



Contribution ID: 729

Type: **Talk**

TeV Emission from PSR B1055-52 with HESS: Evidence for a Pulsar Halo

Tuesday 22 July 2025 14:20 (15 minutes)

Pulsar halos are a recently identified class of TeV γ -ray sources, offering valuable insights into the evolution of pulsar systems at the highest energies. However, only a handful of such sources have been detected so far, making each new identification critical for understanding the properties of the population as a whole. We report the first detection of extended very-high-energy (VHE) γ -ray emission around PSR B1055-52 using observations from the H.E.S.S. array. This middle-aged pulsar, previously grouped together with Geminga and PSR B0656+14 as part of the “Three Musketeers,” has now been confirmed to host a TeV pulsar halo, making it the third detected system of its kind, and the first TeV pulsar halo discovered in the southern hemisphere. Our analysis performed in an energy range of 0.3–60 TeV, reveals gamma-ray emission with an one sigma extension of $(1.92 \pm 0.23)^\circ$. The analysis indicates that the emission extends beyond the region which was observed with H.E.S.S.. No significant spectral variation is detected across the emission.

The diffusion coefficient derived for this halo is significantly lower than the standard ISM value, aligning with findings in the Geminga halo and indicating that slow diffusion may be a common property of pulsar halos. The detection of this new TeV pulsar halo provides a crucial data point for studying the population-wide properties of pulsar halos, their impact on cosmic-ray propagation, and their role as a source of Galactic electrons and positrons.

Collaboration(s)

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Session Classification: GA

Track Classification: Gamma-Ray Astrophysics