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The multipole resonance probe: kinetic damping in its spectra[1]

JENS OBERRATH, Leuphana University Lueneburg — The multipole resonance probe (MRP) has become an accepted diagnostic tool to measure electron densities in low pressure plasmas within the last decade. It excites a resonance of the dipole mode, where the resonance frequency is proportional to the electron plasma frequency. To allow for the measurement of electron density and temperature simultaneously, a second resonance parameter is necessary. A good candidate is the half width of the resonance peak, which is connected to the damping of the probe-plasma system and thus dependent on the electron temperature. However, in low pressure plasmas, the resonance peak is broadened due to kinetic effects, which requires a kinetic model. Such a model in electrostatic approximation based on functional analytic methods for a general probe geometry has been presented [1]. Based on the general solution of this model, the system response function Y of the MRP has to be approximated to determine specific spectra. These spectra show clearly a broadening of the resonance peak due to kinetic effects. The goal of ongoing research is to derive a relation between the half width and the electron temperature.
[1] J. Oberrath and R.P. Brinkmann, Plasma Sources Sci. Technol. 23, 045006 (2014).

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