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Simultaneous determination of electron density and electron temperature in low-pressure plasmas using the Multipole Resonance Probe[1]
MARTIN LAPKE, THOMAS MUSSENBROCK, RALF PETER BRINKMANN, Ruhr University Bochum — Plasma diagnostics is a highly developed science. In this contribution a diagnostic concept is proposed which enables simultaneous determination of electron density and electron temperature in low-pressure gas discharges, suitable for an industrial setting. The proposed method is robust, calibration free, and economical, and can be used for ideal and reactive plasmas alike. The diagnostic tool – the Multipole Resonance Probe [1] – is a radio-frequency driven probe of particular spherical design which is immersed in the plasma to excite a family of spatially bounded surface resonances. An analysis of the measured absorption spectrum provides information on the distribution of the plasma in the probe's vicinity, from which the values of electron density and electron temperature can be inferred. For an idealized case, the probe consists of two dielectrically shielded, conducting hemispheres which are symmetrically driven by an rf source. The excited resonances can be classified as multipole fields, which allows the analytical evaluation of the measured signal. [1] M. Lapke et al., submitted to Appl. Phys. Lett. (2008)

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Martin Lapke
Ruhr University Bochum

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