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Multi-instrument analysis of the very high energy γ-ray emission in the region of HESS J1813-178

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Studies of the region around the young 44.7 ms pulsar PSR J1813-1749 are of significant interest because of the exceptional properties of the pulsar. PSR J1813-1749 is not just the most scattered pulsar known, but it also shows one of the highest spin-down luminosities ever measured, second only to the crab pulsar. These properties, as well as the young age of the pulsar and the supernova remnant in which it is located, present the opportunity to study the evolution of a highly unusual system.
In previous studies of the region with Imaging Atmospheric Cherenkov Telescopes (IACTs), very high energy γ-ray emission, confined in a region of 3.4' around the plusar was discovered. This source, HESS J1813-178, was later identified as a pulsar wind nebula. On the other hand, studies of the region performed by the satellite Fermi-LAT reveal a highly extended emission, suggesting a close by star-forming region as an origin rather than a connection to the pulsar. This analysis reevaluates the data taken by the IACT array H.E.S.S. and by Fermi-LAT in the GeV energy range.
We find significantly extended emission in the TeV energy range which is positionally coincident with the pulsar and the source HESS J1813-178. The angular extension of this discovered emission is 42', corresponding to 78pc assuming a distance of 6.2kpc. Using the newly evaluated data we can find a continuous morphological and spectral description of the region over five decades of energy, from 1GeV up to 100TeV.
Using the open-source modelling package Gamera we evolve different particle populations to determine a scenario which can explain the observed γ-ray emission. We find that the pulsar PSR J1813-1749 is likely to be the origin of both, the very bright emission from HESS J1813-178, as well as the extended diffuse emission observed by Fermi-LAT and H.E.S.S.
We further examine the diffusion properties needed to explain the observed emission using electrons escaping such a young pulsar.

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