Electric fields in the sheath of an ICRF antenna in IShTAR: dedicated diagnostic progress and prospects

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Experimental information on the electric field across the sheaths surrounding the plasma-facing structures of an ICRF antennas can serve to benchmark and lead the theoretical models of the RF sheaths. Such advancement is needed to further optimize the operation of ICRF heating in fusion devices.

In the vicinity of the antennas, plasma and sheath parameters impose numerous constrains on the diagnostic method that can be used to measure the electric field. In this contribution we present the results of a dedicated diagnostic, developed and tested on IShTAR [1] - the device designed to study mutual influence between the ICRF waves and the plasma edge. The diagnostic is based on Stark spectroscopy, where the electric field is optically determined directly from the wavelength shift of the spectral lines of neutral helium. It can detect fields as low as 1.5 kV/cm, at gas pressures below one Pascal, and the electron temperature and density matching the conditions at the edge of a tokamak plasma. The measured profiles are obtained across the 8.5 mm region in the immediate vicinity of the antenna box and resolved it in 7 points using locally injected helium gas and multiple optical channels. These are compared for several values of power at the ICRF antenna.

We further explore the detector's capability for adding the temporal coordinate. Also discussed is the prospect for applying the described diagnostic to the ASDEX Upgrade tokamak.

References

[1] A. Kostic et al. *Review of Scientific Instruments*, 90(12):123101, 2019.