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Deepening and Broadening of Astroparticle Physics European Coordination

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Astroparticle physics: a new interdisciplinary field gains strength

Europe is leading the way in the emerging scientific field known as astroparticle physics. The main promoters — more than 20 national government agencies and CERN — are partners of the ASPERA-2 (Astroparticle Physics European Research Area Network) which is coordinating and funding exciting new projects to shed light on some of the most enduring secrets of our universe.

'This ERA-NET allows us to coordinate and fund exciting new projects to shed light on some of the most enduring secrets of our universe.'

What is the universe made of? How many billions of years old is it? What is dark matter and what is the true nature of gravity? Astroparticle physics seeks to answer these and other fundamental questions on how our universe is constructed by its study of minute astroparticles. Astroparticle physics is fast becoming an established discipline blending the sciences of cosmology, physics and astronomy. Astroparticle physicists apply methods and instruments originally developed in particle physics to study the formation of the universe from its smallest to its largest components.

The ASPERA ERA-NET was originally established under the Sixth Framework Programme (FP6) to create a sustainable structure for European astroparticle physics research. ASPERA laid out a strategy for European astroparticle physics research identifying the highest priority research areas for the next 10 years. The strategy was published in the form of a roadmap in 2008, and was one of ASPERA's main deliverable successes.

Roadmap sets out ambitious plan

The roadmap, which will be updated every two years, lays out a vision of astroparticle physics research over the next decade, giving European astroparticle physicists a clear plan for the future. It is split into five areas: cosmology and the early universe; particle properties; neutrinos as messengers from the Sun, supernovae and the Earth; the non-thermal universe; gravitational waves.

The roadmap proposes a series of exciting new infrastructures that astroparticle physicists are calling the 'Magnificent Seven', which will carry out research into some of the greatest mysteries in the universe.

These infrastructures are: the Cherenkov telescope array project, which will detect cosmic high-energy gamma rays; KM3NeT, a cubic-kilometre scale neutrino telescope that will be situated under the Mediterranean sea; ton-scale detectors to search out dark matter; a ton-scale detector to determine fundamental nature and mass of neutrinos (particles that travel nearly at the speed of light); a megaton-scale detector to investigate properties of neutrinos; a large telescope array to detect charged cosmic rays; and a third generational underground gravitational antenna.

Some of these infrastructures will begin construction by 2012. A huge increase in current investment in astroparticle physics will be needed to sustain such an ambitious programme and funding will come from agencies from all over the world as this will be a global rather than a purely European project.

As well as undertaking the management of the seven new infrastructures, the expanded ASPERA-2 consortium will deepen and broaden its scope by the establishment of joint European activities as the preferred way of funding large projects, and intensifying global and inter-regional coordination.

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ERA-NET Coordination Action

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'The ASPERA-2 consortium has managed to incorporate virtually all European players in astroparticle physics – excellent expertise at the round table.'

ASPERA-2 has other goals as well. It intends to improve European research links with industry and extend the network to all European countries that are interested in developing their knowledge and techniques of astroparticle physics. A worldwide dialogue will also be encouraged with countries that are interested in learning more about the science.

ASPERA examined ways to link existing infrastructures so that researchers across disciplines could make the most effective and efficient use of resources. In ASPERA-2, the results of this best practice study will be applied to linking underground laboratories and other facilities that participate (or are interested in participating) in astroparticle physics projects.

This approach will enable the research community to maximise the use of existing institutions and to create new structures. Specialised task forces will foster links between the institutions based on information gathered on available resources, expertise and tools for management, administration, and legal support.

Synergies with the environmental sciences

ASPERA-2 members are also looking into the potential applications of astroparticle physics infrastructures, technology, and methods for environmental and climate studies, as well as for risk monitoring.

Some astroparticle physics experiments must be protected from terrestrial impacts and various sources of background 'noise'. Therefore, they are located at special places such as in underground labs, in the deep sea or on satellites. Many experiments involve equipping large amounts of space with detectors located in special surroundings.

Underwater, underground, and atmospheric monitoring are three fields where obvious synergies could be best exploited. One of the network's objectives is to identify and engage funding agencies operating in these fields in order to capitalise on joint funding programmes.

Transferring knowledge

Emerging astroparticle R&D activities have started to interest small and medium-sized enterprises (SMEs). Cost-effectiveness drives common endeavours for some applications, as businesses can help to develop and build the hundreds of thousands of sensors needed for the new observatories. Astroparticle physics projects are driving the technology for other applications (e.g. cryodetectors), and the associated SMEs can profit from the spin-offs.

Technologies developed for use in astroparticle physics have a much wider scope for application, particularly for the environmental sciences and risk prevention. Multiple national initiatives of public-private partnerships that are based on astroparticle physics projects have already been established. These relationships will be extended, formalised and monitored in ASPERA-2.

The ASPERA website is essentially the only online resource for comprehensive information and news on astroparticle physics, and is an important strategic tool to highlight the leading position of European astroparticle physics. The website will be extended to support future common activities, in particular the processing of common calls and all other joint actions within the network.

Research field
Astroparticle physics

Coordinator
- Projektträger DESY (Germany)

Partners
- Bundesministerium für Bildung und Forschung (Germany)
- Centre National de la Recherche Scientifique (France)
- Commissariat à l'Energie Atomique (France)
- European Organisation for Nuclear Research (CERN)
- Fonds de la Recherche Scientifique (Belgium)
- Fonds Wetenschappelijk Onderzoek – Vlaanderen (Belgium)
- Fundação para a Ciência e a Tecnologia (Portugal)
- Fyzikalni ustav AV CR, v. v. i. (Czech Republic)
- Institute of Physics and Nuclear Engineering (Romania)
- Istituto Nazionale di Fisica Nucleare (Italy)
- Ministerio de Ciencia e Innovación (Spain)
- Ministry of Education Youth and Sports (Czech Republic)
- Narodowe Centrum Badań i Rozwoju (Poland)
- National Center for Scientific Research (Greece)
- National Foundation for Science, Higher Education and Technological Development of the Republic of Croatia (Croatia)
- Nemzeti Kutatási és Technológiai Hivatal (Hungary)
- Science and Technology Facilities Council (United Kingdom)
- Slovenian Research Agency (Slovenia)
- Stichting voor Fundamenteel Onderzoek der Materie (Netherlands)
- Swedish Research Council (Sweden)
- Swiss National Science Foundation (Switzerland)

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