

## Italy-India bilateral project meeting

*LNF-INFN, Frascati  
September 17-18, 2012*

The purpose of the meeting was to discuss various aspects related with the Italy-India bilateral project coordinated by the LNF-INFN, Frascati and Institute of Plasma Research (IPR), Gandhinagar. Among others, the following points were the main object of discussion.

### *i) presentation of the Indian and Italian teams*

- *Dr. Mukherjee - overview of activities at FCIPT (15 min.)*
- *Dr. Mukesh - nano-patterning related works (15 min.)*
- *Dr. Balasubramanian - review of the contribution to the proposal (15 min.)*
  
- *Dr. Marcelli - LNF laboratory (15 min.)*
- *Dr. Gioacchino - LAMPS laboratory (15 min.) (presentation made by Marcelli because Dr. Di Gioacchino was not able to attend to the meeting)*
- *Prof. Saini - activities at Sapienza university (15 min.)*
- *Prof. Bianconi - activities at RICMASS center:  
Controlling fractal materials for quantum functionalities (15 min.)*

### *ii) discussion on the scientific contents of the project;*

### *iii) experimental plans: XAS, magnetisms, infrared, etc.;*

### *iv) common proposal for experiments at synchrotron radiation facilities;*

### *v) possible bilateral meeting in India in 2013;*

### *vi) others ...*

Those who were present in the meeting on September 17, includes Dr. S. Mukherjee, Dr. Balasubramanian and Dr. Mukesh Rajan from the IPR side while Dr. A. Marcelli (LNF) and Prof. N.L. Saini (La Sapienza) from the Italian side. Prof. A. Bianconi (RICMASS and University of Rome, *Sapienza*) was also present as a special guest in the meeting. Dr. D. Gioacchino could not take part in the meeting and he sent in advance the justification of his absence.

The meeting started at about 11:00 clock in the 'Aula Seminari' of LNF, INFN with a general discussion. Prof. Saini was chairing the session, which included presentations from the Indian and Italian team members. Dr. Mukherjee provided a crisp and nice introduction of the FCIPT and the IPR in very informal way, and the current projects FCIPT is carrying out with nanomaterials being one of the important themes in various fields.

This contribution was followed by the presentation of Dr. Mukesh Rajan who elaborated in detail the recent work he has been carrying out on nanopatterning. After the two presentations from the IPR team, Dr. Balasubramanian who is also the principle investigator of the bilateral project from the Indian side, provided a brief introduction of project objectives and the potentials the IPR team has to contribute in the field of nanoparticles research.

After the presentation from the IPR group, Dr. Marcelli, who is principle investigator of the bilateral project from the Italian side, provided an overview of the LNF and INFN activities and introduction of the laboratory on the magnetic properties,

including the new measurement system which will be able to provide important information on the magnetic properties of materials under high pressure, high magnetic field and low temperature.

Dr. Marcelli also discussed possibilities and need to develop new theoretical approach for the calculations of magnetic properties of nanoparticles. After the presentation of Dr. Marcelli, Prof. Saini gave a brief introduction of research activities at the *Sapienza* university of Rome, and in particular on the nanoscale structural and consequences of local atomic structure on the fundamental electronic properties of functional materials, including superconductors and functional nanoparticles. He also demonstrated the use of X-ray absorption spectroscopy in the study of nanoparticles and the potential, which Italian team has to contribute to the specific bilateral project. Just before the lunch break, Prof. Bianconi gave an introduction of the new materials science center RICMASS, which is being founded during coming months, and possible research activities through a *MoU* with other institutes RICMASS center is planning in the near future. Prof. Bianconi also showed some new results on the phase separation and fractal structures in one of the superconducting materials, highlighting importance of statistical fractal physics in the advanced functional materials. The session was closed for lunch break, however, informal discussions on the work strategies continued during the lunch at the INFN canteen.

The discussion meeting resumed in the INFN 'Aula Seminari' at about 15:00 and the issue of possible bilateral meeting in India was taken up. Both teams agreed that a bilateral meeting in India should be organized under the umbrella of Italian Embassy in India. Contacts have been already established with the Italian *Scientific Officer* in New Delhi. For this purpose a proposal is planned to be submitted to the Italian Embassy by the end of October. There was a discussion on the venue and considering the infrastructural issues it was proposed by the Indian team that meeting can be organized in the IPR campus in Gandhinagar. After a long discussion it was felt that the bilateral meeting can be combined with a school for young researchers, however, the two teams could not reach on a final decision on the structure of the school. It was thought that the meeting can be organized during the period starting from July-December 2013. On the possible title of the bilateral meeting various proposals were put forward. After a detailed discussion the two teams reached on tentative conclusion that the bilateral meeting could be organized under the title '*Nanospace excitations in emergent materials*' or a slightly modified title of '*Nanoscale excitations in emergent nanomaterials*'. The proposal for the bilateral meeting is to be prepared and sent to the Embassy by the end of October 2012.

The discussion continued on the possible common experiments to be performed in the near future. Dr. Balasubramanian provided information on the nanoparticle samples available and the near future availability. It was decided that the work can be started with  $\text{Fe}_2\text{O}_3$  nanoparticles which are already synthesized by the Indian team. The samples will be delivered during October and the Italian team is expected to perform measurements on the local structure of these nanoparticles. On the other hand, Dr. Balasubramanian updated on the progress he is making on the growth of Co-based nanoparticles that are the main research issue of the bilateral project. These Co-based samples are expected to be ready in about three months time. Dr. Marcelli stressed on possibilities of calculations, which should be made on the magnetic response of the nanoparticles. For the purpose, it was thought that a young student with basic knowledge should be trained under the bilateral program. At present, for the Italian side a three months contract has been given to a young

researcher to start working on this topic. The Indian team will be selecting a postgraduate student by beginning of November to work on the project, which could also lead to his/her Ph.D degree.

The teams had a long and fruitful discussion on the possible common project under the EU-FP7 program. Different proposals were put forward on which one can plan the FP7 project and among these following topics were emphasized;

- i) nanoparticles from biology to the solid state;
- ii) in-situ studies of nanoparticles and;
- iii) emerging photovoltaics

During the discussion it was sought that the two teams need to work on finding local industries who could be involved and be partners in the proposed projects. It was also discussed if the FP7-Energy and FP7-NMP should be the target for preparing the project. The discussion was concluded without any concrete decision as it was thought that the FP7 target call should be studied well before taking any action in this direction.

The two teams also briefly discussed proposals for foreseen synchrotron radiation experiments, however, considering that the deadlines for the next semester were all passed away, it was decided that the issue should be taken-up again during the next semester and proposals should be prepared for different facilities. For the present, it was assured by Dr. Marcelli and Prof. Saini that enough beamtime on different synchrotron radiation experiments will be available during this semester considering the already planned common experiments and beamtime assignments.

The meeting was adjourned around 18:00 up to next day at 09:30.

The meeting on 18 September started as scheduled at about 09:30. Dr. S. Mukherjee, Dr. Balasubramanian, Dr. Mukesh Rajan, Dr. A. Marcelli and Prof. N.L. Saini were all present for the informal discussion in the office of Dr. Marcelli at the LNF. Dr. Marcelli organized a scientific visit to the DAFNE accelerator complex for the Indian team, followed by a visit to the Free Electron Laser facility at the INFN. Considering the large interest from the Indian team, Dr. Marcelli also organized a visit of Tokamak FTU of ENEA from 12:00. The visit lasted for more than a hour in which the Indian team got up to date information on the current activities at the FTU, ENEA and the new proposals in the fusion research. The visits were concluded with the lunch break in the INFN canteen.

The two teams continued their informal meeting in the office of Dr. Marcelli after lunch. The main points of discussion were to find some companies of both countries who could be interested in the bilateral meeting to be organized in India next year. Dr. Mukherjee promised to work for finding some pharmaceutical industries in Gandhinagar who would be interested in the use of high-end analytical techniques like synchrotron radiation methods for biomedical applications.

The discussion was also focused on the possible visits of Italian team or some members of the team to IPR by end of this year within the framework of the bilateral project. Considering the time constraints and schedule of Italian team members, it was decided that the two teams will be in touch to organize such a visit as soon as possible.

The two days meeting was concluded at around 16:00.