EGU24-6854, updated on 07 Dec 2024
https://doi.org/10.5194/egusphere-egu24-6854
EGU General Assembly 2024

Modelling energetic particle transport with the PARADISE code

Edin Husidic[1,2], Nicolas Wijsen[1], Stefaan Poedts[1,3], and Rami Vainio[2]
[1]Centre for Mathematical Plasma-Astrophysics, KU Leuven, Leuven, Belgium (edin.husidic@kuleuven.be)
[2]Department of Physics and Astronomy, University of Turku, Turku, Finland
[3]Institute of Physics, University of Maria Curie-Skłodowska, Lublin, Poland

Numerical tools for realistic modelling of energetic processes in the heliosphere, with the prospect of forecasting space weather, are in high demand. Of particular interest are solar energetic particles (SEPs), comprising high-energy charged particles linked to solar eruptive phenomena. During large SEP events, protons can be accelerated to energies ranging from tens of MeV up to a few GeV per nucleon, posing a dangerous threat to astronauts and spacecraft. While the precise acceleration mechanism behind SEP events is still an open challenge, observations indicate that the intensities of SEPs are highly influenced by the large-scale solar wind configuration. Transient structures such as coronal mass ejections (CMEs) or stream interaction regions (SIRs) perturb the interplanetary (IP) magnetic field, ultimately altering the transport of SEPs. In this context, we share recent results obtained with the energetic particle transport code PARADISE. By utilising realistic and complex solar wind configurations derived from magnetohydrodynamic (MHD) models such as EUHFORIA and the MPI-AMRVAC-based model Icarus, the code solves the focused transport equation in a stochastic manner to obtain spatio-temporal intensity distributions of SEPs in the inner heliosphere. Our studies focus on particle acceleration at IP shocks related to CMEs and SIRs.