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Superthermal Ion Transport and Acceleration in Multiple Contracting and Reconnecting Inertial-scale Flux Ropes in the Solar Wind

JAKOBUS LE ROUX, GARY ZANK, GARY WEBB, University of Alabama in Huntsville — MHD turbulence simulations with a strong large-scale magnetic field show that the turbulence is filled with quasi-2D inertial-scale flux ropes that intermittently reconnect. Solar wind observations indicate that the statistical properties of the turbulence agree well with the MHD turbulence simulations, while particle simulations stress how ions can be efficiently accelerated to produce power law spectra when traversing multiple flux ropes. Recent observations show the presence of different size inertial-scale magnetic islands in the slow solar wind near the heliospheric current sheet, evidence of island merging, and of heating of ions and electrons in the vicinity. We will present a new statistical transport theory designed to model the acceleration and transport of superthermal ions traversing multiple contracting and reconnecting inertial-scale quasi-2D flux ropes in the supersonic slow solar wind. A steady-state solution for the accelerated particle spectrum in a radially expanding solar wind will discussed, showing that the theory potentially can explain naturally the existence of superthermal power-law spectra observed during quiet solar wind conditions.

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