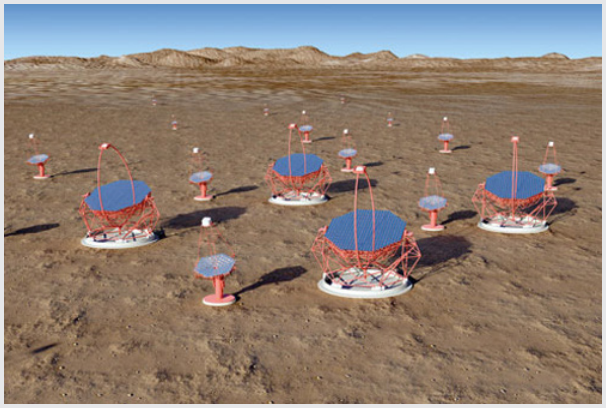
» THE EUROPEAN PROJECT



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.