

» INTERVIEW



ITALY-CHINA: A CONSOLIDATED SYNERGY FOR PARTICLE PHYSICS

Interview with Marco Maggiora, Director of the IHEP-INFN Joint Laboratory (I2JL), Professor of the University of Turin and INFN researcher.

INFN's scientific and technological collaboration with Chinese institutions has seen a quantum leap in the last decade, thanks to the collaborative effort of numerous Italian and Chinese researchers engaged in joint research projects. An effort also recognised during the eighth edition of the China-Italy Science, Technology & Innovation Week, the most important annual event in the context of Sino-Italian scientific and academic cooperation, recently concluded in Beijing, which this year brought together 750 representatives from research centres, universities, Italian spin-offs and companies and over 400 Chinese participants. During the event, in the presence of the Italian Minister of Education, University and Research, Valeria Fedeli, and the Chinese Minister for Science and Technology, Wan Gang, the China-Italy Science and Technology Innovation Cooperation Contribution Award, awarded by the China International Technology Transfer Center Italy, was awarded to Marco Maggiora, Director of the IHEP-INFN Joint Laboratory (I2JL), Professor of the University of Turin and INFN researcher, for his contribution to the development of scientific and technological cooperation between Italy and China, through the continuous strengthening of the strategic collaboration between the INFN and the Institute of High Energy Physics (IHEP), a body of the Chinese Academy of Science (CAS) in Beijing.

We asked Marco Maggiora, an Italian scientist in China since 2009 and coordinator of the European H2020 project in China BESIII/CGEM, to tell us how the Italy-China cooperation came about, how it has developed in the field of Particle Physics and about its technological repercussions.

When and how did the collaboration with China for particle physics research come about?

INFN activities on Particle Physics in China and/or with Chinese scientists range from Astroparticle Physics, inside and outside atmosphere, to particle Physics performed with accelerators, and to neutrino Physics.

» INTERVIEW

INFN started to successfully cooperate with Chinese Institutions since 1995 in AMS (Alpha Magnetic Spectrometer), a detector installed on the International Space Station to investigate antimatter in cosmic rays. But the first joint Collaboration in China was ARGO (Astrophysical Radiation with Ground-based Observatory). We are speaking here of the investigation of astroparticles with detectors in the atmosphere, namely in Tibet. The first joint activities in Tibet dates even to 1998, although data taking started in 2004. A long lasting partnership was emerging among the two institutions, INFN and IHEP, that are strikingly similar both as far as structure and scientific interests are concerned.

We have to wait for early 2009 for the first participation of INFN researchers to a Collaboration investigating Particle Physics with Accelerators: BESIII. I personally joined BESIII (BEijing Spectrometer) leading a small patrol of few researchers that later grew up to become one of the largest national communities within BESIII. This has been also the framework for the first joint H2020 European project, a RISE (Research and Innovation Staff Exchange) project I'm coordinator of, devoted to the construction of the new BESIII Inner Tracker and involving besides INFN and IHEP, German and Swedish Institutions as well.

Few years later the cooperation was extended also to neutrino Physics with JUNO, a Collaboration born in 2012 to which INFN joined in 2014.

What cutting-edge projects are INFN, IHEP and CAS involved in today?

IHEP and INFN cooperate today in DAMPE (DARK Matter Particle Explorer), the first Chinese Academy of Science (CAS) satellite to be launched in late 2015, hosting state of the art silicon detectors, exploiting Italian technology to investigate cosmic rays. An evolution on the same path will be HERD (High Energy Cosmic Radiation Detection); the IHEP-INFN Letter of Intent has been recently signed and the R&D and design stage of this new set of detectors on satellite has just begun.

CSES-Limadou (China Seismo Electromagnetic Satellite) is a synergy among several Chinese and Italian Institutions, aimed to monitor with a whole network of satellites electromagnetic field and waves, plasma and particles perturbations of the atmosphere, ionosphere and magnetosphere and their possible correlation with earthquakes. They want also to investigate low energy cosmic rays. The deployment of the first of these satellites in orbit is expected very soon, in early 2018.

JUNO, as we said, is the first joint IHEP-INFN collaboration on neutrinos. They aim to determine in an underground laboratory the neutrino mass hierarchy exploiting the neutrinos produced by a set of Chinese Nuclear plants.

Last but not least the BESIII spectrometer, that is hosted in the main IHEP campus in Beijing, will soon host the Cylindrical-GEM Inner Tracker we are building in the framework of the European Project BESIIICGEM. The BESIII Collaborations discovered two whole families of new particles, the Zc's. The discovery of the

» INTERVIEW

Zc(3900) at BESIII was selected as one of "China's Top Ten Scientific Advances 2013" and as one of American Physical Society "Highlights of the Year 2013".

The Italian-Chinese synergy spans from the Earth to space, from the study of neutrinos to dark matter. In which sectors does Italy make the biggest contributions?

INFN is leader in the investigation of cosmic rays, inside and outside the atmosphere, since late 80's. This is generally recognized within the scientific community, in particular in China.

The expertise in building particle detectors, and in particular silicon detectors, has been extended bringing these detectors from ground laboratories to satellites, as for DAMPE or CSES. The core of these silicon detectors is Italian technology, originally developed within the PAMELA, FERMI and AMS Collaborations. Moreover INFN is moving to space also other kind of detectors, as the CALOCUBE calorimeter developed for HERD.

The Italian contribution is essential in JUNO as well, profiting of the previous experience from BOREXINO at Gran Sasso INFN Laboratory, and providing the purification system of the JUNO scintillators. In BESIII the new CGEM Inner Tracker, evolving the original Italian technology developed within KLOE-2, will allow for unprecedented detection resolutions even in large magnetic fields. Within the BESIIICGEM project INFN has contributed innovative solutions in cloud computing, allowing for a significant simplification of the access to cloud technologies. IHEP and INFN have jointly organized doctoral summer schools in China on these issues. Finally, future experiments with next generation accelerators require new concepts and pose new challenges. INFN can contribute an unique expertise on many different types of detectors, as well as on accelerator, vacuum and magnetic technologies.

Have INFN research programs undergone changes since the cooperation with China has become relevant? And, vice versa, has Italy influenced Chinese research policy in the field common to INFN and IHEP?

INFN have contributed tremendous efforts to the scientific cooperation with China: in technology sharing, in manpower, and of course with in kind contributions as well. Such resources have been provided, according to the different cases, by the National Commissions or directly by the INFN Executive Board. We are speaking of several millions of Euro, if we add up the INFN contributions to all the Collaborations I quoted before. When a similar amount of resources is provided to support a strategic partnership, choices are needed and priorities must be set. I can safely say that INFN has provided in the last years growing attention and support to the activities jointly performed in China with IHEP and CAS. The cooperation with China has been

» INTERVIEW

added aside to previously existing strategic international partnerships of INFN, the main one being the synergy with CERN, and has become one of the INFN priorities.

This is possible of course also considering how wide is the set of research fields involved by these Collaborations. And let me also say that it is an investment in the future, of INFN and of its scientific community.

On the other hand, in order to exploit the Italian technology, CAS has decided to fund the design and construction of the DAMPE silicon tracker. This is an example of how the Chinese research policies have been adapted as well in order to include the Italian community and its technologies. This is true also for JUNO: the expertise from BOREXINO has strongly influenced the JUNO concept and design.

You have been collaborating in Sino-Italian projects since 2009 and are today the Director of the joint IHEP-INFN laboratory. Which are the main advantages of the collaboration between two very different cultures and which are the main difficulties?

Let me start from the difficulties. What I love of China is that it is a land of opportunities. You are right, our cultures are remarkably different, but characterized by a widespread mutual respect. In our joint Collaborations, no sooner have the difficulties appeared than people have started talking and looking for possible solutions, acceptable by everyone.

It is important to define, for any project, and as soon as possible, joint management structures, where two researchers, one from each Country, jointly take care of each role. This makes the collaboration effective and profitable, since it exploits the different approaches of the two cultures.

This is a unique opportunity for the training of the youngest as well! I always have as guests or with temporary positions in my group in Turin some Chinese students, post-docs or professors. Letting them work together with my students and colleagues is profitable for everyone: each culture learns from the other. And for the same reason, thanks also to the European funds of my project, I try to encourage even extended stays of my students and colleagues in Beijing at IHEP. Besides, it is also a fact that Chinese people and Government have an effective vision and planning of scientific research, with a good fraction of their GDP devoted to these activities. The strategic collaboration with IHEP and CAS, and in the future hopefully with NSFC as well, gives INFN access to a set of funds and opportunities wider with respect to those that can be found in Italy or even in Europe. Last but not least, bringing cutting edge Italian technology in China within high profile projects, provides an excellent showcase for our Country and for our industries. ■