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Research on the performance verification and future applications of the Stereoscopic Water Cherenkov Detection Array

Recently, the technique of detecting high-energy particles using water Cherenkov radiation has achieved great success in ground-based cosmic ray observation experiments. For example, the Tibet ASγ experiment, the HAWC experiment, and the LHAASO experiment. However, research on the basic performance of water Cherenkov detectors is still lacking. In this work, the fundamental performance of the water Cherenkov detector is tested by constructing a prototype detector and calibrating the particle number and arrival time response. The experimental results show that the water Cherenkov detection technique is similar to the scintillator detection technique in determining the incident particle number and arrival time. The water Cerenkov detector uses cheap water as a reaction medium for particles. It uses an efficient Photomultiplier Tube (PMT) to detect the Cherenkov light generated in water, offering significant advantages over conventional scintillator detectors in terms of cost and technology. This capability enables large-scale ground-based cosmic ray experiments with high sensitivity. In this paper, the design and future application of Stereoscopic Water Cherenkov Detection Array (SWCDA) are described in detail. The main scientific objective of the SWCDA project is to observe blazars, active galactic nuclei (AGN or AGN flares), GRBS, etc., in the 100 GeV-10 TeV energy region.

Collaboration(s)

Author: Dr HUANG, S.Y. (Institute of High Energy Physics, CAS)

Co-authors: Prof. LI, Xu (Hebei University); Dr SHANG, M.Y. (IHEP, CAS); Dr LI, Y. Y. (IHEP, CAS); Dr ZHANG, Y. (IHEP, CAS); Prof. HUANG, J. (IHEP, CAS)

Presenter: Dr HUANG, S.Y. (Institute of High Energy Physics, CAS)

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