Contribution ID: **201**   Type: **Oral**

Studies of pulsar wind nebulae in TeV gamma-rays with H.E.S.S.

Tuesday 8 August 2017 15:00 (30 minutes)

The survey of the Galactic plane in TeV gamma-rays by H.E.S.S. allows a systematic study of the population of pulsar wind nebulae (PWNe) in this energy domain. We find a mild trend of decreasing TeV luminosity with age, or decreasing spin-down power, as well as a trend of increasing size with age. Older TeV PWNe are generally displaced from the pulsar position, with offsets larger than can plausibly be explained by pulsar proper motion, which could be due to PWN interaction with the reverse shock in an asymmetric environment. The observed gamma-ray spectra can be ascribed to inverse Compton scattering of ambient photons, in which the Galactic far-infrared background often predominates; this may explain why luminous TeV PWNe are more readily detected in the inner spiral arms than in the outer Galaxy.

We also present a more detailed morphological study of the TeV emission from the PWN in the composite supernova remnant MSH 15-52. We compare its gamma-ray morphology with that in synchrotron emission, obtained from archival X-ray observations, and discuss the implications for the magnetic field in the nebula. We also discuss potential extended gamma-ray emission beyond the X-ray PWN. Such an extended morphological component could come from electrons and positrons which have escaped the PWN, which would have implications for scenarios of PWNe as sources of leptonic cosmic rays.

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Session Classification: Galactic sources

Track Classification: Galactic sources (incl. transients)