



Contribution ID: 72

Type: Poster

## Magnetic diffusion and interaction effects on Ultrahigh Energy Cosmic Rays: protons and nuclei

Magnetic fields present in the Universe and interactions with the cosmic radiation backgrounds play an important role shaping the flux of the ultrahigh energy cosmic rays. To account for both processes we include in the SimProp cosmic ray propagation code a routine to follow the direction of propagation of the particles in a turbulent magnetic field. We compute thus the modification of the spectrum due to the magnetic horizon effect, both for primary nuclei and for the secondary nuclei resulting from the photodisintegration of the primary ones. We provide analytic parameterizations of the attenuation effects, as a function of the magnetic field parameters and of the density of cosmic ray sources. Therefore, we can obtain the expected spectra in the presence of the magnetic fields from the spectra that would be obtained in their absence. The discrete nature of the distribution of sources also affects the spectrum of cosmic rays at the highest energies. There, the interactions with the radiation backgrounds suppress the flux, and we present parameterizations of these effects.

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**Session Classification:** Poster session