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Design of TALIF and CARS Diagnostics for Measuring Atomic and Molecular Hydrogen Densities in Divertor-relevant Plasmas

K. Schutjes[1*], K.J. Loring[1,2], I.G.J. Classen[1], J. Vernimmen[1], H.J. van der Meiden[1], and the Magnum-PSI team[1]

[1]*Dutch Institute For Fundamental Energy Sources (DIFFER), Eindhoven, The Netherlands*
[2]*Stanford University, Palo Alto, California, United States of America*

One of the biggest challenges of a reliable fusion reactor is the handling of large heat and particle loads on the divertor wall. Key to reducing these loads is by plasma detachment, in which a large range of processes occur between the plasma and the neutral background [1,2]. Atomic and molecular processes largely determine the plasma dynamics, which is why these particles are often studied in divertor research [1,2]. However, measurements on electronic ground state densities for atoms and molecules are lacking for divertor-relevant plasmas. We will use active laser spectroscopy, using TALIF and CARS, to measure these densities.

To measure the atomic hydrogen ground state density, a TALIF setup has been developed to allow measurements in the linear plasma device UPP. UPP is able to create divertor-relevant plasma conditions ($n_e \approx 10^{20}$ m^{-3}, $T_e < 5$ eV). Nanosecond laser pulses in the 204-206 nm range are used to excite hydrogen from the ground state, and fluorescence was monitored with a gated ICCD camera. The first spatially-resolved measurements in UPP were performed and will be presented.

A CARS setup has been designed and is tested on a gas cell filled with H_2 gas. Work is currently underway to apply this setup in the linear plasma device UPP. Signal is generated using focused nanosecond laser pulses, and is detected with a gated ICCD camera. Two lasers are used: a seeded Nd:YAG (532 nm, 6 ns pulse, 0.005 cm^{-1} linewidth) and a dye laser (660-685 nm, 6 ns pulse, ~0.1 cm^{-1} linewidth). Spatially-resolved measurements of the lower rovibrational population have been performed and the first preliminary results will be presented.

[1] A. Loarte, *et al.,* Nucl. Fusion 47 S203 (2007). DOI: 10.1088/0029-5515/47/6/S0
[2] S.I. Krasheninnikov and A.S. Kukushkin, J. Plasma Phys. 83 (2017). DOI:10.6100/IR58304

*Presenting author: k.schutjes@differ.nl