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Towards Fermi-LAT Detected Supernova Remnants as Cosmic Ray Accelerators

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With the detection of more than 7 Supernova Remnants (SNRs) by the Fermi-LAT telescope, we now have access to an energy range opening a window onto emission mechanisms not previously available for these objects. In particular in combination with multiwavelength observations, we are now better able to determine the probable particle populations accelerated by the SNRs as well as the environmental conditions, such as the magnetic field strength. The SNR CTB 37A is one example where we have determined that hadrons dominate the GeV emission, as for many “middle-aged” Fermi-LAT SNRs, providing further evidence for this SNR as a probable galactic cosmic ray accelerator. Moreover we have bounded the magnetic field strength to better than an order of magnitude below its previous value, within the constraints of our model, and for first time for this source, we also determined the minimum magnetic field strength necessary to self-consistently produce the multiwavelength emission. We will explore the current understanding of Fermi-LAT SNRs as cosmic ray accelerators and anticipate future developments with the continued increase in SNR associations. By assembling such populations of SNRs, we will be able to more definitively define their contribution to the observed galactic cosmic rays, as well as better understand SNRs themselves, thereby illuminating the long-standing cosmic ray mysteries, shedding light on potential sources, acceleration mechanisms, and cosmic ray propagation.

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