

DESCRIPTION FOR THE GENERAL PUBLIC

Observation of the very high energy (VHE) gamma rays is a challenge for astronomers. The most energetic photons do not reach the surface of the Earth, and their low statistics – only one photon with energy above 100 GeV falls on area of about 1500 m² in one hour - causes, that possible space-born detectors should be incredibly large and the observations would take a lot of time. The very high energy gamma-ray photons interact with the upper layers of the atmosphere and they produce cascades of secondary charged particles. These charged particles emit blue Cherenkov light, while traveling through the atmosphere with the velocities larger than velocity of light in this medium. Cherenkov photons reach the ground level and they can be recorded by astronomer with dedicated telescopes. The reconstruction gives a possibility of indirect detection of primary photons with the energies of tens of teraelectronvolts (1 TeV = 10¹² eV).

This observation method is used by two observatories: H.E.S.S. (the High Energy Stereoscopic System), located in Namibia in the Khomas Highland and MAGIC (the Major Atmospheric Gamma-ray Imaging Cherenkov Telescopes), which is placed on Spanish island La Palma. Five H.E.S.S. telescopes and two MAGIC ones contributed in detection of the most of known TeV gamma-ray emitters. So far, 160 VHE gamma-ray sources has been discovered, but until 2004 there were only 13 such sources. H.E.S.S. monitors the southern hemisphere, while MAGIC the northern one, which makes both instruments complementary.

The main scientific goals of the both projects are: 1) the studies on the origin of cosmic rays and their role in the Universe - this research mainly focuses on cosmic sources such like: supernova remnants, pulsar wind nebulae, pulsars, micro-quasars, massive star forming regions and starburst galaxies, radio-galaxies, blazars and other active galactic nuclei and gamma-ray bursts; 2) studies on the extragalactic background light or the extragalactic magnetic fields; 3) fundamental physics, including search for dark matter particles and Lorentz Invariance Violation.

Research performed by the Polish members of the H.E.S.S. and MAGIC Collaborations will be continued in the forthcoming years (2017-2020) as a main goal of this project. It is worth mentioning that Polish scientists are actively involved in H.E.S.S. and MAGIC tasks including: events reconstruction, data reduction, analysis and interpretation, theoretical modelling of physical processes responsible for the observed VHE emission, planning of the multi-frequency campaigns, writing scientific papers and presentation of the results during international and national meetings and conferences. Previous H.E.S.S. and MAGIC results have been published in over 200 peer-reviewed scientific papers, also in the most prestigious like Science and Nature.