



**OUTCOME ANALYSIS OF RESEARCH PROJECTS
COMPLETED DURING 2011 to 2015
UNDER
COLLABORATIVE SCIENTIFIC RESEARCH PROGRAMME**

**INDO-FRENCH CENTRE FOR THE
PROMOTION OF ADVANCED RESEARCH
(IFCPAR)**

**CENTRE FRANCO-INDIEN POUR LA
PROMOTION DE LA RECHERCHE
AVANCEE (CEFIPRA)**

FOREWORD FROM THE DIRECTOR

It gives me immense pleasure to present this report which contains the outcome analysis of the projects completed during 2011 to 2015 under the Collaborative Scientific Research Programme of CEFIPRA. It is a key programme which has been instrumental in supporting basic and applied research between India and France in advanced



areas of Science & Technology. This programme has significant impact in promoting collaborative research in both countries. The joint publications emerged from the CEFIPRA supported projects under this programme covers the ten major thrust areas and contributed to strengthen the research activities between the two countries. The evaluation of this programme indicates that it has played a major role in linking scientists and the research institutions of both countries and contributing towards development of skill in young researchers. The successful completion of ninety four projects during the period of five years, 2011 to 2015 has indicated growth in developing knowledge base of scientific community of both countries and addressing research challenges, areas of global concerns and finding solutions. A short summary of significant achievements is given in Annexure-I.

I hope that the information provided in this report will be beneficial for the administrators and policy makers of both countries in shaping future interventional policies in line with Collaborative Scientific Research Programme of the Centre which is contributing in strengthening Indo-French collaboration.

Dr. Mukesh Kumar
Director, CEFIPRA

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INTRODUCTION

The Indo-French Centre for the Promotion of Advanced Research (IFCPAR/CEFIPRA) is a model for international collaborative research in advanced areas of Science & Technology. The Centre was established in 1987 and is being supported by Department of Science & Technology, Government of India and the Ministry of Foreign Affairs and International Development, Government of France. CEFIPRA is actively involved in supporting Indo-French Science, Technology & Innovation (ST&I) system through various activities. Collaborative Scientific Research Programme focuses on academia-to-academia collaborations between Indian and French academic collaborators in various domains. Industry Academia Research & Development Programme emphasizes to develop the linkage between Industry and Academia from France and India. Seminars, Workshops and Training Schools supported by the Centre help in dissemination of information and promote networking between the two nations.

Some of the collaborative research projects involving industry & academia partners, have resulted in products which have already come to the market and some promising technologies developed are seeing a ray of hope for commercialization.

Dedicated mobility support programmes of CEFIPRA provide exposure to young researchers to the scientific, social and cultural environment of the partnering country. Targeted Programmes of CEFIPRA provide platform for Indian and French National Funding Agencies to implement programmes for specific areas.

Innovation programmes through PPP mode, are the programmes where industries join hands with CEFIPRA as a funding partner for supporting R & D in defined priority areas. It has worked as an enabling platform for the organizations in India & France to realize potential in terms of product and process development. It has facilitated innovation, risk taking for industries and also bringing in the private industry, public institutions and the government under one roof to promote the research and innovation between India & France.

The projects supported under various targeted programmes have resulted in prominent outcomes in the form of institutional linkages, intellectual contribution through excellence in science, capacity building through training of budding scientists, knowledge advancement in basic and translational research and publications as well as citations made.

In this document we are reporting outcome analysis of the projects completed during 2011 to 2015 under the Collaborative Scientific Research Programme of CEFIPRA.

2. BACKGROUND & SUMMARY OF THE COLLABORATIVE SCIENTIFIC RESEARCH PROGRAMME

Indo-French Centre for the Promotion of Advanced Research (IFCPAR/CEFIPRA) is India's first and France's only bi-lateral organization committed to promote collaboration between the scientific communities (academia-to-academia) of two countries across the knowledge innovation chain. The Centre aligns its activities with the national research priorities of India and France in S&T sectors. The activities of IFCPAR/CEFIPRA are reviewed by a Governing Body comprising of two Co-Chairs and other members nominated by the respective Governments.

The Collaborative Scientific Research Programme of CEFIPRA is core strength in promoting the collaborative research. This core programme is the main pillar of overall CEFIPRA's activities and is keeping pace with the emerging requirement in frontier areas of Science and Technology (S&T). The Programme supports high quality research groups in advanced areas of basic and applied sciences to nurture scientific competency.

Through this programme, the Centre enhances the Indo-French S& T cooperation in all the domains of Science & Technology such as Water, Life and Health Sciences, Environmental Science, Pure and Applied Physics and Chemistry, Supercomputing, Climate System and Modelling, Climate Change and Materials Science etc. The Centre facilitates the scientific exchange under the projects which provides interactive interface for sharing growth of knowledge and development of human resources.

The collaborative projects have helped in establishing network of scientists as well as institutional linkages between academic institutions of India and France leading to the High Impact Scientific Network Programme.

Supported thrust areas for collaboration under the programme

1. Pure and Applied Mathematics
2. Computational Science
3. Life & Health Sciences
4. Pure & Applied Physics
5. Pure & Applied Chemistry
6. Earth & Planetary Science
7. Materials Science
8. Environmental Science
9. Biotechnology
10. Water

The collaborative scientific research activities are monitored by Scientific Council (SC) of the Centre. The SC comprises of eminent scientists of both the countries which enhances the research agenda of the Centre in view of national goal of S&T sectors.

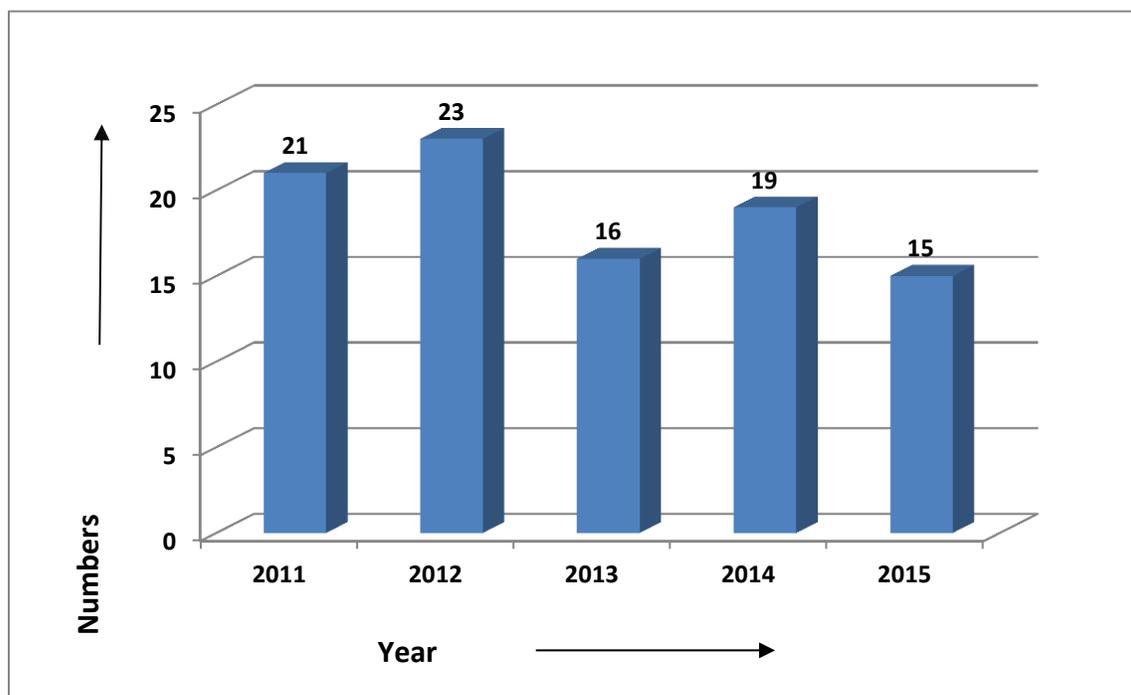
The Governing Body in its 27th and 28th meetings, held on March 6, 2014 at New Delhi & April 13, 2015 at Paris respectively directed as well as suggested about measuring impact of the CEFIPRA supported projects on knowledge generation.

Accordingly, the Centre developed a questionnaire with the help of the Scientific Council, and sent it to the collaborators of the projects completed during 2011-2015. Through the questionnaire, follow up data was collected as inputs for this report. The information received from the final reports submitted after completion of the projects as well as inputs received for annual reports of the Centre were used for analysing the outcome of the completed projects.

The present report has taken both qualitative and quantitative approaches to analyse the outcome of completed projects of collaborative scientific research during 2011 to 2015. During the above said period, a total of 94 projects were completed.

The year & thrust area-wise distribution of completed projects are given as follows:

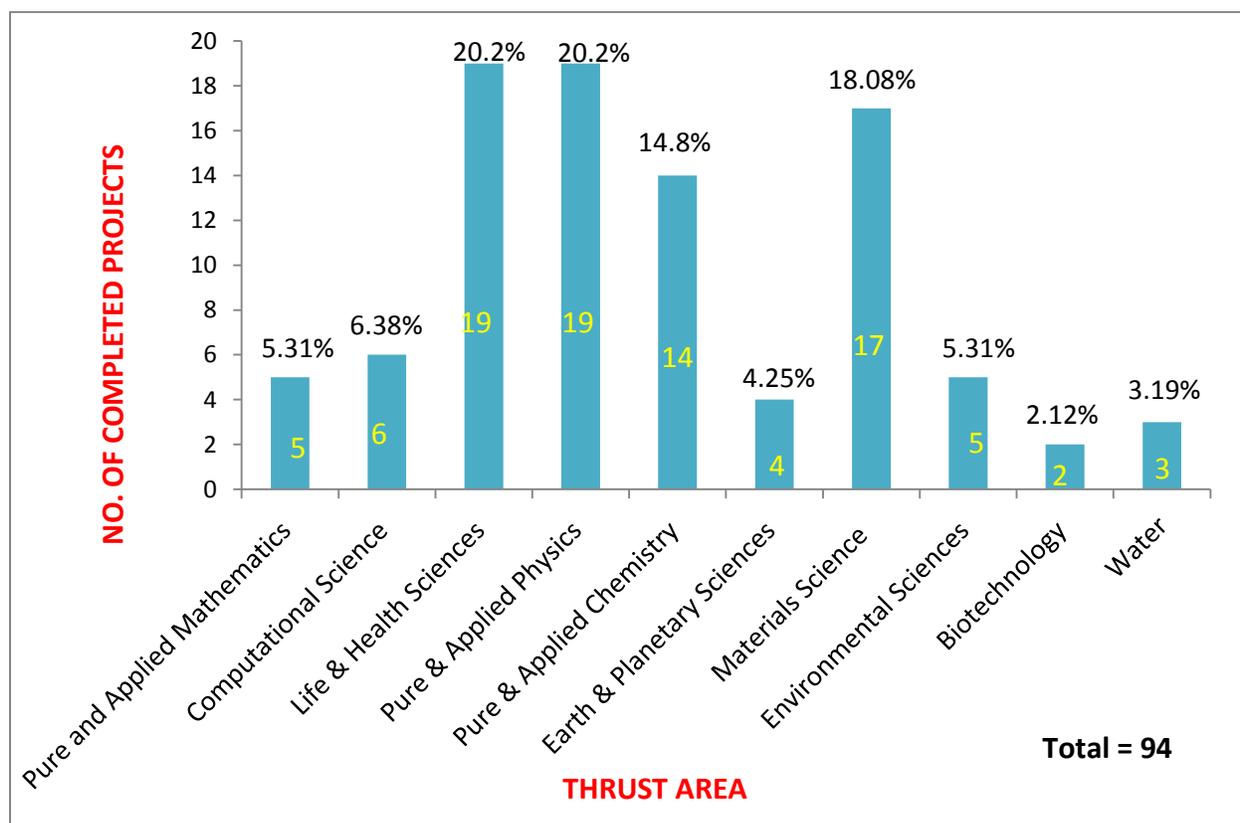
YEAR-WISE DEPICTION OF PROJECTS COMPLETED DURING YEARS 2011-2015



A total of 94 projects were completed during the years 2011 to 2015 under the Collaborative Scientific Research Programme. The year wise breakup of the projects completed is 21 projects in the year 2011, 23 projects in 2012, 16 projects in 2013, 19 projects in 2014 and 15 projects in 2015.

Maximum number of projects were funded in the domains of Life & Health Sciences and Pure & Applied Physics, followed by Materials Science and Pure & Applied Chemistry. In terms of percentage, these four disciplines accounted for 68 projects approximately 73% of the total completed projects. The data indicates that the maximum number of projects were from the areas of Life & Health Sciences (19), Pure & Applied Physics (19), Materials Science (17) and Pure & Applied Chemistry (14) completed during the years 2011 to 2015.

THRUST AREA-WISE PERCENTILE OF PROJECTS COMPLETED DURING YEARS 2011 to 2015

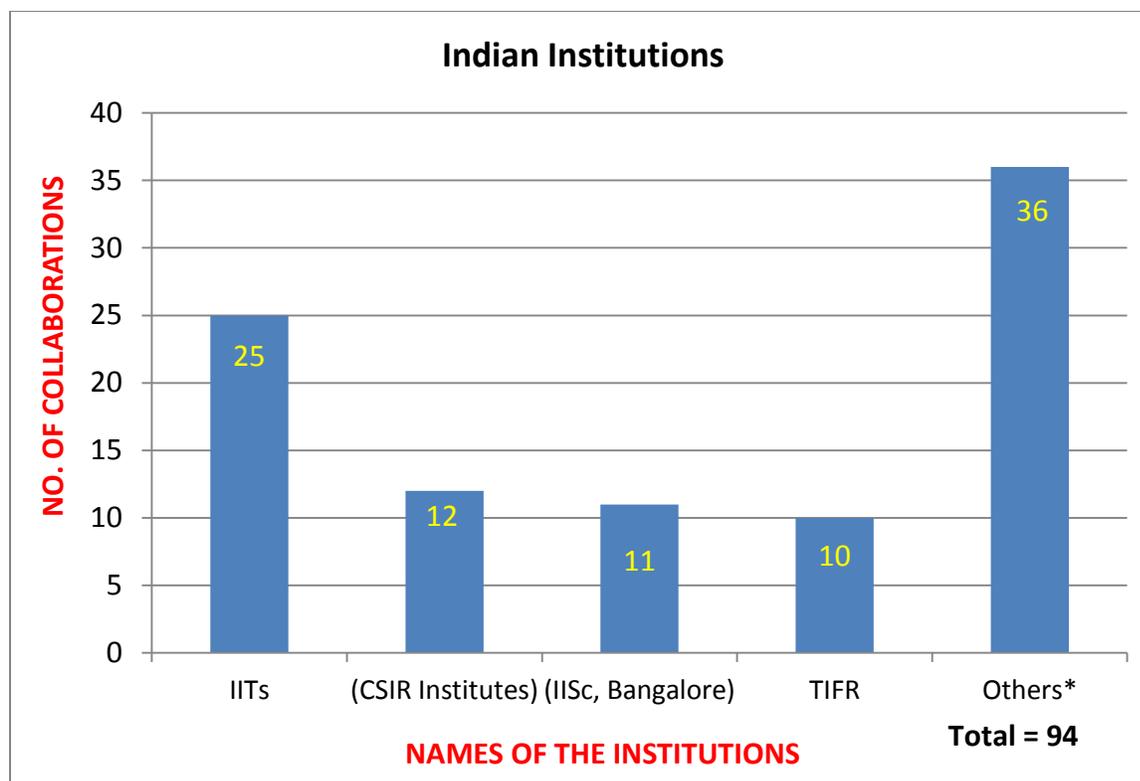


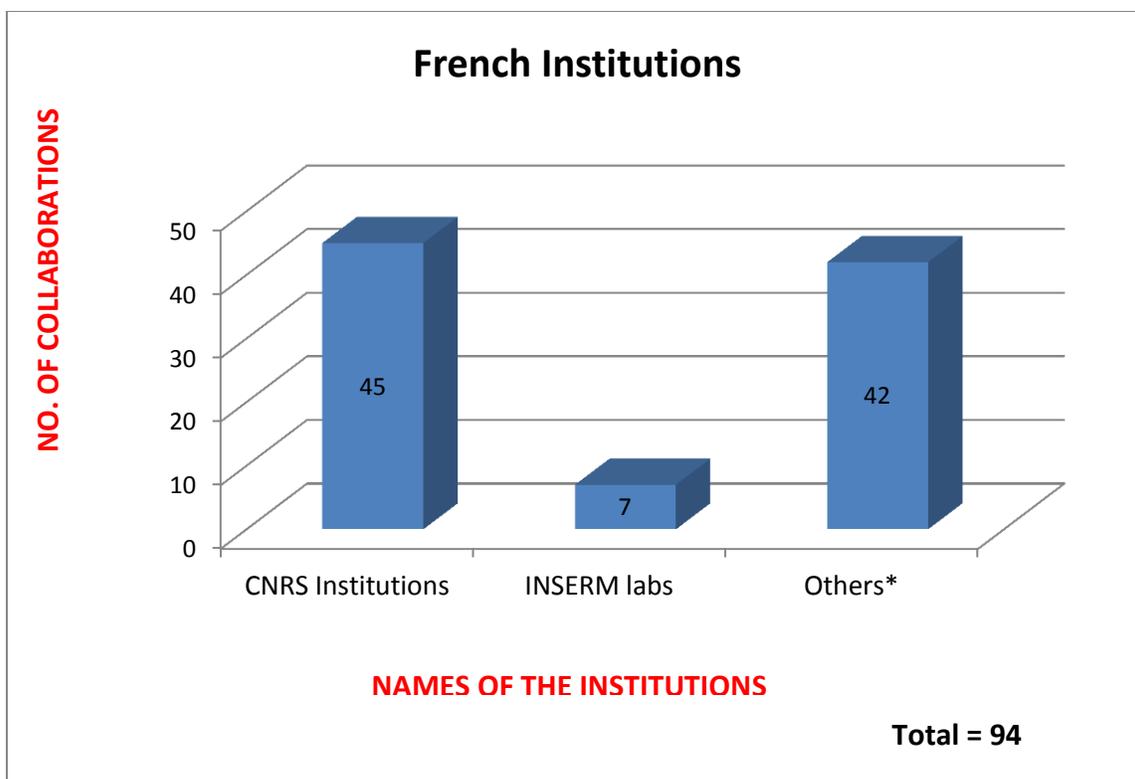
The thrust area-wise list of projects completed during 2011-2015 is given in **Annexure-II**.

3. INSTITUTIONAL PARTICIPATION IN PROJECTS COMPLETED DURING YEARS 2011 to 2015

The Collaborative Scientific Research Programme involves partnership of Institutes from India and France. From the Indian side, the highest number of collaborative projects was from the Indian Institutes of Technology (IITs) having 25 projects which accounted for approximately 27% of all collaborations. Out of the 25 IITs, 11 were from its campus in Mumbai, 7 from Kanpur, 3 from Chennai, 3 from New Delhi and 1 from Hyderabad. Apart from the IITs, there were 12 collaborations from CSIR Institutes/labs, 11 from the Indian Institute of Science, Bangalore and 10 from Tata Institute of Fundamental Research (TIFR). The remaining 36 collaborations were from institutes of DST (6), DAE (4) and DBT (2) along with other Indian Universities/Institutes.

From the French side, there were 45 collaborations involving CNRS Institutes/labs. CNRS, therefore, accounted for approximately 45% for all the French collaborations. The breakup of cities where CNRS institutes are located shows 14 in Paris, 5 in Rennes, 4 in Toulouse, 3 each in Strasbourg and Orsay, 2 each in Pessac, Caen, Villeurbanne and Villeneuve and 1 each in Illkirch, Grenoble, Marseille, Besancon, Amiens, Vandoeuvre Nancy Cedex, Evry and Chatenay Malabry. There were 7 collaborations from INSERM labs and the remaining 41 collaborations were from various other French Universities/Institutes.



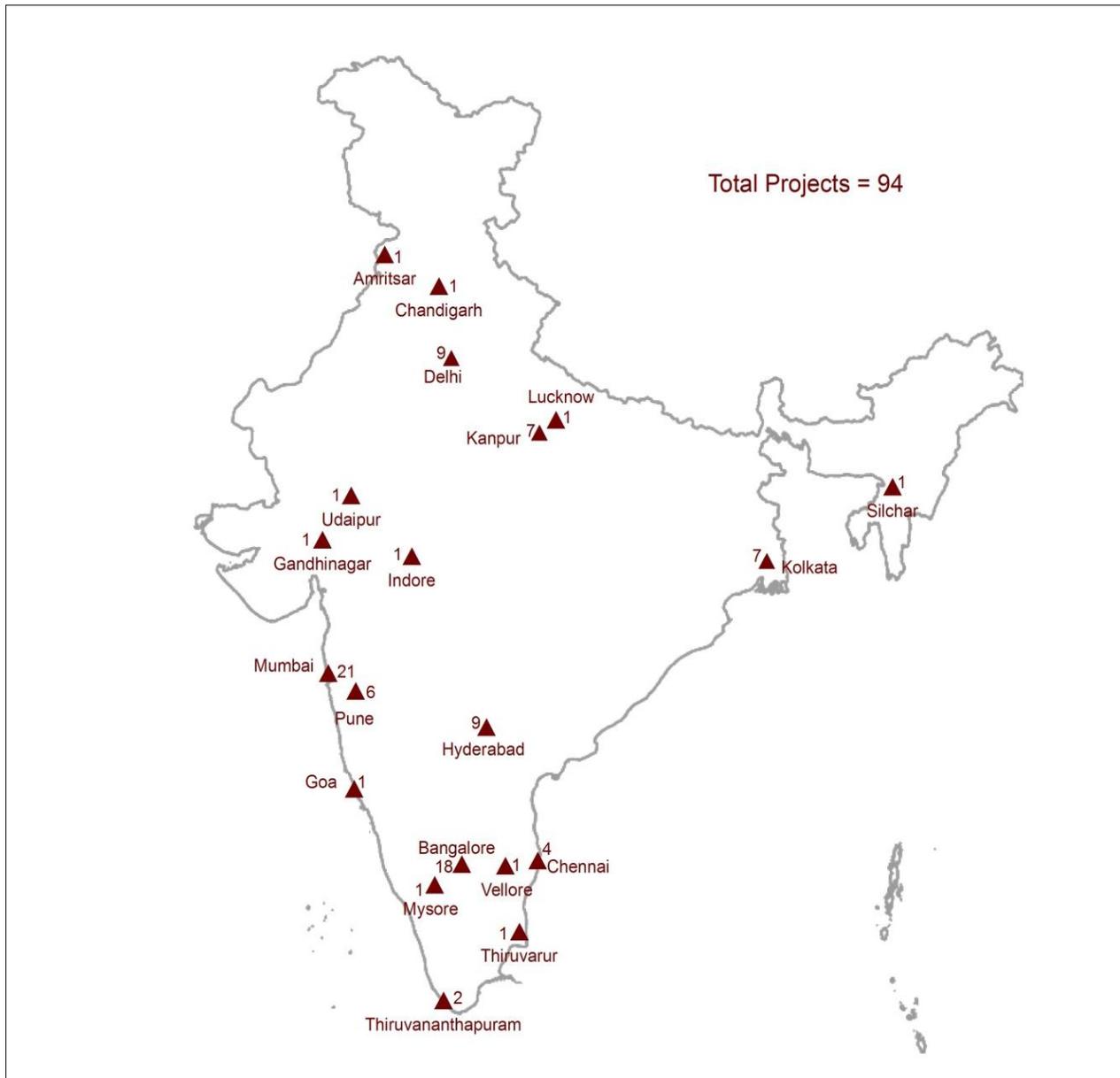


The list of participating Universities/Institutes in the “Others*” section of both India and France is provided in **Annexure-III(a) & III(b)**. This list indicates that the projects supported by CEFIPRA under the Collaborative Scientific Research Programme were spread over the entire geographical regions of both the countries. It is further depicted through Indian and French Maps in the following pages.

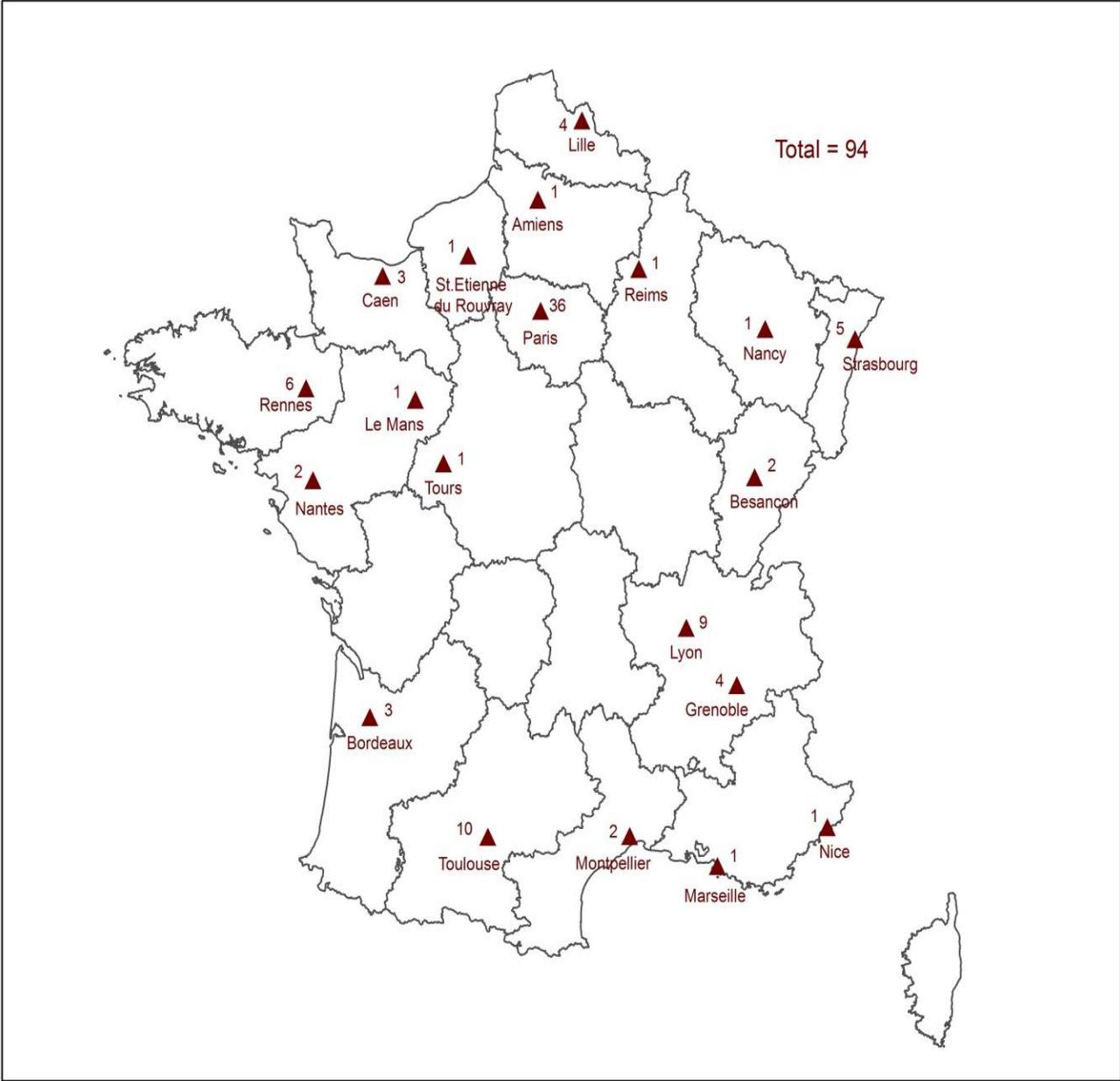
4. GEOGRAPHIC DISTRIBUTION OF PROJECTS COMPLETED DURING YEARS 2011 to 2015

Activities of CEFIPRA have a broad spatial footprint across the S&T ecosystem and institutional landscape of India and France. This gives CEFIPRA the ability to reach out to a significant proportion of S&T stakeholders across both countries. The participating states/regions of India and France with respective number of collaborations are depicted in the following maps.

GEOGRAPHIC DISTRIBUTION OF PROJECTS (94 Nos) IN INDIA



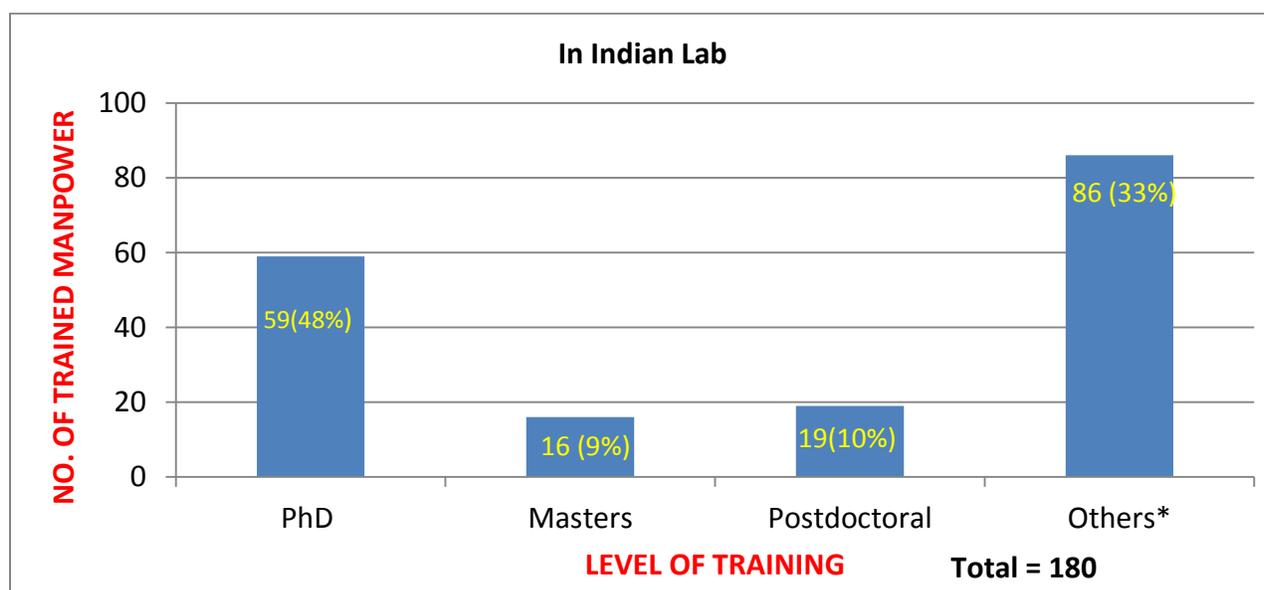
GEOGRAPHIC DISTRIBUTION OF PROJECTS (94 Nos) IN FRANCE



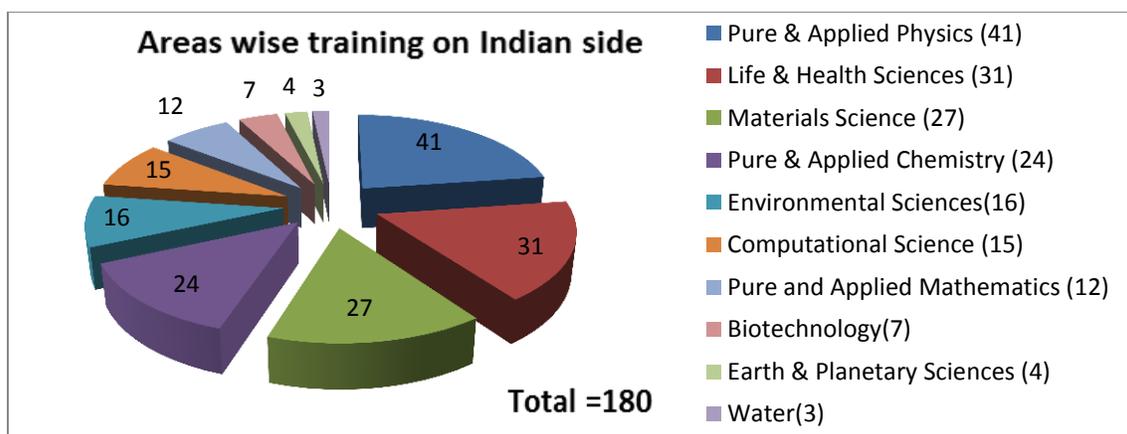
The maps capture the spatial heterogeneity of the projects supported by CEFIPRA during 2011-2015 in terms of geographical distribution of institutions in India and France.

5. MANPOWER TRAINED UNDER THE PROJECTS COMPLETED DURING YEARS 2011 to 2015

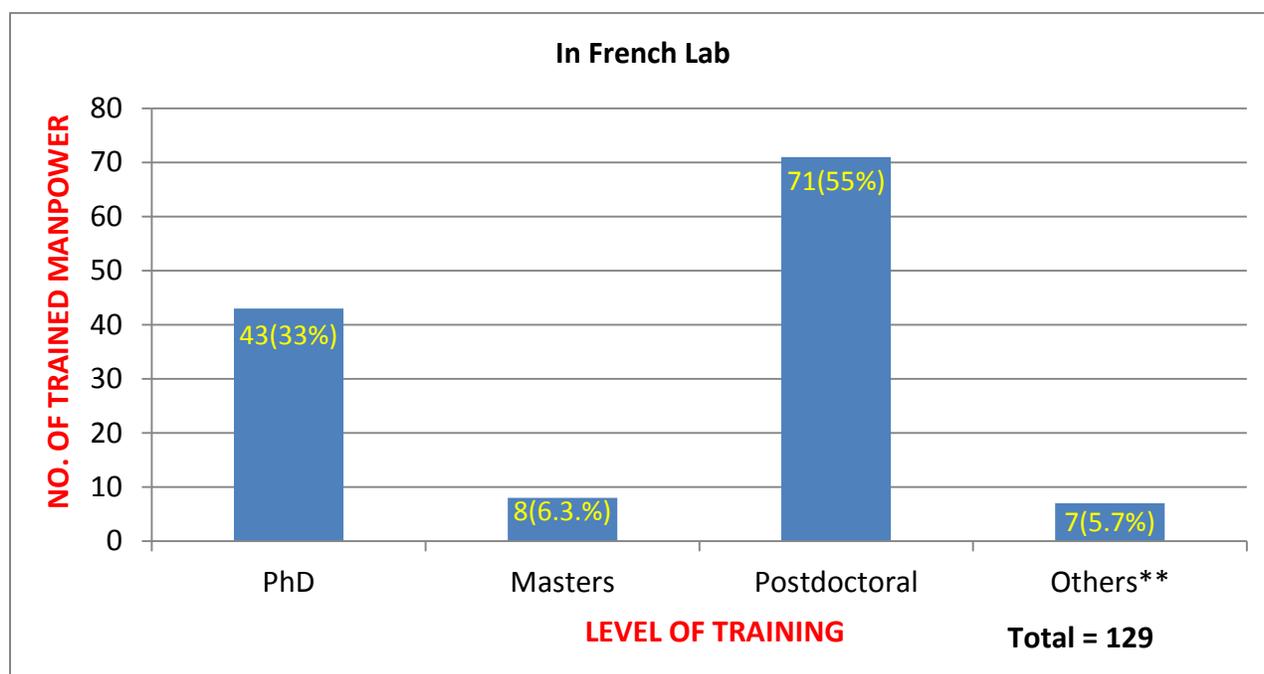
The Collaborative Scientific Research Programme provides funding support for Manpower (PhD/Post-Doctoral positions for French Partners; Junior Research Fellow, Senior Research Fellow Research Associate for Indian Partners). Manpower as PhD students, Master level students and Post-Doctoral Fellows are hired to carry out the objectives of the research projects. Analysis of the data shows that from the Indian side, approximately 33% of the trained manpower were PhD students whereas 48% were Project Assistants, Project Associates, Research Fellows and Scientists who have been included in the 'Others' category. However, only 10.5% of the trained manpower from the Indian side was Post-Doctoral Fellows. Maximum number of manpower was trained in the field of Life and Health Sciences on Indian side.



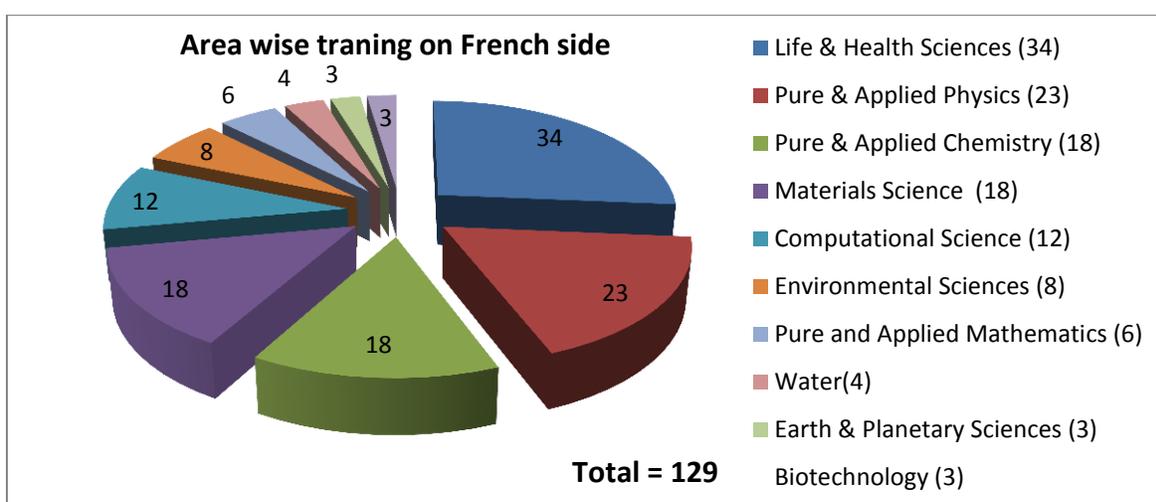
* Others include Project Assistants, Project Associates, Research Scientists, and Senior & Junior Research Fellows



From the French side, 55% of the trained manpower comprised of Post-Doctoral Fellows, followed by 33% PhD students. Available data suggests that for the projects completed during 2011 to 2015, the percentage of manpower trained in terms of PhD students from both sides was the same but the French side trained a significantly higher percentage of Post-Doctoral Fellows as compared to the Indian side. Maximum number of manpower was trained in the area of Pure and Applied Physics on French side.



** Others include Student Trainees



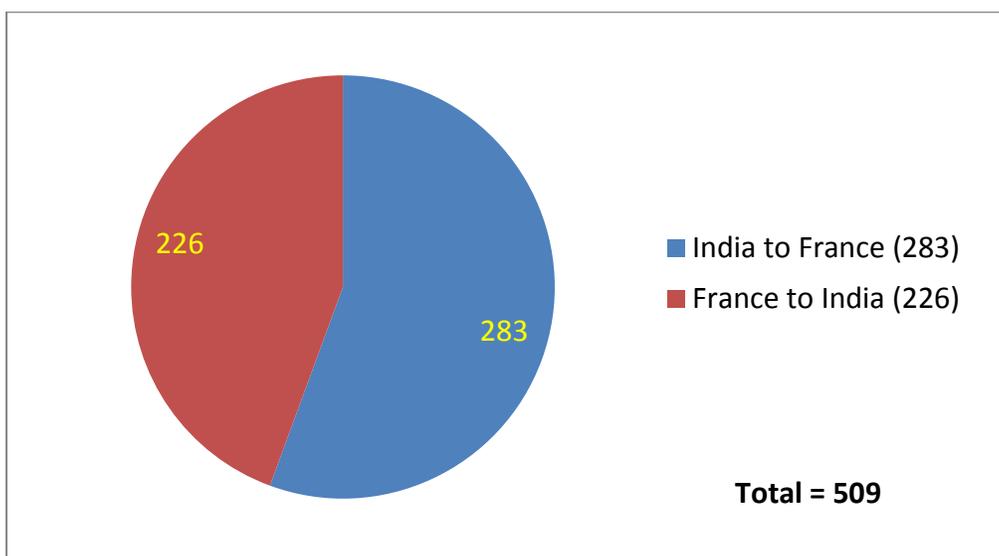
6. EXCHANGE VISITS UNDERTAKEN BETWEEN INDIA AND FRANCE IN 94 PROJECTS COMPLETED DURING YEARS 2011 to 2015

CEFIPRA supports numerous projects from various domains under its Collaborative Scientific Research Programme. Under these projects, CEFIPRA provided support to concerned scientists and students from India and France for exchange visits.

The purpose of such visits is to execute and discuss the necessary aspects of work related to scientific research under the project. These visits help in speeding up the collaborative work and also provide exposure to researchers/students. The visits undertaken during the years 2011 to 2015 under this programmes are 283 from India to France whereas 226 from France to India.

Exchange visits between the collaborating groups are an important aspect of scientific research project. These visits are usually intended to carry out a designated set of experiment(s) related to the project and can also led to a transfer of experimental material, protocol or methodology and ideas across the participating laboratories. Academic interaction is significantly enhanced by these visits and the researchers/institutions are benefited through these exchange visits in a long run. In addition, exchange visits also provided an opportunity for cultural exchange.

Out of total 509 exchange visits (both ways) took place in projects completed during the period from 2011 to 2015, about 56% of the visits were from India to France and rest 44% were from France to India. The domain-wise analysis indicates that in Life & Health Sciences, maximum number (95) of visits were undertaken followed by Pure & Applied Physics (94). It corresponds to the number of projects completed during the period and the interactions.



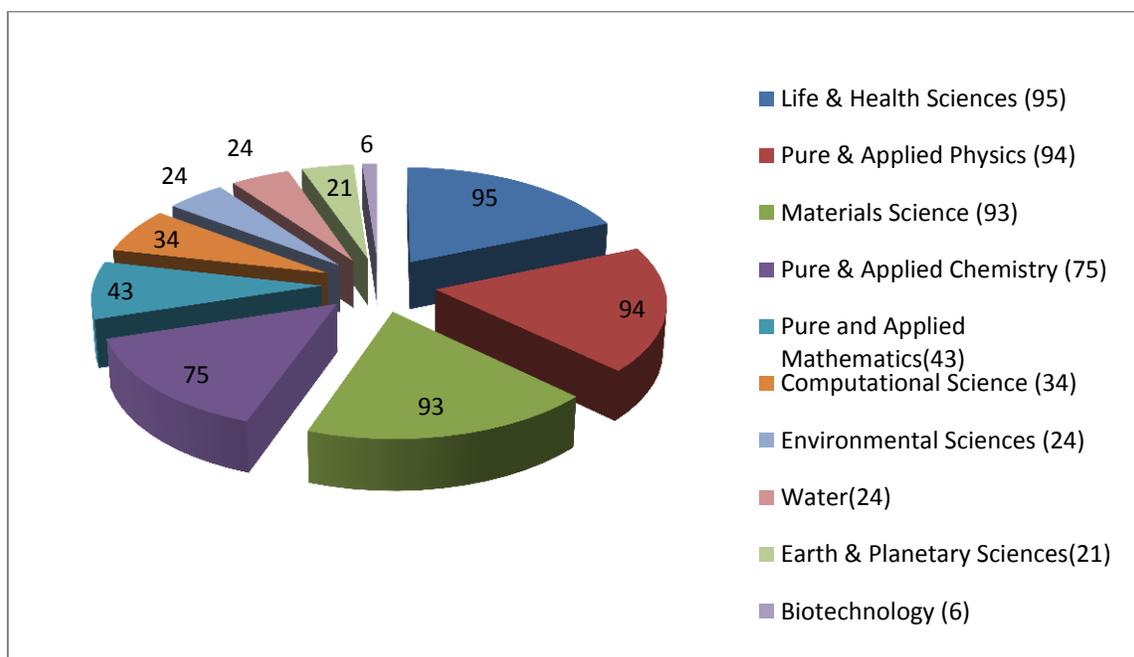
Year-wise Exchange Visits under the completed projects

Year	India to France	France to India	Total
2011	70	53	123
2012	68	49	117
2013	38	23	61
2014	58	54	112
2015	49	47	96
Total	283	226	509

Break-up of these visits shows that 123 visits were undertaken in 2011, 117 in 2012, 61 in 2013, 112 in 2014 and 96 in 2015 under the projects. This indicates that there was a slump in the number of visits for the projects completed in 2013 as the number of projects completed during 2013 was less as compared to other years. But it recovered from the year 2014 onwards.

The mobility programmes made significant contributions in terms of creating futuristic networks between individual scientists and institutions of India and France leading to future collaborations of institutions and individual scientists. The networks developed among the scientists through the projects were harvested through the High Impact Scientific Network Programme of the Centre initiated in 2015 resulting to two projects in High Energy Physics and Health Science.

SUBJECT AREA-WISE MOBILITY SUPPORT UNDER COMPLETED PROJECTS

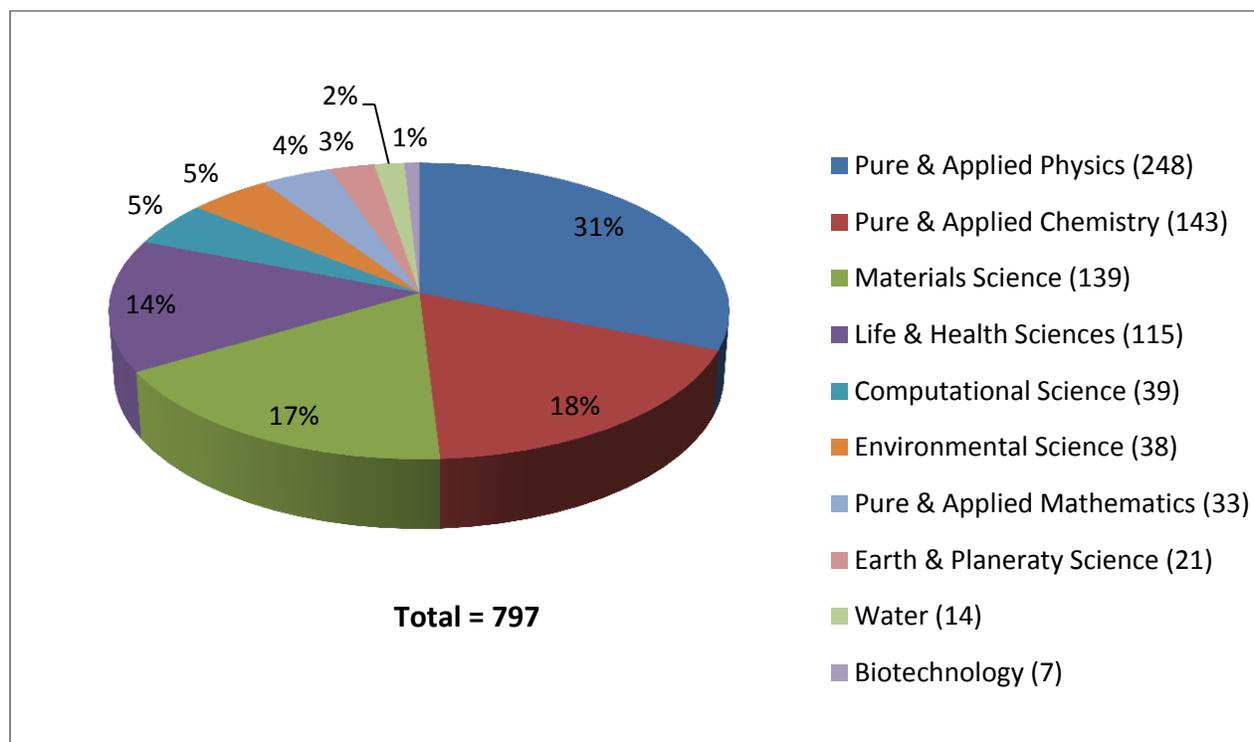


7. ANALYSIS OF PUBLICATIONS EMANATED FROM 94 PROJECTS COMPLETED DURING YEARS 2011 to 2015

Scientific results such as publications in peer reviewed journals are one of the important yardsticks in measuring the outcome of projects. A multifaceted bibliometric analysis of publications resulted from 94 completed projects was carried out by National Institute of Science Communications and Information Resources (NISCAIR), New Delhi as sponsored by the Centre. The study was based on the information on publications received along with the final reports submitted by the Project Investigators after completion of their projects as well as follow up information received after an intervening period.

The analysis has been done based on the list of 797 papers published from 94 projects completed during 2011-2015. The list of papers categorized from 85 projects out of 94 projects have been considered for the study. On average, there are 9 papers resulted from each project.

AREA-WISE DEPICTION OF PUBLICATIONS EMANATED FROM THE PROJECTS COMPLETED DURING 2011-15



CEFIPRA papers were published in iconic journals such as Nature (38.138), Nature Materials (36.503), Cell (32.406) and so on.

The list of papers was categorized from the publications of 94 projects of CEFIPRA. It is found that the highest number of 62 papers emanated from a project entitled “Effect of the correlations in the statics and the dynamics of extended systems (4604-3)” under Dr. Sanjib Sabhapandit, Raman Research Institute, India and Dr. Alberto Rosso, Université Paris Sud, France as the PIs. Further, it is seen that 44.29% of papers were published from 14 projects.

With regard to the ranked list of projects based on Avg IF, it is seen that the project entitled “siRNAome of toxin endocytosis and retrograde transport (3803-2)” under Prof. Satyajit Mayor, National Centre for Biological Sciences, TIFR, India and Prof. Ludger Johannes, CNRS, France as PIs published 5 papers and has the highest Avg IF of 16.449.

It is seen that CEFIPRA projects are supported across 10 subject areas/domains of Science and Technology. It can be seen that “Pure and Applied Physics” domain that has 16 projects and contributed the maximum number of 248 papers followed by “Pure and Applied Chemistry” and “Materials Science” with about 140 papers each.

With regard to the ranking of subject areas/domains based on the Avg IF, “Life and Health Sciences” tops the list with Avg IF 5.571.

Out of the 797 papers, there are 33 papers that have received 50 or more citations.

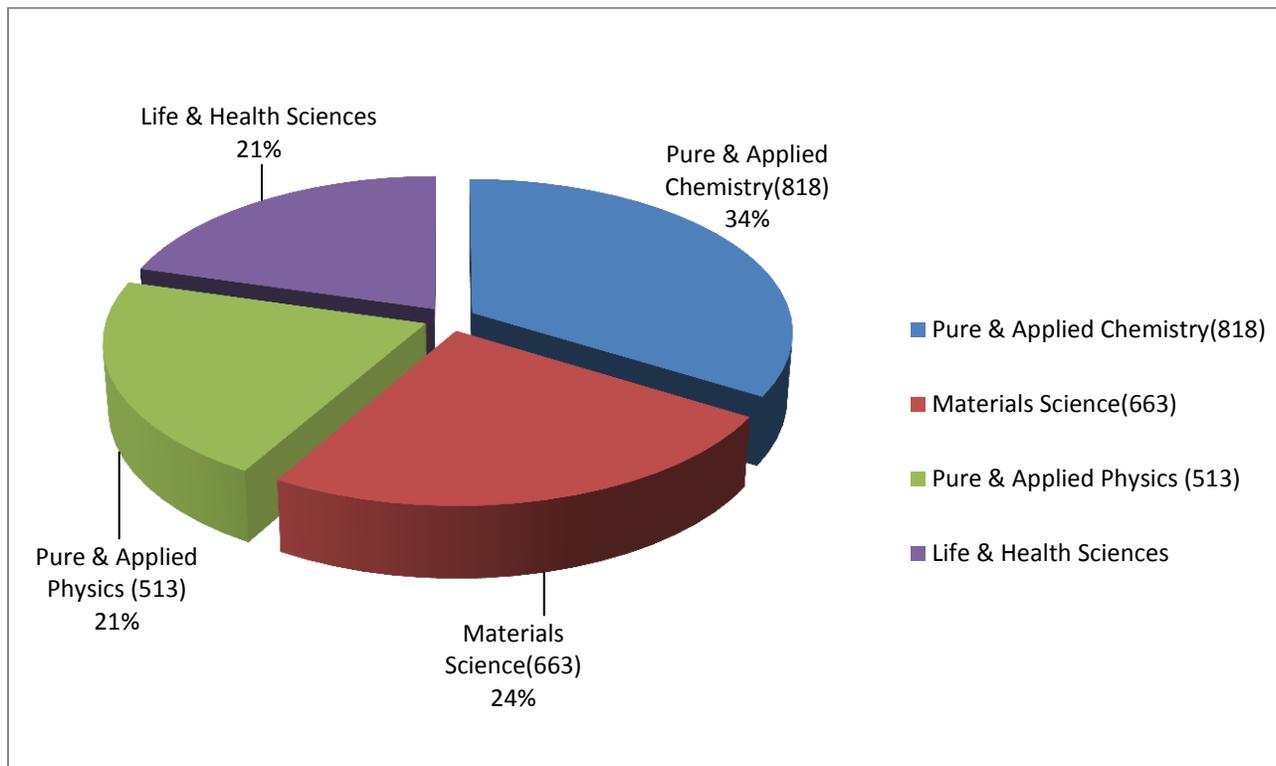
The top 5 institutions, each from France and India shows CNRS, France is the most productive institution with 52.44% of papers. The second most productive institution from France is Université de Paris, Saclay. From India, the most productive institutions are the IITs followed by CSIR, India.

A comparison of CEFIPRA papers of 2015 with CSIR, TIFR and IISc shows that these papers have the highest Avg IF of 4.122 followed by TIFR (Avg IF 4.090), IISc (Avg IF 3.253) and CSIR (Avg IF 3.005).

The leading collaborative authors Prof. Petitjean P. of CNRS, France and Dr. Srianand R. of IUCAA, India (Project No. 4304-2), have jointly contributed the maximum number of 27 papers.

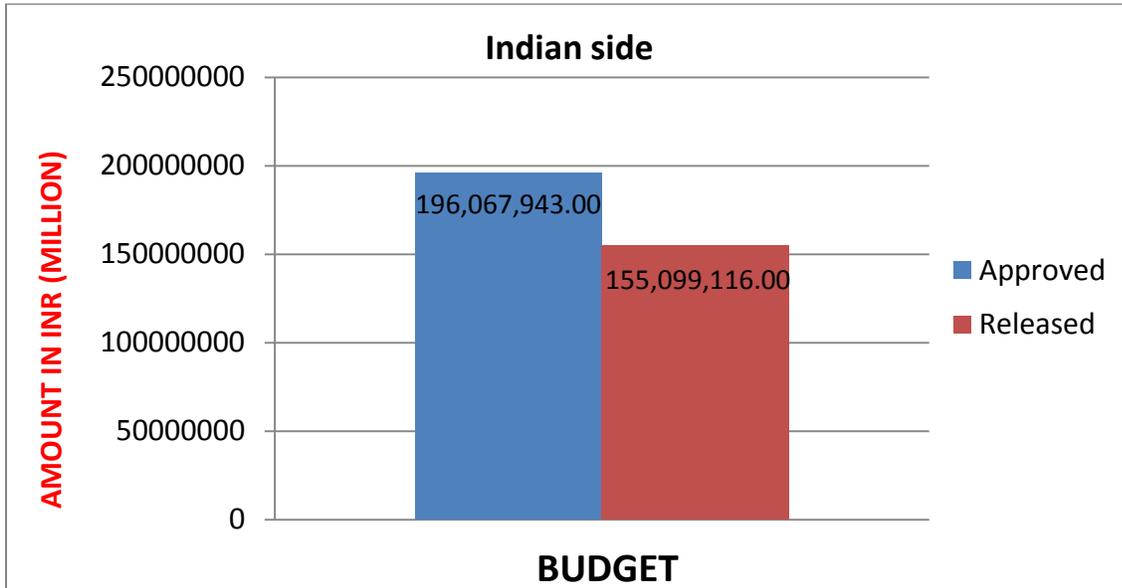
Out of 797 papers published from CEFIPRA funded 94 projects, 268 papers have institutional affiliations from India and France only. Papers having institutional affiliations from India, France and other countries are 112 and rest of the papers (417) have acknowledged CEFIPRA's support in their publications.

AREA-WISE DEPICTION OF HIGHLY CITED PAPERS

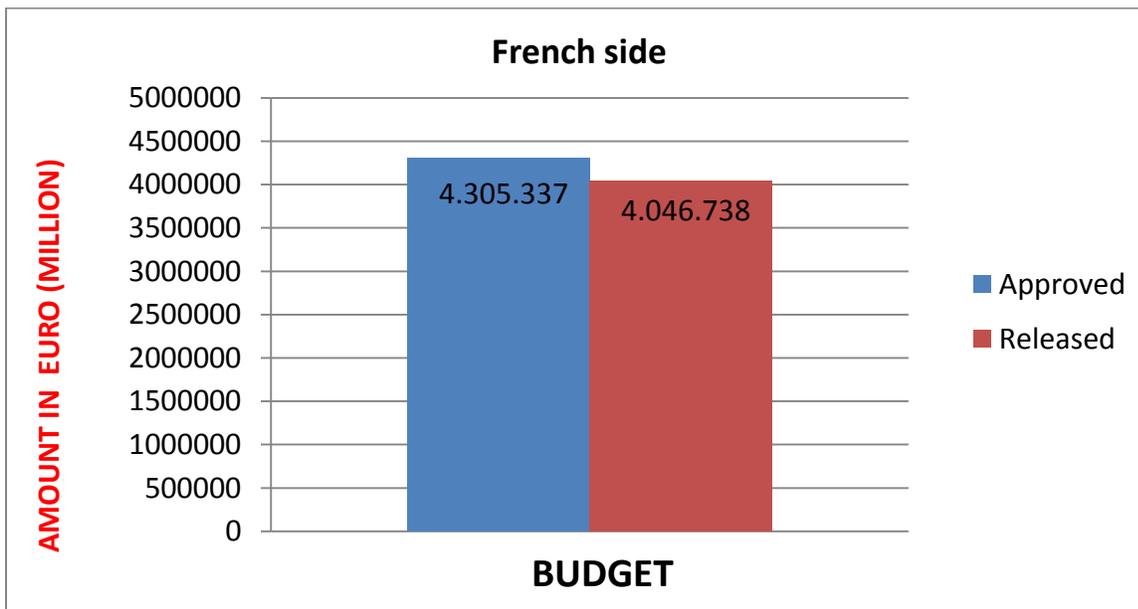


8. BUDGET COMPONENT (APPROVED v/s RELEASED) OF THE 94 PROJECTS COMPLETED DURING YEARS 2011 to 2015

A comparative study of expenditure incurred under the 94 projects on Indian and French sides are as follows:



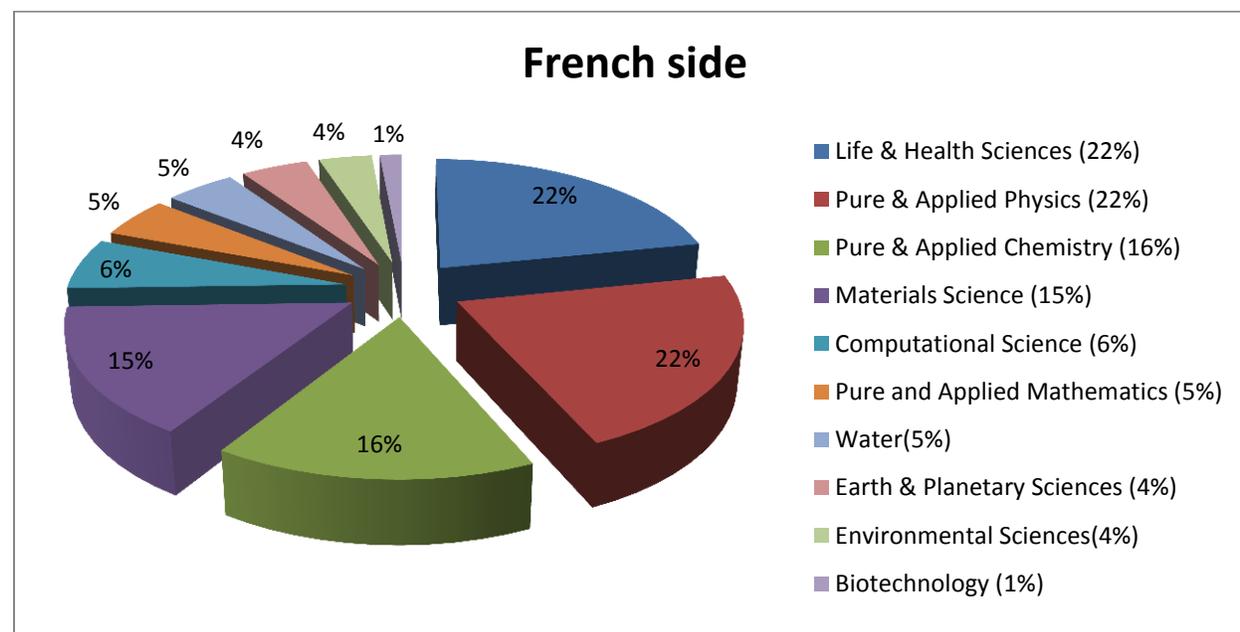
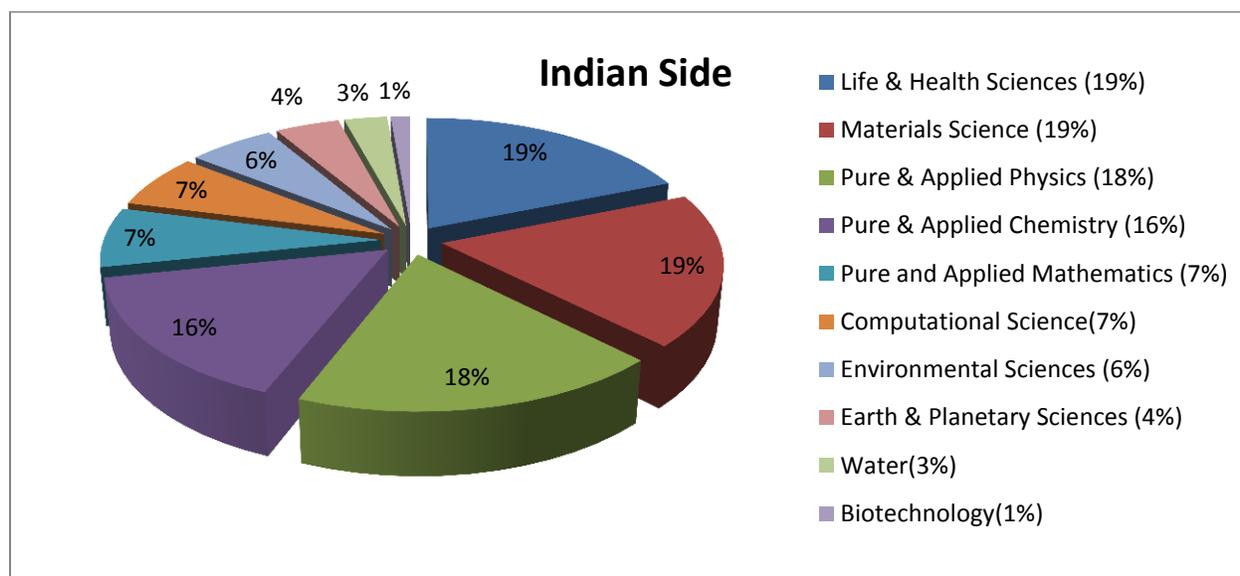
Percentage of budget released for the Indian side is 79% as compared to approved



Percentage of budget released for the French side is 94% as compared to approved

The difference in actual approved budget and released budget of the completed projects was mainly due to lesser number of exchange visits undertaken under the projects than the approved budget. Another factor contributed to this is the utilization of funds under recurring expenses was less compared to the estimate given in the proposals approved by the Scientific Council. In addition to that, for Indian side decrease in actual expenditure of Manpower also caused more reduction compared to French side. The budget on both sides shows that the areas of Life & Health Sciences and Pure & Applied Physics together were around 40% of total budget.

SUBJECT AREA WISE BUDGET EXPENDITURE IN PROJECTS COMPLETED DURING YEARS 2011-2015

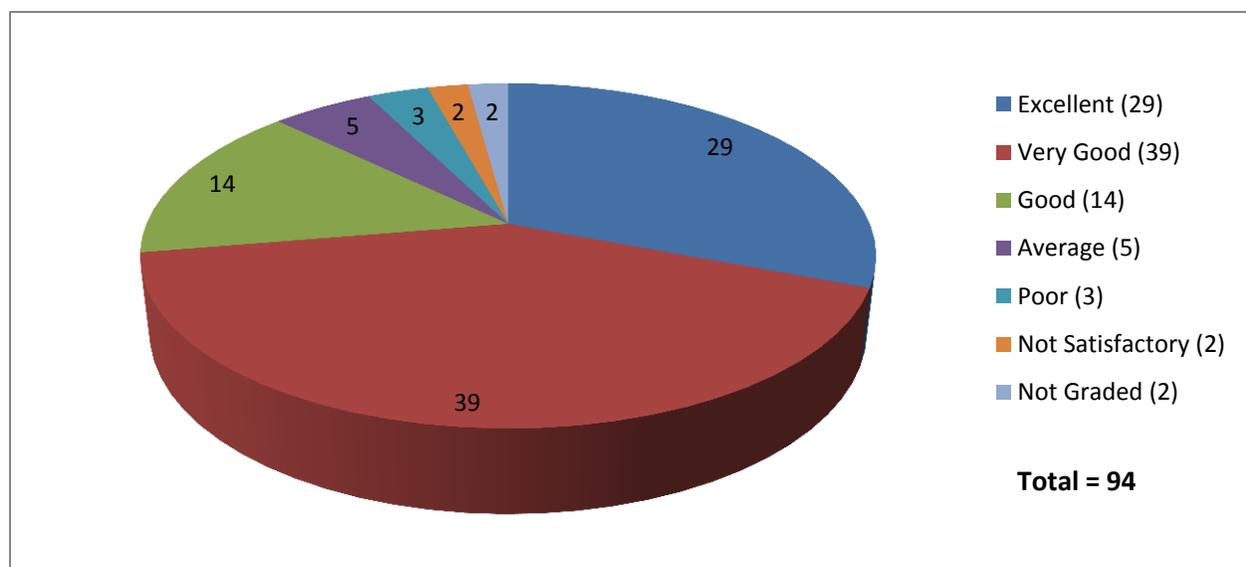


9. PERFORMANCE INDEX FOR PROJECTS COMPLETED DURING YEARS 2011 to 2015

The Scientific Council (SC) of CEFIPRA consists of five eminent scientists from each country as its members. The SC identifies thrust areas of research, selects research themes for support by the Centre and evaluates joint project outcome and other scientific activities as may be desired by the Governing Body.

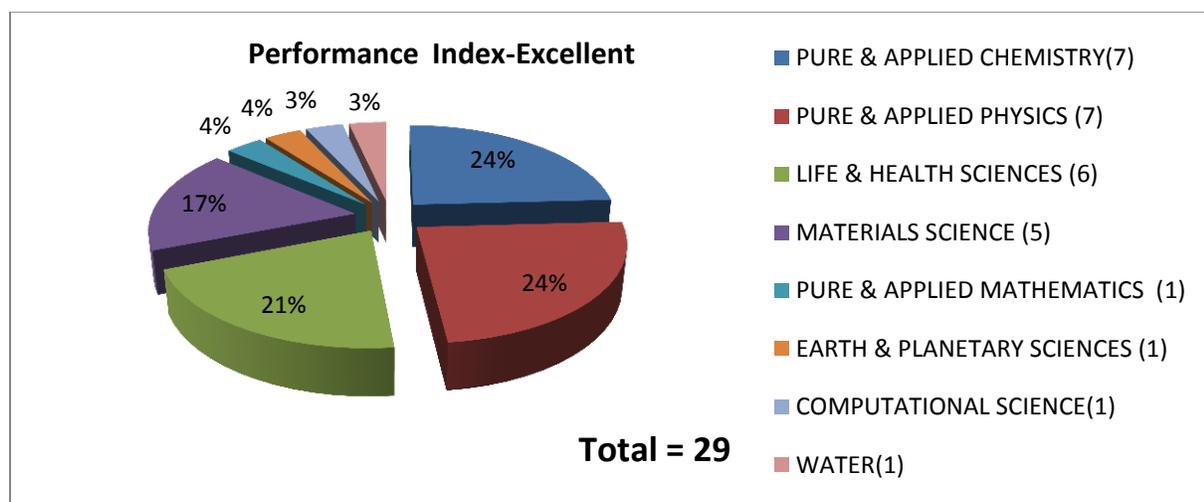
The SC developed the parameters for assessment/reviewing of completed projects which were graded on the performance index as (excellent, very good, good, average and poor) of completed projects. The defined criteria based on parameters like excellence in science through collaboration, training of young doctoral/postdoctoral students, potential output for knowledge forward chain and long term partnership between the collaborating investigators and their groups. Moreover, the achievements against the objectives of the projects, scientific publications, development of resources (libraries, new methods, data collections etc.) and innovation/resulting patents or potential of application/commercialisation (new technology/products/process) were also assessed. For the projects, which are graded as 'excellent', the French and Indian Principal Collaborators are eligible for additional exchange visit of 15 days each to be undertaken within one year of review of the project.

In this report, ninety two (92) completed projects were graded by the Scientific Council of CEFIPRA based on the above-mentioned parameters in its various meetings held during 2011-15, while 2 projects were found not satisfactory by the SC as per the scientific outputs such as publications, innovative contents and collaboration.

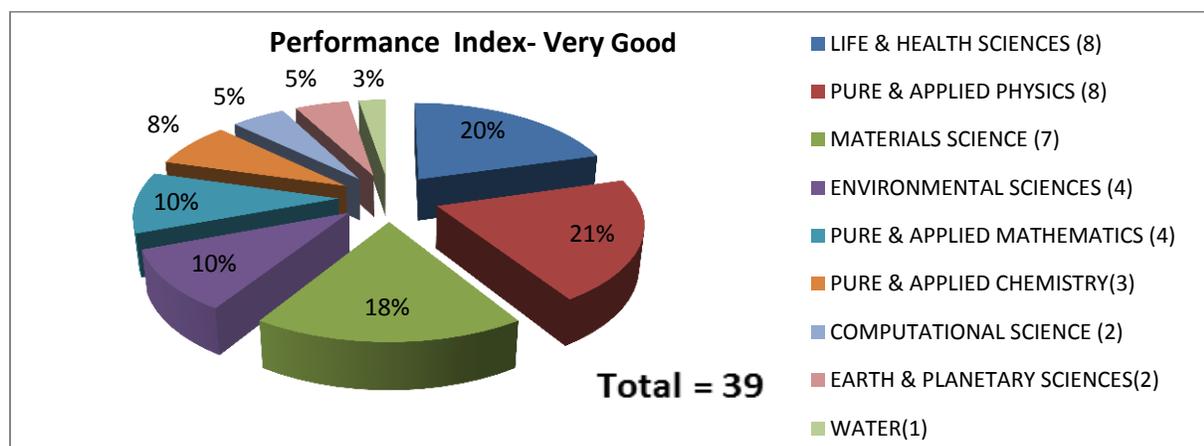


The spectrum of knowledge generated across the different thematic areas and the grading received from **Excellent to Good in 88% of the completed projects** explain Centre's commitment for high quality Research & Development.

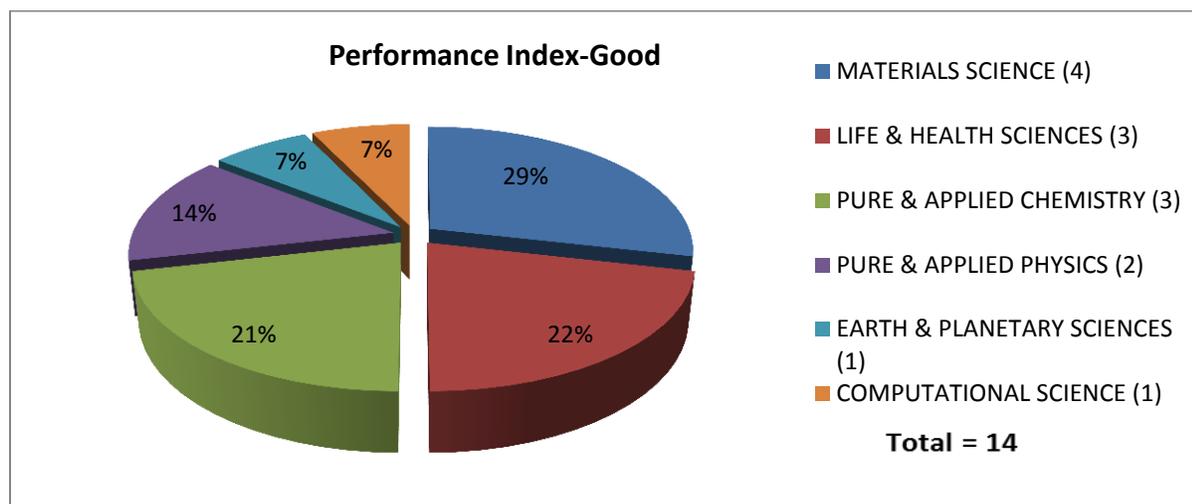
Twenty-nine (29) projects were graded by SC as **excellent**. Out of these, 25 are from the areas of Pure & Applied Physics, Pure & Applied Chemistry, Materials Science and Life & Health Science. In remaining four (4) excellent graded projects, one each belonged to Pure & Applied Mathematics, Earth & Planetary Sciences, Computational Science and Water.



The thirty-nine (39) projects in **very good** category including eight projects each from the area of Life & Health Sciences and Pure & Applied Physics, seven projects from the domain of Materials Science and four projects each belonged to Environmental Science and Pure & Applied Mathematics. For the remaining projects in the **very good** category, three were from the areas of Pure & Applied Chemistry, two each from Earth & Planetary Science and Computational Science and one from Water.



In **good** category of projects, three (3) projects belonged to each of the areas of Life & Health Sciences and Pure & Applied Chemistry, four (4) projects belonged to the area of Materials Science, two (2) projects in Pure & Applied Physics and one each for Computational Science and Earth & Planetary Sciences. Taken together, these results suggest that the predominant areas of collaboration for the projects completed during 2011 to 2015 have also performed well in terms of scientific output.



Two projects were not graded.

Some significant outcomes resulted from the 94 completed projects are given in **Annexure- IV**.

Out comes in the form of patents filed/obtained and a list of projects showing commercial potential are given in **Annexure- V(a) & V(b)**.

Summary of achievements and outcomes from the 94 projects completed during years 2011-2015 is given in **Annexure-VI**

10. TRENDS IN SCIENTIFIC RESEARCH PROGRAMME

The Collaborative Scientific Research Programme is the flagship programme of CEFIPRA. It provides a platform for collaborative research since inception. In 2017, the Centre will complete 30 years of collaboration in cutting edge Science and Technology research. Till December 2016, 492 research projects have been supported under this programme while 7 proposals are awaiting Governmental clearance.

This report analyzes the outcome of projects completed during the period from 2011 to 2015. A total of 94 projects were completed during this period in the area of Pure and Applied Mathematics, Pure & Applied Physics, Pure & Applied Chemistry, Computational Science, Life and Health Sciences, Environmental Science, Earth & Planetary Sciences, Biotechnology, Materials Science and Water.

Of these, 19 projects were completed in the area of Life and Health Sciences, which indicates that issues of human health and disease control were significant areas for collaboration between both the countries. Out of 19 projects funded in this area, the Scientific Council in its final review has graded 17 projects as excellent, very good or Good. In another thrust areas of Pure and Applied Physics, Pure and Applied Chemistry, and Materials Science, 45 projects have been graded excellent to Good, out of 92 projects. Such rating is based upon outcomes indicated by enhanced knowledge along with development of individual/ institutional linkages. The above four domains namely Pure and Applied Physics/Chemistry, Materials Science and Life and Health Sciences, collectively have the bulk of research publications with maximum citations in reputed scientific journals with maximum impact factors. The budget analysis highlighted the percentage budget released in comparison to actually approved is more in France (94%) as compared to India (79%).

Geographical distribution of projects shows the states/region that attracted maximum number of projects in India and France. In India, it can be observed that Maharashtra has the highest (27) number of projects, out of 94 completed projects, whereas Ile de France mainly Paris has the highest concentration of projects as compared to rest of the regions in France. The involvement of state/regional universities and institutes from both the countries indicates the broad spread of this programme. This is particularly significant in the Indian context, India being a country of emerging economy.

A total of 509 exchange visits took place in 94 completed projects during the period. 180 Manpower from India and 129 from France were trained at different levels. These trained manpower and exchange visits have yielded significant outcomes in terms of research competence, enhancement of skills, and capacity building through collaboration. Through projects supported on Indian side, 16 Masters and 59 PhDs were generated and 19 Post -Docs were trained whereas 8 Masters, 43 PhDs were

generated and 71 Post-Doctorals were trained on French side. The number of research personnel involved is more in India. The students used this platform to learn from peers about new tools, methodology and techniques. Mobility support to students allowed them to expose themselves to different scientific ecosystems, and work in variety of environment setting with enhanced understanding with social and cultural norms. Thus the rising trend in number of mobility among students/scientists under the projects is in line with CEFIPRA's role for emphasizing international competitiveness and competence.

CEFIPRA through collaborative projects helped institutions to build research linkages in India as well as in France. In India, top performing/participating institutes in terms of the number of projects completed during the said period have been with IITs, CSIR and IISc, Bangalore whereas in France most of the projects have been from CNRS institutes/labs followed by INSERM. The development of institutional linkages with India's apex institute for engineering research like IITs and French public research bodies like CNRS has been showcased. The institutional collaborations through CEFIPRA supported projects happened in key disciplinary areas that promote understanding of complex problems of global concern.

In all, 40 institutes from India including IITs, CSIR institutions, IISc and TIFR and 44 institutes from France including CNRS and INSERM institutes/labs were linked in undertaking 94 projects.

The scientific output in terms of 797 papers published in scientific journals including 11 conference proceedings emanated from 94 completed projects clearly assessing research effectiveness in important domains of global concerns. The highest average impact factor of publications is from projects emanated from Life and Health Sciences which is 5.57, followed by Pure and Applied Chemistry at 4.652. Some papers made significant impact as indication derived on the basis of high citation degree.

CEFIPRA has also taken initiatives to bring academic and industrial partners together to carry forward the knowledge. However, it's observed that outcomes in terms of patents are limited; there were only 7 patents from the completed projects during 2011 to 2015. A primary reason for this, could be the disclosure of results in the form of publications. The secondary reason could be lack of awareness or willingness among the collaborators to proceed with filing of patents on the outcome of the projects. The CEFIPRA has started working in the direction of increasing awareness among the collaborators and mentoring the Principal Investigators about the IP potential & patents generated. This would definitely add more value to the outcome of the projects in coming years. This value addition may, in turn, be more beneficial to the society in the long run. Keeping this objective in mind, we have recently (in August 2016) formulated a Standard Expert Panel (SEP). The postulated role of the Standard Expert Panel in

addition to Monitoring the outcome & Mentoring the PIs is to *a)* increase awareness among the PIs regarding the IP and commercial potential of their respective projects and *b)* encourage the PIs to analyze the results of their experimental findings in terms of patentability and commercialization before publishing the results or presenting the same in a conference/meeting.

Thus, CEFIPRA enables to foster economy driving innovation by addressing the above mentioned gap along with strengthening the research and technological competency of scientific communities in both the countries.

11. ASSESSMENT BY THE INVESTIGATORS OF THE PROJECTS

The feedback (assessments) from PIs has indicated that the scientific complementarity is the main gain of the scientific collaborations in terms of redefining the research questions, exploring other aspects in more details or in other way during project progressions. The following were some of the foremost quotes from PIs of CEFIPRA projects;

1. The major push to research progression was through the exchange visits of young researchers/scientists. The physical interaction can take leap ahead the scientific work in the project and discussions to conclude the decision. The visits to French and Indian laboratories were very fruitful not only for groups but also for the institutions.
2. CEFIPRA was the easiest way for us to engage joint research in a flexible frame, with a fast decision making process and light administrative work, a key point in present time for promoting research. Operational flexibility has been very supportive to carry out the study forward.
3. The partnership bond between the two collaborators from France and India, which had been developed for joint work under the CEFIPRA supported projects will continue to work even after the CEFIPRA project is completed. Thus the long term commitment has been developed.
4. As partners working on joint project, we feel extremely satisfied with the way, research has progressed. It has indeed been a wonderful experience, not only on the scientific front but also on inter-personal and cultural front. We are thankful to CEFIPRA and all associated bodies who have created this platform for Franco-Indian interaction.
5. We have received excellent and most outstanding support from the CEFIPRA administrative office at New Delhi. The team there is highly efficient, prompt, and sensitive, always providing personalized service and attention to required details.
6. Exchange visits have opened up several new fronts for collaboration, understanding of the respective academic system, academic administration, pedagogic structures, student culture and approach to scientific investigations.
7. CEFIPRA collaborative projects are reputed, and well organised programmes. We are happy with the dealings, support and cooperation extended to us by CEFIPRA. The timely reply to queries, answers to questions, honouring requests for extension etc. helped us in running the project to a completion.
8. Main difficulties were related to the correspondence between starting/ending dates of grant for PhD students that could not match with starting/ending dates of

project itself. But this was solved properly to let students having three full years of fellowships to complete their PhD.

However, some negative comments were also received, which are given as below::

1. CEFIPRA does not give grant for participation to international conferences (outside France and India), though it is an important part of the research work to spread our results in the corresponding community, and still more important for the students to meet other researchers in the field.

Response from CEFIPRA: *As a bilateral organisation, CEFIPRA is able to support participation in conferences in India & France only.*

2. Another point, which might be improved, is the lack of flexibility on how to use budget. Mainly, since travels (international) cannot be taken from project (except for visits related to project), it was difficult to attend to conferences related to the project. This is at the same time a problem for dissemination/publicity of the project, as well as an impediment to submission (and so to quality of PhD defended, visibility of results). We think that allowing using budget for conferences would be very useful.

Response from CEFIPRA: *Project related visits are always supported in India and France. Since 2016, we do allow usage of global envelope for project related visits but not for attending conference outside India or France.*

3. On such kind of project software development is needed to achieve a proper publicity about the achievements (and so to increase visibility of labs as well as IFCPAR for both research community as well for the companies, institutes and common people), it would be necessary to include the recruitment of advanced engineers.

Response from CEFIPRA: *Once the research results are received by CEFIPRA, we disseminate the results through various channels like News Letter/Web-Site/Meetings etc. Regarding Recruitment of advanced Engineer, it is done based on the project works and administrative procedure of CEFIPRA.*

4. Some Universities in France does not allow Ph.D. students or Post-Docs to work in laboratories unless hired with a working contract. This excludes the possibility recommended by CEFIPRA to hire via Campus France. Thereby, in our case, the cost of the Post-Doc was much higher and the initial budget on French side did not allow hiring a Post-Doc for 2 years. In order to compensate for this, most of the budget dedicated to laboratory expenses was invested in salary to prolong the contract of the Postdoc and the laboratories had to use other funds to pay for laboratory expenses. Therefore it has to be mentioned that our global budget

was higher than that allocated by CEFIPRA (in addition, some additional dedicated equipment was purchased).

Response from CEFIPRA: CEFIPRA approves budget for manpower within the limit of manpower approved by Governing Body of CEFIPRA. However, funds re-appropriation clause is available in the Bye-Laws of CEFIPRA.

5. Initially, several visits of the French collaborators to India were planned. The current procedure for visa application made it however impossible for the French collaborator to organize a second visit to India within the years 2015 and early 2016. Indeed, it has to be planned that the passport can be blocked at the Indian embassy for about 4 weeks (for non-French residents). The very busy schedule of the French collaborator (not a French citizen) did not allow such a long deposit (passport was needed to travel frequently within Europe and to Asia). In addition, the newly introduced “fast last-minute procedure” for scientists is only available for French citizens, thus not applicable to the present P.I. Therefore, in the future, it would be very useful if a “three year multiple entry visa” could be given to the P.I.s for the whole duration of the project. Alternatively, another “fast procedure” would be very useful (applicable also for non-French citizens).

Response from CEFIPRA: Will seek comments from Embassies in India and France on possibilities of issuance of such long term visa.

6. The paperwork required at the Indian side appeared excessive. Even for the purchase of minor equipments, all the purchase related documents had to be sent to the CEFIPRA. To the best of our knowledge, other government funding agencies such as CSIR or DST do not require such paperwork.

Response from CEFIPRA: It is a minimum requirement every funding agency fulfills for a transparent way with cost saving from a lowest vendor. However, the important issue is quick & hassle free decisions are taken by CEFIPRA.

Annexure-I

A SUMMARY OF ACHIEVEMENTS IN THE COMPLETED PROJECTS DURING YEARS 2011 to 2015								
S. No.	Subject Areas	Actual Budget Released		Exchange Visits	Man Power Trained	No. Patents	No. Commercial Potential	No. of Publications
		Indian (INR.)	French (Euro)					
1	Pure and Applied Mathematics (5)	1,13,10,459	199.622	43	18			33
2	Computational Science (6)	1,02,60,603	251.700	34	27			39
3	Life & health Sciences (19)	2,92,55,888	882.229,67	95	65	4	1	115
4	Pure and Applied Physics (19)	2,86,49,547	873.452	94	64			248
5	Pure and Applied Chemistry (14)	2,43,77,741	63.4084,21	75	42	1	3	143
6	Earth & Planetary Sciences (4)	66,94,506	182.832,9	21	7			21
7	Materials Science (17)	2,89,44,344	626.107	93	45			139
8	Environmental Sciences (5)	90,66,433	144.698	24	24			38
9	Biotechnology (2)	20,58,613	60.000	6	10	1	2	7
10	Water (3)	44,80,982	192.012,41	24	7			14
	Total (94)	15,50,99,116	4.046.738	509	309	6	6	797*

*797 Publications include 788 SCI Journal papers and 11 conference proceedings.

Annexure- II

LIST OF PROJECTS COMPLETED DURING YEARS 2011 to 2015: THRUST AREA-WISE

1. Pure and Applied Mathematics (5)

S. No.	Title of the project	Project No.
1	Control of systems of partial differential equations	3701-1
2	Numerical treatment of integral operators with non-smooth kernels	4101-1
3	Kleinian groups: Geometrical and analytical aspects	4301-1
4	Discontinuous galerkin method for nonlinear acoustics	4601-1
5	Analytic aspects of modular forms	4601-2

2. Computational Science (6)

S. No.	Title of the project	Project No.
1	Constraint-based design of controllers and prefilters	4502-1
2	Wireless network sensors using saw devices	3900-IT-1
3	Emerging strategies for wireless communication networks	4000-IT-1
4	Robust ultra-low-power double-gate MOSFET design of analog, digital and SRAM memory circuits	4100-IT-1
5	An advanced platform for question answering systems	4200-IT-1
6	Compact modeling of asymmetric double gate nano scale transistors	4300-IT-1

3. Life & Health Sciences (19)

S. No.	Title of the project	Project No.
1	Juxtacrine and/or paracrine control of brain plasticity	3603-2
2	Studies on the regulation of p53 mRNA translation	3703-1
3	Role of immune and genetic factors in the outcome of <i>Plasmodium falciparum</i> malaria	3703-2
4	Structure-function analysis of histone chaperones: Role in chromatin dynamics and transcriptional regulation	3803-1
5	siRNAome of toxin endocytosis and retrograde transport	3803-2
6	Neural differentiation of embryonic stem cells	3803-3

7	3-D comparison of proteins represented by blocks	3903-1
8	Role of chromatin architecture in cellular senescence	4003-1
9	Analysis of protein flexibility in biological recognition	4003-2
10	Ripening of fleshy fruits species and their adaptation to stress	4003-3
11	Epigenetics of transcription by RNA polymerase III	4103-1
12	Catalytic antibodies in immune-mediated disorders	4103-2
13	Protection by new arecoline derivatives in Alzheimer's disease	4303-1
14	Studying the interactome of NAD-dependent deacetylase Sirt1 in the testis	4503-1
15	Evaluation of cellular and immune response in mice and patients with acute promyelocytic leukemia treated with arsenic trioxide	4503-2
16	Genome wide recruitment profiling of BLM (Bloom's syndrome protein) after DNA damage	4603-1
17	Dynamics of serotonin 1A receptors by single particle tracking	4603-2
18	Mechanisms of lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use thereof in memory	4803-3
19	Novel nanotechnological approaches for treatment of leishmaniasis using 2 propylquinoline	4803-4

4. Pure & Applied Physics (19)

S. No.	Title of the project	Project No.
1	Transient phenomena in the Sun-Earth system	3704-1
2	Spin transport in single molecule transistors	3804-1
3	Plasmonic properties of checkerboard metallic structures and films	3804-2
4	Memory effects in three-level systems	3904-1
5	Fuzzy approach to quantum field theory and gravity	4004-1
6	Dynamics of multifragmentation	4104-1
7	Moduli stabilization, magnetized branes and particles	4104-2
8	Breakup of moving liquid sheets under acoustic excitation	4204-1
9	High accuracy gravitational waves from black hole binaries	4204-2
10	Interstellar and intergalactic medium at high redshift: Reservoir for galaxy formation	4304-2

11	Nonadiabatic quantum reactive scattering dynamics on multisheeted potential energy surfaces	4404-1
12	Extreme QCD in the LHC era	4404-2
13	Distant obscured galaxies from GMRT and Herschel	4404-3
14	Computational studies of frustrated quantum magnets	4504-1
15	Probing dense matter and strong gravity	4604-1
16	Slow highly charged ion molecule collisions	4604-2
17	Effect of the correlations in the statics and the dynamics of extended systems	4604-3
18	Two dimensional electron gas physics in oxide heterostructures	4704-1
19	Terahertz free-electron laser	3706-1

5. Pure & Applied Chemistry (14)

S. No.	Title of the project	Project No.
1	Development of functionalized carbon nanotubes-nucleobase constructs and their use in biomimetic catalysis	3705-2
2	New environment friendly media for organic transformations	3805-1
3	Non-natural peptides in asymmetric catalysis: metal-mediated synthesis of peptide-based materials and their applications	3805-2
4	Design & synthesis of novel Sugar Amino Acid (SAA) based glycosidase inhibitors	3905-1
5	Development of waste derived activated carbon supported oxide catalyst for low temperature Volatile Organic Compounds (VOC) oxidation	4005-1
6	Practical methods for surface biofunctionalisation	4105-1
7	Mechanism based lead generation in cancer chemotherapy from natural products	4105-2
8	Bimetallic catalysis involving ruthenium and palladium: C-H Bond activation/functionalization and beyond	4205-1
9	Self-assembly in novel macromolecular systems based on bio-resource materials: synthesis, characterization and applications	4305-1
10	Chemistry and application of metallasila and metallagermaboranes derived from group 14 unsaturated organic substrates	4405-1
11	Development of fulvene-based Zr(II) and Ti(II) chemistry:	4505-1

	organometallics, reactivity and applications in organic synthesis	
12	Studies of iron complexes of N/O functionalized N-heterocyclic carbenes in homogeneous catalysis	4605-1
13	Development of carbon nanotube-metal hybrid catalysts	4705-1
14	All polymer flexible gas sensors (flexi sensors)	4705-2

6. Earth & Planetary Sciences (4)

S. No.	Title of the project	Project No.
1	Palaeomagnetism of great dyke and vindhyan supergroup rocks of India	3607-1
2	Multi-scale interactions and predictability of the Indian summer monsoon	3907-1
3	Development of a non-hydrostatic finite volume icosahedral model for regional/global climate simulation and weather forecast	4107-1
4	Cometary grains: observations and simulations	4507-1

7. Materials Science (17)

S. No.	Title of the project	Project No.
1	Development of an experimentally validated simulation scheme for fracture of glassy, amorphous polymers	3608-1
2	Self-organized nanostructures at surfaces	3608-2
3	Photomagnetic investigations on magnetic oxides	3708-1
4	Functional hybrid nanomaterials of polymeric gels and π -conjugated self-assemblies	3708-2
5	Orientation dependent recovery in metallic materials	3808-1
6	Atomistic studies of supported metal oxide nanosystems	3808-2
7	Puzzling properties of ultrathin polymer films	3808-3
8	Field effect transistors of perovskite oxides for spintronics applications	3908-1
9	Study and development of high temperature sealants for Solid Oxide Fuel Cells (SOFCs) based on phosphate - containing glass and glass-ceramics	4008-1
10	Nanostructured and composite silicides for thermoelectric power generation	4008-2

11	Studies on bulk, thin film and nanostructured forms of Co based and other oxide materials for SOFC applications	4108-1
12	Organic materials for energy devices	4208-1
13	Boundary lubrication using metal nanoparticles in aqueous suspension	4208-2
14	Thermo-hydrodynamics of phase-change induced oscillating Taylor Bubble (T-B)flows	4408-1
15	Mechanisms of new long-lasting luminescence biomarkers	4508-1
16	Developing design guidance for rammed earth construction	4608-1
17	Research of new layered oxides for energy storage and conversion	4608-2

8. Environmental Science (5)

S. No.	Title of the project	Project No.
1	Phylogeny and acoustic evolution in crickets	3009-1
2	Characterization of metal responsive genes from bacteria	3709-1
3	Risk of cracking of clay liners for landfill capping and environmental hazard	3809-1
4	Biology peroxide sensing: The bacterial regulator PerR, synthetic analogues and biomimetic reactivity	4109-1
5	Mineral fluid interaction model for CO ₂ sequestration	4409-1

9. Biotechnology (2)

S.No.	Title of the project	Project No.
1	Targeted delivery of RNAi using synthetic vectors for gene therapy of head and neck squamous cell carcinomas	3700-B1
2	Synthetic biology of cyanobacteria for solar ethanol	3800-B1

10. Water (3)

S. No.	Title of the project	Project No.
1	Mass, energy and hydrological balances of Chhota Shigri glacier(HP)	3900-W1
2	Hydrology and water resources from space over the Indian continent	4000-W1
3	The Kosi river alluvial dynamics and associated risks	4500-W1

Annexure- III (a)

LIST OF OTHER INDIAN UNIVERSITIES/INSTITUTES INVOLVED IN PROJECTS

Serial No.	Names and location of Universities/Institutes	No. of Collaborations
1.	Jawaharlal Nehru Centre for Advanced Scientific Research(JNCASR), Bangalore, Karnataka	3
2.	Saha Institute of Nuclear Physics(SINP), Kolkata, West Bengal	2
3.	Jawaharlal Nehru University, New Delhi	2
4.	Bhabha Atomic Research Centre(BARC), Mumbai, Maharashtra	2
5.	Raman Research Institute, Bangalore, Karnataka	2
6.	Guru Nanak Dev University(GNDU), Amritsar, Punjab	1
7.	Advanced Centre for Treatment, Research and Education in Cancer((ACTREC), Navi Mumbai, Maharashtra	1
8.	Udaipur Solar Observatory, Physical Research Laboratory(PRL), Udaipur, Rajasthan	1
9.	Raja Ramanna Centre for Advanced Technology (RRCAT) , Indore, Madhya Pradesh	1
10.	Osmania University, Hyderabad, Andhra Pradesh	1
11.	Indian Institute of Tropical Meteorology(IITM),Pune, Maharashtra	1
12.	Indian Institute of Science Education and Research(IISER), Pune, Maharashtra	1
13.	Bose Institute Kolkata, West Bengal	1
14.	National Institute for Plant Genome Research(NIPGR),New Delhi	1
15.	The Energy and Resources Institute (TERI), New Delhi	1
16.	Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT), Gandhinagar, Gujarat	1
17.	Punjab University, Chandigarh, Punjab	1
18.	Indian Association for the Cultivation of Sciences (IACS), Jadavpur, West Bengal	1
19.	Central University of Tamil Nadu(CUTN), Thiruvarur, Tamil Nadu	1
20.	Jadavpur University, Kolkata, West Bengal	1
21.	Ramakrishna Mission Vivekananda University, Howrah, West Bengal	1
22.	Mysore University / Karnataka State Open University, Mysore, Karnataka	1
23.	Inter University Centre for Astronomy & Astrophysics(IUCAA), Pune, Maharashtra	1
24.	University of Hyderabad, Hyderabad, Andhra Pradesh	1
25.	St. Xavier's College, Kolkata, West Bengal	1
26.	Christian Medical College(CMC), Vellore, Tamil Nadu	1
27.	Assam University, Silchar, Assam	1
28.	Goa Univesity, Goa	1
29.	National Institute of Immunology(NII), New Delhi-DBT	1
30.	Inter University Accelerator Centre(IUAC), New Delhi	1
Total		36

Annexure-III (b)

LIST OF OTHER FRENCH UNIVERSITIES/INSTITUTES INVOLVED IN PROJECTS

Serial No.	Names and location of Universities/Institutes	No. of Collaborations
1.	Université Paul Sabatier, Toulouse Cedex 9	3
2.	Institut National des Sciences Appliquées de (INSA), Lyon Villeurbanne Cedex	2
3.	Institut Supérieur d'Electronique de Paris(ISEP,), Paris	2
4.	Ecole Polytechnique, Palaiseau	2
5.	Université de rennes 1, Rennes	2
6.	Commissariat à l'énergie atomique(CEA), Saclay, Gif sur Yvette	2
7.	Université Paris-Sud XI, Orsay	2
8.	Institut Pasteur de Lille, Lille	1
9.	Observatoire de Paris-LESIA, Meudon Cedex	1
10.	Ecole Normale Supérieure de Lyon (ENS de Lyon), Lyon	1
11.	Ecole des Mines de Saint Etienne, St. Etienne	1
12.	Université de Rouen, St. Etienne du Rouvray Cedex	1
13.	Université du Maine, Le Mans	1
14.	Université Grenoble 1, Grenoble Cedex 9	1
15.	IRD, St. Martin d'Herès	1
16.	LOCEAN-IPSL, Paris Cedex 05	1
17.	INRIA, Sophia-Antipolis	1
18.	Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS) CNES, Toulouse	1
19.	INRA, Villeneuve d'Ornon	1
20.	Université de Tours, Tours	1
21.	Université de St. Etienne, Saint Etienne	1
22.	Université Paris, Paris	1
23.	Ecole des Mines de Nantes, Nantes	1
24.	Installé au cœur d'un environnement scientifique, industriel et universitaire très riche, le centre (CEA) Grenoble	1
25.	Institut de Physique et Chimie des Matériaux de Strasbourg (IPCMS) -DMO-Université Strasbourg, Ecully	1
26.	Ecole Centrale de Lyon	1
27.	Université de Franche-Comté, (UFC) Besançon Cedex	1
28.	Université de Montpellier, Montpellier Cedex 5	1
29.	Université de Nantes, Nantes Cedex 1	1
30.	Ecole Normale Supérieure(ENS), Toulouse Cedex 4	1
32.	Université Pierre et Marie Curie(UPMC), Paris Cedex 05	1
33.	Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), Caen Cedex 5	1
34.	Ecole National des Travaux Publics de l'Etat ((ENTPE)), Vaulx en Velin Cedex Lyon	1
Total		41

Annexure -IV

SOME SIGNIFICANT OUTCOMES, AS A RESULT OF COMPLETED PROJECTS

Life and Health Sciences

- The design of new therapeutic strategies for p53 based anti-cancer drug
- Described for the first time, the nucleolar histone chaperone, Nucleolin is post-translationally modified by acetylation is involved in cellular processes such as transcription and splicing
- The PIs laboratories shared their respective expertise on microscopic techniques like purification of recombinant Nucleolin protein from insect cells, expertise on histone acetyltransferase assays and ChIP-sequencing analysis
- Provided validated cellular models that have been used in neuroprotective studies of newly identified molecules (HIP/PAP) against excitotoxicity (Haldipur, Ann Clin Transl Neurol 2014) & the development of iPSC and modelling of human developmental diseases
- Development of a public database for multiple structural alignments of proteins.
- Development of a database called Flexbase which forms a basis of a teaching module centered on protein-protein interactions
- Generation of transgenic plants in India and Characterization of transgenic plants in India and France
- Development of Arecoline derivatives for treatment of Alzheimer's disease.
- Development of DNA based plasmid vaccine and its evaluation in a mouse model
- Technology for in house evaluation of antibody response to Acute Promyelocytic Leukemia(APL)
- Institutional partnership between Institut Curie and NCBS (signature on August 6, 2012)3803-2
- Development of a novel formulation to treat visceral Leishmaniasis

Materials Sciences

- Complementary studies on Taylor bubble flows resulted in profound impact on understanding of the transport mechanisms of Taylor slugs/Taylor bubbles
- A passive phase change thermal management platform having potential to use in future for space and terrestrial applications

- New phases as electrode material for Li ion batteries FeOHSO_4 have been discovered and some of them are very interesting electrode materials for Li/Na ion batteries
- IIT Madras and the University of Montpellier signed a MoU - To develop a common curriculum for a Materials Science Master Course, MaMaSELF which has the Erasmus Mundus label from the EU
- Development of a passive phase-change thermal management platform for future space and terrestrial applications

Computational Science

- Development of wireless network sensors for use in health care and patient health monitoring and Indo-French symposium at IIT Delhi in March 2012 on “Sensors, Technologies and Systems”
- Three novel SRAM cells and four different architectures supporting low voltage operation
- Automatic loop shaping tool for design of robust controllers and filters
- Design and implementation of an interval constraint solving platform with local/global optimization in C++ and interface to/from Matlab
- Design of an optimization-based method to combine the design of controllers and prefilters in one step, instead of the classical two steps with backtracking
- Developed a full compact model named ‘indDG’ for generic double gate MOSFET

Earth and Planetary Sciences

- Understanding obtained from this project have also complemented to two important programs of Indian Institute of Tropical Meteorology – Seasonal and Extended Range Monsoon Prediction and Development of statistical tools and models for weather prediction
- The collaborations between IITM and LOCEAN/IPSL was enhanced, in particular in the perspective of the next IPCC AR5 report on climate change and global warming (collaborations between IITM and IPSL)
- Dynamical core is coupled with physics package of LMDZ5, a well-established French climate model. Aqua planet simulations are carried out with this setup
- Synthetic procedures for the preparation of fullerene derivatives have been developed which have interesting properties and look promising in terms of applications

Environmental Sciences

- Identification of proteins significant in bioremediation applications. Successful demonstration of the use of engineered bacteria for the removal of radioactive cobalt.
- Development of guidelines for improved clay-based landfill covers for Municipal Solid Waste landfills and Low-level Radioactive waste landfill sites
- First report of a single-component metal efflux transporter, mrdH, showing chimeric domain organization, a broad substrate spectrum, and a location amid metal- inducible mobile genetic elements
- The collaborations between IITM and LOCEAN/IPSL was enhanced, in particular in the perspective of the next IPCC AR5 report on climate change and global warming

Pure and Applied Mathematics

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

Pure and Applied Chemistry

- Development of carbon nanotubes (CNTs)/nanohybrids with nucleobases which have application in nucleic acid delivery
- Development of amphiphilic compounds for organic transformation – a green technology
- Development of novel catalysts for organic synthesis
- Development of inhibitors of enzymes involved in Oligosaccharide synthesis – Implications in human disease
- Development of a method to modify wastes to obtain catalysts
- Development of concepts which can be adapted for designing and developing nano-sized bio-chips for specific application
- Discovery of new chemical entities able to restore apoptosis selectively on cancer cells in a very promising new approach to anti-cancer drugs
- Development of hydrogels for possible use in biomedical application
- Development of complexes which can be used as precursor for bimetallic nanoparticle catalysts
- The discoveries of efficient catalytic systems applied to the modifications of the glycopeptides produced at IICT. One catalytic system based on RuCp systems has allowed efficient allylation of amino acid derivatives and has introduced a new tool for direct allylation from allylic alcohols. A second system based on Ru(arene) (phosphinosulfonate) catalysts can be seen as a side product of the collaboration, but it led to the discovery of an unprecedented sp³C-H bond activation, which will be a useful tool in organic synthesis

- Development of efficient methodologies for the synthesis of molecules with potential biological activity – Implication in pharmaceutical chemistry
- New thermo-thickening polymers based on bio-resource materials such as Guar gum and Xyloglucans were synthesized and characterized
- Development of nanohybrid catalysts which can be used in chemical/pharmaceutical industry
- Synthesis and reactivity of first metallocenefulvene complexes

Pure and Applied Physics

- Enhancement of collaboration between Indian Institute of Technology, Kanpur and Fresnel Institute (UMR CNRS, Aix-Marseille University) as a basis for an application for International unit of CNRS called Laboratoire International Associé.
- Demonstration of potential of plasmonic checkerboard systems for various applications such as enhanced fluorescence
- Novel experimental technique to measure the film thickness variation down to a few microns
- Developed a new and efficient PNComBin package
- Development of two new numerical methods (of quantum Monte Carlo and exact diagonalization types) to study thermodynamics of frustrated quantum antiferromagnets

Water

- Use of GPS to generate data vital for flood management in future and food security

Biotechnology

- Insight into Metabolic engineering of Cyanobacteria for biofuel production

Annexure- V(a)

OUTCOME IN THE FORM OF PATENTS FILED/OBTAINED FROM THE 94 PROJECTS COMPLETED DURING YEARS 2011 to 2015:

S No.	Discipline	Project details	Patent title	Application Status
1.	Biotechnology	Project No. 3700B1 Title: Targeted delivery of RNAi using synthetic vectors for Gene Therapy of Head and Neck squamous cell carcinomas under Dr. Rita Mulherkar/Dr. Guy Zuber	'Polymers for Delivering Molecules of Interest'	A PCT application with no. WO2011120953 titled "Polymers for Delivering Molecules of Interest" has been filed by the group of Dr. Guy Zuber on completion of the project on 29.03.2011. The application is undergoing examination in the European Union (EU) and has been granted in the USA (03.02.2015).
2.	Life and Health Sciences	Project No. 3803-3 Title: Neural differentiation of embryonic stem cells under Dr. Shyamala Mani/Dr. Pierre Gressens	'Novel applications of HIP/PAP or derivatives thereof'	The application is undergoing examination. European Patent, (No. 09290437.4 – 1521)
3.	Pure and Applied Chemistry	Project No. 4105-1 Title: Practical methods for surface bio functionalization under Prof. Amitabha Sarkar/Dr. Michèle Salmain	'A visual detection method of a protein using gold nanoparticles generated <i>in situ</i> and a kit thereof'	A Patent (294/KOL/2010) entitled 'A visual detection method of a protein using gold nanoparticles generated <i>in situ</i> and a kit thereof' filed on 23.3.2010 and under examination at Indian Patent Office.

SN.	Discipline	Project details	Patent title	Application Status
4.	Life and Health Sciences	Project No. 4503-2 Title: Evaluation of cellular and immune response in mice and patients with acute promyelocytic leukemia treated with arsenic trioxide under Dr. Vikram Mathews/ Prof.Christine Chomienne	Not available	The French group has already a patent on the Vaccine.
5	Life and Health Sciences	Project No. 4803-3 Title: Mechanisms of Lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use thereof in memory under Prof. Tapas Kumar /Dr. Anne-Laurence BOUTILLIER	'A Nanosphere-Histone Acetyltransferase (HAT) Activator Composition and Process Thereof'	1. US Patent Application No: 14/397,561; Status: Received Notice of Allowance.
6.	Life and Health Sciences	Project No. 4803-3 Title: Mechanisms of Lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use thereof in memory under Prof. Tapas Kumar /Dr. Anne-Laurence BOUTILLIER	'A Nanosphere-Histone Acetyltransferase (HAT) Activator Composition and Process Thereof'	European Patent Application No: 13731163.5; Status: Received Communication under Rule 71(3) EPC-Intention to Grant Patent.

Annexure- V(b)

COMMERCIAL POTENTIAL FROM 94 PROJECTS COMPLETED DURING 2011-2015:

S No.	Discipline	Project details	Commercial potential
1.	Biotechnology	Project No. 3700-B1 Title: Targeted delivery of RNAi using synthetic vectors for Gene Therapy of Head and Neck squamous cell carcinomas under Dr. Rita Mulherkar/ Dr. Guy Zuber	The oligonucleotide delivery system developed by the team seems to have significant commercial potential. However, further testing is required to validate the system <i>in vivo</i> (animal model) before an industry can take it up for preclinical and clinical trials for commercialization.
2.	Biotechnology	Project No. 3800- B1 Title: Synthetic biology of cyanobacteria for solar ethanol under Dr. Pramod P Wangikar/ Dr. Alfonso Jaramillo	Studies pertaining to the stability of the mutant strain, its tolerance to high ethanol concentration and optimization of ethanol yield need to be done before eliciting response from potential industry partners.
3.	Life & Health Sciences	Project No. 4303-1 Title: Protection by New Arecoline Derivatives in Alzheimer's Disease under Prof. K. S. Rangappa/Dr.T. Maurice	The arecoline derivatives designed and synthesized are expected to have good commercial potential based on the lab-scale studies conducted. Although, further testing is required to validate the compounds through extensive testing of their safety and efficacy <i>in vivo</i> , the synthesized molecules offer potential for transfer to suitable companies for further development and commercialization.

4.	Pure and Applied Chemistry	Project No. 3705-2 Title: Development of Functionalized CNTs-Nucleobase Constructs and their use in Biomimetic Catalysis under Prof. Sandeep Verma/ Dr. Alberto Bianco	CNT-nucleobase hybrids may be further validated on the aspects of stability and uniformity before transfer to an industry partner for scale up and commercialization. CNT-nucleobase-metal NP conjugates may be further validated for its application in biosensors and heterogenous catalysis for eliciting interest from industry. The Polyamine functionalized CNTs have potential application in gene silencing and need to be subjected to <i>in vitro</i> and <i>in vivo</i> animal studies before taking it up for commercialisation.
5.	Pure and Applied Chemistry	Project No. 3805-1 Title: New Environmental Friendly Media for Organic Transformation under Dr. Anil Kumar/ Dr Yves Queneau	The process for synthesis of new compounds using ionic liquids may act as an alternative to currently used industrial methods subject to testing and validation of yields in comparison with existing processes. The reaction system/synthesis process may be anticipated to have market potential if proven for its reproducibility, stability and adaptability for large scale production.
6.	Pure and Applied Chemistry	Project No. 3805-2 Title: Non-natural peptides in asymmetric catalysis :Metal-Mediated Synthesis of Peptide-based Materials and their Applications under Dr. G. V. M. Sharma/ Dr. Christian Bruneau	The Pd- and Ru-catalytic system has shown efficient catalytic activity and the USP of these two catalytic systems is that they provide a greener approach for nucleophilic allylic substitution. If the catalytic systems are proven for their adaptability for large scale production of allylic intermediates, the catalytic system and reaction condition will have licensing potential.

Annexure –VI

SUMMARY OF ACHIEVEMENTS AND OUTCOMES OF THE PROJECTS COMPLETED DURING YEARS 2011 to 2015

1. Project No. 3009-1

Principal Collaborators

Dr. Rohini Balakrishnan Centre for Ecological Sciences Indian Institute of Science Bangalore	Dr. Laure Desutter-Grandcolas Museum national d'Histoire naturelle Département Systematique et Evolution UMR7205 CNRS, Origine, Structure et Evolution de la Biodiversite (OSEBParis
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The project elucidates the phylogeny of crickets of the subfamily *Gryllinae*. The collaborators have extended the analysis from the Indian *Gryllinae* to a global phylogeny, including genera from outside India, using specimens from the collections of MNHN. Morphological characters, character states of wings and genitalia have been determined and defined for 33 genera of the *Gryllinae* and four outgroups (*Itarinae*, *Landrevinae*, *Eneopterinae*) and included in the character matrix for the phylogeny. The study on acoustics, phylogeny and song evolution in the genus *Itaropsis* has been completed: both the acoustic analysis and the molecular phylogeny suggest the existence of three species. One species is widely distributed, extending from Bombay to Bangalore, the second corresponds to the population in the southern Western Ghats near Karkala and the third occurs south of the Palghat Gap in Val This project resulted in the first global phylogeny of this sub-family .

2. Project No. 3603-2

Principal Collaborators	
Dr. Gurcharan Kaur Department of Biotechnology Guru Nanak Dev University Amritsar	Prof. Vincent Prévot Jean-Pierre Aubert Research Centre INSERM Unité 837, Université de Lille-2 Neuroendocrinologie et Physiopathologie Neuronale, Lille

The project aimed to determine whether juxtacrine (PSA-NCAM) and/or paracrine (erbB signaling) communication processes and the crosstalk between these two modes of signalization might play a major role in the integration of the great diversity of stimuli that astrocytes, tanycytes and GnRH axons receive under varying physiological situations during estrous cycle within the median eminence of the hypothalamus. The investigators have provided strong evidence that PSA-NCAM plays permissive role in

GnRH neuron-astrocytes interactions to facilitate remodeling of GnRH terminals. Upregulation of PSA-NCAM on GnRH cell bodies and their terminals in the proestrous phase and EBP primed OVX rats, which was dynamically regulated by norepinephrine and GABA has been observed. The biosynthesis of PSA is regulated at the transcriptional level. Enzymatic removal of PSA by endoneuraminidase-N (Endo-N), *in vivo* further confirmed that PSA-NCAM is essential for morphological plasticity of GnRH neurons.

3. Project No. 3607-1

Principal Collaborators	
Dr. Anil Kumar Palaeomagnetism Laboratory National Geophysical Research Institute Hyderabad.	Dr. Jean Besse Laboratoire de Paléomagnétisme Institut de Physique du Globe de Paris, Paris

The project aim was document dynamic evolution of the planet by using paleomagnetic constraints. Identification of major dyke swarms in the Bundlekhand craton and sampling of these dykes in most responsive sites; Paleomagnetic, rock magnetic, anisotropy magnetic susceptibility and paleointensity studies completed at IPGP, Paris and NGRI, Hyderabad. Four temporally distinct Proterozoic paleomagnetic pole positions have been identified from the Bundlekhandcraton. The studies on the 300 km long great dyke have resulted in extremely important information on magma flow pattern in long mid crustal channels. Sampling of additional Paleoproterozoic dykes from the Dharwar craton for paleomagnetic, geochemical and geochronological studies was also done.

4. Project No. 3608-1

Principal Collaborators	
Dr. Sumit Basu Department of Mechanical Engineering Indian Institute of Technology -Kanpur, Kanpur	Prof. Rafael Estevez Laboratoire GEMPPM INSA de Lyon Villeurbanne Cedex

In this joint project, PIs developed an experimentally validated simulation scheme for fracture of glassy, amorphous polymers. Development of a robust MD technique for studying the micromechanics of deformation and early stages of fracture in glassy, amorphous polymers; Development of dynamic FE code for analysing fracture initiation in these materials from a continuum point of view; Development of a UMAT (user material subroutine) capable of performing 3 dimensional stress analysis of these materials and compatible with the commercial software ABAQUS; Extensive simulations for the calibration and validation with comparisons of the predictions with measurements.

5. Project No. 3608-2

Principal Collaborators	
Dr. Shobhana Narasimhan Theoretical Sciences Unit Jawaharlal Nehru Centre for Advanced Scientific Research Bangalore	Prof. Sylvie Rousset Laboratoire Matériaux et Phénomènes Quantiques, CNRS-UMR 7162 Université Paris 7, Paris

In this project, the PIs have studied the design and study of magnetic surface alloys system like magnetic surface alloys, magnetic over layers on metal substrates, and periodic arrays of steps on vicinal metal surfaces both experimentally, using scanning tunnelling microscopy and other techniques of surface science, and theoretically, using density functional theory. The achievements of the project are following:

a) Understanding of the factors governing the formation of surface alloys, including the relative importance of elastic and chemical interactions, and the absence of a simple size-based mixing rule.

b) Successful experimental demonstration that the AuFe/Ru(0001) system forms a long-range ordered (LRO) surface alloy even though Au and Fe are bulk-immiscible. The PIs have also shown that, the main stabilizing force for the formation of this alloy is magnetism and not stress relief.

c) Self-organization of cobalt nanodots on Au(111) have been used in order to give new insights into the magnetization anisotropy energy of nanostructures, which is the key parameter for applications in high density magnetic storage. The PIs have shown the role of atomic relaxations when Co dots are encapsulated into a gold matrix and also shown for the first time the role of spin density waves in thermal assisted magnetization reversal.

d) Studied the spin polarized surface states formed when Fe is deposited on Au(111) and shown that they behave like free electron states that are scattered by the boundaries of the islands.

e) Demonstrated that grazing angle Xray diffraction can be successfully used to extract near-surface displacements on a stepped surface, in agreement with calculations and elastic models

6. Project No. 3700-B1

Principal Collaborators	
Dr. Rita Mulherkar Genetic Engineering Advanced Centre for Treatment, Research and Education in Cancer, Tata Memorial Centre Navi Mumbai	Dr. Guy Zuber UMR 7199 - CNRS Université de Strasbourg Faculté de Pharmacie Illkirch

The French group have been granted patent -A PCT application with no. WO2011120953 titled “Polymers for Delivering Molecules of Interest”. The application is undergoing examination in the European Union (EU) and has been granted in the USA (03.02.2015). The outcome of this project has significant commercial potential. The PIs have been able to design and clone shRNA to Cyclin D1 and ATM and show that they can sensitize cells to conventional therapy. Synthetic nucleic acids delivery systems appear extremely effective *in vitro*. PIs successfully prepared shRNA cloned in plasmid vectors and tested them *in vitro*. The biggest collaborative achievement was actually to test a “virus-like’ delivery systems *in vivo*.. This project also provided invaluable information for designing and tailoring nucleic acid systems for *in vivo* administration.

7. Project No. 3701-1

Principal Collaborators	
Prof. Mythily Ramaswamy T.I.F.R Centre for Applicable Mathematics Bangalore,	Prof. Jean Pierre Raymond Laboratoire MIP UMR 5640 CNRS-Université Paul Sabatier Université Paul Sabatier Toulouse

Different models for fluid-solid interaction have been studied in appropriate mathematical framework for controllability questions:

- (a) Coupled system with Stokes equation for the fluid in 2 dimensional domain and an o.d.e for the structure, modeling the deformations of an elastic body,
- (b) Helmholtz equation to model the vibrations of a coupled fluid-solid system;
- ii) The study of meta-materials which are electromagnetic materials having negative permittivities and/or permeabilities has been initiated by setting up a mathematical model and is ready for further study of control and homogenization;
- iii) A numerical implementation of feedback control for the important problem of fluid control modelled by Navier-Stokes equation has been initiated and is being investigated;
- iv) The practical problem of Data assimilation has been tried numerically for the Burgers’ equation model using optimal control techniques. Further applications with models used in atmospheric sciences is now possible; and
- v) Compressible Navier-Stokes system has been taken up for the study of controllability and stabilizability and optimal control.

8. Project No. 3703-1

Principal Collaborators	
Dr. Saumitra Das Department of Microbiology and Cell Biology Indian Institute of Science Bangalore	Dr. Robin Fahraeus Laboratoire de Pharmacologie Expérimentale et Clinique INSERM Unité 716 Hôpital St. Louis Paris

The work carried out on p53 mRNA translation has firmly shown the importance of p53 mRNA translation control in regulating p53 tumor suppressor activity. The collaborators have identified three important cellular protein factors (Mdm2, PTB, hnRNPC1/C2) that regulate the synthesis of p53 and its isoforms. Demonstrated that Mdm2 influences both the synthesis and degradation of p53 protein. PTB has been shown to differentially regulate the function of the two IRES elements that controls the synthesis of p53 and the p47/53 isoform. Moreover PIs able to demonstrated that the control of p53 mRNA translation serves as an important event in activating p53 in response to different stress pathways. This information will help in the design of new therapeutic strategies for p53 based anti -cancer drug.

9. Project No. 3703-2

Principal Collaborators	
Dr. Shobhona Sharma Department of Biological Sciences Tata Institute of Fundamental Research Mumbai	Dr. Sylviane Pied Immunophysiopathologie du Paludisme INSERM U 547 Centre d'Immunologie et de Biologie Parasitaire Institut Pasteur de Lille Lille

The project was based on prior observation that the pathological profile of the malaria patients in Orissa, India, were changing over the last decade. The major objective was to assess a correlation of cytokine profile, antibody production and host-genetic factors with specific malaria severity, in order to ascribe certain immunological pathways for different kinds of sever disease. The cytokine patterns allowed to identify IL15 as a key cytokine in malaria pathogenesis. The genetic polymorphism studies have revealed interesting results regarding TLR, iNOS and TNF-alpha and malaria susceptibility. Interesting observations are also obtained regarding genetic polymorphisms is populations of Orissa versus cosmopolitan cities such as Mumbai. The analysis of the repertoire of autoantibody against brain, liver, kidney and lung produced in malaria patients allowed to identify a discriminant response depending on the clinical manifestation. Proteins recognized by these antibodies are under identification.

The parasite antigen specific antibody response revealed that response generally mild malaria category gave the lowest response and multi-organ dysfunction patients showed the highest response. Responses of cerebral malaria and cerebral malaria patients exhibiting multi-organ dysfunction were statistically indistinguishable and lower than those with multi-organ dysfunction alone. The humoral response was also largely polyreactive. The results will also help consolidate the contribution of several immunological parameters that play a role in malaria disease pathology.

7. Project No. 3704-1

Principal Collaborators	
Prof. P. Venkatakrisnan	Dr. Guillaume Molodij

Udaipur Solar Observatory Physical Research Laboratory Udaipur	LESIA, Observatoire de Paris Meudon
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The project aim was to understand the chain of phenomena occurring from the Sun to the Earth as a global system. The achievements of the project are i) International campaign JOP 178 of Observations on filaments ii) workshop on Transient Phenomena in Sun-Earth System in Nov/Dec 2010 at Udaipur, India and also a week long winter school for young researchers; and iv) development of a new proposal for observation with THEMIS for Multiheight. The project leads to capacity building. Results from project outcome were presented in several international meetings.

11. Project No. 3705-2

Principal Collaborators	
Prof. Sandeep Verma Department of Chemistry Indian Institute of Technology Kanpur	Dr. Alberto Bianco UPR 9021, CNRS Immunologie et Chimie Thérapeutiques Institut de Biologie Moléculaire et Cellulaire Strasbourg

The project provides a novel process to develop functionalized CNT hybrids; and studies the potential applications of the developed CNT hybrids. The achievements by PIs were:

1. Designed and developed the first examples of covalent functionalization of carbon nanotubes (CNTs) with nucleobases.
2. Obtained well-aligned CNTs and were able to observe the horizontal alignment of CNTs functionalized with adenine using atomic force microscopy.
3. Showed that a simple approach of functionalization with uracil nucleobase could result in nanorings of carbon nanotubes. These circular nanohybrids can be conceived for electronic and biomedical applications.
4. Carbon nanotubes are spearhead candidates as support for catalytic metal nanoparticles, however assembly of nanoparticles (NPs) to the nanotubes mediated by the presence of functional groups was little explored. PIs focused their attention on using adenine functional groups which triggered the growth of silver NPs directly on the surface of functionalized CNTs using adenine-metal coordination.
5. Heterogeneous catalysis to produce quinones with high recovery yield and recycling efficiency has been not extensively explored. They observed that their CNT/Ag-NPs nanohybrids resulted in an efficient and re-usable heterogeneous catalyst for the oxidation of hydroquinones.
Catalytic processes always have a big impact on the development of technology and society.
6. Reported new cationic carbon nanotubes based on polyamines for the development of advanced systems for the delivery and/or modulation of nucleic acids.

7. Immobilized adenine-CNTs on the gold surface with one end like nanotube brushes whereas adenine at the other end of the nanotubes can interact with the ferrocenyl uracil molecule. Due to complementary base-pair interaction between adenine and uracil, PIs observed changed response in the electrochemical behavior of ferrocene.

12. Project No. 3706-1

Principal Collaborators	
Dr. Srinivas Krishnagopal Beam Physics and FEL Laboratory Raja Ramanna Centre for Advanced Technology Indore	Prof. Jean-Michel Ortega Laboratoire de Chimie Physique UMR-CNRS-Université Paris Sud Orsay

. The long experience of the CLIO team was very useful in validating the CUTE-FEL design, and in solving problems in its commissioning. In this context, very specific inputs were received on a wide variety of issues, such as RF, optics, diagnostics, etc., and these have definitely helped the development of the CUTE-FEL. The knowledge thus gained will allow scientific community to move forward. Experiments done at CLIO could be nicely reproduced by simulations done in India, validating this understanding. The interaction also had other, very useful, spin-offs, such discussions at SOLEIL about the design and construction of undulators for INDUS-2. The main benefit coming out of this project is the improved operation of the CUTE-FEL, deeper theoretical understanding of FELs, and, development of the upcoming IR-FEL at RRCAT.

13. Project No. 3708-1

Principal Collaborators	
Prof. D. Bahadur Department of Metallurgical Engineering and Material Science Indian Institute of Technology Mumbai	Prof. Jean François Létard Institut de Chimie de la Matière Condensée de Bordeaux UPR CNRS 9048 Groupe des Sciences Moléculaires Université Bordeaux 1 Pessac

The project aim was to investigate the photo induced magnetism (PIM) of magnetic oxides for this synthesis of several nanocrystalline systems thought to be suitable by using a variety of soft chemistry routes. The systems like cobaltites, manganites, ferrites, layered double hydroxides and TM doped zinc oxides have been thoroughly characterized for their structural, magnetic and other physical properties. Photomagnetic and magnetic studies on the nanocrystalline form of the spinel $\text{Ni}_{0.5}\text{Zn}_{0.5}\text{Fe}_{1.7}\text{Co}_{0.3}\text{O}_4$ have been studied. An explanation of these results is given in the framework of freezing/melting of cluster glass behaviour. Layered double hydroxides containing paramagnetic Ni^{2+} and Fe^{3+} ions with $\text{Fe}(\text{CN})_6^{3-}$ intercalated anions exhibit significant enhancement of magnetization after one hour of light irradiation. This effect

has been found to be due to contribution of thermal and photo magnetic effect. To the best of the knowledge of the investigators, this is the first report of photomagnetic studies on Ni/Fe layered double hydroxide. Studies of photo magnetic nanoparticles have been successful. The influence of the nanosize of the compound has been exhibited. Influence of polymorphism on the photo magnetic properties on a molecular based compound has been investigated.

14. Project No. 3708-2

Principal Collaborators	
Prof. Ayyappanpillai Ajayghosh Chemical Sciences and Technology Division CSIR ,National Institute for Interdisciplinary Science & Technology(NIIST), Thiruvananthapuram	Prof. Jean-Michel Guenet CNRS UPR 22 Institut Charles Sadron CNRS Strasbourg

The objective of this project was the design of stable functional nanomaterials and nanocomposites either through hybrid interpenetrated fibrillar networks between thermoreversible polymer gels and π -conjugated organogels or through the encapsulation of supramolecular gels by the fibrils of covalent polymers. The Salient achievements of this project were- Composition of polystyrene, oligo (para phenylene vinylene) and carbonnanotubes (CNT's) with improved properties have been synthesized. Hydroxymethyl end functionalized OPVOH produces a very stable gel in polar benzyl alcohol. It has been found that, the self-assembly process is extremely sensitive to the chemical structure of the end groups. Two new OPV moieties equipped with an ester (OPVE) or a methoxy group (OPVMe) at the ends have been synthesized. Extensive morphological investigation (by FESEM, TEM, Confocal laser microscopy and AFM) reveals that OPVOH forms nanofibrils which are seemingly to be different from those formed by OPVE or OPVMe self assembly. A detailed structural analysis has been carried out by small angle and wide angle X-ray scattering measurements which establishes that, for the superstructure made by OPVOH the fibrillar growth is privileged in one direction which is definitely not the case for other two gel systems. Superstructures of a red emissive OPV (OPVR) in different solvents have been investigated.

15. Project No. 3709-1

Principal Collaborators	
Prof. Surya S. Singh Department of Biochemistry Osmania University Hyderabad	Dr. Agnès Rodrigue Microbiologie, Adaptation et Pathogénie UMR 5240 CNRS-UCBL-INSA-BCS Université Claude Bernard Lyon 1 Villeurbanne

A novel chromosomal metal resistance determinant *mrhH*, located in the genomic island 55 was identified and characterized from *Pseudomonas putida* KT2440. It encodes for *MrhH*, a predicted protein of 40 kDa with a chimeric domain organization derived from the *RcnA* and *RND* (for resistance-nodulation-cell division) metal efflux proteins. The metal resistance function of *mrhH* was identified by the ability to confer nickel resistance upon its complementation into *rcnA* mutant (nickel- and cobalt-sensitive mutant) of *Escherichia coli*. Expression studies using quantitative reverse transcription-PCR showed the induction of *mrhH* by cadmium, nickel, zinc, and cobalt. In association with *mrhH*, the collaborators have also identified a conserved hypothetical gene *mreA* whose encoded protein showed significant homology to *NreA* and *NreA*-like proteins. Expression of the *mreA* gene in *rcnA* mutant of *E. coli* enhanced its cadmium and nickel resistance. Transcriptional studies showed that both *mrhH* and *mreA* underwent parallel changes in gene expression. The mobile genetic elements Tn4652 and IS1246, flanking *mrhH* and *mreA* were found to be induced by cadmium, nickel, and zinc, but not by cobalt. This study is the first report of a single-component metal efflux transporter, *mrhH*, showing chimeric domain organization, a broad substrate spectrum, and a location amid metal- inducible mobile genetic elements.

16. Project No. 3800-B1

Principal Collaborators	
Dr. Pramod P. Wangikar Dept. of Chem. Engg. Indian Institute of Technology Mumbai	Dr. Alfonso Jaramillo SYNTH-BIO group, Epigenomics Project Universite d'Evry Val d'Essonne- Genopole®-CNRS UPS3201, Evry Cedex

The project work has given us considerable insight into the metabolism of *Synechocystis* sp. PCC 6803 and how its metabolism can be harnessed for producing ethanol optimally. Ethanol can be used for several purposes such as a gasoline additive, in medicines, as a preservative for biological specimens, etc. Hence it is important to design means for producing ethanol in an economically feasible fashion. In this regard, this project work can be regarded as an important benchmark which can be used for further metabolic engineering studies in the ethanol production problem using *Synechocystis* sp. PCC 6803 as the model organism.

17. Project No. 3803-1

Principal Collaborators	
Prof. Tapas K. Kundu Molecular Biology and Genetics Unit Jawaharlal Nehru Centre for Advanced Scientific Research Bangalore	Prof. Philippe Bouvet Ecole Normale Supérieure de Lyon Laboratoire de Biologie Moléculaire de la Cellule Lyon Cedex 07

The project elucidates the functional comparisons between histone chaperones with canonical nucleosomes on histone deposition specificity, nucleosome dynamics, and co-remodelling activity, on conventional and variants nucleosomes. The investigators found that acetylated Nucleolin did not occupy the rDNA regions, and instead it colocalized with splicing factors. Thus, they described for the first time, the nucleolar histone chaperone. Nucleolin is post-translationally modified by acetylation is involved in cellular processes such as transcription and splicing. During the collaboration, both laboratories shared information and knowledge about some of the techniques for which the other laboratory did not have expertise. For example, most of the *in vitro* chaperone assays, transcription assays with CENP-A chromatin as well as Nucleolin were done in the Indian laboratory whereas the nucleosome remodeling assays with Nucleolin and NPM1 were done in the French laboratory. The expertise of preparing baculoviruses and subsequent purification of recombinant Nucleolin protein from insect cells was shared with the French laboratory, and the entire method was carried out in French laboratory during Indian Scientist visit to France. The Indian laboratory also shared their expertise on histone acetyltransferase assays and showed for the first time that the nucleolar histone chaperone, Nucleolin is post-translationally modified by acetylation. The two laboratories also shared their respective expertise on microscopic techniques. Further, genome-wide ChIP-seq analyses of Nucleolin and acetylated Nucleolin was performed by the French laboratory which gave interesting insights into the function of acetylated Nucleolin. The expertise of ChIP-sequencing analysis was shared with the Indian laboratory which was useful in performing similar kind of studies on another nucleolar histone chaperone, Nucleophosmin, research on which was being pursued by the Indian laboratory for the past 15 years.

18. Project No. 3803-2

Principal Collaborators	
Prof. Satyajit Jitu Mayor National Centre for Biological Sciences Bangalore	Prof. Ludger Johannes Institut Curie UMR 144 Curie/CNRS Paris Cedex 05

The project aimed at using genome-wide siRNA and expression screens to establish the list of gene functions required for Shiga toxin (and ricin) uptake. By making a detailed comparison to results on GPI-anchored proteins (available via a DST funded Nano-Bio Science project to SM), the collaborators expect to arrive at general principles underlying clathrin-independent endocytosis.

The investigators have found the exciting observation that certain cellular proteins induce tubular plasma membrane invaginations, such as Shiga toxin, strongly suggesting that the toxin-driven endocytic mechanism is not restricted to toxins and viruses, as shown earlier, but that it may also be shared by cellular proteins.

The collaboration between the two collaborators Dr. Mayor and Dr. Johannes groups that is being extended into an institutional partnership between Institut Curie and NCBS

(signature on August 6, 2012). The study involves the role for glycosphingolipid nano compartmentalization in toxin binding to cells thereafter extension of glycosphingolipid-based membrane bending mechanisms to cellular proteins.

19. Project No. 3803-3

Principal Collaborators	
Dr. Shyamala Mani Centre for Neuroscience Indian Institute of Science Bangalore	Prof. Pierre Gressens INSERM U 676, IFR 02 & IFRH Hôpital Robert Debré(AP-HP) Paris

The study helped to identify critical pathways that extrinsic cues induce to generate any kind of neuronal subtype *in vitro* and enable to advance understanding of basic mechanisms of neuronal subtype specification and pathophysiological mechanisms underlying several neural diseases. Another significant achievement was that quantitatively analyzed the changes in cerebellar cortical layers in preterm infants and provided a framework for understanding the reason behind the cerebellar volume change that has been seen in preterm infants and investigators are getting ready for transplantation into animal models. It has brought new insights on the specification of mouse and human neurons *in vitro* and *in vivo*, in particular important progress in the understanding of cerebellar specification and differentiation. The project provided validated cellular models that have been used in neuroprotective studies of newly identified molecules (HIP/PAP) against excitotoxicity.

The collaboration between the two labs is still ongoing and has been broadened to new topics related to neural specification, but with regard to human diseases.

20. Project No. 3804-1

Principal Collaborators	
Dr. Mandar Deshmukh Tata Institute of Fundamental Research Mumbai	Dr. Vincent Bouchiat Institut Neel, CNRS/UJF Grenoble

The project objectives were to probe spin dependent transport across single molecule magnets and spectroscopically probe the excitation spectrum of the molecules. Further research work on graphene as a part of the single molecule research was included. The achievements of work done under the projects are-

- a) Rate equation calculations to study spin polarized tunnelling in molecular transistors.
- b) Fabrication of a low temperature insert that allows low-temperature measurements and in situ evaporation of molecules at low temperature.
- c) Fabrication of graphene based NEMS devices

21. Project No. 3804-2

Principal Collaborators	
Dr. S. Anantha Ramakrishna Department of Physics Indian Institute of Technology Kanpur	Dr. Sebastien Guenneau Institut Fresnel UMR 6133, Université Aix-Marseille Iii- CNRS Université Aix-Marseille III Marseille

This project was instrumental in the two groups' continued collaboration resulting in the advancement of the earlier theoretical ideas on checkerboard systems and their experimental implementation. Individually, the French and Indian groups have been able to build up their capabilities on electromagnetic computations and experimental capabilities respectively. The following are salient achievements of the project.

- a) Discovery of broad-band extra-ordinary transmittance through checkerboard structured plasmonic films (experimental and theory).
- b) Negative refraction of plasmons on structured metallic films (theory).
- c) Plasma-like meta-surfaces consisting of subwavelength structured plasmonic meta-surfaces of gold that support spoof surface plasmons with broad-band properties (experiments and theory).
- d) Fluorescence enhancements and SERS from molecules on checkerboard plasmonic structures. (experiments).
- e) Generalization of checkerboard effects to non-Euclidean geometries and origami perfect lenses (theory). Extension of the generalized lens theorem to chiral media.

The results of the project have well advanced our knowledge of plasmonic systems, and in particular, checkerboard structured plasmonic systems. New plasmonic effects and the potential of plasmonic checkerboard systems for various applications such as enhanced fluorescence and SERS has been demonstrated both theoretically and experimentally. Much further collaborative work between the two groups is expected in the future whereby much of the potential results generated in this project will be exploited.

22. Project No. 3805-1

Principal Collaborators	
Dr. Anil Kumar Physical Chemistry Division National Chemical Laboratory Pune	Dr. Yves Queneau Laboratoire de Chimie Organique UMR 5181 CNRS-INSA de Lyon Université Claude Bernard Lyon I Villeurbanne

The project program included a critical literature survey of the chemistry of carbohydrates in unusual media such as ionic liquids. Outcomes of this project are as follows:

1. New environment friendly media for organic Transformations
2. Synthesis of a full family of new amphiphilic compounds and significant progress in the development of the analytical method;
3. Exploration of the reactivity with epoxides in ionic liquids;

In this green chemistry project the work has resulted on the synthesis of new amphiphilic carbohydrate derivatives and the investigation of their physicochemical behavior. The two investigators were also organized the workshop in the field of green chemistry, new media, new substrates notably biomass.

23. Project No. 3805-2

Principal Collaborators	
Dr. G. V. M. Sharma Organic Chemistry Division III Indian Institute of Chemical Technology Hyderabad	Prof. Christian Bruneau UMR 6226 CNRS Université de Rennes I-“Sciences chimiques de Rennes- Catalyse et Organométalliques” Université de Rennes Rennes

The project proposed to synthesize new catalysts and use them to develop a variety of functionally diversified amino acids/peptides and new materials for asymmetric catalysis and for bio-medical applications. The outcomes of the join work are as follows:

Development of novel catalysts for organic synthesis, the studies investigate in deriving the factors that are governing the cyclization and macrocyclization reactions, the discoveries of efficient catalytic systems applied to the modifications of the glycopeptides produced at IICT. It led to the discovery of unprecedented sp³C-H bond activation, which will be a useful tool in organic synthesis. Several peptides from β-amino acids with C-allylic and C-propargylic side chains have been synthesized. All the dipeptides synthesized from β-amino acid units were subjected to allylation reactions. All the dipeptides with unsaturated allylic side chains placed at different positions of the main peptidic chain were studied in the Ring Closing Metathesis (RCM) reaction for the formation of new cyclic dipeptides. Coordination with ruthenium of β-amino acid derivatives and other ligands containing acidic moieties was examined in order to be applied in catalysis. The RCM mediated cyclization of different peptides resulted in interesting results. The systems which would result in 11-and 13-membered rings, underwent facile cyclization, while, the systems that are expected to give 9- membered rings were found to be reluctant to RCM. Another interesting observation on the RCM of a different dipeptide was in the formation of a selective head-to-tail double cross metathesis product from two units

24. Project No. 3808-1

Principal Collaborators	
Prof. Indradev Samajdar Dept. of Metallurgical Engg. & Materials Science Indian Institute of Technology Mumbai	Prof. Julian Driver Centre SMS Ecole des Mines de Saint Etienne St. Etienne

The outcomes of the joint collaboration are as follows:

- Several new quantitative methods have been developed to characterize recovery of deformed metals by advanced diffraction techniques, in particular: High Angular Resolution EBSD, peak profile X-ray diffraction and a new multiple {hkl} glancing X-ray micro-diffraction technique
- New, statistically valid, experimental data has been generated on the relative effects of different material variables on recovery: the influence of crystallographic orientation on recovery kinetics has been determined in strongly deformed Al-Mn crystals; orientation sensitive recovery has been directly observed in aluminium the transformation of cube fragments into cube recrystallization nuclei has also been studied in aluminium by in-situ annealing and EBSD; orientation-sensitive recovery has been quantified statistically in texture components of low carbon steel by an improved orientation function method
- Residual stresses at the macroscopic and microscopic levels have been characterized during recovery annealing: by the new multiple {hkl} glancing incidence X-ray diffraction method ;recovery kinetics have been quantified by local stresses as measured by peak profile analysis
- A realistic model to describe orientation dependent recovery has been applied to the problem of sub-grain coarsening in aluminium: the Vertex dynamics model of recovery in individual grains by sub grain movement

25. Project No. 3808-2

Principal Collaborators	
Dr. Satish Chandra Ogale Physical & Materials Chemistry Division National Chemical Laboratory Pune	Prof. Beatrice Hannoyer LASTSM-UPRES EA1290 Institut des Matériaux de Rouen Université de Rouen St. Etienne du Rouvray Cedex

The project aimed to examine surface supported metal oxide nanosystems of technological interest (magnetic, electronic and/or optic) by combining the novel microbial and chemical (shape control, composite nanomaterials) synthesis at NCL

(Pune) and the expertise of the French group (GPM) in the fields of special spectroscopic and atomistic probe studies.

- a) Controlled chemical and biochemical synthesis of anisotropic magnetic nanostructures and functional nanocomposites, their atomistic characterizations, and the development of an understanding about the growth mechanisms.
- b) Synthesis, thorough characterization and application of bi-functional magnetic and fluorescent nanoparticles of Fe₃O₄ (CdTe) Core (Shell).
- c) Synthesis, characterization and (solar cell) application of optical nanomaterials.
- d) Explorations of transition element (Fe, Co) doping in TiO₂ nanoparticles.
- e) Application of the novel technique of laser ablation wide angle atom probe tomography to the study of metal oxide systems (iron oxide) and elucidating the attendant mechanisms.

26. Project No. 3808-3

Principal Collaborators	
Prof. Milan K. Sanyal Surface Physics Division Saha Institute of Nuclear Physics Kolkata	Prof. Alain Gibaud Université du Maine Le Mans Cedex 9

The projects involves studies of properties of ultrathin polymer films, such as; Structural properties, Swelling of homopolymer (PS and PBMA) under supercritical CO₂; Swelling of triblock copolymer under controlled humidity, A way out to prepare a spin-coat based smooth, wetted polymer film less than 10 nm and Uniform smooth film (<10nm, even below 2 nm) is achievable by two step process, such as (a) Spin-coating (b) solvent rinsing. Rinsing time and annealing determine the thickness of residual film.

Metal (Au)-Polymer(PS) hybrid interfacial nanostructure in the vicinity of T_g:
New ideas have also emerged from the study of the physical aging of these ultra-thin polymer films after they had been swollen. Finally PIs opened a new route in making ultra- thin homogeneous films of PS which is very promising for some new applications. PIs gave the details about the physical aging of ultrathin films of PS swollen in sc-CO₂ and the comparative results between the swelling of PS and PMMA thin films.

27. Project No. 3809-1:

Principal Collaborators	
Prof. B. V. S. Viswanadham Department of Civil Engineering Indian Institute of Technology Mumbai	Prof. J. P. Gourc LIRIGM/ LTHE Université Grenoble 1 Grenoble Cedex 9

The study investigates the gas permeability behaviour of soil beams with and without polyester fiber reinforcement inclusions through custom developed and designed gas

permeability-bending tests in the laboratory. The study demonstrated use of centrifuge model testing to understand the hydro-mechanical behaviour of landfill cover barriers at the onset of differential settlements. Explored the behaviour of composite barriers at the onset of differential settlements and significance of geo-membrane in imparting a downward thrust on the clay barrier (retaining the sealing efficiency) could be brought out through centrifuge model tests for the first time.

28. Project No. 3900-IT1:

Principal Collaborators	
Dr. B. S. Panwar Centre for Applied Research in Electronics(CARE) Indian Institute of Technology Delhi New-Delhi	Dr. Sylvain Ballandras DR2, UMR CNRS 6174 FEMTO-ST ENSMM-UTBM, CSO - SENSEOR Département Temp, TEMIS Innovation Besançon Cedex

The collaboration between IIT Delhi-India, and FEMTO – ST Besancon France was aimed at developing the surface Acoustic Wave (SAW) sensors for interrogation the vital health parameters for connecting the patients to the clinical laboratory and ambulatory patient services. The technology developed in this project is at the door step of incubation for health care and patient health monitoring. The major accomplishment, apart from achieving the project goals had been the exchange of research ideas and in a highly interactive mode through visits between two countries.

29. Project No. 3900-W1:

Principal Collaborators	
Dr. AL (Alagappan). Ramanathan School of Environmental Sciences Jawaharlal Nehru University New Delhi	Dr. Patrick Wagon Laboratoire de Glaciologie et Géophysique de l'Environnement IRD – St Martin d'Hères

The study aimed is to extrapolate the results obtained on Chhota Shigri glacier to the 2 upper Chandra River basin (approximately 2000 km) using remote sensing tools in order to assess the impact of glacier shrinkage over local and regional water resources.

- Using Ground penetrating Radar and ice flow velocities measurements, the ice fluxes were determined at 5 transverse cross sections. These ice fluxes show that the glacier experienced slightly positive mass balances during the 1990s.
- Attempt has been made using AWS data to predict the energy budget
- Hydrological measurement for the last two years has been acquired to establish hydrological budget
- This glacier is almost free debris covered and it is expected that its mass balance change is closely related to climate changes.

30. Project No. 3903-1:

Principal Collaborators	
Prof. Narayanaswamy Srinivasan Molecular Biophysics Unit Indian Institute of Science Bangalore	Dr. Alexandre G. de Brevern INSERM UMR-S 665 University Paris Diderot - Paris 7 Dynamique des Structures et Interactions des Macromolécules Biologiques (DSIMB) Paris Cedex 15

Development of a public database named iPBA for multiple structural alignments of proteins with following salient achievements. 1. Best available approach to superimpose protein structures and the Protein Data Bank. 2. A **mulPBA: the webserver** on this approach is freely available to the scientific community 3. Useful approach to improve previously superimposed protein structures. 4. The extension of the approach to multiple structure superimpositions was excellent. 5. Analysis of protein – protein interactions with a structural alphabet which enabled proposition of allostery mediated by transient protein-protein interactions.

31. Project No. 3904-1:

Principal Collaborators	
Prof. Rupamanjari Ghosh School of Physical Sciences Jawaharlal Nehru University New Delhi	Dr. Fabien Bretenaker Laboratoire Aimé Cotton, CNRS Orsay

The main implications of this study would be in expecting the work on slow and fast light effect to result in an improvement of the sensitivity of some optical sensors such as gyrometers or magnetometers. This also has implications in the study of the fundamental noise limit in lasers containing strongly dispersive media. Furthermore, the work on the tripod system has just started and the existence of unexpected resonance paves the way for new fundamental studies and also possible applications to quantum information processes. Finally, two-frequency VECSELs are very interesting lasers for microwave photonics applications: further fundamental studies about noise correlations between modes and applied developments such as implementation of phase-lock loops are without any doubt very promising for societal benefit.

32. Project No. 3905-1:

Principal Collaborators	
Dr. Tushar Kanti Chakraborty Central Drug Research Institute Lucknow	Dr. Aloysius Harindra Siriwardena Laboratoire des Glucides (UMR CNRS 6219)

	Université de Picardie Jules Verne Amiens
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The project involves the studies on correlation of biological functions of structurally well-defined glycopeptides with their secondary structures that have been relatively sparse, despite the importance of such targets in the quest for carbohydrate-based therapeutics. Various carbohydrate appended Sugar Amino Acid (SAA) based foldamers have been synthesized as glycopeptides mimics for the inhibition of glycosyl hydrolases, lectins, glycosyl transferases. The compounds were further tested for their conformation preferences. Effect of the appended sugar moieties on the overall conformation of these glycopeptides mimics and its impact on their biological activities have been studied in details. The outcomes of the studies clearly demonstrated that the conformational changes arising due to glycosylation of the parent foldamers were essentially mirrored in their distinct and contrasting interaction with selected biological targets, proving the underlying importance of glycosylation on the structures and functions of glycopeptides.

33. Project No. 3907-1:

Principal Collaborators	
Dr. Atul Kumar Sahai Indian Institute of Tropical Meteorology Pune	Dr. Pascal Terray Laboratoire d'Océanographie et du Climat LOCEAN-IPSL UMR 7617 CNRS/ IRD/ UPMC/ MNHN Université Pierre et Marie Curie, CNRS, IRD Paris Cedex 05

The present project was an effort to improve the skills of dynamical extended and seasonal prediction of the Indian summer monsoon (ISM) Rainfall. This collaborative effort has benefited both the countries, in terms of monsoon rainfall forecasting and state-of-the art model availability for India, model improvement and information on the monsoon for France, and understanding of the monsoon processes in general for the scientists of both the countries. The results and understanding obtained from this project have also complemented to two important programs of Indian Institute of Tropical Meteorology – Seasonal and Extended Range Monsoon Prediction.

From a scientific perspective, the results obtained with the SINTEX-F2 coupled model concerning the simulation of monsoon-ENSO relationship highlight the need of a proper assessment of both temporal scale interactions and coupling strategies in order to improve current CGCMs. The project outcomes enhanced the experience and knowledge on various aspects of monsoon features and the challenging problems of its numerical simulation.

34. Project No. 3908-1:

Principal Collaborators	
Prof. R.C. Budhani Indian Institute of Technology Kanpur	Dr. Wilfrid Prellier Laboratoire CRISMAT-ISMRA CNRS-UMR 6508 Caen, Cedex

The goal of the project was to make a unique multifunctional spintronic device whose response can be modulated by electric field in a gated configuration, by light, and by small magnetic fields: The following were the Salient achievements of the project:

- a) Electron beam deposition of Ta₂O₅ dielectric films.
- b) Synthesis of V₂O₃ target/films after reduction of V₂O₅.
- c) Synthesis of NdNiO₃ films.
- d) Polarization microscopy of LPCMO films.
- e) High resolution electron microscopy, Lorentz microscopy and scanning tunnelling microscopy of LPCMO films.
- f) Electron transport in 2D electron gas at LTO-STO interfaces.
- g) Magnetocaloric effects study in superlattices and Mn₃O₄.

35. Project No. 4000-IT-1

Principal Collaborators	
Prof. Anurag Kumar Indian Institute of Science Bangalore	Dr. Eitan Altman INRIA sophia Antipolis Sophia-Antipolis

The technology focus in this project was in the emerging area of “ad hoc wireless networks,”

The usefulness of fluid limit models for a large number of interacting mobile wireless nodes; Control laws have been derived with these limit models, in a variety of settings, and shown that they work well for realistic size problems, and PIs have also provided a fundamental study of such limits themselves. Competitive and cooperative behaviour among wireless nodes, the use of game theoretic models, and the design of effective controls in such settings: for example, power controls in cellular systems; dynamic link scheduling when selfish users can misrepresent their channel conditions; spectrum pooling among cellular operators. Optimal control of wireless networks, using stochastic control formulations: such as the use of the asset selling problem in geographical packet forwarding in sensor networks; control of epidemic copying in mobile opportunistic networks. Problems involving game theory to model competition in networking that involves geometric properties. For example, in a problem of base station placement, this allowed PIs to discover non-intuitive behaviour such as an

equilibrium in which cells are not connected, that is there could be mobiles connecting to a given base station, whereas other mobiles even closer to that same base station may prefer not to connect to it.

36. Project No. 4000-W1:

Principal Collaborators	
Dr. V.M. Tiwari Gravity Group National Geophysical Research Institute Hyderabad	Dr. Jean François Cretaux Laboratoire d'Études en Géophysique et Océanographie Spatiales LEGOS-CNES Observatoire Midi-Pyrénées Toulouse

The objective of this project was to monitor land and water storage of the Indian continent using space gravimetry and satellite altimetry data. Use of GPS to generate data vital for flood management in future and food security.

Inundations and volumes of floods in two river basins namely Ganga and Indus were estimated as follows:

- 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

37. Project No. 4003-1:

Principal Collaborators	
Dr. Sanjeev Galande Indian Institute of Science Education and Research (IISER) Pune	Dr. Oliver Bischof INSERM U579 Unité d'Organisation Nucléaire et Oncogénèse Institut Pasteur Paris Cedex 15

The outcomes of this joint collaboration are as follows:

- Generation of primary fibroblast stably silenced for SATB1 expression, and, transcriptional profile of SATB1-silenced cells
- SATB1 expression profile in tumor cell lines and primary tumor samples
- Expression of SATB1 and SATB2 in primary and senescent fibroblasts at RNA and protein level;
- Expression of repressive histone modification mark H3K27 (me)³ in primary and senescent cells

- ChIP (Chromatin Immunoprecipitation) analysis of primary and senescent cells for occupancy of SATB family proteins

38. Project No. 4003-2:

Principal Collaborators	
Prof. P. Chakrabarti Department of Biochemistry Bose Institute Kolkata	Dr. Charles Robert CNRS - UPR 9080 Laboratoire de Biochimie Théorique Institut de Biologie Physico Chimique Paris

The project work involved creating datasets containing structures of protein-protein complexes and their individual components

a) New patterns were observed in side chain rotamer distributions in protein-protein complex interfaces compared to the free protein surfaces, suggesting previously unknown roles for sidechain conformation in biological recognition.

b) Several databases were created, including a structure-affinity database for correlating experimental binding affinities with structural data for known protein complexes; a database of homodimeric proteins including a subset known to dissociate under biological conditions, shown to have smaller and more loosely packed interfaces relative to the rest; and a database of >160 human hemoglobin tetramers that furnished new insights into our understanding of subunit interactions and allostery.

d) New dynamics analyses have been carried out to understand the roles of global collective movements of the protein and localized side-chain movements in the association reaction.

e) A new resource for data-mining, *Flexbase*, has undergone constant development and amelioration throughout the project. *Flexbase* allowed the centralization of hundreds of thousands of measurement results from structural analyses. This structured storage of the measurements permitted uniform access and facilitated comparison of structural and dynamical information as well as statistical exploration of new patterns in the data.

Patents have resulted from the project.

39. Project No. 4003-3

Principal Collaborators	
Dr. Sudip Chattopadhyay National Institute for Plant Genome Research Laboratory New Delhi	Prof. Serge Delrot Ecophysiologie et Génétique Fonctionnelle de la Vigne UMR INRA 1287 Université de Bordeaux 2, Villenave d'Ornon

This joint collaboration elucidates the following:

- Cloning of VvZBF1 genes and their use in transformation of Vitis.

- Expression studies in various Vitis samples in France.
- Use of VvZBF1 gene to transform Tomato/Arabidopsis and generation of transgenic plants in India.
- Use of VvZBF1 gene to transform Arabidopsis and generation of transgenic plants in India.
- Characterization of transgenic plants in India and France.

40. Project No. 4004-1:

Principal Collaborators	
Dr. Kumar Sankar Gupta Saha Institute of Nuclear Physics, Kolkata	Dr. Xavier Martin Laboratoire de Mathématiques et Physique Théorique Université de Tours Tours

This outcome of this project was that it is the very first study of scalar field theories in the background of a non-commutative BTZ black hole. It gives important clues about the behaviour of quantum fields at the Planck scale where quantum effects of gravity dominate the dynamics.

41. Project No. 4005-1:

Principal Collaborators	
Dr. Vidya S. Batra The Energy and Resources Institute New Delhi	Prof. Jean-François Lamonier Unité de Catalyse et de Chimie du Solides UME CNRS 8181 Université des Sciences et Technologies de Lille, University of Lille 1 Villeneuve d'Ascq Cedex

The joint project has contributed towards modification of wastes to obtain catalysts with high performances in Volatile Organic Compounds (VOC) removal. The separated carbon from bagasse fly ash has been imparted high surface area and good thermal stability. Red mud leached with oxalic acid offered a suitable iron rich solution for impregnation of the carbon support.

The project has successfully developed catalysts from two different wastes namely unburned carbon from bagasse fly ash and red mud waste produced during enrichment of bauxite ore. The project has contributed towards modification of wastes to obtain catalysts whose performance is comparable to commercial activated carbon. Based on promising results from this work, TERI has done some experiments on catalytic tar removal from biomass gasifier producer gas.

42. Project No. 4008-1

Principal Collaborators	
Dr. G. P. Kothiyal Glass & Ceramics Technology Section, TP&PED Bhabha Atomic Research Centre Mumbai	Prof. Lionel Montagne UMR 8181, ENS Chimie de Lille Université des Sciences et Technologies de Lille Villeneuve d'Ascq

These studies on oxygen isotope exchange measurements will contribute for a more general understanding of oxygen mobility in solid electrolytes which can be directly used for optimizing and tuning the effect of particle sizes in oxygen membranes in SOFCs along with helping in understanding the fundamental physics and chemistry aspects of oxide systems and in realizing new oxides for SOFC applications. Study has clearly shown that oxygen mobility can be achieved in nano-form at reduced temperature which is a good step in technological development of SOFCs.

43. Project No. 4008-2

Principal Collaborators	
Dr. Arun Umarji Materials Research Centre Indian Institute of Science Bangalore	Dr. Stéphane Gorsse ICMCB – CNRS, UPR9048, PESSAC Cedex,

The main objective of this work was to engineer the nano/microstructure of tellurides and silicides thermoelectric materials in order to enhance the thermoelectric performance in these systems. The outcomes of the projects are as follows:-

- a) A lamellar pattern of PbTe/GeTe at the nano- and microscale was produced in (Pb,Ge)Te alloy by the diffusional decomposition of a supersaturated solid solution.
- b) A nano/microstructure was generated in the FeSi₂ thermoelectric compound through the control of the eutectoid phase transformation present in this system.
- c) The grain structure in the CrSi₂ thermoelectric compound was refined via mechanical alloying in order to decrease the lattice thermal conductivity.
- d) The nanostructure genesis in as-melt spun and annealed ribbons of higher manganese silicide compounds was investigated.

44. Project No. 4100-IT-1

Principal Collaborators	
Prof. Dipankar Nagchoudhuri Dhirubhai Ambani Institute of Information and Communication Technology Gandhinagar	Dr. Amara Amara Institut Supérieur d'Electronique de Paris Paris

The objective of this project was to explore alternative device and circuit structures to the present bulk-CMOS for the 22nm technology node and beyond. The outcome of the project elucidates the following:

- Low power and fast adder implementation with sub-32-nm Double Gate MOSFETs
- Novel Differential sensing for 0.5-V sub-32 nm UTBB FD-SOI SRAMs
- A 110 MHz rail-to-rail opamp architecture
- A 0.7-V rail-to-rail voltage buffer
- Three novel SRAM cells and four different architectures supporting low voltage operation
- down to less than 0.5V (working for silicon proof with 28FD)
- Low Power and High Speed comparator with DG-MOSFET

45. Project No. 4101-1

Principal Collaborators	
Prof. Rekha P. Kulkarni Department of Mathematics Indian Institute of Technology Bombay Mumbai	Prof. Mario Ahues Laboratoire de Mathématiques de l'Université de St. Etienne, Saint-Etienne

The joint collaboration shed light on the following:

- 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

46. Project No. 4103-1

Principal Collaborators	
Dr. Purnima Bhargava Transcription and Chromatin lab Centre for Cellular and Molecular Biology Hyderabad	Dr. Olivier Gadal Equipe Organisation et Dynamique Nucleaire, LBME du CNRS, UMR 5099 CNRS-UPS Université Paul Sabatier Toulouse Cedex 9

The highlights of the joint collaboration are as follows:

- 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.

47. Project No. 4103-2

Principal Collaborators	
Prof. Valakunja Nagaraja Department of Microbiology and Cell Biology Indian Institute of Science Bangalore	Dr. Srinivas V. Kaveri Immunopathologie et Immunointervention Thérapeutique UMR S 872 INSERM – UPMC-Université Paris Descartes Centre de Recherche des Cordeliers Paris

The PIs of the joint collaboration have clarified the following through this joint study:

- 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-hydrolyzing antibodies in patients with SLE and in patients with scleroderma.

48. Project No. 4104-1

Principal Collaborators	
Prof. Rajeev K. Puri Department of Physics Punjab University Chandigarh	Prof. Joerg Ulrich Aichelin SUBATECH, UMR 6457 Ecole des Mines de Nantes Nantes Cedex 03

The joint study report elucidates the following:

- Showed that IQMD can reproduce isospin effects correctly.
- Suggested a stronger role of the neutron rich matter in reaction dynamics.
- Analysed role of model ingredients. Identified method to measure potential between kaons and nuclear matter

49. Project No. 4104-2

Principal Collaborators	
Prof. Prasanta Tripathi Department of Physics Indian Institute of Technology Chennai	Dr. Marios Petropoulos Centre de Physique Théorique Ecole Polytechnique Palaiseau

The highlights of the joint collaboration are as follows:

- Understanding of the role played by heavy fields (possibly stringy in origin) on the dynamics of cosmic microwave background observables.
- Understanding of the role played by stringy corrections to the N=2 supergravity theory in the stability of non-sypersymmetric attractors.
- Embedding Bianchi attractors in gauged supergravity and studying their stability.
- Computation of the primordial power spectrum in multi-field inflation.
- Generalization of the Geroch group in presence of cosmological constant.

50. Project No. 4105-1.

Principal Collaborators	
Prof. Amitabha Sarkar Department of Organic Chemistry Indian Association for the Cultivation of Sciences Kolkata	Prof. Michèle Salmain Chimie ParisTech (ENSCP) Laboratoire Charles Friedel (UMR CNRS 7223) Paris Cedex 05

Development of concepts which can be adapted for designing and developing nano-sized bio-chips for specific application. The objectives of the project were efficient methods to immobilize biomolecules on surfaces like gold or silica, for eventual

adaptation in bio-sensing, has been successfully accomplished. Fabrication of bio-chips rely on efficient, selective and mild methods to immobilize especially through covalent bond formation that leads to much greater stability and control of density of loading useful biological molecules that sense primarily through their biorecognition/ affinity attributes.

51. Project No. 4105-2.

Principal Collaborators	
Dr. J. S. Yadav Indian Institute of Chemical Technology Hyderabad	Prof. René Grée Université de Rennes 1/CNRS Laboratoire de Chimie et Photonique Moléculaire, CNRS UMR 6510 Rennes Cedex

The joint interdisciplinary project between chemistry and biology develop novel anticancer compounds. The PIs of the joint project have clarified the following through this joint study:

- Efficient strategised to access the target molecules in different series.
- Small chemical libraries of designed compounds.
- Preliminary biological screening validated some of our working hypotheses, affording first series of active analogues.
- The discovery of new chemical entities able to restore apoptosis selectively on cancer cells in a very promising new approach to anti-cancer drugs.

52. Project No. 4107-1

Principal Collaborators	
Dr. H. C. Upadhyaya Centre for Atmospheric Sciences Indian Institute of Technology New Delhi	Dr. Frédéric Hourdin Laboratoire de Meteorologie Dynamique UMR 8539-CNRS/UPMC Paris

The project goal is to develop a comprehensive and complete weather model that can cater the needs of the present times. The outcome of the project elucidates the following:

A dynamical core equipped with MPI capability of parallel execution was 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.

53. Project No. 4108-1

Principal Collaborators	
Prof. M. S. Ramachandra Rao Centre and Materials Science Research Centre Indian Institute of Technology Chennai	Prof. Werner Paulus Matériaux Inorganique: Chimie douce et Réactivité Université de Rennes 1 UMR 6226-CNRS Rennes

The project aim was to synthesis and characterization of brownmillerite $\text{CaFeO}_{2.5}$ in bulk and nano forms. The joint work elucidates the following:

Brownmillerite compound $\text{CaFeO}_{2.5}$ was synthesized in nano form for the first time. Various characterization tools such as XRD, HRTEM, HRSEM, and Raman were performed and the results were been compared with bulk $\text{CaFeO}_{2.5}$. Oxygen isotope exchange reaction of bulk and nano $\text{CaFeO}_{2.5}$ confirmed that the for nano- $\text{CaFeO}_{2.5}$, oxygen diffusion sets in at 320°C , which was much lower than that of bulk sample (450°C). The temperature where oxygen diffusion sets was found to decrease with particle size. High resolution Transmission electron microscopic (HRTEM) studies showed that the reason for this low temperature oxygen diffusion in nano $\text{CaFeO}_{2.5}$ was due to the presence of high density of planar defects (antiphase boundaries) compared to bulk and based on this a model was proposed to explain the low temperature oxygen diffusion in nano $\text{CaFeO}_{2.5}$. Phase pure Brownmillerite $\text{SrFeO}_{2.5}$ was synthesized for the first time by sol-gel (Pechini) method. Also, it was found that nano $\text{CaFeO}_{2.5}$ could be oxidized in large quantities to CaFeO_3 by low temperature solid-gas reaction using ozone. Stoichiometric CaFeO_3 compound was synthesized in nano form via ozone oxidation of nano- $\text{CaFeO}_{2.5}$ for the first time and it was found that it showed cluster-glass behavior compared to reported antiferromagnetic behaviour for bulk- CaFeO_3 compound.

A MoU was signed from both sides with an aim to develop a common curriculum for a Materials Science Master Course. It is to create a real partnership according to the Humboldt principle to unify research and teaching.

54. Project No. 4109-1

Principal Collaborators	
Prof. Mallayan Palaniandavar School of Chemistry Bharathidasan University Tiruchirappalli	Prof. Jean-Marc Latour Institut de Recherches en Technologies et Sciences du Vivant iRTSDV/LCBM/PMB UMR 5155 CEA-CNRS-UJF CEA- Grenoble, Grenoble

This project aimed at probing PerR mechanism at the molecular level by combining chemical (model studies), biochemical (protein chemistry) and biophysical (molecular spectroscopy) approaches. Through various studies on this joint project, several 5N, 4N, 2N2O ligands proposed have been isolated and characterised successfully. Other outcomes are as follows:

- 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 (new biomimetic) 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.

55. Project No. 4200-1T

Principal Collaborators	
Prof. Sivaji Bandyopadhyay Computer Science and Engineering Department Jadavpur University Kolkata	Dr. Patrick Saint-Dizier Institut de Recherche en Informatique du Toulouse, IRIT UMR 5505 CNRS- INPT-UPS-UT1 Toulouse Cedex 9

The collaboration has increased the knowledge in the area of advanced question answering so that it could be customized to a variety of domains.

- a) Prototype development of a Procedural QA system (Cooking Recipe domain) and a How-to QA system.
- b) Prototype development of a Comparative and Evaluative QA system (Tourism domain).
- c) Work on Multi document summarization by the Indian JRF leading to research publications.
- d) Participation from the Indian side in the following Evaluation tracks: ResPubliQA (at CLEF 2010, 1st position in Answer Selection task) and Question Answering for Machine Reading Evaluation (QA4MRE) at CLEF 2011 and CLEF 2012 and have got the first position in both the years.
- e) Development of a grammar dedicated to explanation (in QA) and its implementation on the TextCoop platform

56. Project No. 4204-1

Principal Collaborators	
Dr. Mahesh S. Tirumkudulu Department of Chemical Engineering Indian Institute of Technology-Bombay Mumbai	Prof. Peter J Schmid Laboratoire d'Hydrodynamique (LadHyX) Ecole Polytechnique Palaiseau

The project was to study of the response behavior to external excitation (of a harmonic as well as stochastic type) and into an investigation where an acoustic field is tailored to best achieves a user-defined cost objective. The outcome of the project elucidates the following:

- A novel experimental technique to measure the film thickness variation down to a few microns.
- A new stability theory to show that a radially expanding liquid sheet is unstable even in the absence of the surrounding gas.
- A preliminary computer code using the boundary element method to simulate liquid sheet formation and sheet break-up
- A Preliminary code using Gerris® software to simulate the sheet formation and sheet break-up.
- A vortex-particle based method to track the interface explicitly under the effects of induced velocity and surface tension.

57. Project No. 4204-2

Principal Collaborators	
Prof. Balasubramanian R. Iyer Raman Research Institute Bangalore	Dr. Luc Blanchet Institut d'Astrophysique de Paris Gravitation et Cosmologie (GReCO) Paris

The major objective of this project was the construction of the dominant spherical harmonic modes 1122 and 1133 to $3.5PN$ and $3PN$ orders respectively. All this would pave the way to $3.5PN$ accurate templates for numerical relativity and GW data analysis.

- Developed a new and efficient PNComBin package based on xTensor for PN computations and validated it systematically with all relevant available results based on MathTensor .
- Identified an efficient strategy to obtain the dominant mode of the waveform at $3.5PN$ order.
- Computed the $3.5PN$ accurate mass quadrupole and the $(2,2)$ mode of GW polarization.
- Computed tail terms in canonical and source moments up to $3.5PN$ for general sources.

- Computed tail-of-tail integrals and their contributions to the mass octupole and current quadrupole at 3.5PN.
- Checks in progress for the computation of the mass octupole. This will allow subsequent computation of the $l=3$ modes

58. Project No. 4205-1:

Principal Collaborators	
Dr. Jitendra K. Bera Department of Chemistry Indian Institute of Technology Kanpur Kanpur	Dr. Henri Doucet Institut Sciences Chimiques de Rennes UMR 6226 CNRS- Université de Rennes "Catalyse et Organometalliques" Rennes

The central theme of this project was cooperative bimetallic catalysis and it aimed to utilize bimetallic compounds in organic transformations. The outcomes of the joint study highlight the following:

- The cooperative bimetallic catalysts having higher reactivity and better selectivity. A diruthenium(I) compound has been shown to catalyze aldehyde olefination reactions effectively.
- A set of diruthenium(I) compounds with NHC ligands are shown to catalyze carbene-transfer reactions.
- Palladium-catalyzed direct arylation of thiophenes or arenes bearing SO_2R 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

59. Project No. 4208-1:

Principal Collaborators	
Dr. Satish Patil Solid State and Structural Chemistry Unit Indian Institute of Science Bangalore	Dr. Jean-Louis GALLANI IPCMS-DMO Strasbourg Cedex 2

This project was directed towards the development of low-to-medium temperature (60-200°C) fuel cell proton conducting membrane electrolytes, and polar liquid crystalline materials. The new knowledge generated through the joint work is as follows:

- Development of synthetic procedures for the preparation of fullerene derivatives for use in energy devices.
- Synthesis and Characterization of penta-adducts of fullerenes.
- Preparation of Langmuir-Blodgett (LB) films from fullerene derivatives and study of the film morphology by AFM probe.

- Preparation of Nafion Composite Membrane with Fullerene derivatives.
- Measurement of conductivity and performance of the membrane.

60. Project No. 4208-2

Principal Collaborators	
Prof. Vikram Jayaram Department of Materials Engineering Indian Institute of Science Bangalore	Dr. Fabrice Dassenoy University Institute of France Laboratory of Tribology and System Dynamics Ecole Centrale de Lyon (ECL) ECULLY Cedex

The project was based on designing and development of environment friendly and eco compatible nano-lubricant additives with low friction, surface protecting, improved thermal and oxidative properties for addressing the industrial problems related to functionality, reliability and lifetime of machinery, engines and transmission and the control of manufacturing process. The PIs of the joint project have shed light on the following through this joint study:

- Layered MoS₂ single particles deform by interlayer slip, registering a low coefficient of friction. When the particles are allowed to agglomerate the mechanism of deformation is by plowing where the response is isotropic plasticity.
- Single (crystal) MoS₂ particles when slid in reciprocating tribology form a coherent 30-50nm tribofilm on steel substrate which aids in yielding a low coefficient of friction. Such a tribofilm does not form if the particles used are agglomerates, the coefficient friction is high in the case. tribometer was designed, fabricated and commissioned to yield high resolution dynamic Images and phase shifts insitu (during triboexperiments). The early phases of tribofilm formation was observed for the first time in high resolution.
- Cold rolling mills were modeled using classical mechanics and Finite element Analysis. Friction maps to set the limitations of the mills in rolling with nanoparticles in aqueous suspension were constructed to help industry to exploit aqueous lubrication in metal working.
- Dispersion and stability of nanoparticle suspension in liquid lubricant

61. Project No. 4300-IT-1

Principal Collaborators	
Prof. Santanu Mahapatra Centre for Electronics Design and Technology Indian Institute of Science Bangalore	Prof. Costin Anghel Institut Supérieure d'Electronique de Paris (ISEP) Paris

The project involves the development of compact models for the electrostatics of asymmetric DG Transistors.

The joint collaboration elucidates the following:

- 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).

62. Project No. 4301-1:

Principal Collaborators	
Dr. Mahan Mj School of Mathematical Sciences Ramakrishna Mission Vivekananda University Dt Howrah West Bengal	Dr. Jean Pierre Otal Université Paul Sabatier Institut de Mathématiques de Toulouse Toulouse

Through this joint project, PIs have described the structure of Cannon-Thurston maps in details in terms of the ending laminations and proved the existence of combinations theorems. Studied the lines of minima of Steven Kerckhoff which are defined as the set of points $s(t)$ in the Teichmuller space $T(S)$ where the lamination $l+t'$ has shortest length when t varies over the positive reals. Extended the theorem of bonahon on the quasi-fuchsian. and pattern rigidity theorems for hyperbolic groups, pattern rigidity in lattices in real hyperbolic space

63. Project No. 4303-1:

Principal Collaborators	
Prof. K. S. Rangappa Karnataka State Open University(KSOU) Mysore	Dr. Tangui Maurice Team II <i>Endogenous Neuroprotection in Neurodegenerative Diseases</i> INSERM U 710 Université Montpellier Montpellier

The PIs have designed and synthesized novel heterocyclic derivatives of arecoline through a one pot synthesis process for their potential use as selective M1 agonists for the treatment of AD. The arecoline derivatives were screened for their M1 receptor agonist activity. However, experimental details of the compounds screened and their

relative activity have not been reported. The neuro-protective activity of the new arecoline derivatives was evaluated in a non-transgenic mouse model wherein Alzheimer's disease was induced by intra cerebral injection of oligomeric A β ₂₅₋₃₅ peptide (9 nmol). Mice were treated intraperitoneally with arecoline thiazolidinone (AT), 3-morpholino arecoline thioamide (MAT) and 3-morpholino arecoline amide (MAA), in the 0.01-1 mg/kg dose range. After one week, learning and memory deficits were tested by tests like spontaneous alternation, passive avoidance and novel object recognition. Mice were sacrificed and the levels of lipid peroxidation (index of oxidative stress) and choline acetyltransferase activity (ChAT) (index of cholinergic functionality) were analyzed in the hippocampus of the mice. AT and MAT showed significant efficacy in preventing the A β ₂₅₋₃₅ deficits at 0.3 and 0.1 mg/kg, respectively, whereas the activity of MAA was much less. All the derivatives have not yet been published and need to be protected by filing suitable patent applications. The Arecoline derivatives hold good potential for exploring transfer to suitable companies for further development and commercialization.

64. Project No. 4304-2

Principal Collaborators	
Prof. Raghunathan Srianand Inter-University Centre for Astronomy & Astrophysics, Pune	Prof. Patrick Petitjean Institut d'Astrophysique de Paris Paris

A major goal of observational cosmology is to find answers to questions such as the progression of star-formation. The joint collaboration shed light on the following:

- 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.
- Reported the discovery of a double hump Lyman-alpha emission line from a high redshift damped Lymanalpha system using X-shooter observations
- Reported the first case of variable Fe fine-structure absorption in a low ionization BAL QSO.
- Reported the first detection of Diffuse Interstellar Bands (DIBs) from a low-z QSO galaxy pair.

65. Project No. 4305-1:

Principal Collaborators	
Dr. M. V. Badiger National Chemical Laboratory Pune	Prof. Dominique Hourdet Laboratoire de Physico-Chimie des Polymères et des Milieux Dispersés UMR 7615 UPMC-CNRS, ESPCI Paris

The study focused on novel associating polymers and hydrogels based on polysaccharides. The outcome of this joint project is as follows:

a) New thermo-thickening polymers based on bio-resource materials such as Guar gum and Xyloglucans were synthesized and characterized using state-of-the-art techniques. These polymers showed promising applications in drug delivery as injectable systems.

b) Hydrogel based on polysaccharide namely, Tamarind Kernel Powder (TKP) was synthesized using Divinyl sulphone as a crosslinking agent. The properties in terms of swelling and mechanical strength were studied. The ion-conducting channels based on these hydrogels were designed and characterized. These gels can have applications in neural interface.

c) Self-recovering hydrogel based on IPNs of PHEMA and PEG was synthesized and their mechanical recovery was investigated. The confined mineralization of hydroxy apatite in these hydrogels was studied which showed potential applications in acute bone injury.

d) Double Network (DN) hydrogels based on hyaluronic acid (HA) and PHEMA were prepared and characterized in terms of swelling and mechanical properties.

e) High mannuronic alginates were grafted with LCST side-chains. Their viscoelastic behavior in aqueous media demonstrated antagonistic thermoresponsive property with an original gel-sol-gel transition that can be finely tuned with added salts.

f) New rheological behaviours of hyaluronan have been revealed by adding various potassium salts at different pH. The grafting of LCST stickers on hyaluronan paved the way to a large panel of viscoelastic properties in aqueous media that can be finely tuned or triggered by environmental parameters like temperature, pH, and nature of salt or concentration

(Some new hydrogels based on Polysaccharides of Indian origin namely Guar gum and Xyloglucan have been developed. However, these hydrogels need to be further evaluated for their biomedical applications. Knowledge generated on the new injectable polymers based on biocompatible polysaccharides can be used in pharmaceutical industries).

66. Project No. 4404-1

Principal Collaborators	
Prof. Susanta MAHAPATRA School of Chemistry University of Hyderabad Hyderabad	Prof. Pascal HONVAULT Institut UTINAM UMR CNRS 6213 UFR Sciences et Techniques Université de Franche-Comté Besançon Cedex

Salient features of this joint work are as follows:

- The potential energy surfaces of the electronic ground state of S + O 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.
- Time-independent 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.

67. Project No. 4404-2

Principal Collaborators	
Prof. Rajeev S. BHALERAO Tata Institute of Fundamental Research Mumbai	Prof. Jean-Yves Ollitrault Institut de physique théorique CEA Saclay Gif-sur-Yvette Cedex

The project was devoted to theoretical studies in close relation with the experimental programme of the LHC at CERN that included acceleration and collisions of beams of Lead nuclei, at energies about 15 times larger than those at the Relativistic Heavy-Ion Collider (RHIC) at Brookhaven. These collisions produce a phase of matter named the Quark-Gluon Plasma (QGP). A complete set of multiparticle correlation observables for ultra-relativistic heavy-ion collisions is presented. These include moments of the distribution of the anisotropic flow in a single harmonic, and also mixed moments, which contain the information on correlations between event planes of different harmonics. A guide to the principal component analysis method and its application to multiplicity fluctuations and anisotropic flow, using ALICE data and simulated events are presented. In particular, elliptic and triangular flow fluctuations as a function of transverse momentum and rapidity were studied. This method reveals previously unknown subleading modes in both rapidity and transverse momentum for the momentum distribution as well as elliptic and triangular flows.

Quark-Gluon Plasma has been discovered and the experiments provide a strong support to hydrodynamics as the appropriate effective theory for relativistic heavy-ion collisions.

68. Project No. 4404-3

Principal Collaborators	
Dr. Yogesh Wadadekar National Centre for Radio Astrophysics TIFR Pune	Dr. Alexandre Beelen Institut d'Astrophysique Spatiale Université Paris-Sud XI Orsay Cedex

The present work combined far infrared data from the European Herschel space telescope with the Giant Meter wave Radio Telescope in India to study a number of problems in the overall context of understanding distant, obscured galaxies. The outcome of study resulted in observation of the radio-far infrared (FIR) correlation, Spectral Energy distribution (SED) modelling and identification and segregation of obscured galaxies and AGNs.

69. Project No. 4405-1:

Principal Collaborators	
Prof. Sundargopal Ghosh Indian Institute of Technology Madras Chennai	Prof. Jean-François Halet Sciences Chimiques de Rennes UMR 6226 CNRS-Université de Rennes 1 Rennes Cedex

Experimental chemical synthesis work, made in India has led to the characterization of a series of dimetallaboranes. The salient features of this joint collaboration are as follows :

- Theoretical calculations were carried out at Rennes at the density-functional theory level to complement the experimental studies, allowing to understand the electronic and structural properties of these new species. Synthesis and theoretical study of new hypoelectronic metallaboranes of formula $(Cp^*TaX)_2B_5H_{11}$ ($X = F, Cl, Br, I$) and $(Cp^*Ta)_2B_4H_8I(\mu-BH_4)$.
- Synthesis of first open-cage hypoelectronic 11-vertex tantalaborane that possesses a nido geometry based onicosahedron 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.

70. Project No. 4408-1:

Principal Collaborators	
Dr. Sameer Khandekar Indian Institute of Technology Kanpur Kanpur (UP)	Prof. Jocelyn Bonjour Institut National des Sciences Appliquées de Lyon (INSA Lyon) Centre de Thermique de Lyon (CETHIL) Villeurbanne

The project aimed at understanding thermo-hydrodynamic transport and response of interfacial flows in micro-miniscale geometries under different boundary conditions as

applicable to heat pipes, by using state of art experimental techniques of High Speed Videography (HSV), Infra-red thermography (IRt) and Particle Image Velcimetry (PIV). All experimental setups originally planned, were fabricated, validated and extensively used.

The major outcomes are as follows:

- Complementarity studies resulted in profound impact on understanding of the transport mechanisms of Taylor slugs/ Taylor bubbles.
- State-of-the-art results were obtained, with HSV, IRT and PIV techniques.

The project was taken forward through the Industry Academia R&D Programme of CEFIPRA.

71. Project No. 4409-1:

Principal Collaborators	
Dr. Tapati Dutta Department of Physics St. Xavier’s College Kolkata	Dr. Philippe Gouze Geosciences Research Unit Université de Montpellier Montpellier Cedex 5,

The outcomes of the project are as follows:

- 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).

72. Project No. 4500-W1

Principal Collaborators	
Prof. Rajiv Sinha Indian Institute of Technology Kanpur	Prof. François Métivier Université Paris Diderot & Institut de Physique du Globe de Paris UFR STEP, Paris Cedex 05

The project was to study the dynamics of alluvial fan building and evolution with a special emphasis on avulsion dynamics. New knowledge generated through this joint study is as follows:

- Understanding of fundamental controls on river morphology particularly in terms of multi-thread systems
- Understanding of pre-historic river dynamics from alluvial architecture
- Development of novel method for discharge estimation through satellite images
- Development of criteria for avulsion threshold based on morphological characteristics
- Understanding of evolutionary processes for fan development

The architecture of the Kosi fan and the provenance of its sediments are now known with a good level of precision due to this project. Experiments and theories have provided a framework to understand the quasi-statics of fan building. Experiments, theories and field tests on the Kosi and other Indo-Gangetic rivers have provided a framework to understand the quasi-statics of river morphologies.

73. Project No. 4502-1

Principal Collaborators	
Prof. P. S. V. Nataraj Systems and Control Engineering Group Indian Institute of Technology Bombay Mumbai	Dr. Frédéric Goualard Laboratoire d'Informatique de Nantes-Atlantique Université de Nantes, LINA UMR CNRS 6241Nantes Cedex 1

For development of applications in science and engineering it is necessary to design a robust multi-variable control system by using Quantitative Feedback Theory QFT and tools of Interval Constraint Satisfaction Techniques (ICST). Under the project an automatic loop shaping tool for design of robust controllers and filters has been developed. The tool has been applied to some practical real-world problems, such as DC motor and magnetic levitation systems. It is found that the developed tool successfully generates controllers and filters that are more optimal compared to existing methods. Design and implementation of an interval constraint solving platform with local/global optimization in C++ and interface to/from Matlab is the highlight of the joint work. Designing of an optimization-based method to combine the design of controllers and prefilters in one step, instead of the classical two steps with backtracking.

74. Project No. 4503-1

Principal Collaborators	
Dr. Ullas Kolthur Seetharam Tata Institute of Fundamental Research	Dr. Anne Gonzalez de Peredo Institut de Pharmacologie et de Biologie

Mumbai	Structurale, CNRS Universite de Toulouse Toulouse, Cedex 4
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This project was aimed at identifying novel Sirt1 interacting partners from mouse testis using proteomic approaches. The outcome of the joint collaboration is as follows:

- Transfer of DNA plasmid vaccine and its evaluation in a mouse model
- Identified novel isoform of Sirt1 based on MS/MS analyses
- Performed high throughput analyses and identified novel Sirt1 interacting proteins (both full length and delta-E2 isoforms) from cells in culture and from tissues
- Identified novel interacting proteins of Sirt4
- Standardised and established methodologies to analyse acetyl-proteome of cells and tissues
- Unravelling the role of acetylation in regulating CDK1 functions in cell cycle progression

75. Project No. 4503-2:

Principal Collaborators	
Dr. Vikram Mathews Department of Haematology Christian Medical College Vellore	Prof. Christine Chomienne Hopital Saint Louis Institute of Universitaire Hématologie Paris

The project overall goal was to study the effects of novel agents used in treatment of APL on immune response through preclinical studies in mice models. The outcomes of the efforts of the research teams have demonstrated the following achievements.

- Development of plasmid based vaccine for promyelocytic leukemia.
- Demonstrated the synergistic effect between all- transretinoic acid (ATRA) and a DNA plasmid vaccine in a mouse model of leukemia.
- Demonstrated the absence of synergy with this vaccine when ATO was used as a single agent.
- Demonstrated *in-vitro* the upregulation of NK cell receptors and ligands on malignant promyelocytes in a direction that enhances NK cell mediated cytolytic activity against malignant promyelocytes.
- First time demonstrated the presence myeloid derived suppressor cells(MDSC) in patients with acute leukemia.
- Successfully transferred the mouse model of leukemia and the use of DNA plasmid vaccine to laboratory and considerably increased institutional ability to further pursue research in leukemia.

76. Project No. (4504-1)

Principal Collaborators	
Prof. Kedar Damle Tata Institute of Fundamental Research Mumbai	Dr. Fabien Alet Laboratoire de Physique Théorique IRSAMC , Université Paul Sabatier Toulouse Cedex 4

This project has led to a much deeper understanding of an important class of variational wave functions, namely the Resonating Valence Bond (RVB) wave functions for spin liquids, including the idea that underlying such spin liquid wave functions is an interacting dimer model. It has also provided the first unequivocal demonstration that the transition from Neel order to columnar valence bond solid order on the honeycomb lattice is of the deconfined type in spite of the nearly marginal nature of the three-fold anisotropy in the phase of the valence bond order parameter. In addition, this collaboration has led to the development of a new algorithm that allows for large-scale QMC simulations of an interesting class of frustrated antiferromagnets.

77. Project No. 4505-1:

Principal Collaborators	
Dr. K. V. Radhakrishnan Chemical Sciences and Technology Division National Institute for Interdisciplinary Science and Technology Thiruvananthapuram	Prof. Jan Szymoniak Université de Reims Champagne-Ardenne (URCA) ICMR-CNRS UMR 6229 Reims Cedex 2

Noticeable features of this joint collaboration are as follows:

- Synthesis and reactivity of first metallocenefulvene complexes. Straightforward lewis acid catalysed transformation of fulvenes to polycyclic compounds.
- 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 metallocene-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 alkylidene cyclopentenenes.
- The compound generated under the projects has commercial potential after validation.

78. Project No. 4507-1in

Principal Collaborators	
Prof. Asoke Kumar Sen Department of Physics Assam University Silchar	Dr Robert Botet Laboratoire de Physique des Solides CNRS UMR 8502- Université Paris-Sud Orsay Cedex

The prominent work of this joint work was as follow:

PIs obtained a set of fully-controlled data about light scattering by four cometary-coma dust. Some asteroids were observed and data on some previously observed asteroids were analysed during the project. Results on the optical features of five generic dust particle models allowed defining conditions in which the simple coated sphere model can be used as a good approximation. This gives practical shortcut to obtain the optical characteristics of the light scattered by astrophysical dust particles, saving heavy numerical calculations in a number of applications. It was concluded that large slow particles exist in the inner coma and fragment into smaller particles under sublimation process.

79. Project No. 4508-1:

Principal Collaborators	
Dr. Kaustubh R. S. Priolkar Department of Physics Goa University Goa	Dr. Aurélie Bessiere Laboratoire de Chimie de la Matière Condensée de Paris LCMCP-ENSCP (Chimie ParisTech) CNRS UMR 7574 Paris Cedx 05

The new knowledges generated in this project are as follows

- Developed new long lasting phosphorescence (LLP) materials, $\text{ZnGa}_2\text{O}_4:\text{Cr}_{3+}$ and $\text{MgGa}_2\text{O}_4:\text{Cr}_{3+}$ suitable for bioimaging.
- These materials show excellent LLP not only with X-rays or UV excitation but also with visible light excitation
- This has a great implication in bioimaging as the biomarker can now be re-excited from within the animal body thereby enhancing the detection time.
- 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.
- Presence of Cr-O-Cr linkages (Cr clusters) however, is detrimental to observation of visible light induced persistent luminescence.

80. Project No. 4601-1:

Principal Collaborators	
Dr. Baskar Sambandam Department of Mathematics Indian Institute of Technology Bombay Mumbai	Prof. Régis Marchiano Institut Jean Le Rond d'Alembert – UMR UPMC/CNRS 7190 Université Pierre et Marie Curie (Paris 6) Paris Cedex 05

The aim of this project was to develop a new numerical solver for the propagation of acoustical shock waves in complex geometry, which has been developed. The following outcomes were achieved:

- Theoretical formulation of the problem (1D and 2D)
- Study of different numerical methods (CSQI, FD and DG): selection of the DG method
- Development of a new method of artificial viscosity to manage acoustic shock waves
- Development of a software for 1D and 2D problems involving shock waves in complex geometry
- The software works on Graphics Processing Units (GPU).

The numerical solver has been validated by comparisons between numerical results and standard configurations.

81. Project No. 4601-2:

Principal Collaborators	
Prof. J. Sengupta School of Mathematics Tata Institute of Fundamental Research Mumbai	Prof. Jie Wu Institut Elie Cartan University Henri Poincare-CNRS- INRIA. Vandœuvre Nancy Cedex

The theme of the project was to study the analytic aspects of the theory of modular forms, in particular the study of the L functions of modular forms. The latter was undertaken in the case of Siegel cusp form of genus two in the case of the spinor zeta function. The other highlights of the joint project are as follows:

- Results on sign changes in short intervals of coefficients of spinor zeta function of a Siegel cusp form of genus two.
- Results on sign changes in short intervals of coefficients of spinor zeta function of a siegel cusp form of genus two.

- Results on sign changes of Hecke eigenvalues of siegel cusp form of genus two.
- Many projects resulted out of this collaboration

82. Project No. 4603-1:

Principal Collaborators	
Dr. Sagar Sengupta National Institute of Immunology New Delhi	Prof. Gaëlle Legube Chromatin and DNA repair group Laboratoire de Biologie Moleculaire et Cellulaire du Controle de la Proliferation LBCMCP-CNRS UMR 5088 Toulouse

The result of the joint collaboration are following:

- Demonstrated that BLM and H2AX are present at the double strand breaks (DSBs) upon DNA damage induction in U2OS-AsiSI-ER cells Provided evidence that BLM and H2AX are present in a chromatin bound complex at the sites of double stand breaks
- Successfully carried out the genome-wide recruitment of BLM following DNA damage Carried out validation of BLM recruitment at DSBs. Determined the effect of BLM depletion on resection.
- Carried out the cell synchronization studies to determine the recruitment of BLM at the DSBs at different phases of the cell cycle
- Demonstrated the recruitment of BLM in S and G1 phase of the cell cycle Shown how BLM interacts with different repair machineries in S and G1 phase of the cell cycle. Provided evidence that the recruitment of BLM to the site of damage depends not on ATM but on MRN complex
- Mechanistically shown that the interaction between BLM and MRN complex regulates its recruitment to the DSBs

83. Project No. 4603-2:

Principal Collaborators	
Prof. Amitabha Chattopadhyay Centre for Cellular & Molecular Biology Hyderabad	Dr. Laurence Salomé Institute of Pharmacology and Structural Biology University Paul Sabatier – CNRS UMR 5089 Toulouse Cedex 04

A new stable cell line has been established, expressing a serotonin mutant which can be labelled on its extracellular side using antibodies. The Indian collaborator has been trained to Single Particle Tracking experiments and advanced analysis of the trajectories. The following are the salient achievement of the projects which are production of a HEK cell line expressing His-Myc-5HT_{1A} receptor, validation of the full functionality of the expressed receptors; pharmacological responses of serotonin

receptors in basal state; under cholesterol depletion and destabilization of actin; SPT analysis of the Transferrin receptor as a non raft reference, SPT analysis of serotonin receptors in basal state, under cholesterol depletion and destabilization of actin cytoskeleton.

84. Project No. 4604-1:

Principal Collaborators	
Dr. Sudip Bhattacharyya Tata Institute of Fundamental Research Mumbai	Dr. Didier Barret Centre d'Etude Spatiale des Rayonnements CNRS Toulouse Cedex 4

The noticeable highlight of the project is as follows:

- Developed innovative analysis tools to measure energy dependent phase lag, rms and covariance spectra, and associated spectral decomposition. These tools have been successfully applied for the RXTE satellite data. More specifically, these tools have been applied for the lower kHz QPO from a source 4U 1608522, and for both the lower and upper kHz QPOs from another source 4U 172834.
- Developed a code to semi theoretically model the above mentioned kHz QPO properties. This code uses the realistic spectral models, and hence provides an excellent way to connect the spectral and timing properties. The outputs of this code are now being compared with the data provided by the French collaborator in order to understand the kHz QPO properties.

85. Project No. 4604-2

Principal Collaborators	
Dr. C P Safvan Inter University Accelerator Centre New Delhi	Dr. Amine Cassimi CIMAP Laboratory Centre de Recherche sur les Ions, les Matériaux et la Photonique Caen Cedex 5

The joint collaboration developed beams of slow highly charged ions, and characterize them. In addition to that the following were done:

- Simulations for extraction of fragment ions formed in the collisions of such highly charged ions have been conducted.
- Several experiments on ion molecule collisions have been conducted and data analysis is in progress.

86. Project No. 4604-3

Principal Collaborators	
Dr. Sanjib Sabhapandit Raman Research Institute Bangalore	Dr. Alberto Rosso Laboratoire de Physique Théorique et Modèles, Statistiques Université Paris Sud Orsay

The outcome of the project elucidates the following:

- Resetting phenomena: Studied the dynamics of a fluctuating interface subject to constant resetting to its initial condition and demonstrated that at long times it evolves into novel nonequilibrium steady states. The physical properties of such a nontrivial steady state are characterized analytically.
- Memory and Aging dynamics in polymer and interfaces: It is shown that in extended systems, such as polymers or fluctuating interfaces, the memory of the initial state is lost only after an infinite time. Power laws and non-monotonic behaviours characterize the time evolution of these objects ubiquitous in biological and physical systems.
- Rare events and disordered dynamics: It is shown that the particle diffusion on strongly correlated events is affected by the occurrence of very rare and very relevant disordered configurations that obscure the typical behaviour of the system.

87. Project No. 4605-1

Principal Collaborators	
Dr. Prasenjit Ghosh Department of Chemistry Indian Institute of Technology Bombay Mumbai	Prof. Christophe Darcel Université de Rennes1 UMRCNRS-UR16226, «Sciences chimiques de Rennes», Equipe «Catalyset Organométalliques» Rennes

The project is an exploratory study on new synthetic routes to develop metal-NHC complexes (iron N-heterocyclic carbene complexes) of achiral and chiral imidazole and benzimidazole based NHC ligands, and the nickel complexes of 1,2,4-triazole derived amido-functionalized NHC ligands. The Fe-NHC complexes were used in the hydrosilylation of aldehydes and ketone substrates and the Ni-NHC complexes were used in the hydrosilylation reactions of aldehydes and ketones and the borylation reaction of aryl bromide substrates. **The patentability potential has been published by the PIs. (BCIL report)**

88. Project No. 4608-1:

Principal Collaborators	
Prof. B.V. Venkatarama Reddy Department of Civil Engineering Indian Institute of Science Bangalore	Dr. J. C. Morel DGCB Ecole National des Travaux Publics de l'Etat Vaulx en Velin Cedex Lyon

The outcomes of the joint collaboration are follows:

- Development of methods for designing new building and promoting new construction guidelines. Developing stress reduction factors accounting for the slenderness and eccentricity of loading for cement stabilised rammed earth wall elements is partly completed.
- Developing a shear test device devoted to rammed earth wall elements is completed. The mechanical parameters obtained with this test will be useful for the design of rammed earth walls against horizontal loads in the code of practice on rammed earth.
- Specimen slenderness effect on compressive strength of cement stabilised rammed earth (CSRE) was examined by testing large number of wallettes for height to thickness (h/t) ratio ranging from 2 to 6 in a displacement controlled test rig.
- Demonstrated that compressive strength is not sensitive to h/t ratio in the range of 2 to 6 and therefore the characteristic compressive strength of CSRE can be assessed using cylindrical or prism specimens having h/t ratio of 2.

89. Project No. 4608-2:

Principal Collaborators	
Prof. U.V. Varadaraju Indian Institute of Technology Yeddumailaram Andhra Pradesh	Dr. Valerie Pralong Laboratoire CRISMAT ENSICAEN, CNRS Caen

The PIs of this joint project shed light on the following:

- Development of new compounds for use in energy storage devices.
- Discovering of new structures synthesized based on transition metal phosphate, new phases as electrode material for Na ion batteries:
 - $\text{NaFe}_3(\text{SO}_4)_2(\text{OH})_6$
 - TiOSO_4

- LiTiOPO₄
- barbosalite Fe₃(PO₄)₂(OH)₂
- Lipscombite with complete iron(III) Fe₃[PO₄]₂O(OH)
- iron fluorides FeF₃·0.33H₂O, FeF₃·0.5H₂O

90. Project No. 4704-1:

Principal Collaborators	
Dr. Anjana Dogra National Physical Laboratory New Delhi	Prof. Jérôme Lesueur Laboratoire de Physique et d'Etude des Matériaux (LPEM) ESPCI Paris Cedex 05

The outcomes of the following joint collaboration are as follows:

- 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.
- In photo conducting investigation, increase in both photoresponse and relaxation time with Cr doping is observed. In addition an anomalous peak was observed at 690nm.
- Study of the interplay between Superconductivity, Spin orbit coupling and Kondo effect on Cr-doped LAO/STO interfaces.
- Role of the electrostatic doping.
- Discovery of a new type of superconducting fluctuations with an anomalous dynamics driven by density fluctuations ($z=3$ and $\nu=1/2$).

91. Project No. 4705-1:

Principal Collaborators	
Dr. Irishi N. N. Namboothiri Department of Chemistry Indian Institute of Technology Mumbai	Dr. Eric Doris CEA/Saclay iBiTec-S/SCBMGif-sur-Yvette Cedex

This project dealt with novel supported catalytic systems based on carbon nanotube (CNT)-metal assemblies and their performance in various organic transformations. New knowledge generated:

- Four different metal-carbon nanotube (CNT) catalysts and one organic nanotube catalyst have been designed and synthesized.
- AuCNT has been employed in oxidation of alcohols, silanes, dihydropyridines, reductive amination of aldehydes, deoxygenation of amine N-oxides, N-formylation of amines and in the synthesis of quinoxalines.
- Other metal-CNT catalysts such as PdCNT in Suzuki coupling and Wacker oxidation, RuCNT in selective reduction of nitro groups and subsequent synthesis of heterocycles, RhCNT in dehydrogenation of N-heterocycles and various oxidation reactions and a metal-organic nanotube such as AuONT in oxidative coupling of primary amines have been successfully utilized.
- The newly developed catalysts are very efficient in that the reactions can be carried out under extremely mild conditions (room temperature, open air) with very low catalyst loading. Moreover, one catalyst is effective for many transformations and the catalyst is recyclable up to 5 times.
- The above features make the novel catalyst systems potential candidates for large scale reactions in a batch and possibly flow setup.

92. Project No. 4705-2:

Principal Collaborators	
Dr. D.K. Aswal Technical Physics Division, Bhabha Atomic Research Center Mumbai	Prof. M. M. Chehimi Research Director, Interfaces, Traitements, Organisation et Dynamique des Systèmes (ITODYS), Université Paris Diderot -CNRS (UMR 7086)Paris,

The outcomes of this joint collaboration are as follows:

- Synthesis of PPy-Ag films on silanised BOPET sheets by UV induced polymerization for room temperature operated flexi-sensors selective for parts per million (ppm) level detection of NH₃ and H₂S
- New strategies for synthesis of highly ordered free standing PPy-Ag films by photopolymerization.
- Process for synthesis of highly ordered cobalt phthalocyanine thin films on flexible BOPET sheets exhibiting high charge carrier mobility (~118 cm²/V-s) selective for NH₃ chemi-resistive gas sensing.
- Reproducible modification of the flexible ITO coated PEN substrates by diazonium coupling agent for covalent grafting of polypyrrolesilver (PPy-Ag) nanocomposite films.
- Knowledge process/product developed, if any
- Flexible gas sensors with controlled interfacial chemical composition.
- Making of robust conductive/metal nanocomposite sensing coating by photopolymerization.

93. Project No. 4803-3:

Principal Collaborators	
Prof. Tapas Kumar Kundu Molecular Biology and Genetics Unit Jawaharlal Nehru Centre for Advanced Scientific Research Bangalore	Dr. Anne-Laurence Boutillier Laboratoire d'Imagerie et de Neurosciences Cognitives UMR 7237 UdS/CNRS Strasbourg

PIs elucidated the following through this joint study:

First time that *in vivo* pharmacological activation of the HATs CBP/p300 is achieved in the adult mouse, with the conjugation of an activator molecule (TTK21) to a carbon nanosphere (CSP) particle. Pre-clinical studies with CSP-TTK21 HAT activator led in normal and pathological (Alzheimer's model) mice showed a benefic effect on plasticity and memory-related processes, with a clear mode of action defined at the epigenomic and genomic levels. Such molecules - or derivatives - could be of use for bringing cognitive recovery in neurodegenerative diseases. Further improvement in the drug delivery by producing shape-directed nanoparticles able to specify subcellular compartment, will help to carry molecules targeting epigenetic enzyme closer to the gene sites.

94. Project No. 4803-4:

Principal Collaborators	
Prof. V. Kesavan Department of Biotechnology Indian Institute of Technology Madras Chennai	Prof. Philippe Loiseau Groupe Chimiothérapie Antiparasitaire UMR 8076 CNRS, Labex LERMIT Université Paris-Sud 11, Châtenay-Malabry,

The outcomes of the project are as follows:

2-n-propylquinoline (2-n-PQ) had shown interesting *in vivo* anti-leishmanial activities after administration by oral route on leishmaniasis animal models.

Two strategies were developed, one focused on soluble drug-polymer conjugates and the other one dedicated to particles systems.

Aliposomal formulation of 2-n-propylquinoline, dedicated to the treatment of visceral leishmaniasis has successfully been prepared and, some quinolones derivatives have been synthesized for *in vitro* and *in vivo* anti-leishmanial evaluation.

Disclaimer:- This outcome analysis report was generated based on final project reports and project follow-up reports submitted by the Principal Investigators(PIs) of the projects. Any opinions, findings, and achievements expressed in this document are as per the reports submitted by the PIs. Any discrepancies may be reported to CEFIPRA. An acknowledgement would be appreciated, if any reference/quote is made from this report.



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For further information please contact:

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