# RF-Driven Radial Current and Plasma Rotation in a Tokamak

V.S. Chan, S.C. Chiu,* Y.A. Omelchenko

*General Atomics, P.O. Box 85608, San Diego, CA 92186-5608*

**Abstract.** Plasma rotational shear is potentially important for controlling the formation and positioning of internal transport barriers that could stabilize tokamak microturbulence and improve plasma confinement. A new physical mechanism capable of inducing plasma rotation and rotational shear via the ion cyclotron resonance frequency (ICRF) heating of minority ion species in a tokamak has been proposed [F.W. Perkins, et al., “Generation of Plasma Rotation in a Tokamak by Ion-Cyclotron Absorption of Fast Alfvén Waves,” to appear in Phys. Plasmas, May 2001]. Our work evaluates the validity of this mechanism under the realistic condition when fast ions are continuously heated and slowed down in a driven system. Ion dynamics are calculated with a Monte-Carlo code in which wave-induced diffusion in velocity space is accounted for by a quasilinear operator. The code follows the drift trajectories of test particles in a tokamak geometry under the influence of given rf fields and collisions with the background plasma. When the heating geometry is such that no net toroidal wave momentum is injected, the rotational characteristics described in Perkins et al. is reproduced. A physical picture emerges which ascribes the directionality of the rotation as a consequence of finite drift orbit width. The stochastic nature of the wave-induced diffusion can result in a net toroidal torque on the bulk plasma. A number of predicted features can be experimentally tested as a validation of finite orbit drift physics and rf-induced orbit diffusion.

Keywords: ICRH, plasma rotation, simulation, Monte-Carlo, tokamak

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