The Propagation of Cosmic Rays from the Galactic Wind Termination Shock: Back to the Galaxy?

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Abstract

Observations suggest that the transition from Galactic to extragalactic sources occurs between the 'knee' and the 'ankle'. In this talk we show whether a Galactic wind which eventually forms a termination shock far outside the Galactic plane can contribute to the observed flux in the region of interest. Previous work by Bustard et al. (2017) estimated that particles can be accelerated up to energies above the 'knee' up to Rmax = 10 PeV for parameters drawn from a model of a Milky Way wind (Everett et al. 2010). A remaining question is whether these cosmic rays can propagate back into the Galaxy. To answer this crucial question, we simulate the propagation of the cosmic rays using the low energy extension of the CRPropa framework, based on the solution of the transport equation via stochastic differential equations. The setup includes all relevant processes, including three-dimensional anisotropic spatial diffusion, advection, and corresponding adiabatic cooling. We find that, assuming realistic parameters for the shock evolution, a possible Galactic termination shock can contribute significantly to the energy budget in the 'knee' region and above. We estimate the resulting produced neutrino fluxes and find them to be below measurements from IceCube and limits by KM3NeT.

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