

Aperiodic magnetic field fluctuations and their effect on cosmic rays

Friday, 27 September 2013 09:55 (30 minutes)

Understanding cosmic $(\delta B, \delta E)$ -fluctuations in magnetized (interstellar medium) and nonmagnetized (IGM: intergalactic medium) plasmas is of crucial importance for cosmic ray transport, including the role of collective and noncollective modes and wave-like, weakly-propagating and aperiodic fluctuations. The ordering $B_0 \gg \delta B \gg \delta E$ in magnetized systems, necessary for explaining the observed nearly isotropic CR momentum distribution function, is the basis for a perturbation scheme leading to the modified diffusion-convection CR transport equation and expressions for the CR anisotropy.

The nonmagnetized IGM medium contains aperiodic magnetic fluctuations which are spontaneously emitted by the fully-ionized thermal electron-proton IGM plasma at a level of $|\delta B| = 1.5 \cdot 10^{-16} n_{-7} T_4^{-3/2}$ G. These spontaneously emitted fluctuations affect the propagation of CR protons and electrons in the IGM at energies below 10^{15} eV.

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Session Classification: Aperiodic magnetic field fluctuations and their effect on cosmic rays - Reinhardt Schlickeiser, Ruhr-U Bochum

Track Classification: Reinhardt Schlickeiser