LSP simulations of fast ions slowing down in cool magnetized plasma

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In MFE devices, rapid transport of fusion products, e.g., tritons and alpha particles, from the plasma core into the scrape-off layer (SOL) could perform the dual roles of energy and ash removal. Through these two processes in the SOL, the fast particle slowing-down time will have a major effect on both the energy balance of a fusion reactor and its neutron emissions. In small field-reversed configuration (FRC) devices, the first-orbit trajectories of most fusion products will traverse the SOL, potentially allowing those particles to deposit their energy in the SOL and eventually be exhausted along the open field lines. However, the dynamics of the fast-ion energy loss processes under conditions expected in the FRC SOL, where the Debye length is greater than the electron gyroradius, are not fully understood. What modifications to the classical slowing down rate are necessary? Will instabilities accelerate the energy loss? We use LSP, a 3D PIC code, to examine the effects of SOL plasma parameters (density, temperature and background magnetic field strength) on the slowing down time of fast ions in a cool plasma with parameters similar to those expected in the SOL of small FRC reactors.

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