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Beam particle distribution modification by low amplitude modes[1]

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Modification of a high energy particle distribution by a spectrum of low amplitude modes is investigated using a guiding center code. Only through resonance are modes effective in modifying the distribution. Diagnostics are investigated to illustrate the mode-particle interaction. Effects of pitch angle scattering and drag are included, as well as time dependence of the equilibrium and mode frequencies. A specific example of changes observed in a DIIID neutral beam distribution in the presence of low amplitude Toroidal Alfvèn (TAE) eigenmodes and Reversed Shear Alfvèn (RSAE) eigenmodes is examined in detail. Comparison with experimental data shows that low amplitude modes, properly including sufficient mode harmonics and the polarization potentials, in conjunction with pitch angle scattering and mode frequency chirping, can account for significant modification of high energy beam particle distributions. The existence of these effects make necessary the inclusion of a phase space dependent term for beam evolution in deposition codes, which can be larger than neoclassical diffusion terms. It is found that there is a stochastic threshold for beam profile modification, and that the experimental amplitudes are only slightly above this threshold.

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