

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

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The  $\gamma$ -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  $\gamma$ -ray sky, greatly complicating the analysis. Using the publicly available dataset of the Fermi-LAT space  $\gamma$ -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  $\gamma$ -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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