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Electromagnetic treatment of the multipole resonance probe¹

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Institute for Theoretical Electrical Engineering, Ruhr University Bochum — We present an electromagnetic model of the “multipole resonance probe” (MRP)– a diagnostic concept which enables the simultaneous determination of plasma density, electron temperature, and collision rate in low-pressure gas discharges. The MRP is a radio-frequency driven probe of particular spherical design. In an idealized version the probe consists of two dielectrically shielded, conducting hemispheres. Driven by a radio-frequency source, the hemispheres are powered symmetrically. An analysis of the absorption spectrum shows a multitude of resonances, which allows for an analytical evaluation of the measured signal. The signal provides information on the distribution of the plasma in the probe’s vicinity, from which the values of electron density, electron temperature and collision rate can be inferred. In this contribution the MRP will be modeled electromagnetically. Based on a comparison between full electromagnetic and electrostatic treatment, we show that a previously presented electrostatic treatment [1] was well justified.

[1] M.Lapke et al., Appl. Phys. Lett. **93**, 051502 (2008)

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