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Istituto Nazionale di Fisica Nucleare

INTERVIEW

NEWS

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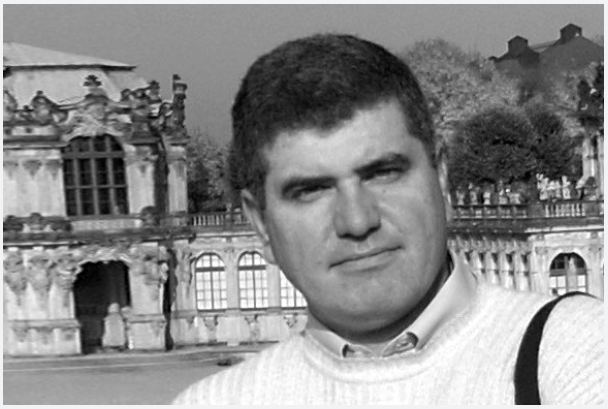

PARTICLES FOR SOCIETY

Interview with Ezio Previtali, coordinator of the INFN National Committee for Technology Transfer (CNTT)

Promoting and strengthening technology transfer activities is one of the areas on which INFN has been strategically investing for some years. Since 2012, it has set up the National Committee for Technology Transfer (CNTT), with a dedicated Office, and it has launched several projects, the most recent being R4I (Research for Innovation). We spoke about this with Ezio Previtali, coordinator of the CNTT.

What is meant by technology transfer?

'Research turns into innovation when it exceeds the social threshold', this is how one of my professors described technology transfer. It's a process through which knowledge, technologies and prototypes, which are developed by research institutions for scientific purposes, are made available to the market and society. It's an important mechanism, and sometimes we do not realise how intrinsic it is in what we do. Technology transfer has by its very nature an interdisciplinary aspect: we develop a product that is used for high energy physics and we apply it to medicine, for example. It's a very satisfying activity because, in order to achieve our scientific objectives, technologies are pushed to the limit, to then be transferred to other areas, which can benefit from them but where it would have been difficult to develop them.

What does the Committee that you coordinate deal with?

The CNTT is a steering structure that supervises technology transfer activities. We try to facilitate INFN's capacity to add value, where by adding value we mean the protection of intellectual property, patents, support for research ideas that can evolve into innovative projects, translating a prototype

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into an object that can be industrialised. Another important aspect that we take care of is the transfer of know-how, which we also try to make available to industrial partners. The CNTT also coordinates the network of local contacts and manages activities related to the support of research groups and laboratories.

How does technology transfer work at INFN?

There are two basic mechanisms. The first is intrinsic in research activities. To develop the technologies for our experiments, industries work with us because otherwise they would not know how to do it. They hence acquire new skills and specialisations: this mechanism is called 'by procurement'. What is emerging in the world is that big science has a very high impact on industry, LHC being a prime example: its construction required technological innovation and the companies involved had a direct benefit. This merit is attributed to us: we conducted a survey with 200 companies and it emerged that those who worked with us started to develop new products and open up to new markets. In the case of technology transfer by procurement, the task of the CNTT is to bring out the process, which in itself happens in, a more or less, automatic way.

The second mechanism is the one in which ideas are developed in scientific groups and can then be turned into a product of possible interest to the markets. This is the technology transfer mechanism that, as CNTT, we follow more directly, because it is the one that requires greater support and is more related to relationships with companies. We ensure that innovative technologies for basic research become a driving force for the society in which we live: from technologies for research on the Higgs boson to machines for the treatment of tumours. When using public money, there is a duty to make the most of the investments, not only achieving the scientific objectives, but promoting economic growth and making what is produced available to everyone. Transfer to industry constitutes a great advantage, especially in the case of SMEs, small and medium sized enterprises, which in Italy are many, because an SME often does not have large resources to invest in R&D: in this way, we facilitate their growth and their competitiveness in the market, also internationally. A researcher must therefore also try to understand if there is something in the laboratory that can be exploited at the social level.

How can results sharing and patents be reconciled?

In Italy, the patent is often seen only as a means of protecting oneself: if someone wants to do something with my research, he must pay. In reality, the patent does not end with this aspect. Let's say that I develop a new idea thanks to a loan received, and that I thus obtain an innovative

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prototype. There are now two possibilities: either I publish or I patent it. If I publish, in principle, I have informed the whole world, and anyone can freely exploit my project. If I patent, someone has to negotiate the financial aspect with me. But this is a rather naive interpretation, often things work differently. What happens when a result is made public is that interested companies can take it and develop it, but this happens in a very competitive environment. It is clear that this is a huge risk, which only the largest companies can afford, because it means investing significant sums with very high risk capital to develop something they cannot protect, because it is known to all. This tends to minimise the investments of industries because they are less protected by a return on the investments. On the other hand, the patent offers an advantage: a company can invest a significant amount of capital having the security of having an advantage over the competition. So, it is not true that the patent limits, it often enhances the possibilities: so much so that there are cases in which a technology still in the embryonic stage without a patent does not make headway, because nobody is willing to invest risking a lot. Not all projects can be patented or the patent is not always the best way to give a chance to a technology: publication therefore remains a good practice, even if the patent does not exclude subsequent publication.

What are the main difficulties you encounter?

There is a cultural difficulty: many researchers still see technology transfer as a "distraction" from their main activities. What is required of researchers is awareness and willingness to highlight activities that may be of interest outside the laboratories. Another critical aspect is related to our nature as a public institution, due to which we are subject to sometimes very binding rules and regulations. An industry has different timing and ways than those of public administration: when innovation is made, the time factor is fundamental to be competitive. Then there are another two aspects, albeit more marginal, but still characteristic of a situation. The INFN has employees and associate university staff: this leads to difficulties in the management of intellectual property because it is often difficult to reconcile the regulatory constraints of both. We would need a more streamlined and clearer regulation. The last factor, very strange but we always bump into it: INFN researchers do not assign the right value to their technology transfer projects, underestimating what they produce.

What are the most interesting cases of technology transfer at INFN?

A very successful example is CHNet: the cultural heritage network focusing on survey technologies. Or the use of accelerators in the validation of space technologies. There are applications to medical physics: CATANA at the INFN South National Laboratories for the treatment of ocular melanoma

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thanks to proton beams (proton therapy) and the National Center of Oncological Hadrontherapy (CNAO) in Pavia.
There are also more specific activities. We have signed a large contract with an important international company, Waters, for the development of a mass spectrometer prototype. Another successful project is MID, a tool developed for thalassemia analysis. MID has recently been concluded, with the last certifications, and is available at the Galliera Hospital in Genoa. We are now aiming to start its mass production. In addition, we have sold prototypes for the analysis of radioactivity in nuclear plants under decommissioning, currently used by Sogin. They were developed in collaboration with Else Nuclear, a company that then produced the devices and put them on the market. We also have applications deriving from the use of muon detection techniques for the study of volcanoes or radioactive deposits in nuclear power plants. In addition, we support calculation projects for time optimisation in financial markets, for which we have developed activity and data (including sensitive) file management systems, etc. The last interesting aspect that I would like to mention, even though there would be many others, is the one related to spin-offs. Above all, the case of the small PIXIRAD that in 2017 was acquired by the Dutch company PANALYtical: in the success of this operation of the foreign sale of an INFN spin-off we must recognise the merit of the PIXIRAD researchers who were able to manage the negotiation with professionalism. Since last September we have also a new regulation concerning spin-offs, so we hope to make this sector grow even more. In short, INFN is working hard in order to ensure that the skills and knowledge, which for many years have remained closed in laboratories, become the heritage of society and can contribute to the economic and social development of the country. And this is starting to be known and recognised outside INFN: from January to date we have been contacted by three venture capitalists who have seen a possible innovative partner in INFN. Today, technology transfer at INFN invoices a couple of million a year, but we are working hard to make this sector grow even more.

INFN has recently launched a new technology exploitation project, R4I. What is it?
As CNTT we realised some time ago that there was a problem that mainly concerned interdisciplinary technologies. When a project is developed in Commission 5 [the National Scientific Commission of INFN which deals with technological research, ed.] one reaches at most the development of a prototype, that is to say a product not yet solid enough to be put on the market. At the same time, however, it is no longer justified as a research project. With R4I we have therefore created the conditions to support these technologies for another year, giving them the opportunity to become more solid. Usually, the prototypes have a Technology Readiness Levels (TRL) of 4/5 on a scale that

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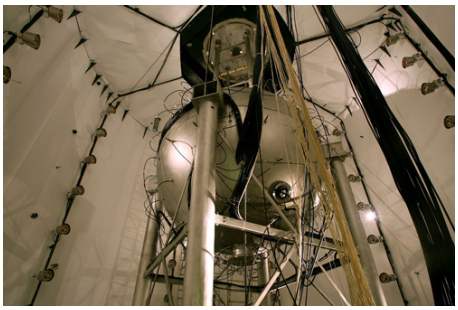
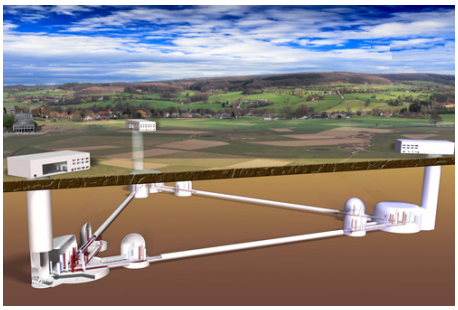
reaches up to 9, representing products ready for the market and for society. We therefore support technologies, from both a financial point of view, with the proceeds deriving from technological transfer activities, as well as an infrastructural and administrative point of view. Our support can in some cases last a second year, without a financial contribution: in essence, the project has a year to reach solidity from the technological point of view, and then has a second year to get on the market. In summary, R4I is an initiative to support what we call 'last mile' projects, the mile that separates research from innovation. ■



RESEARCH

DARK MATTER: DARKSIDE CONFIRMS ARGON'S EFFECTIVENSS

The DarkSide-50 experiment in operation at the INFN Gran Sasso National Laboratories reported two new results on dark matter studies. DarkSide-50 was designed to detect a specific type of large mass weakly interacting massive particles, WIMPs larger than 50 GeV/c^2. The main difficulty relates to the ability to detect and reject the background noise, which hides the signal. At the end of a data-taking period of 530 days, without any signals detected in the data collected, DarkSide-50 confirmed the outstanding capacity for discrimination of its argon-based technology. This led to the conclusion that the DarkSide technology can distinguish with extreme accuracy between the interactions typical of WIMPs (nuclear recoils) and those caused by natural radioactivity. In addition, a second result about a new analysis of low-energy ionisation events, revealed that DarkSide-50 is also effective in the detection of dark matter particles with a smaller mass (below 10 GeV/c^2). The results, which further confirm the future DarkSide-20k project, were unveiled on 21 February during the 2018 Dark Matter conference held in the United States, at the University of California, Los Angeles (UCLA). ■

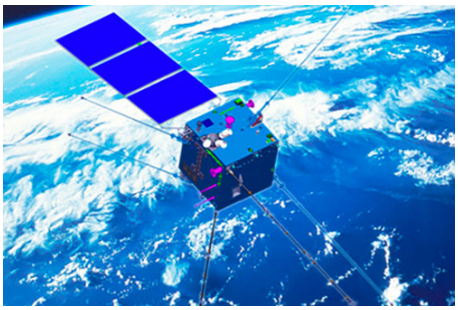


INFRASTRUCTURE

SARDINIA APPLIES TO HOST THE EINSTEIN TELESCOPE

The Autonomous Region of Sardinia applied to host the Einstein Telescope (ET), the future third-generation infermometre to study gravitational waves. The application filed by the Sos Enattos mine site is supported by the Ministry of Education, University and Research (MIUR), INFN and the University of Sassari. The site, located close to Lula (Nuoro province), meets the very low seismic and antropic noise requirements necessary to build the new research infrastructure. Indeed, the future observatory is to be installed in underground galleries and the studies carried out confirmed that this site has adequate geological and urbanisation characteristics. After the success of the recent discoveries of gravitational waves, aiming at maintaining and strengthening the leading role earned thanks to the commitment of INFN's scientific community in this field of research, Italy now focuses on the planning of a specific two-pillar strategy: strengthening Advanced VIRGO and investing in a new international infrastructure, the Einstein Telescope.

The Ministry will support the application with 17 million Euro, while the Sardinia Region has already disbursed one million Euro to ensure the reopening of the Sos Enattos research laboratories. ■



SPACE

LIMADOU, THE HUNTER OF EARTHQUAKE INDICATORS

CSES, China Seismo-Electromagnetic Satellite to observe the Earth, was successfully launched on 2 February from the China-based Jiuquan Satellite Launch Centre, in the Gobi desert (inner Mongolia). The satellite was built by the China Space Agency (CNSA) to develop on a global scale new methods to study geophysical phenomena, such as earthquakes and volcanic eruptions. One of the leading tools onboard the CSES mission, known as Zhangheng 1, is the High Energic Particle Detector (HEPD), built by the Italian researchers of the "LIMADOU collaboration", which takes its name from Matteo Ricci, known in Mandarin as Li Madou, a missionary and explorer of China in the sixteenth century. The aim is to study the existence of possible time and space correlations between seismic events and the observation of both iono-magnetospheric perturbations and the anomalous precipitation of particles from the Van Allen inner belts. Italy's main players are, together with the INFN, the Italian Space Agency (ASI), the Universities of Bologna, Roma Tor Vergata, Trento and Uninettuno, the National Institute for Astrophysics (INAF) through the INAF-IAPS institute and the CNR with IFAC. The National Institute of Geophysics and Volcanology (INGV) also contributes to the project. ■

APPOINTMENTS

ROBERTO CARLIN APPOINTED CMS SPOKESPERSON

The Italian Roberto Carlin, INFN researcher and professor at the University of Padua, was appointed as the new international spokesperson of the CMS scientific collaboration and will lead the experiment from September 2018, taking over from the American Joel Butler, to August 2020. Roberto Carlin's appointment brings to three out of four the number of Italian researchers heading CERN's LHC large experiments: in addition to him, in charge of CMS, Federico Antinori and Giovanni Passaleva head, respectively, ALICE and LHCb. Whilst Simone Giani coordinates the TOTEM collaboration, a smaller experiment compared to the four giants, but it is equally fundamental to the results that CERN is obtaining in terms of understanding the infinitely small universe. ■

INFRASTRUCTURES

NOA, THE GRAN SASSO LABORATORIES' NEW TECHNLOGICAL HUB

On 14 February, the Abruzzo Region and INFN signed an agreement governing the participation in the master plan of the DarkSide-20k project. The aim is to achieve synergy between the scientific world and companies, exploiting the Nuova Officina Assergi (NOA) infrastructure (the Gran Sasso laboratories' new technological hub supported by the Abruzzo Region). Through research projects, PhD programs and research grants, young scientists will play a central role, finding in NOA a unique place where to train and develop their professional expertise in the technological field. This is a highly-specialised post-graduate program which enables students to find a job in the industrial and technologically-advanced field. The young students will work with researchers and senior technologists already specialised in various fields in an international context, training a new generation of specialised technicians and graduates who will contribute significantly to the growth and development of the territory. ■

COMPUTING

LAUNCH OF THE CLOUD AND BIG DATA PROJECTS

The two projects financed by the European Commission as part of the Horizon 2020 program were launched with a joint kick-off meeting. These projects, which see INFN's participation, focus on distributed computing and big data, eXtreme Data Cloud and DEEP-Hybrid DataCloud. Together with the EOSC-hub European project, they are INDIGO-DataCloud's continuation and extension. During the kick-off meeting, the range of possible relations between the three projects were discussed in order to achieve all possible synergies that generate useful and effective services to develop the European Open Science Cloud (EOSC), an infrastructure commissioned by the European Commission to share scientific data and services. As part of EOSC, the INDIGO-DataCloud project, coordinated by INFN, developed a series of software components that facilitate the use, by several scientific communities, of a hybrid Cloud infrastructure, made up of both public and private resources. The assessment of the European auditors confirms the success of this project as well as the fact that the three projects were approved within the scope of H2020, actually representing its continuation and ensuring the dissemination and exploitation of results. ■

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THE GGI BECOMES NATIONAL CENTRE OF ADVANCED STUDIES FOR THEORETICAL PHYSICS

The Galileo Galilei Institute (GGI), a centre of excellence for high education in theoretical physics, has become the National Centre of Advanced Studies of INFN, in partnership with the University of Florence. A ceremony in Florence celebrated the event with the participation of the scientific community and the institutions. The ceremony was held on 15 February, the date which marks the anniversary of Galileo Galilei's birth, to whom the centre which, every year, houses hundreds of the world's best scientists, is dedicated. The GGI is now INFN's third national centre, joining CNAF, the National Centre for the Research and Development in Information and Communication Technologies based in Bologna, and TIFPA, Trento's Institute for Fundamental Physics and Applications. In addition to the GGI's transformation into a National Centre, the Galileo Galilei Medal was introduced. This award will be assigned for the first time in 2019 to the researchers who contributed significantly to the progress on theoretical physics research.

Based on the Arcetri hill, a historical location for physics and astronomy in Florence, the GGI is the first European institute dedicated to the theoretical physics of fundamental interactions. Its mission is to organise and host advanced-level workshops. Its transformation into a National Centre of Advanced Studies confirms the driving role played by the centre over the first twelve years of activity for the national and international scientific community in the field of theoretical physics: in the past, this field provided the basis for the recent discoveries of the Higgs boson and the gravitational waves and, today, it plays a fundamental role in the new exploratory phase.

The GGI was founded by Giuseppe Marchesini and other theoretical physicists, and was developed thanks to the collaboration between INFN and the University of Florence. Since 2006, the GGI hosted over 5000 scientists from all over the world. Every year, it organises four graduate schools, lasting 2-3

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weeks each, focused on the String theory, the Theoretical physics of elementary particles, the Nuclear theoretical physics and the Theory of fields and statistical mechanics. In 2019, a school of Cosmology and astroparticles will also be introduced. Thanks to its activities, the Centre also benefits from a loan of approximately 600,000€ granted by the US-based Simons Foundation which funded a five-year project aiming at promoting and supporting the presence of scientists of international standing and young researchers at the Institute. ■

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