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Transport of energetic particles from reconnecting current sheets in flaring corona to the heliosphere

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In this study, we inverstigate the acceleration of electrons and ions at current sheets in the flaring solar corona, and their transport into the heliosphere. We consider both generic solar flare models and specific flaring events with a data-driven approach. The aim is to answer two questions: (a) what fraction of particles accelerated in different flares can escape into the heliosphere?; and (b) what are the characteristics of the particle populations propagating towards the chromosphere and into the heliosphere?

We use a combination of data-driven 3D magnetohydrodynamics simulations with drift-kinetic particle simulations to model the evolution of the magnetic field and both thermal and non-thermal plasma and to forward-model observable characteristics. Particles are accelerated in current sheets associated with flaring reconnection. When applied to a specific flare, the model successfully predicts observed features such as the location and relative intensity of hard X-ray sources and helioseismic source locations. This confirms the viability of the approach.

Using these MHD-particle models, we will show how the magnetic field evolution and particle transport processes affect the characteristics of both energetic electrons and ions in the the inner corona and the heliosphere. The implications for interpretation of in situ measurements of energetic particles by Solar Orbiter and Parker Solar Probe will be discussed.