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Electromagnetic high frequency gyrokinetic particle-in-cell simulation of radio frequency waves in magnetically-confined plasmas. ROMAN KOLESNIKOV, HONG QIN, W.W. LEE, PPPL — Using the gyrocenter-gauge kinetic theory, we developed an electromagnetic version of the high frequency gyrokinetic algorithm [1, 2] for particle-in-cell (PIC) simulation of plasma heating and current drive with RF waves. Gyrokinetic formalism enables separation of gyrocenter and gyrophase motions of a particle in a magnetic field. From this point of view, a particle may be viewed as a combination of a slow gyrocenter and a quickly changing Kruskal ring. The efficiency of the algorithm is due to the fact that the simulation particles are advanced along the slow gyrocenter orbits, while the Kruskal rings capture fast gyrophase physics. The nonlinear dynamics of RF waves is described by the Kruskal rings based on first principles physics. Self-consistent simulation is performed by solving Faraday's and Ampere's laws using Yee's algorithm together with the locally implicit method [3]. We performed a number of simulations of electromagnetic wave propagation in hot inhomogeneous plasmas using new nonlinear delta-f PIC algorithm. Comparisons with a direct Lorentz-force approach are presented. This work is supported by the MSG project (U.S. DoE ASCR Multiscale Mathematics Research and Education Program). [1] R. A. Kolesnikov et al., Phys. Plasmas, **14**, 072506 (2007). [2] H. Qin et al., 17^{th} RF Conference (2007). [3] D.Smithe et al., 17^{th} RF Conference (2007).

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