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HESS J1641-463, a very hard spectrum TeV gamma-ray source in the Galactic plane

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HESS J1641-463 is a unique source discovered by the H.E.S.S. telescope array in the very-high energy (VHE, $E \geq 0.1$ TeV) domain. The source had been previously hidden in the extended tail of emission from the bright nearby source HESS J1640-465. However, the analysis of the VHE data from the region at energies above 4 TeV revealed this new source at a significance level of 8.5 sigma. HESS J1641-463 showed a moderate flux level $F(E > 1 \text{ TeV}) = (3.64 \pm 0.44_{\text{stat}} \pm 0.73_{\text{sys}}) \times 10^{-13} \text{ cm}^{-2} \text{ s}^{-1}$, corresponding to 1.8% of the Crab Nebula flux above the same energy, and a hard spectrum with a photon index $\Gamma = 2.07 \pm 0.11_{\text{stat}} \pm 0.20_{\text{sys}}$. The light curve was investigated for evidence of variability, but none was found on both short (28-min observation) timescales and long (yearly) timescales. HESS J1641-463 is positionally coincident with the radio supernova remnant SNR G338.5+0.1. There is no clear X-ray counterpart of the SNR, although Chandra and XMM-Newton data reveal some weak emission that may be associated. If the emission from HESS J1641-463 is produced by cosmic ray protons colliding with the ambient gas, then the proton spectrum extends up to at least 0.1 PeV (99% confidence limit). If this is the case, then HESS J1641-463 may be a member of a larger source population contributing to the Galactic cosmic-ray flux around the knee.

Collaboration

H.E.S.S.

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