ID de Contribution: **117** Type: **Non spécifié**

Cosmic-ray ionisation of molecular clouds

jeudi 30 juin 2011 17:40 (20 minutes)

We explore the possibility that a low-energy component of cosmic rays, not directly measurable from the Earth, can account for the discrepancy between the ionisation rate measured in diffuse and dense interstellar clouds. Starting from different extrapolations at low energies of the demodulated cosmic-ray proton and electron spectra, we computed the propagated spectra in molecular clouds in the continuous slowing-down approximation taking all the relevant energy loss processes into account. Available data combined with simple propagation models support the existence of a low-energy component (below about 100 MeV) of cosmic-ray electrons or protons responsible for the ionisation of molecular cloud cores and dense protostellar envelopes. We also computed the attenuation of the cosmic-ray flux rate in a cloud core taking into account magnetic focusing and magnetic mirroring, adopting a standard cloud model characterised by a mass-to-flux ratio supercritical by a factor of about 2 to describe the density and magnetic field distribution of a low-mass starless core, following the propagation of cosmic rays through the core along flux tubes enclosing different amount of mass.

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Classification de Session: Diffuse emission and cosmic ray interaction with interstellar matter