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Sensitivity of HAWC to Primordial Black Hole Bursts

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Primordial Black Holes (PBHs) are gravitationally collapsed objects that may have been created in the early universe and could have arbitrarily small masses down to the Planck scale. Due to quantum gravitational effects, it is believed that a black hole has a temperature inversely proportional to its mass and will emit all species of fundamental particles thermally. PBHs with initial masses of ˜5.0 x 10ˆ14 g should be expiring in the present epoch with bursts of high-energy particles, including gamma radiation in the GeV/TeV energy range. The HAWC (High Altitude Water Cherenkov) high energy observatory is sensitive to the high end of the PBH evaporation gamma-ray spectrum. Due to its large field of view, duty cycle above 90 % and sensitivity up to 100 TeV, the HAWC observatory is well suited to perform a search for PBH bursts. In this work, we show that if the PBH explodes with in 0.25 light years from Earth and within 26 degrees of zenith, HAWC will have a 95% probability of detecting the PBH burst at 5 sigma level. On the other hand a null detection from HAWC for a >2 year search will set PBH upper limits which are significantly better than any other upper limits set by any previous PBH search.

Collaboration

HAWC

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