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Lessons from the remote detection of Galactic cosmic rays

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The gamma radiation spawn by cosmic rays along their interstellar journey has received much attention over the years as an efficient means to trace the evolution of the cosmic-ray flux and spectrum on kiloparsec scales across the Milky Way.

The data are interpreted in the framework of an elementary scenario which involves cosmic-ray production by diffusive shock acceleration in supernova remnants, a nearly black box for their escape from the source, followed by diffusion at large with energy-dependent, but often spatially uniform diffusion properties. The abundance and quality of the Fermi LAT data allow us to test this scenario and we (happily) start to see a few cracks that I will review: detection or not of irradiated clouds near supernova remnants, cocoon of fresh cosmic rays in OB associations, cosmic-ray gradient problems in and out of the Galactic plane.

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