MODELLING OF VOLUME- AND SURFACE WAVE BASED PLASMA RESONANCE SPECTROSCOPY*

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The term ”plasma resonance spectroscopy” denotes a family of diagnostic methods which exploit the natural ability of a plasma to resonate on or near the plasma frequency: A radio-frequency signal in the range of 100MHz - 10 GHz is coupled to the plasma via an antenna or an immersed probe. The measured absorption or transmission spectrum $S(\omega)$ shows characteristic resonances from which parameters like electron density n_e or electron temperature T_e can be derived. This general concept has found numerous realizations in the last decades. To classify the approaches, one may make the following fundamental distinction: *Volume wave based methods* observe resonances that are present already in vacuum; the plasma density is then given by the *shift* of the resonance [1]. *Surface wave based methods*, in contrast, utilize resonances which are not present in vacuum and deduce the plasma parameters from the *absolute value* of the resonance frequency [2,3]. As an example, we study the behavior of two symmetrically RF-driven hemispheres surrounded by a plasma sheath and located in the center of a bounded spherical plasma. The analysis reveals two families of resonances, one below the plasma frequency ω_{pe} and one above. These families correlate with the distinction introduced above. We clarify the differences in the modeling of the two regimes and their advantages and disadvantages for diagnostics purposes.

[1] Piejak et al., PSST 14 (2005)
[2] Kokura et al., Jap. J. of Appl. Phys. 38 (1999)
[3] M. Lapke et al., Appl. Phys. Lett. 93, 051502 (2008)

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