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Redistribution of Energetic Particles Due to Internal Kink Modes

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The internal kink modes associated with sawtooth oscillations can produce a redistribution of the energetic particles population, thus modifying the power deposition profile and increasing particle losses and wall loading. We study the effect of internal kink modes on the confinement of alpha particles and neutral beam ions by following the trajectories of a large number of particles in the total electric and magnetic fields, sum of the equilibrium plus the perturbation. The equilibrium is a simple analytical solution of the Grad-Shafranov equation with ITER like parameters and q_{axis} less than 1. To calculate the perturbed fields we use the experimental information regarding the space and time dependence of the displacement eigenfunctions corresponding to the modes considered and ideal MHD. A redistribution parameter is introduced to quantify the displacement of the particles from their initial flux surface. The effect of the (1,1), (2,2) and (2,1) modes is studied for different particle energies and mode frequency and amplitude. The results show that, for energies below 1 MeV, the redistribution can have a strong dependence on the particle energy and mode frequency.

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