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TeV emission surrounding the high galactic latitude pulsar J1740+1000: a possible pulsar halo or a TeV source from the tail of bow shock

We report the discovery of an unidentified point-like very-high-energy (VHE) gamma-ray source around the PSR J1740+1000 named LHAASO J1740+0948.
Its significance is 12σ (5.4σ) above $25\mathrm{TeV}$ ($100\mathrm{TeV}$) and the best-fit position is $(\mathrm{R.A.}, \mathrm{decl}) = (265.01 \pm 0.03, 9.79 \pm 0.04)$. The energy spectrum can be described by a single power-law function with an index of -3.15 ± 0.17. PSR J1740+1000 is a middle-aged (114 kyr) pulsar with a long X-ray tail. This means that TeV radiation may come from (1) high energy electrons escaping from the pulsar/PWN and scattering the interstellar radiation field, i.e, pulsar halo. But the TeV source and PSR J1740+1000 position offsets are difficult to interpret; (2) upscattering of CMB photons by the ultrarelativistic particles from the PWN tail. We speculate the particles were re-accelerated at the tail of the bow shock.

Summary

Primary author: XU, Renfeng (Institute of High Energy Physics, CAS)

Presenter: XU, Renfeng (Institute of High Energy Physics, CAS)