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Suprathermal ion transport theory and experiments in the SMT[1] KYLE GUSTAFSON, ALEXANDRE BOVET, AMBROGIO FASOLI, IVO FURNO, PAOLO RICCI, EPFL — Recent advances in the suprathermal ion diagnostic in the basic plasma experiment TORPEX have inspired our comprehensive theoretical study of suprathermal ion transport. TORPEX, an example of a simple magnetized toroidal plasma (SMT), is equipped with a flexible fast ion source and detector capable of exploring fast ion dynamics in a wide range of positions and energies. We simulate an ensemble of ion tracer trajectories as specified by ideal interchange-mode turbulence imported from a validated numerical simulation based on the drift-reduced Braginskii model. Using the variance of displacements, $\sigma^2(t) \sim t^\gamma$, we find that γ depends strongly on suprathermal ion injection energy and the magnitude of turbulent fluctuations. When the beam interacts with the turbulence, we find the remarkable presence of three regimes of dispersion: superdiffusive, diffusive, and subdiffusive, depending on the energy of the suprathermal ions and the amplitude of the turbulent fluctuations. Results from the source on TORPEX are consistent with the theoretical predictions.

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