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## Probing circumgalactic cosmic rays and their sources around the Milky Way

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Cosmic ray (CR) hadrons with GeV-PeV energies are expected to reside in the circumgalactic medium (CGM) around the Milky Way (MW), having escaped from the Galactic disk, or injected in situ by satellite galaxies, large scale shocks due to Galactic winds, etc. In some cases, circumgalactic CRs (CGCRs) may play important thermal and dynamical roles in the evolution of galaxies, but observational evidence for them is very scarce to date. We discuss the various advantages of PeV gamma rays for probing CGCRs, by virtue of gamma-gamma absorption with the cosmic microwave background. Recent observations of the MW CGM suggest that the cool, highly structured gas traced by intermediate-velocity clouds (IVCs) and high-velocity clouds (HVCs) is comparable to the hot gas in total mass, implying that gamma-ray and neutrino emission from the MW CGM can be significantly anisotropic. Using data from Tibet AS $\gamma$ , we search for signals associated with IVCs and HVCs, and find no clear evidence so far. We discuss the implications for the origin and propagation of CRs around the MW, expectations for LHAASO, and the relation to high-energy neutrinos observed by IceCube. The prospects for future Southern facilities such as ALPACA and SWGO are also discussed.

### Summary

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