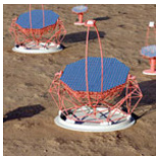
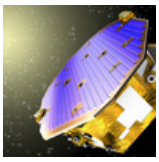
NEWSLETTER 06

Italian National Institute for Nuclear Physics

DECEMBER 2014

NEWS





SCIENCE AND TECHNOLOGY
ICARUS, FROM THE NATIONAL LABORATORIES OF GRAN SASSO TO CERN

The long journey of the largest liquid argon detector in the world is reaching its destination: the gigantic neutrino hunter ICARUS T600 has left the INFN laboratories of Gran Sasso heading towards CERN in Geneva. Until 2012, ICARUS observed the neutrino beam coming from CERN, after a journey of 730 miles through the Earth's crust. Now, with a delicate transport operation by means of two special convoys, it is being transferred to CERN for maintenance and upgrading of its performance, in anticipation of its probable future use in the United States: physicists consider it an essential element for an experiment with low-energy neutrinos at the Fermilab in Chicago. ICARUS is a liquid argon ionization detector (600 tons of liquefied gas): its technology was proposed in 1977 by the Nobel Prize winner in physics, Carlo Rubbia, spokesman of the experiment, and represents an example of the Italian supremacy of INFN in proposing an original solution, the validity of which is proven by its success. ICARUS thus combines the originality of the idea with the precision and efficiency of the technical implementation. ■

MEDICINE
THE PRE-CLINICAL ROOM OF THE NEW HADRON THERAPY CENTRE IN PRAGUE WILL BE BUILT BY INFN

INFN has been awarded the public tender for construction of the pre-clinical room of the new hadron therapy centre to be built in Prague, Czech Republic, within the scope of the European ELI (Extreme Light Infrastructure) project, and more specifically of the ELIMAIA (ELI Multidisciplinary Applications of Laser Ion Acceleration) project. It will be the first complete room of its kind in the world, with state-of-the-art facilities for research in physics, dosimetry and pre-clinical tests. The INFN National Laboratories of the South will, over the next three years, manage the partnership for implementation of the project. The new hadron therapy centre to be built in Prague will differ from those already in existence in terms of the technique for production of the accelerated particle beams: in this case, in fact, instead of using a traditional accelerator, particles will be accelerated in plasmas, exploiting the interaction between matter and laser. This technique enables high quality proton beams to be produced at low cost for use in cancer therapy. ■

NOMINATION
THE APPOINTMENT OF FABIOLA GIANOTTI AS HEAD OF CERN FROM 2016

On 12 December, the Council of CERN formalised the election of Fabiola Gianotti as head of the largest particle physics research centre in the world. Now, the Italian scientist is officially the future Director General of CERN, a position she will take up as from 1 January 2016. “Italy has always had a special relationship with CERN, – recalls Fernando Ferroni, INFN President and member of the Council – since its inception, with Edoardo Amaldi among the founding fathers, to the successes of the LHC experiments, with the involvement of many Italian physicists, sealed by the discovery of the Higgs boson, not to mention the Nobel Prize winner, Carlo Rubbia, also Director General, as too was Luciano Maiani”. “It was with immense joy and great satisfaction that we learned of the appointment of Fabiola as head of CERN, which will therefore be directed with the class and confidence which are her hallmark, by an Italian of our school, demonstrating the vitality and visibility it has at a global level. For Italy it is an extraordinary recognition, and for INFN a confirmation of its scientific and educational strategy, as well as an encouragement to continue in the direction of uncompromising excellence that distinguishes it”, concludes Ferroni. ■

HIGHER EDUCATION
NEW ACADEMIC YEAR OF THE GRAN SASSO SCIENCE INSTITUTE INAUGURATED

The second academic year of the Gran Sasso Science Institute, the GSSI, the INFN International PhD School founded in L'Aquila with a view to cultural, social and economic redevelopment of the area following the 2009 earthquake, has been inaugurated with a wonderful ceremony. The event was attended by prominent figures from the scientific and institutional world, including Nobel Prize winner in physics, Carlo Rubbia. And also many young people: bright graduate students from all over the world, which are the core of the GSSI. “I have fellow students from Pakistan, Vietnam, India and various European countries”, says Alkida Balliu, an Albanian IT student who opened the day's proceedings. “In this beautiful city that teems with culture, – continued Balliu – it's as if the world has been united, I am sure we will do great things”. “This is an international place of excellence”, underlined the GSSI Director, Eugenio Coccia “of the 80 PhDs currently working here, selected from more than 1,000 applications received, 50% are from abroad. These numbers justify our existence and testify to the success of our mission: attract young talent to L'Aquila from around the world”. ■

» INTERVIEW

TRAINING AND MOBILITY OF RESEARCHERS IN EUROPE

Interview with Alessandra Luchetti

Alessandra Luchetti is a member of the General Directorate for Education and Culture of the European Commission in Brussels. She is responsible for the "Marie Curie Actions" sector for the training and mobility of researchers at the beginning of and during their career.

In 2011, the European Commission has set 2014 as the deadline for completion of the European Research Area. What exactly is this?

The European Research Area (ERA) enables researchers, research institutions and businesses to work and co-operate freely across borders. In September 2014 the latest ERA Progress Report was published. It emphasises the key role of human resources policies: open recruitment enables research institutions to hire the best researchers at all career stages, and fosters effective geographical mobility. The report also highlights new OECD data showing that the research impact of mobile researchers is nearly 20% higher than that of those who never moved abroad.

Which are the main tools made available by the Commission to improve Europe's growth capacity and promote excellence and competitiveness?

Horizon 2020 is the biggest EU Research and Innovation programme ever with EUR 79 billion of funding available over 7 years (2014 to 2020). It is a single programme bringing together three separate previous programmes/ initiatives: The 7th Research Framework Programme (FP7), innovation aspects of Competitiveness and Innovation Framework Programme (CIP), and the European Institute of Innovation and Technology (EIT)
Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. The Innovation Union requires the EU to attract one million

» INTERVIEW

more people to the research profession by 2020. The Marie Skłodowska-Curie actions (MSCA) are key to that, not only by funding 65 000 researchers directly but also through their positive impact on the conditions for researchers in Europe as a whole.

For a long time, and with increasing attention, the Commission has been supporting the development of human resources in European research. What is the latest news with regard to actions for the mobility and training of researchers?

The latest ERA Progress Report mentioned above states that the MSCA have had a pronounced structuring impact on the ERA. They set standards for research training, attractive employment conditions and open recruitment for all researchers, as well as influencing regional or national programmes through cofunding.
In 2014 the first MSCA calls for proposals within Horizon 2020 were launched. The approach of extending and simplifying the previous Marie Curie actions has been clearly endorsed - the oversubscription rate this year was 7 times the available budget of EUR 805 million.

Highlights from this year's calls include 8 European Joint Doctorates, following the successful integration of the former Erasmus Mundus Joint Doctorates initiative into the MSCA. In addition, the MSCA remain a key mechanism to bring experienced researchers to Europe, as shown by the 20% of Individual Fellowship applications from those residing elsewhere.

Through which programmes are the Marie Curie actions developed and which is the target audience?

The MSCA offer opportunities for researchers at any career stage, regardless of research field, nationality or age. The programme supports mobility to any country within or beyond the EU, provided that the fellowship finishes with return to Europe. However we may not fund activities specified in the EURATOM Treaty.
In the Innovative Training Networks (ITN), a number of European organisations are financed to provide structured doctoral-level training based on intersectoral secondments. The Individual Fellowships support the mobility of experienced researchers to, from and within Europe. They apply directly to the Commission with their research proposal.
The new Research and Innovation Staff Exchange (RISE) action supports partnerships of European and/or international organisations jointly to implement or plan a research project through exchanging their staff.
Finally, the COFUND action supports organisations in Europe that manage high-quality transnational doctoral or fellowship programmes.

What is the relationship today between European researchers and industry? Are there any specific

» INTERVIEW

programmes for development of innovation and promotion of ideas?

Thanks to the essential participation of the non-academic sector in the MSCA-funded training programmes, they provide both specialist knowledge in the given research field and transferable competencies that foster innovation, such as entrepreneurship. 600 companies are foreseen to be funded through the ITN call of 2014. In addition, there is the specific MSCA for staff exchange to transfer knowledge between academia and businesses. Non-academic organisations make up around 30% of those successful in the first RISE call for proposals. Over 100 of these participants are SMEs.

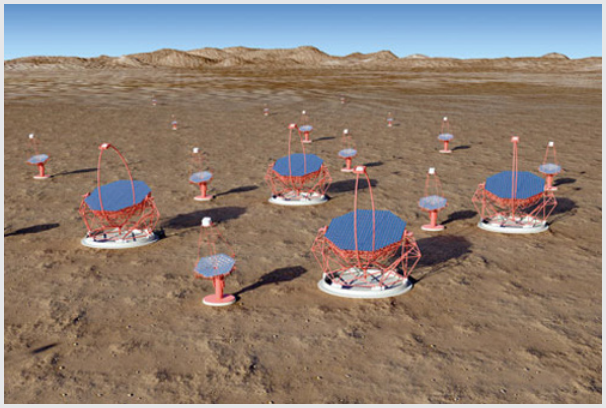
In comparison with other Member States, what is Italy's response to actions to encourage researcher mobility?

Italy was highly successful in the programme that preceded the MSCA. There were 1377 participations by Italian organisations in the Marie Curie actions (MCA) between 2007 and 2013, which were financed with EUR 281 million. 4913 Italian researchers so far have been funded to gain skills and experience abroad – Italian fellows are the largest group in the MCA. 2976 foreign researchers have gone to Italy through an MCA grant. In addition, from the first two MSCA call evaluations to be completed a total of 125 Italian participations are foreseen to be financed: 69 in the ITN action, 56 in the RISE action.

What suggestions would you give to European researchers in order for them to make the best of the opportunities offered by the Commission?

National Contact Points dedicated to the MSCA exist in all EU Member States and Horizon 2020 Associated Countries, plus in a number of other countries around the globe. Their main role is to guide potential applicants on choosing relevant types of action, advise on administrative procedures and contractual issues, provide training and assistance on proposal writing, distribute documentation (forms, guidelines, manuals etc.) and assist in partner search. Their contact details can be found on the Horizon 2020 Participant Portal.

» THE EUROPEAN PROJECT



CTA, AN ADVANCED OBSERVATORY FOR HIGH-ENERGY GAMMA-RAYS

The Cherenkov Telescope Array (CTA), a next-generation observatory for very high enrgy gamma-ray astronomy, will be the first facility of this kind to be operated as an 'Open Observatory', serving a wide astrophysics and astroparticle physics community and being driven by proposals from the users community. The project builds on expertise gained in the highly successful projects HESS (*High Energy Stereoscopic System*), in Namibia, and MAGIC (*Major Atmospheric Gamma-ray Imaging Cherenkov telescopes*) in the Canary Islands, and brings together the existing community in Europe working in this field. CTA will consist of arrays of Cherenkov telescopes, which will offer significantly improved performance with respect to currently operating gamma-ray telescopes. This will be essential to study the many types of gamma-ray sources and identify cosmic ray acceleration mechanisms, as well as possible new physics e.g. dark matter signals. High energy particles are everywhere in the Universe, coming from cosmic bodies such as remnants of supernova explosions, binary stars, jets around black holes in distant galaxies, star formation regions and many other violent phenomena. To hunt for such particles can help us to understand what is going on inside these extreme environments and also answer fundamental physics questions such as the nature of dark matter and of gravity.

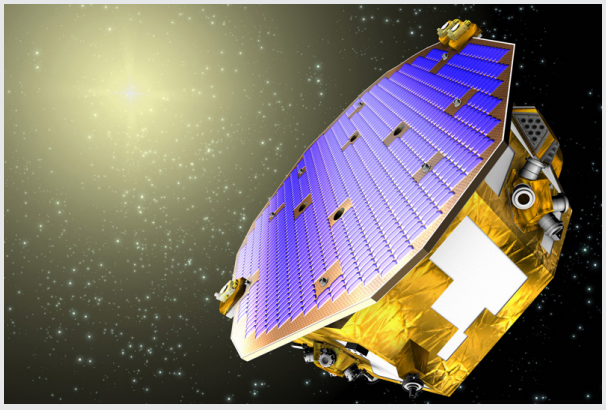
While these high-energy phenomena are hard to trace, they are normally associated with the production of flashes of blue light in the atmosphere, the Cherenkov radiation, which can be detected from Earth. To collect the faint and very fast flashes, large mirrors and high-speed 'cameras' are required. Moreover, CTA will achieve its unprecedented level of sensitivity to gamma rays by using telescopes of three sizes, covering the low, intermediate and high energy regimes. Gamma rays at the highest energies, in particular, produce so many Cherenkov photons that they can be easily seen with small (4-6 m diameter) telescopes. However, these extremely energetic photons are rare, and a large area on the ground (1-10 km^2) must be covered, requiring tens of small telescopes to achieve the required sensitivity. The members of the CTA Consortium have a wide experience of constructing and operating telescopes similar to those of CTA. The main challenge for these telescopes lies thus in the industrialization of all aspects of the production and the exploitation of economies of scale – as well as in technological developments. Many countries* in the world have joined their efforts and capabilities to reach this important result, which will really open multi-messenger astronomy to us, extending

» THE EUROPEAN PROJECT

the observable spectrum and allowing us to see the invisible high-energy universe.
INFN, in particular, is involved in the development of innovative light sensors (silicon photomultipliers, which have applications also in medical physics), mostly for the small telescopes, and in the electronics and the mechanics for the large telescope. All this is done in cooperation with national research and industrial partners.
During 2015 the construction of the first large telescope in the Canary Island of La Palma will start, and should be finished in September 2016. ■

*The CTA project involves: Argentina, Armenia, Austria, Brazil, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Greece, India, Ireland, Italy, Japan, Namibia, Netherlands, Poland, Slovenia, South Africa, Spain, Sweden, Switzerland, United Kingdom and United States of America.
CTA is included in the 2008 roadmap of the European Strategy Forum on Research Infrastructures (ESFRI). It is one of the "Magnificent Seven" of the European strategy for astroparticle physics published by ASPERA (AStroParticle ERAnet), and highly ranked in the "strategic plan for European astronomy" of ASTRONET. In addition CTA is a recommended project for the next decade in the US National Academies of Sciences Decadal Review.

» TECHNOLOGY TRANSFER



ITALIAN SENSORS FOR LISA PATHFINDER

The LISA Pathfinder space mission, leaving in a few months time with the task of testing technologies for implementation of the first space observatory for gravitational waves, will take highly sophisticated made-in-Italy inertial sensors into orbit. The mission, involving INFN, the European Space Agency (ESA) and the Italian Space Agency (ISA), is the first step in the implementation of a future laser Interferometer composed of three satellites in orbit around the Sun, eLISA (*Evolved Laser Interferometer Space Antenna*), which launch has been scheduled by ESA around 2030. This challenging project will be capable to detect gravitational waves directly from space, thus avoiding disturbances like earth vibrations or atmospheric noise, and will be complementary to the two terrestrial laser interferometer which are now operative for gravitational waves coming to Earth, the Italian-French Virgo, in Tuscany, and the American Ligo. eLISA will orbit around the Sun, following the Earth at a distance of some tens million kilometres, and will be constituted by three satellites few million kilometres away from each other.
The first milestone towards eLISA, the LISA-Pathfinder mission, is part of the ESA Scientific Programme, to which Italy contributes for 13%. A Multilateral Agreement between all Member States participating in the project was signed in May 2005.
LISA Pathfinder will inaugurate the gravitational astronomy, orbiting around the Sun at a distance of 150 million kilometres from it. The satellite will bring on board a system composed of two test masses and an interferometer, which together with the associated electronics and optics constitute the LISA Technology Package (LTP), made by a consortium of European research institutions. Italy is responsible for ESA for the definition of the overall LTP architecture.
Key components of this ambitious project are the inertial sensors, a completely Italian technology produced by CGS spa with the funding of ASI (Italian Space Agency) and based on the design of INFN and University of Trento scientists.
“Exploration of the gravitational universe, only possible via a space observatory, will revolutionise astrophysics, cosmology and fundamental physics and this research will lead to enormous progress in the understanding of the universe" said Stefano Vitale of INFN and the University of Trento, member of the eLISA scientific team and Principal Investigator of the LISA Pathfinder mission. ■

ITALIAN NATIONAL INSTITUTE FOR NUCLEAR PHYSICS

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