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Astroparticles: Their detection and crucial role in XXI century science

Astroparticles are gamma rays, cosmic rays and neutrinos. Their crucial role in astrophysics of the 21st century is to contribute to the knowledge of the highest energy physics associated with the most violent and extreme universe. Generally speaking, highest energy physics or particle physics can be divided into three main subjects: 1- Physics of particle accelerators like the one involved in the Large Hadron Collider (LHC), 2- Astroparticles and 3- Nuclear physics. The difference lies in study energy. LHC is an artificial accelerator that reaches energies of a few Tera-Electrons-Volts (TeV; the light energy that our eyes can see is of a few EVs) and with which it is not possible to perform studies at higher energy like hundreds of TeVs, Peta-Electron-Volts or Exa-Electron-Volts. However, some astronomical objects behave as natural particle accelerators that allow studying this range. These astronomical objects are related to cataclysmic events such as the death of massive stars and systems involving black holes. The astroparticles from these astronomical objects reach the earth and impact on aeronautics and space science, because being light or the most energetic particles of the universe, they affect the missions, instrumentation and protection of astronauts. However, to detect and study them, not only satellites such as NASA-FERMI can be used but special detectors installed at ground level. The reason is that to study more energy, more effective detection area is required. This is where it is important to perform "ad-hoc" instrumentation work and to use detection techniques such as Vavilov-Cherenkov radiation and calorimeters. In particular, astroparticle detectors that use the most important water Cherenkov radiation are IceCube (Neutrinos, located in the south pole), HAWC (High Altitude Water Cherenkov, Gamma Rays, located in Mexico) and Auger (Cosmic Rays; located in Argentina).

Biography

Eduardo de la Fuente has his expertise in Astrophysics (radio, optical, and gamma rays) and Astroparticles. He has completed his PhD at the age of 33 years from CUCEI, University of Guadalajara, Mexico. He is Associate Professor of the physics department at CUCEI, University of Guadalajara. He also works on the HAWC Gamma Ray Observatory, is a member of the Mars Society and co-founder of the Mexican Space Society.

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