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Detector Considerations for a Southern Hemisphere HAWC Experiment

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The High-Altitude Water Cherenkov (HAWC) observatory in central Mexico is currently the world's only synoptic survey instrument for gamma rays above 1 TeV. Because there is significant interest in covering the full TeV gamma-ray sky with a survey instrument, we have examined options for a Southern Hemisphere counterpart to HAWC. In addition to providing all-sky coverage of TeV sources, a southern site would complement existing surveys of the densest part of the Galactic Plane, provide continuous monitoring of Galactic and extragalactic transient sources in both Hemispheres, and simplify the analysis of spatially extended signals such as diffuse gamma rays and the TeV-PeV cosmic-ray anisotropy. To take advantage of the air-shower physics and lower the energy threshold of the experiment as much as possible, a high altitude site above 5000 m a.s.l. (vs. 4100 m a.s.l. at the current site in Mexico) is especially interesting. To facilitate efficient detector construction at such altitudes, the detector tanks would be assembled at lower altitude and delivered to the site. An all-digital communications and data acquisition scheme is proposed. Possible designs include taking advantage of digital optical module technology from the IceCube experiment as well as new custom electronics. We discuss the physics potential of such an experiment, focusing on the energy threshold, angular resolution, and background suppression capability of the experiment, as well as the advantages of full-sky coverage above 1 TeV.

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