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Searching for escaped cosmic rays from supernova remnants using Fermi-LAT data

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The origin of cosmic rays has been an active area of research since their discovery over a century ago. Supernova remnants (SNRs) are believed to be able to accelerate cosmic rays up to the 'knee' of the observed cosmic-ray spectrum. Although the acceleration at SNR shocks has been extensively modelled, it is still not clear that cosmic rays are able to escape these sources. After acceleration, cosmic rays may escape the shock front and diffuse into the surrounding environment where they could interact with ambient gas to produce gamma rays. Detection of gamma-ray emission outside the observed shell of an SNR will provide evidence for cosmic-ray escape from SNRs. In this contribution, we will outline an approach to search for escaped cosmic rays from SNRs using Fermi-LAT data. We will discuss our methods to perform both a morphological and spectral analysis for a SNR. We also look for a spatial correlation between the observed gamma rays and surrounding molecular clouds. We will present preliminary results for a selection of Galactic SNRs, including W28. We aim to use these results to perform multi-wavelength spectral modelling for the SNRs and investigate the possible hadronic or leptonic origin of the gamma-ray emission.

Collaboration(s)

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