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A concept of wide-angle Cherenkov gamma-ray instrument with minimal imaging

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The energy range >100 TeV is of central importance for high-energy astrophysics. PeV accelerators are expected to produce also copious photons of about a decade less in energy. Thus registering gamma-rays with energies above 100 TeV will pinpoint the galactic sources able to accelerate particles up to PeV energies (so-called PeVatrons).
We suggest a concept of a novel wide-angle imaging detector for gamma-rays with energies from largely unexplored range between 10 TeV and several PeV. The All-Sky Gamma-Ray Detector (ASGaRD) is an array of optical modules with wide (˜50 degree) field of view and a low cost imaging, allowing affordable coverage of large areas for high energies. The ASGaRD optical modules comprise a Fresnel lens with a multipixel SiPM camera, followed by a novel dead-time-free data acquisition system based on FPGAs.

ASGaRD is designed for simultaneous observation of large portions of the sky and to reach to energies of about 10 PeV. We study the capability of ASGaRD to yield a better gamma-ray sensitivity (for E>20 TeV) than CTA and HAWC, at a fraction of the cost. The power of the background reduction given the limited, as compared to the Imaging Atmospheric Cherenkov Telescopes (IACTs), image quality is investigated. We address also the ability of ASGaRD to complement both, the wide-field non-imaging and the narrow-field imaging gamma-ray experiments for energies beyond 10 TeV by studying the performance of hybrid ASGaRD/IACTs arrays.

Collaboration

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