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# Piernik MHD code extension: modelling energy dependent transport of cosmic ray electrons with energy spectrum evolution.

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## Abstract

Cosmic ray electrons are one of the main ingredients of the total cosmic ray population and the main source of galactic synchrotron emission.

A new extension to MHD code PIERNIK allows us to model energy dependent propagation of cosmic ray electron population in the magnetized interstellar medium, taking into account evolution of spectrum. Our algorithm, "Cosmic Ray Energy SPectrum" (CRESP) was developed to seek numerical solutions of Focker-Planck equation. Cosmic ray spectrum is approximated with power-law in the momentum space. Algorithm includes alteration of cosmic ray spectrum by physical processes taking place in the momentum space (i.e. synchrotron energy losses) and allows injection of particles into the interstellar medium (i.e. in the form of supernova explosions), while PIERNIK code evolves the spatial distribution of spectrum components. "CRESP" algorithm opens up an opportunity to numerically study with PIERNIK a set of astrophysical phenomena, among which are ISM heating, cosmic ray propagation, synchrotron and gamma ray emission, formation of galactic magnetic field, and to eventually compare numerical results with observational data.

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