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TeV-PeV Cosmic-Ray Anisotropy as a Probe of Interstellar Turbulence

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IceTop and IceCube have observed a mysterious cold spot in the angular distribution of high energy ($\geq$ 100 TeV) cosmic rays (CR), thereby placing interesting constraints on their transport properties. We examine here these constraints by comparing the observations with the predictions of pitch-angle diffusion in various kinds of turbulence. In the case of Alfvenic turbulence with a Goldreich-Sridhar power-spectrum and a small outer scale ($\ll$ 10 pc), we show that pseudo-Alfven modes can produce a signature that is compatible with the observations. Adding fast magnetosonic modes reduces the CR mean free path. We further show that, in the case of fast modes, the CR anisotropy can still match the observations, for physically relevant values of the turbulence parameters. Finally, we suggest that the increase, with energy, of the size of the cold spot in IceTop data may be a hint at an anisotropy in the power spectrum of the local interstellar magnetic turbulence.

Summary

Author: Dr GIACINTI, Gwenael (MPIK Heidelberg)

Presenter: Dr GIACINTI, Gwenael (MPIK Heidelberg)

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