

LMC N132D: a mature supernova remnant with a youthful spectrum

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Supernova remnant LMC N132D is a remarkably luminous gamma-ray emitter at ~ 50 kpc with an age of ~ 2500 years. It belongs to the small group of oxygen-rich SNRs, which includes Cassiopeia A and Puppis A. N132D is interacting with a nearby molecular cloud. By adding 102 hours of new observations with the High Energy Stereoscopic System (H.E.S.S.) to the previously published data with exposure time of 150 hours, we achieve the significant detection of N132D at a 5.7 sigma level in the very high energy (VHE) domain. The gamma-ray spectrum is compatible with a single power law extending above 10 TeV. We set a lower limit on an exponential cut-off energy at 8 TeV with 95% CL. The multi-wavelength study supports a hadronic origin of VHE gamma-ray emission indicating the presence of sub-PeV cosmic-ray protons. The detection of N132D is remarkable since the TeV luminosity is higher than that of Cassiopeia A by more than an order of magnitude. Its luminosity is comparable to, or even exceeding the luminosity of RX J1713.7-3946 or HESS J1640-465. Moreover, the extended power-law tail in the VHE spectrum of N132D is surprising given both the exponential cut-off at 3.5 TeV in the spectrum of its 340-year-old sibling, Cassiopeia A, and the lack of TeV emission from a Fermi-LAT 2FHL source ($E > 50$ GeV), Puppis A. We discuss a physical scenario leading to the enhancement of TeV emission via the interaction between N132D and a near molecular cloud.

Keywords

Supernova remnants, N132D, cosmic rays, molecular clouds, gamma-rays, H.E.S.S.

Collaboration

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other Collaboration

Subcategory

Experimental Results

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