Monte-Carlo Simulation of Fast Alfvén Wave Interactions with Neutral-Beam and Minority Ions on the DIII-D and C-Mod Tokamaks*

M. Choi,[1] V.S. Chan,[1] V. Tang,[2] J. Wright,[2] and P. Bonoli[2]
[1]*General Atomics, P.O. Box 85608, San Diego, California, USA*
[2]*MIT Plasma Science and Fusion Center, Cambridge USA*

To quantitatively simulate the resonant interaction of fast Alfvén wave (FW) heating and Coulomb collisions on energetic ions, including finite orbit effects, a Monte-Carlo code ORBIT-RF has been coupled with a 2D full wave code TORIC. ORBIT-RF solves Hamiltonian guiding center drift equations to follow trajectories of test ions in 2D axisymmetric numerical magnetic equilibrium under Coulomb collisions and ICRF quasi-linear heating. Monte-Carlo operators for pitch-angle scattering and drag calculate the changes of test ions in velocity and pitch angle due to Coulomb collisions. A rf-induced random walk model describing fast ion stochastic interaction with FW reproduces quasi-linear diffusion in velocity space. FW fields and its wave numbers from TORIC are passed on to ORBIT-RF to calculate perpendicular rf kicks of resonant ions with a arbitrary harmonic rf diffusion operator. ORBIT-RF coupled with TORIC using a single dominant toroidal and poloidal wave number has demonstrated consistency of simulations with previous DIII-D FW experimental results for interaction between injected neutral-beam ions and FW, including measured neutron enhancement and enhanced high energy tail. Comparison with C-Mod fundamental heating discharges yielded reasonable agreement.

*Work supported by USDOE under DE-FG03-95ER54309.