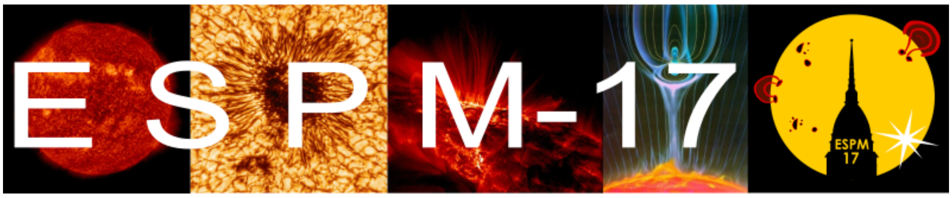

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Simulating Energetic Particle Transport in the Solar Corona with COCONUT+PARADISE

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Solar eruptive events such as coronal mass ejections (CMEs), along with the associated solar energetic particles (SEPs), pose serious threats to spacecraft and astronauts. The growing impact of these harsh space weather events on modern societies has driven the development of numerical models capable of enhancing our understanding of the underlying physics and reliably forecasting these events. A recent example is the particle transport code PARADISE, which is coupled to heliospheric magnetohydrodynamic (MHD) models such as EUHFORIA and Icarus, and is used to model the acceleration and transport of SEPs at radial distances $r > 0.1$ au.

However, since the evolution of CMEs as well as the acceleration and transport of SEPs occur already deep in the corona ($r < 0.1$ au), we introduce the novel COCONUT+PARADISE model to address this issue. The data-driven, global coronal MHD model COCONUT, part of the COOLFLuiD platform, uses synoptic magnetograms for the inner boundary conditions and solves the three-dimensional ideal MHD equations to derive coronal background configurations from 1 up to 25 solar radii. To model CMEs in COCONUT, the unstable modified Titov-Démoulin flux rope model is utilised. Subsequently, PARADISE uses these coronal configurations to evolve energetic particles through these backgrounds by solving the focused transport equation (FTE) using a Monte-Carlo approach. We present simulation results that illustrate the propagation of SEPs within the solar atmosphere. Furthermore, we highlight the potential of our model for future work encompassing the study of particle transport from the base of the corona to Earth and beyond.

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