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Nonthermal hard X-ray and TeV gamma-ray diagnostics of diffusion coefficient near supernova remnants shocks

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The shock waves at supernova remnants (SNRs) are the prominent acceleration sites of Galactic cosmic rays. The diffusion of the accelerated particles around the SNR shock is assumed to be Bohm type, where the diffusion coefficient is proportional to the particle energy. The details, however, remain unrevealed.
There is a method to diagnose the diffusion coefficient from the cutoff shape of the electron distribution, corresponding to the synchrotron X-ray spectrum. We apply this to nonthermal hard X-ray observations of four synchrotron-dominated Galactic SNRs: RX J1713.7−3946, Vela Jr., G1.9+0.3, and SN 1006. Recent NuSTAR observations provide us with the spatially-resolved hard X-ray spectra up to tens of keV.
The precise measurement of synchrotron X-ray cutoff form constrains the diffusion coefficient around the cutoff energy of electron. Irrespective of the diffusion type, i.e. the energy dependence on the coefficient, the diffusion coefficient around the maximum energy of electron is obtained to be roughly comparable. For example, it is about 10^{25} cm^2/s in 20-40 TeV with magnetic field of 100 μG for RX J1713.7−3946 NW.
We also test the application to the gamma-ray cutoff form using TeV gamma-ray observations with H.E.S.S. We report and discuss its result.

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