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Cosmic Ray Studies with the High-Altitude Water Cherenkov (HAWC) Observatory

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The High-Altitude Water Cherenkov (HAWC) observatory is a continuously operated, wide field of view detector principally designed to observe astrophysical sources of gamma rays. HAWC can reliably estimate the energy and arrival direction of cosmic and gamma rays arriving from zenith angles of up to 450. As the Earth rotates over one day, HAWC observes a swath of the sky from -260 to 640 in Declination and 0 to 24 hours in Right Ascension, roughly 2/3 of the sky. This nearly all-sky coverage enables the measurement of large-scale as well as small-scale anisotropy in the arrival direction distribution of cosmic rays. The HAWC detector area of approximately 22,000m2 located at an altitude of 4100 m results in significant sensitivity to gamma rays and cosmic rays with energies from several hundred GeV up to several hundred TeV. Precise measurements of the energy spectrum and arrival direction dependence of the cosmic ray flux have been performed using several billion events after selection cuts from a data set including trillions of air shower triggers. The large statistics have enabled measurement of spectra of the light-components, protons plus helium, using analysis techniques guided by CORSIKA simulations. HAWC observations of the emission of gamma-rays in astrophysical objects also provide constraints on the possible sources of galactic cosmic rays. This presentation will review the techniques and results of these cosmic ray measurements performed by HAWC.

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