

VirtEx: **V**irtual **E**xperiments on first principle simulation platform for fusion plasmas

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A virtual experimental simulation platform has been developed to numerically investigate the radio frequency (RF) heating, as well as energetic particle physics, macro-instabilities (classical tearing mode in particular) in fusion plasmas. The particle-in-cell RF module, suitable for investigating nonlinear phenomena in radio frequency (RF) heating and current drive, was first developed and verified thereafter through a series of fidelity tests for field solvers and single-particle motions in toroidal geometry, where simulation results show good coincidence with analytical prediction. The RF capability was then demonstrated through the integrated benchmarks with the linear lower hybrid wave and ion Bernstein wave theory in cylindrical geometry, where the analytic result was readily available. The frequency and mode structure in the simulations agree well with the theoretical prediction.

关键词： first principle, particle-in-cell, radio frequency, heating, energetic particle, macro-instabilities

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