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A closed Vlasov-Maxwell simulation model for high-frequency nonlinear processes in plasma PENGFEI LIU, JINGBO LIN, Department of Modern Physics, University of Science and Technology of China, WENLU ZHANG, Institute of Physics, Chinese Academy of Science, IHOR HOLOD, LIU CHEN, ZHIHONG LIN, Department of Physics and Astronomy, University of California, Irvine
— A kinetic simulation model has been developed to investigate the plasma dynamics with a frequency lower than the electron cyclotron frequency. The electrons are described by gyro-kinetic or drift-kinetic equations that ignores the rapid electron cyclotron motions, and the ions are described by fully kinetic equations that captures the fast ion cyclotron motion. The gyrokinetic Vlasov equation for electrons is derived using the Lie-transform perturbation theory, and the electron charge density, current density and thermal pressure tensor is expressed in terms of the pull-back transformation from gyro-center distribution to particle distribution. A fully kinetic ion and gyro-kinetic electron Vlasov-Maxwell model in Tokamak geometry is then formulated with a realistic ion-to-electron mass ratio . Both full-f and δ-f scheme have then been derived in magnetic coordinate systems. This model can be applied to global particle simulations of ion-cyclotron-radio-frequency (ICRF) heating and lower-hybrid current driven (LHCD), which are important issues for fusion plasmas.

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