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Anisotropic diffusion cannot explain TeV halos

TeV halos have become a new class of astrophysical objects which were not predicted before their recent observation. They offer evidence that diffusion around sources (concretely, pulsars) is not compatible with the effective average diffusion that our models predict for the Galaxy. This directly impacts Galaxy formation, our knowledge of the propagation process throughout the Galaxy and our models of acceleration of charged particles by astrophysical sources like supernova remnants (SNRs) or Pulsar Wind Nebulae (PWN).
In this talk we show that, while anisotropic models may explain a unique source such as Geminga, the phase space of such solutions is very small and they are unable to simultaneously explain the size and approximate radial symmetry of the TeV halo population. Furthermore, we note that this conclusion holds for any CR-powered source (hadronic or leptonic), implying more generally that anisotropic diffusion does not dominate the propagation of particles near energetic sources (at least, below hundreds of TeV) because of the self-generated turbulence.

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