SPECTRAL-KINETIC SIMULATION OF THE MULTIPOLE RESONANCE PROBE*

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Plasma resonance spectroscopy is a well established plasma diagnostic method realized in several designs. One of these designs is the multipole resonance probe (MRP)\(^1\). In its idealized – geometrically simplified – version it consists of two dielectrically shielded, hemispherical electrodes to which an RF signal is applied. A numerical tool is under development, which is capable of simulating the dynamics of the plasma surrounding the MRP in electrostatic approximation.

For the present, the simulation tool consists of a two parts: First a specialized Poisson solver and second a particle pusher. Due to the spherical geometry of the idealized MRP and the assumption of point charges Poisson’s equation can be solved analytically by an expansion in spherical harmonics. For a practical implementation of the Poisson solver, the expansion must be appropriately truncated. The particle pusher in spherical coordinates determines the new velocities and positions of the particles. This completes one cycle of a collisionless kinetic simulation, which can be used to investigate kinetic effects on the resonance behavior of the MRP. Compared to a PIC simulation a grid is unnecessary to calculate the potential and the force on the particles.


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