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Particle based discharge simulations: electron heating and electromagnetic effects[1]

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It is widely acknowledged that kinetic effects play a significant role in almost all kinds of technological plasmas. These plasmas often exhibit several groups of electrons with significantly different energies. The intrinsically non-Maxwellian behavior of the electron energy distribution function in this case invalidates fluid-based simulation approaches, so that a self-consistent kinetic treatment is needed to capture all important physics features. This holds in particular for the heating of electrons. The situation becomes even more complicated if in addition to the kinetic treatment electromagnetic effects have to be considered. This is for example the case when the electrode size and driving frequency of capacitive discharges increase. In this contribution we discuss how electromagnetic models based on the Darwin approximation of Maxwell's equations can be incorporated into kinetic simulations of technological plasmas to meet the goals of scientific accuracy and computational efficiency.

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