

Constraining the primary proton spectrum of the hadronic PeVatron candidate HAWC J1825-134

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The γ -ray spectrum of the Galactic source HAWC J1825-134 measured with HAWC [Albert et al., ApJ Lett., 907, L30 (2021)] extends beyond 200 TeV and does not reveal a knee or a cutoff. HAWC J1825-134 is among the best candidates for hadronic PeVatrons — the objects able to accelerate protons up to the energy of at least 1 PeV. However, this source is situated in a crowded region of the γ -ray sky, greatly complicating the analysis. Using the publicly available dataset of the Fermi-LAT space γ -ray telescope, we dissect the region around HAWC J1825-134 and eventually derive upper limits on the intensity of the source in the 1 GeV–1 TeV energy range. We show that only a very hard ($\gamma_p < 1.5$) primary proton spectrum at $E_p < 10$ TeV describes the Fermi-LAT data set well. Very hard γ -ray spectra below several TeV could represent a useful signature of Galactic hadronic PeVatrons.

A simple power-law-exponential cutoff spectrum could in principle describe the combined HAWC and Fermi-LAT data sets reasonably well for $\gamma_p \approx 1.5$ and the cutoff energy $E_{p-c} \approx 500$ TeV. More details could be found in [Dzhatdoev et al., ApJ, 929, 25 (2022)].

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