and marine ecosystem emerged, in order to capitalize on the expertise of the Indian (terrestrial/marine) and French (marine) participants.

Raman Charpak Fellowship-2019, Selection Committee Meetings



Meeting for Preliminary Selection of Candidates for the Raman-Charpak Fellowship-2019 on 22 August, 2019 at New Delhi



Meeting for Final Selection of Candidates for the Raman-Charpak Fellowship-2019 on 27 September, 2019 at New Delhi

Raman-Charpak Fellowship aims to facilitate the exchange of doctoral students between India and France in order to broaden the scope and depth of future engagements in ST&I. A Call was launched on 15 April, 2019 for French Masters students and on 15 May, 2019 for Indian and French PhD students. The Centre has received 291 applications (with some repetitions) against the deadline of 15 July, 2019 from Indian and French PhD students. The meeting for preliminary selection of candidates for the Raman-Charpak Fellowship-2019 was held on 22 August, 2019 at CEFIPRA office, New Delhi. The Committee had shortlisted 71 Indian candidates for consideration in the final selection meeting. The Expert Committee meeting for the final selection of pre-selected candidates was held on 27 September, 2019. These meetings were attended by area experts from different institutes/organizations, representatives of the granting agencies and officials of CEFIPRA. Director, CEFIPRA appreciated the cooperation and support received from Department of Science and Technology (DST), GOI & French Embassy in India for the Programme.

2nd Steering Board Meeting of the Indo-French Centre for Applied Mathematics (IFCAM)

The Second Steering Board Meeting of the Indo-French Centre for Applied Mathematics (IFCAM) Phase II was held on 2 July, 2019 at Indian Institute of Science, Bangalore. Director, IFCAM, Prof. Rangarajan, made a presentation on the activities of IFCAM and informed about the selection process followed last year, the projects sanctioned the number of exchange visits under these projects, the Summer and Winter Schools and the Research Workshop conducted during the first year. In 2019, 15 project proposals were received and 3 were awarded grade A+ by the Scientific Committee which were recommended for support by the Steering Board. Director, CEFIPRA, Dr. Purnima Rupal, also attended meeting of IFCAM as a member of the Steering Board.

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Multiple exchange visits have been carried out between Indian researchers and French researchers, which help not only in enhancing technical knowledge among researchers, but also has established a long lasting association between these research groups. Both research groups are equipped with rich expertise in handling security and privacy challenges in modern and future Internet applications and the kind of knowledge exchanges between the groups through this project is immensely helpful to both sides.

The research problem of the project work has immensely encouraged students for doing their thesis and project work under this project. As outcome, two PhD theses, six MTech theses, and six undergraduate projects have been supervised under this project. These students have also got an opportunity for their knowledge sharing with French researchers.

In summary, the objective of the project is fulfilled through this research collaboration. The results achieved from this project in terms of primitives, development of secure protocols and formal security model, etc. will be made available for the scientific community, which can integrate them into IoT applications in order to guarantee security and privacy objective of IoT applications. The results of the project will be of immediate use for the further development of IoT applications, not only by the institutions involved in the project, but also by other researchers in the scientific community.

Science, Technology and Innovation Policy (STIP) lecture: 23rd lecture

19 September, 2019



The 23rd Science, Technology and Innovation Policy (STIP) lecture was delivered by Dr Shekhar C. Mande, Secretary of Department of Scientific and Industrial Research (DSIR) & Director-General of Council of Scientific and Industrial Research. The thought provoking lecture was delivered on the journey of science, technology and innovation in Independent India and the role of CSIR in its journey. He quoted various examples from ancient times, where ST&I had played an important role in public engagement and promoting economy and trade at that time. He further remarked for progress of society only solution was to make science, technology and innovation as the driver to rise up.

He also remarked proposing more pragmatic provision for Social Scientific Responsibility for which greater collaboration between society, and the scientific community was required to ensure that there was proper promotion of scientific endeavours and effective utilisation of the fruits of science, technology and innovation for the welfare of the people.

Prof. Chandrima Shaha, President-Elect, Indian National Science Academy, chaired the session, while Sachin Chaturvedi, Director General, RIS, welcomed the speaker and Chair, while Director CEFIPRA thanked the speaker and Chair for their valuable time to enlighten the gathering.



New Members

CEFIPRA extends warm welcome to Prof. Rinti Banerjee as new SC member (Life & Health Sciences) & Dr. Vijay Chandru as new IRC member.



Dr. Vijay Chandru

Dr. Vijay Chandru co-founded Strand in 2000 as a spin-off from the prestigious Indian Institute of Science (IISc), Bangalore. His academic career has spanned over two decades at Purdue University and IISc. Dr. Chandru is the recipient of several awards and honors: Fellow of Indian Academy of Sciences (1996), MCIT Dewang Mehta Award for Innovation in IT (2001), UGC Hari Om Trust award for "Science and Society" (2003), the President's Medal of INFORMS in 2006, distinguished Alumni award by the MIT India Program in 2007, and was recognized as the Biospectrum Biotech Entrepreneur of 2007.



Prof. Rinti Banerjee

Dr. Banerjee is the Madhuri Sinha Chair Professor at the Department of Biosciences & Bioengineering at IIT Bombay. She has an MBBS from BJ Medical College Pune, a PhD in Biomedical Engineering from IIT Bombay and postdoctoral from the University of California, San Francisco. She is an expert in smart biomaterials, nanomedicine and drug delivery and has published over 150 papers in international journals including invited editorials, fifteen book chapters/books, and has more than 35 patents filed/awarded. She is the recipient of many awards including CDRI Award for Excellence in Drug Research, NASI-Reliance Platinum Jubilee Award for Biological Sciences and the HH Mathur Award for excellence in Applied research. Many of the technologies developed by her have been licensed for commercialisation.

Welcome to New Ambassador of France to India Mr. Emmanuel Lenain & Farewell to Mr. Alexandre Ziegler



Mr. Emmanuel Lenain



Mr. Alexandre Ziegler

CEFIPRA welcomes the new Ambassador of France to India H.E. Mr. Emmanuel Lenain, LENAIN as the new French Ambassador of France to India. He graduated from Sciences Po (IEP) in Paris and ESSEC Business School. He is also an alumnus of the Ecole Nationale d'Administration (ENA).

Mr. Emmanuel Lenain began his diplomatic career in 1997, serving in the French Foreign Ministry's United Nations Department. He has also worked as Diplomatic Adviser to the French Prime Minister in 2017.

CEFIPRA hopes to have enhanced joint S& T activities between France and India during his tenure in India and sure to continue enjoying the support and valuable guidance H.E. Mr Emmanuel Lenain.

CEFIPRA also express its sincere thanks to the former Ambassador of France to India, Mr. Alexandre Ziegler, who provided tremendous support and guidance to the Centre's activities during his tenure in India.

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thermo-hydraulic behavior of LHPs, especially those related to flow-oscillations during operation. In that context, the dryout of the capillary wick is of major importance. Hence, in order to understand and model such a unique and physically rich engineering system of LHP, my first step at INSA Lyon was to assemble the Loop Heat Pipe, with glass transport lines (for visual inspection of the transport phenomena in the system), which is a very delicate process. Further challenges warrants in the subsequent steps to detect and correct leaks in the system, before working with it. As trivial it may sound, the process of leak detection and its elimination is indeed difficult. This process would not have been possible without the help of high-caliber technicians and leak detections facilities that are available with the CETHIL Laboratory. The good part about such collaborative research lies in the synchronous working of the members involved and the feedback for improvement and knowledge transfer is tremendous. For instance, in the timeline of this project, we have been able to test the wicks that are developed in India (IITK and Golden Star Ltd.) and specify them with recommendations for making it efficient in a LHP. Further, the lab environment is so enriching with engaging discussion form Prof. Jocelyn Bonjour and Prof. Frederic Lefèvre on future studies with the LHP, with valuable inputs from Prof. Sameer Khandekar. I thank them for the trust they instilled in me to explore new ideas on the system and the feedback and

knowledge they impart to me on a continuous basis.

Overall, the progress of the project enthalls me, especially to see the LHP functioning, which offers plethora of physical phenomena waiting to be discerned. For me, the transformation from fundamental research during PhD to its application on a new technology development for Post-Doc is immensely fulfilling and enriches my knowledge. To this opportunity, I owe my sincere gratitude to Prof. Jocelyn Bonjour, Prof. Frederic Lefèvre and Prof. Sameer Khandekar, for being a pillar of support in mentoring me both on personal and professional aspects. On a personal level, I am very happy that I took the right step in traveling to CETHIL Labs at INSA Lyon, which offers me the pleasing environment to carry out fruitful research and broaden my horizon. Indeed, a big cheers and thanks to CEFIPRA for encouraging and promoting researchers to gain such a worthwhile experience.

Under TDB-CEFIPRA-Bpifrance Programme:

Project Monitoring Committee (PMC) meeting was held on 30 September and 1 October, 2019 at Bengaluru for assessment and monitoring of the Project entitled "Development and commercialization of IMRT/IGRT based Treatment Planning System (TPS) for 6 MV Medical LINAC"

Mobility of Indian Scientists/researchers supported under CEFIPRA projects during July-September, 2019

S.No.	Project / Programme Title	Institutional Affiliation (From)	Name / Institution Visited (To)
1.	Nuclear structure at the extreme of isospin and spin	Dr. Sarmishtha Bhattacharyya (PI) Variable Energy Cyclotron Center Kolkata	Dr. Navin Alahari Grand Accelérateur National D'Ions Lourds (GANIL) Caen
2.	Metal chelators derived from imidazole thiones and selones for detoxification	Mr. Ranajit Das (Stu) Shiv Nadar University Gautam Buddha Nagar	Dr. Pascale Delangle CEA Centre de Grenoble Grenoble
3.	A genome-wide study to identify novel regulators of chromosome stability using a human pathogenic yeast <i>Candida albicans</i> as the model system	Dr. Kaustuv Sanyal (PI) Jawaharlal Nehru Centre For Advanced Scientific Research Bengaluru	Dr. Christophe D'Enfert Institut Pasteur-Paris Paris
4.	Phase transitions in sub-saturation nuclear matter and applications to core-collapse supernova and nuclear experiments	Dr. Naosad Alam (Post-Doc) Variable Energy Cyclotron Centre Kolkata	Prof. Francesca Gulminelli, LPC/ENSICAEN, Basse-Normandie Caen
5.	Extreme events and large deviations in strongly correlated many body systems	Dr. Abhishek Dhar (PI), Dr. Anupam Kundu (Co-PI), Mr. Varum Dubey (Stu) & Mr. Prashant Singh (Stu) International Centre for Theoretical Sciences (TIFR) Bengaluru	Prof. Cedric Bernardin University of Nice Sophia-Antipolis, Parc Valrose Nice
6.	To develop an effective extraction and separation technology to selectively extract rare earth elements – Erbium (Er), Terbium (Tb), Europium (Eu), Praseodymium (Pr) Neodymium (Nd) and Dysprosium (Dy) from WEEE (Waste Electrical and Electronic Equipment's)	Ms. Aarti Kumari (PI) CSIR-NMLCSIR-National Metallurgical Laboratory, Burmahmines Jamshedpur	Dr. Stéphane Pellet-Rostaing Director of ICSM Bagnols-sur-Cèze
7.	To develop an effective extraction and separation technology to selectively extract rare earth elements – Erbium (Er), Terbium (Tb), Europium (Eu), Praseodymium (Pr), Neodymium (Nd) and Dysprosium (Dy) from WEEE (Waste Electrical and Electronic Equipment's)	Mr. Santosh Daware (Co-PI) Ms. Shally Gupta (Co-PI) TRDDC Tata Research Development and Design Centre, 54 B, Hadapsar Industrial Estate, Hadapsar Pune	Dr. Stéphane Pellet-Rostaing Director of ICSM Bagnols-sur-Cèze
8.	Development of new anti-counterfeit printing techniques for medicine packaging	Ms. Paulomi Kundu Jadavpur University	Prof. Alain Trémeau University Jean Monnet (UJM), Laboratoire Hubert Curien UMR 5516 (LaHC), Bâtiment F 18 Rue du Professeur Benoît Lauras 42000 Saint-Etienne
9.	The Economics of Networks and Queues	Prof. D. Manjunath (Co-PI) Indian Institute of Technology Mumabi	Dr. M. Liviu Nicu Laboratory for Analysis and Architecture of Systems (LAAS-CNRS) Toulouse
10.	Chiral Phosphahelicenes in Gold(I) Enantioselective Catalysis	Prof. Akhila Kumar Sahoo (PI) University of Hyderabad Hyderabad	Dr. Angela Marinetti Institut de Chimie des Substances Naturelles, Gif sur Yvette

S.No.	Project / Programme Title	Institutional Affiliation (From)	Name / Institution Visited (To)
11.	Wavelet Graphs for Gravitational Wave Searches	Dr. Disha Sawant (Post Doc) Indian Institute of Technology Mumbai	Dr. Eric Chassande-Mottin Astro Particule et Cosmologie, University Paris Denis Diderot Paris
12.	Hematopoiesis and metabolism	Dr. Tina Mukherjee (PI) Institute for Stem Cell Biology and Regenerative Medicine	Dr. Angela Giangrande Institut de Génétique et de Biologie Moléculaire et Cellulaire, Alsace Strasbourg
13.	Yielding in glasses and colloidal systems under cyclic deformation	Prof. Srikanth Sastry (PI) & Dr. Himangshu Bhoumick (Post Doc) Jawaharlal Nehru Centre for Advanced Scientific Research Bengaluru	Prof. Giuseppe Foffi Université Paris Sud Paris
14.	Modeling Soft Glassy Flow from Micro to Macro Scale	Dr. Pinaki Chaudhri (PI) Institute of Mathematical Sciences Chennai	Dr. Kirsten Martens Laboratoire Interdisciplinaire de Physique, University of Grenoble-Alpes Grenoble

Mobility of French Scientists/researchers supported under CEFIPRA projects during July-September, 2019

S.No.	Project / Programme Title	Institutional Affiliation (From)	Name / Institution Visited (To)
1.	Nutrient transfers through groundwater in India (NUNDERGROUND)	Dr. Dameien Cardinal (PI) Université Curie Paris	Dr. V.V.S.S.Sarma CSIR-National Institute of Oceanography Visakhapatnam
2.	Pathogenic Aspergillus: Interaction with innate immune cells	Dr. Vishu Kumar Aimanianda Bopaiah (PI) Dr. Sze Wah Sarah (Post-Doc) Institut Pasteur Paris	Dr. Lalitha Prajna Aravind Medical Research Foundation Madurai
3.	Enhanced CO ₂ adsorption and its photo- electrochemical conversion using semiconductor-metal complex hybrids	Dr. Shubhadip Chakraborty (Post-Doc) Institut de Physique de Rennes, University of Rennes Rennes	Prof. E. Arunan Indian Institute of Science Bengaluru
4.	Impact of the Indian Monsoon convection on the Tropical Tropopause Layer and climate	Dr. Bernard Legras Ecole Normale Supérieure de Paris Paris Cedex	Prof. Kesavapillai Mohanakumar Cochin University of Science and Technology (CUSAT) Cochin

Forthcoming Events

- The second edition of Knowledge Summit will be held from 17 - 18 October, 2019 at Lyon.
- The Scientific Council (SC) Meeting will be held from 18 - 20 November, 2019 at Bhubaneswar.
- The Overlapping Meeting will be held from 21 November, 2019 at Bhubaneswar.
- The IRC Meeting will be held from 22 - 23 November, 2019 at Bhubaneswar.
- Indo-French "Seminar on "Small molecules activation for fuels and commodity chemicals production" scheduled to be held during 27-29 November, 2019 in IACS, Kolkata, West Bengal.
- Indo-French Seminar on "Recent Advances in ElectroHydroDynamics - applications in Microfluidics" scheduled to be held during 27-29 November, 2019 in IIT Kharagpur, West Bengal.

Dr. Paarivendhar Research Colloquium - 2019



Director, CEFIPRA inaugurated Dr. Paarivendhar Research colloquium, which was organized by SRM Institute of Science and Technology, Kattankulathu during from 23-25 September 2019. Director, CEFIPRA briefed the participants about the activities of CEFIPRA. The event provided an exclusive opportunity for all Ph.D. research scholars of SRM group of institutions to meet, showcase and share their research findings. The three day research colloquium was well attended by several experts in different disciplines. The event also provided a unique interdisciplinary forum to SRM research scholars for presentations of their posters.

CALL FOR PROPOSALS

Industry Academia Research Development Programme (IARDP) of CEFIPRA

Deadline for submission of proposals: 1st February, 2020

CEFIPRA supports Industry centric collaborative research projects in a framework (2+2 Model) under IARDP. Proposals with at least one industrial partner either in France or in India and a research institute from the other country can also be considered with proper justification.

Expected Outcome

The proposals should have clear deliverables like demonstration of proof of concept & prototype building up to Technology Readiness Levels (TRL 4-5). The scope of work and responsibilities of each partner must be highlighted.

Eligibility Criteria for Industry Collaborator

The Company or SME should have well established in-house R&D unit with a good track record of R&D achievements. They should be registered and operational for at least last three years. If a start-up is incubating in a recognized Technology Business Incubators/clusters it may be exempted from the criteria of 3 years.

Eligibility Criteria for Academic Collaborator

Permanent Position in an Indian or French university / R&D institution

Budget Support

Support will be given up to Euro 200.000. Outstanding proposals may be considered outside this range as exceptional cases. The industrial partners must invest more than 10% of the project cost in cash in the project (MSME and startups are exempted).



How to Apply:
Submit a joint proposal to CEFIPRA through online as per prescribed format (www.cefipraonline.in)

For detail information, please visit following link:
http://cefipra.org/Industry_Academia.aspx

CALL FOR PROPOSALS

under *CSRP - Thematic Research*

(Deadline for submission of Proposals 15 Jan, 2020)

CEFIPRA considers and supports research groups through high quality collaborative research projects in advanced areas of basic and applied science to nurture scientific competency in India and France. For upcoming cycle the thematic research specifically aims at contributing to solving important societal challenges. The four areas research themes covering cross-disciplinary (or interdisciplinary) issues.

Eligibility to apply

Principal Collaborators and Joint Collaborators (Indian & French) should have permanent position in an Indian or French University / R&D Institution. They should meet national level eligibility criteria with respect to the operation of grants and age of retirement.

Funding support for the proposals

- Manpower (PhD/Post-doctoral/Master students positions for French Partners; JRF/SRF/RA/Master students for Indian Partners)
- Purchase of consumables
- Travel (International & domestic)
- Equipment (only to Indian Partners : Minor equipment and accessories which are essential for the project with a limit of max. of 10% of total approved budget of the project (max. 20.000Euros))

The four thematic areas are:

Topic 1 : AI & Big Data

The aim of the thematic is to promote new research on the use of Artificial Intelligence (AI) and Big Data. The thematic will be structured around (but not limited to) the following areas:

- Applied Artificial Intelligence and real-life applications of AI
- Cyber-Physical Systems (CPS)
- Internet of things (IoT)
- Machine Learning / Deep Learning Applications
- Cloud / Edge Internet of Things
- Distributed Big Data Analytics
- Intelligent Agent Applications
- Data and Model reduction

There should be significant novelty in the computer science aspect of the proposal.

Topic 2 : Science for Sustainability

It includes, but not limited to, fundamental research on

- Better practices for the preservation of water resources
- Zero or low carbon emission technologies for an increased climate action
- The preservation of ecosystems and biodiversity
- Minerals resources and recycling technologies
- Science and policy for sustainability

Topic 3 : Quantum Materials

Quantum materials are materials where the quantum mechanical effects underline their physical properties, being dominated by quantum fluctuations, quantum entanglement, quantum coherence, topological behavior. The research in this interdisciplinary area which may include theory/modeling, advanced instrumentation, materials synthesis, knowledge of nano- and meso-scale science is at the intersection of physics, material science and engineering.

Key-words: Novel phenomena in topological materials like Topological Insulators. Dirac and Weyl semimetals, Quantum Spin Liquids, superconductors and their hybrids with possible applications such as ultra-sensitive sensors, Heterostructures of 2D materials, Discovery and growth of novel high-quality quantum materials by different methods, Quantum Materials Theory

Topic 4 : Addressing Biological Questions Using or Developing Mathematical, Computational or Physical Approaches

Elaboration of concepts, development of novel approaches or use/adaptation of innovative methods of physics, mathematics and computational sciences for addressing biological questions. A particular attention will be paid to the following fields (not limited): Data acquisition, treatment and analysis, interoperability; Predictive analysis; Simulation; Quantitative biology; Mechano biology; Single molecule studies.



CEFIPRA

For further information, please contact:

Director

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