

Cosmic Ray Acceleration and Propagation from Galactic Wind Shocks

Wednesday, August 29, 2018 5:23 PM (0:17)

Abstract content

Diffusive shock acceleration (DSA) at supernova remnant (SNR) shock fronts is thought to accelerate galactic cosmic rays (CRs) to energies below the knee, while an extragalactic origin is presumed for CRs with energies beyond the ankle. CRs with energies between 3×10^{15} and 10^{18} eV, which we dub the “shin,” have an unknown origin. In this talk, I will outline our recent theoretical work on the acceleration and propagation of shin CRs generated at galactic wind shocks. Using the steady-state wind model developed by Bustard et al. 2016, combined with optimistic assumptions for the CR acceleration rate, we estimate the energies of CRs accelerated by galactic wind termination shocks both in starburst galaxies and our own Milky Way. Our results suggest that shin CRs can be accelerated within reasonable times at such sites; however, the production of ultrahigh energy CRs is somewhat disfavored. Using parameters for a possible wind in our own Galaxy, we then utilize the CRPropa propagation code to produce CR and neutrino spectra for CRs diffusing back to the galaxy in opposition of a galactic wind. We find the flux to be significant but below IceCube measurements and KM3NeT limits. Shocks produced closer to the Galaxy’s center, which are evident in time-dependent wind models, may provide a more significant CR source. (References: Bustard et al. 2017, ApJ; Merten, Bustard, et al. 2018, ApJ)

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Session Classification : Cosmic Rays

Track Classification : Cosmic Rays