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Italian National Institute for Nuclear Physics

INTERVIEW



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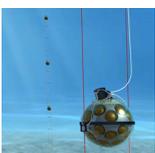
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» INTERVIEW**GENEVA: FROM CERN TO THE ENVIRONMENT, ITALIAN INDUSTRY AND KNOW HOW FOR INTERNATIONAL SCIENTIFIC COOPERATION**

Interview with Umberto Dosselli, Scientific Attaché at the Permanent Mission of Italy to the International Organisations in Geneva

For over 100 years Switzerland has hosted international organisations: today 22 of them are based in Geneva (8 of which are United Nations agencies), including CERN, the most important particle physics laboratory in the world, unique for its complexity, scientific-technological prospects and potential for industry. Italy, with INFN, participates in its activities at the highest level. The economic return of these activities is important for Italian industry, thanks to the high capacity of Italian industry to take part in the experiments with high technology products. However, the international organisations also offer Italy other opportunities that the Permanent Mission of Italy in Geneva seeks to encourage, fostering communications and supporting national skills and know-how.

What is the scenario in which the Permanent Mission of Italy in Geneva operates?

First of all, we have to make a distinction. The diplomatic networks in Geneva are divided into two spheres: bilateral relations and multilateral relations. And the Italian diplomatic network is obviously organised in this way. Bilateral relations are between Italy and the local host State, and they are followed by the Embassy and by the potential Consulates. In Switzerland the Embassy is in Berne, but diplomacy is also followed by a Consulate in Geneva. Geneva, however, is special because it is the seat of many international organisations, such as the UN, NATO, the Red Cross, CERN, the WMO (World Meteorological Organization), the ITU (International Telecommunication Union), the WIPO (World Intellectual Property Organization), the WTO (World Trade Organization), to mention just a few. And it is with these organisations that the multilateral relations are conducted. The Permanent Missions, which have the status of embassies, are indeed in charge of the relations between the single countries and the international organisations. Thus, it is the Ambassador who conducts the relations, in our case,

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between Italy and the single international organisations. Some are “technical”, other are scientific and technological relations: my mandate, in particular, in the capacity of Scientific Attaché, is to follow the latter ones. For example, I'm the Italian representative of the finance committee of CERN, while the Ambassador himself and the INFN President are the national representatives on the CERN Council.

For INFN, the most profitable collaboration is obviously the one with CERN.

Yes, INFN is clearly highly focused on CERN. In this case, our task is to check that the cooperation between the two institutions continues as in the past, because relations are really excellent, perfect, I would say. At CERN, INFN is very present at all levels, not only scientific and managerial: it is worth noting, for example, the participation of Italian students, who have success in the international calls because - it has to be said - they are really clever. And we are equally valid in outreach: this year, in the competition addressed to schools, which CERN promotes throughout the world, "A Beamline for School", one of the two winners is an Italian high school.

And then, always linked to CERN, the question of the industrial return is important.

Of course, for Italy, the Industrial return that derives from the CERN projects is a relevant aspect, both for politics and for public opinion. Our country is the fourth contributor to CERN, after Germany, England and France: we therefore expect a return for our companies; the orders have to be consistent with the investment. We also work for this, in order to find the right channels to increase the presence of our industry in the technological projects developed at CERN. This takes place also thanks to the serious and constant work that the ILO (Industrial Liaison Officer) carries out. The next interesting opportunity is offered by the HiLumi LHC project, for which the awarding of the contracts has already begun. From Italy's viewpoint, the coordination with the HiLumi top management is perfect, and the ILO has done an excellent job in identifying the industrial sectors that could be more favourable for the participation of our companies. For example, Italians are very good at developing high-temperature superconductors and, in fact, we have recently been awarded contracts in this sector. HiLumi represents an interesting scientific and technological opportunity, and I'm certain that Italy will play its part well on this competitive international terrain.

In addition to CERN, what other international institutions do you liaise with?

As the Scientific Attaché, I also follow the WMO and the ITU, which are both UN agencies. In addition, I work with the Intergovernmental Panel on Climate Change (IPCC), and the various organisations that deal with the environment, like the United Nations Environment Programme (UNEP) and the International

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Union for Conservation of Nature (IUCN). What I mainly do in these organisations is to maintain contacts with the Italian staff, to understand whether Italy is suitably represented, or if there is discrimination, if we have claims to make or unsolved problems for which a solution has to be found. Then I try to understand whether Italy uses these organisations well. With CERN, coordination is perfect, because an institution like INFN follows it. In the other organisations, this is not the case and the situation is not so clear. I have to understand, for example, if it is possible to promote additional cooperation as well as that already existing with our research institutes, our universities, and so on, and if there is Italian research or technology that can be usefully exploited to develop projects within the international organisations.

What is the situation with the other international organisations?

In the light of the profitable industrial presence in the CERN projects, as the Permanent Mission, we have looked around to understand whether other international organisations could offer good opportunities for Italian industry. I think there are interesting possibilities, we must, therefore, foster the creation of new relationships. This is why we are organising, for the end of October, at the MAECI (the Ministry of Foreign Affairs and International Cooperation), a day of contact between the international organisations present in Geneva and the Italian industrial world; to explain the possibilities that exist and how to participate and collaborate.

And as far as concerns the INFN?

I think INFN has certain skills that can also be used in other sectors: I'm thinking of computing, for example. It's a sphere in which INFN excels for what concerns research and development, and it is at the cutting edge, because it's a sector in which it has always been engaged for the intrinsic needs of the activity of particle physics research; computing which can be fruitfully used, for example, in meteorology studies.

In this context, what are relations like between Italy and Switzerland?

Italy has a network of scientific attachés which - I have to say - other countries envy us: it has about 25 scientific attachés in the world who, as I said, are active in the embassies and who follow scientific and technological relations between Italy and the various countries. There are, however, exceptions: one is myself, since I'm not based at the Embassy in Berne but in Geneva. On the other hand, there is no scientific attaché who specifically follows the rest of Switzerland. At present, the MAECI is considering how to deal with this aspect; whether to appoint another person or to expand my own area of competence

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to the rest of Switzerland is being discussed. Certainly, relations with scientific institutes such as the PSI (Paul Scherrer Institut) or the Zurich and Lausanne Polytechnics, with which Italy already collaborates, are interesting for us and they can be further developed.

How do you operate?

We look with attention at the Italian situation and we speak with the national institutions such as the CRUI (Conference of Italian University Rectors) or the research bodies, in order to create new contacts with the organisations in Geneva. This year, in April, an agreement was signed with the WMO, the MAECI and an institute of the CNR (Italian National Research Council) to promote actions aimed at instructing the farmers in the Niger region on how to deal with the effects of the drought. A problem like this has repercussions also on us: improving the living conditions in the Niger region, in fact, also means contributing to mitigate one of the causes that favour the migration phenomenon. Now, however, we are assessing, together with the ASI (Italian Space Agency) and the WMO, the possibility of using satellite data for a constant and complete mapping of the North Pole, with particular interest in the North-West Passage.

In general, we have to make efforts in order to overcome the tendency to consider with interest only relations with Brussels and with the European Union because that is where the funds come from. The international organisations in Geneva, even if they are not the source of financing, can represent an excellent and very effective showcase for presenting their validity at international level. The ITU, for example, is a body that issues standards and exploits this opportunity to "impose" know-how that our industries already have. This certainly represents a good incentive for cooperation.

What conclusions can be drawn?

My experience, after a year as the Scientific Attaché in Geneva, is that Italians have many high-level skills. I therefore believe that there is still room to increase the opportunities for cooperation between our country and the international organisations, and that we can further exploit our resources, that are based on a strong scientific and technological background. ■



RESEARCH

IN AUGUST THE FIRST MONTH OF VIRGO'S DATA ACQUISITION

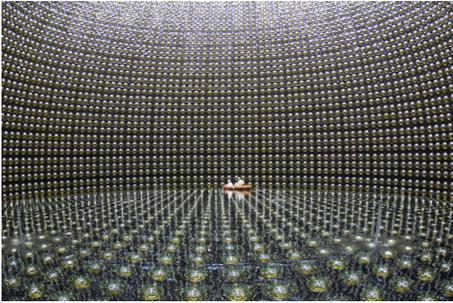
The second run of data (Run O2) of the gravitational wave detectors LIGO and Virgo ended on August 25 with very interesting results, now under analysis. The Run O2 began on November 2016 with the two American LIGO interferometers that, from 1 August 2017, have been joined by Virgo, the European Gravitational Observatory's interferometer, located in Italy, Cascina (Pisa), and co-operated by the INFN. Virgo's entry in the data taking, alongside the two already active LIGO American detectors, marks a key step forward for the gravitational waves search program: with three active detectors at the same time, it is possible, thanks to the triangulation process, to enormously increase the capacity of localization of gravitational waves sources. This will allow us to observe the region of the sky from which the gravitational wave came in order to search for other signals (electromagnetic or neutrinos). Virgo has entered the data acquisition following the completion of the Advanced VIRGO project, a five-year upgrade phase focused on improving detector sensitivity that has been brought over 25 Megaparsec. The simultaneous operation of the three detectors is the first stone of an ambitious building: a network of 5 detectors (in addition to the two LIGOs in the US and Virgo in Italy, an interferometer in Japan and one in India) that will be able to explore the Sky in search of gravitational waves with an unprecedented sensitivity. The next LIGO-VIRGO data acquisition phase, the Observational Run 3, is scheduled for Fall 2018, following the maintenance and upgrading phase to further improve the sensitivity of the detectors. ■



RESEARCH

LIGHT INTERACTS WITH ITSELF AT HIGH ENERGY: THE PREDICTION OF QED HAS BEEN CONFIRMED FOR THE FIRST TIME

The ATLAS experiment at the LHC has observed the first direct evidence of high energy photon-on-photon scattering. This is a very rare process in which two photons interact and change impulse, energy and direction. The result, published in August on Nature Physics, confirms one of the oldest predictions of quantum electrodynamics (QED), and is the first direct evidence of light interacting with itself at high energy, a phenomenon that is not possible in classical theories of electromagnetism. Physicists obtained the result using data produced in collisions between lead ions. As bunches of lead ions are accelerated, an enormous flux of surrounding photons is generated, which can interact with one another, giving rise to the phenomenon of photon-on-photon scattering. These interactions are known as "ultra-peripheral collisions". Finding evidence of this rare phenomenon required the development of a new 'trigger' for the ATLAS detector. The new trigger's success in selecting the events demonstrates the power and flexibility of the system, as well as the skill and expertise of the analysts and groups who designed and developed it. ■



RESEARCH

T2K: GROWING EVIDENCE OF THE ASYMMETRY BETWEEN NEUTRINO AND ANTINEUTRINO OSCILLATIONS

A year after announcing their first findings, the T2K collaboration, of which the INFN is part, has produced new evidence of the asymmetry between neutrino and antineutrino oscillations. At the ICHEP 2016 conference, the T2K collaboration presented the first hints of a possible asymmetry between the oscillations of neutrinos and antineutrinos. Their findings suggested a difference in the oscillation probabilities of neutrinos and their antimatter particles. Although there were not enough data to speak of "discovery", their findings aroused great interest among the international scientific community. Now, the new findings, presented on 4 August at the KEK laboratory in Japan, based on twice the neutrino data compared to the previous results, not only confirm but indeed strengthen the hypothesis announced last summer: the probability of statistical fluctuation being at the origin of the effect measured by T2K is now less than 1 in 20, and it appears increasingly likely that we are on the brink of an important discovery. ■

» **FOCUS**



**OnDE: FROM OBSERVING
NEUTRINOS TO MONITORING
DOLPHINS**

Dolphins prefer to hunt at night. The hunting patterns of these cetaceans have been revealed in a study published recently in *Scientific Reports* and based on data obtained by the OnDE deep-sea experimental station, set up in 2005 at the underwater observatory of the INFN's Southern National Laboratories, at a depth of 2,100 m off the coast of Catania. Built for the main purpose of measuring underwater acoustic background noise, to investigate the feasibility of building a neutrino acoustic detector, the OnDE station also obtains important information about the behaviour of dolphins, predators at the top of the marine food chain, whose activities in their natural habitat are not yet well known. In detail, the interdisciplinary study presents an analysis of the sounds, or "clicks", produced by dolphins to echolocate, i.e. to interpret the echoes of sound waves to identify the presence of prey or obstacles. These clicks are much more frequent at night than during the day. The biosonar activity of the dolphins studied off the coast of Eastern Sicily has been found to vary greatly between daytime and night-time. They emit more echolocation signals at night, when they cannot rely on their vision to hunt or obtain information about their surroundings. The software used to automatically detect these acoustic signals was developed by a team of physicists and biologists. The key element of this research is its interdisciplinary approach. The project involved INFN, the Italian National Research Council - Institute for Coastal Marine Environment (CNR-IAMC), the Department of Climate Change Observations and Modelling of the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), the Universities of Messina and Catania and the Interdisciplinary Centre for Bioacoustics and Environmental Research (CIBRA) of the University of Pavia. Since the year 1998 INFN has launched a strong research activity to build an astrophysics neutrino telescope to be installed on the seabed off the coast of Sicily. The project has proved immediately to be useful also as a facility for interdisciplinary studies. One of the first experiments dates back to 2005-

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2006, when the OnDE station was installed to enable real-time monitoring of underwater acoustic noise, thanks to which, scientists have been able to record the presence of cetaceans in the Ionian Sea over several years. Today, in collaboration with numerous European research organisations, the project has now evolved the KM3NeT infrastructure, a ERIC (European Research Infrastructure Consortium) promoted by European Strategic Forum for Research Infrastructures (ESFRI). The ultimate objective is to discover high energy astrophysical neutrinos, using a network of 700-m-tall mechanical structures hosting numerous optical sensors (photo-multipliers), acoustic devices (hydrophones, underwater acoustic transducers) and oceanographic instruments, anchored to the seabed, and connected to the shore station by an electro-optical cable. To install the neutrino telescope, the Italian research team working on the KM3NeT project has identified a site located 100 km south-east of Portopalo di Capo Passero (Syracuse, Sicily), at a depth of more than 3,500 m. With the SMO (Submarine Multidisciplinary Observatory) project, the INFN has been also engaged in developing new sensors and methods for analysing acoustical data to monitor the position of the underwater structure, environmental noise and measurable acoustic sources (cetaceans, earthquakes, ships, sonar, etc.). As part of the SMO project - funded by the Italian Ministry of Education Universities and Research - 2 new broadband hydrophones (10 Hz ÷ 70 kHz) have been installed on the structure at the Capo Passero site and off the Gulf of Catania. The environmental and acoustic data obtained by these instruments, recorded by the multidisciplinary underwater observatories, are also collected in the databases of the EMSO (European Multidisciplinary Seafloor Observatory), based in Italy at the National Institute of Geophysics and Volcanology (INGV), whose purpose is geophysical, environmental and acoustic monitoring of deep-sea environments at various European sites. ■



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