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Modelling the Gamma-ray Morphology of the Supernova Remnant W28

Gamma-ray emission in the GeV and TeV energy regime has been detected towards the old supernova remnant (SNR) W28. This object is a prime candidate for the study of cosmic-ray acceleration and diffusion, as the adjacent molecular clouds provide target material for gamma-ray production and, due to its age, most particles have already escaped the shock front into the interstellar medium. While gamma-ray spectra from different regions around the SNR have been successfully modelled by several authors, none has ever modelled the morphology. Lacking this, we cannot fully understand the acceleration mechanisms and diffusion properties. High-energy gamma rays can be produced by the decay of neutral pions produced in inelastic collisions of protons and the interstellar gas. For accurate modelling of morphology, we need to know the location of cosmic rays and the interstellar gas in 3D, as small changes in relative position cause large differences in morphology.

In this contribution, we will introduce our novel 3D modelling and present the gamma-ray morphology around the SNR W28 using arcminute-scale molecular and atomic hydrogen gas distributions from the Mopra CO survey and the HI Southern Galactic Plane Survey. We will also discuss our grid search of SNR, diffusion and gas properties to reproduce spatial and spectral gamma-ray observations from the HESS Galactic Plane Survey and Fermi-LAT.

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