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Simulation of excitation of whistler waves and momentum diffusion of runaway electrons in DIII-D tokamak CHANG LIU, EERO HIRVIJOKI, Princeton Plasma Phys Lab, DYLAN BRENNAN, Princeton University, AMITAVA BHATTACHARJEE, GUO-YONG FU, Princeton Plasma Phys Lab, DONALD SPONG, Oak Ridge National Lab — In recent quiescent runaway electron experiments (QRE) experiments in DIII-D, whistler waves excited by runaway electrons have been observed and are found to be associated with the fluctuation of electron cyclotron emission (ECE) signals. To understand this connection and how the whistler instabilities affect the runaway electron distribution in momentum space, a self-consistent kinetic simulation of runaway electrons, including both the secondary generation and the quasilinear diffusion effects from the excited modes, is conducted. The results show that three different branches of waves can be excited. The low frequency whistler waves and the high frequency magnetized plasma waves are excited by runaway electrons in high energy and low energy regimes respectively, through anomalous Doppler resonance. Due to the close phase velocities of these two branches, the Landau damping of them happens at the same energy regime. These two branches of waves are not observed directly in experiments due to their high frequencies. In addition, we find a third branch of waves with wavevector almost oblique to the magnetic field direction, excited by the bump-on-tail distribution of the runaway electrons. These waves are in the 100-200 MHz frequency range, which agrees with the experimental observations. The cyclic behavior of excitation and damping of whistler waves associated with the fluctuations of ECE signals are also reproduced.

Chang Liu
Princeton Plasma Phys Lab

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