Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

Low pressure characteristics of the multipole resonance probe[1]

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The term "Active plasma resonance spectroscopy" (APRS) denotes a class of related techniques which utilize, for diagnostic purposes, the natural ability of plasmas to resonate on or near the electron plasma frequency ω_{pe}. The basic idea dates back to the early days of discharge physics but has recently found renewed interest as an approach to industry-compatible plasma diagnostics: A radio frequent signal (in the GHz range) is coupled into the plasma via an antenna or probe, the spectral response is recorded (with the same or another antenna or probe), and a mathematical model is used to determine plasma parameters like the electron density or the electron temperature. When the method is applied to low pressure plasmas (of a few Pa and lower), kinetic effects must be accounted for in the mathematical model. This contribution studies a particular realization of the APRS scheme, the geometrically and electrically symmetric Multipole Resonance Probe (MRP). It is shown that the resonances of the MRP exhibit a residual damping in the limit $p \to 0$ which cannot be explained by Ohmic dissipation but only by kinetic effects.

[1]Supported by the German Federal Ministry of Education and Research (BMBF) in the framework of the PluTO project

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Date submitted: 14 Jun 2014 Electronic form version 1.4