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Nonlinear kinetic effects in inductively coupled plasmas via particle-in-cell simulations AARON FROESE, ANDREI SMOLYAKOV, University of Saskatchewan, DMYTRO SYDORENKO, University of Alberta — Kinetic effects in inductively coupled plasmas due to thermal motion of particles modified by self-consistent magnetic fields are studied using a particle-in-cell code. In the low pressure, low frequency regime, electron mean free paths are large relative to device size and the trajectories are strongly curved by the induced rf magnetic field. Analytic linear theories are unable to recover effects accumulated along each nonlinear path. Therefore, the simulated ICP is made progressively more complex to find the source of observed plasma behaviours. With only thermal motion modifying the wave-particle interaction, nonlocal behaviour becomes dominant at low frequencies, causing an anomalous skin effect with increased skin depth and power absorption and decreased ponderomotive force. However, when influenced by magnetic fields, the nonlocal effects are suppressed at large wave amplitudes due to nonlinear trapping. A mechanism is proposed for this low frequency restoration of local behaviour. Finally, a low rate of electron-neutral collisions is found to counteract the nonlinear behaviour, and hence reinforces nonlocal behaviour.

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