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**Electromagnetic particle simulation of the linear mode conversion and the nonlinear parametric decay instability of lower hybrid waves in tokamaks** JIAN BAO, Peking University, ZHIHONG LIN, ANIMESH KULEY, ZHIXUAN WANG, University of California, Irvine — An electromagnetic fluid-kinetic model is developed to study the lower hybrid (LH) waves in tokamaks with low numerical noise, in which electron density is pushed forward by the continuity equation, and the kinetic markers are introduced for closure. A generalized weight-based particle-in-cell scheme is also applied to the simulation for the local high resolution in phase space. This new model has been successfully implemented into the global gyro-kinetic toroidal code (GTC), and the electromagnetic particle simulations of the LH waves have been carried out with a realistic electron-to-ion mass ratio. The simulation shows that toroidal effects induce an upshift of the parallel reflective index when LH waves propagate from the tokamak edge toward the core, which modifies the radial position for the mode conversion between slow and fast LH waves. The broadening of the poloidal spectrum of the wave-packet due to the wave diffraction is also observed in the simulation of LH wave propagation, and both the toroidal upshift and broadening effects of the wave-packet spectrum modify the parallel phase velocity and thus the linear absorption of LH waves by electrons through Landau resonance. In the nonlinear simulation, the LH wave can drive a net current during the propagation when its phase velocity gets closed to the local electron thermal speed. Finally, the parametric decay instability is observed when we increase the power of LH waves, in which a LH sideband and a low frequency ion plasma waves are generated.

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