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High-resolution TALIF measurements of atomic oxygen: determination of gas temperature and collisional broadening coefficients¹ JEAN-PAUL BOOTH, DANIIL MARINOV, OLIVIER GUAITELLA, LPP, CNRS-Ecole Polytechnique-UPMC, CYRIL DRAG, LAV, CNRS-ENS Cachan-UPsud, France, RICHARD ENGELN, TU Eindhoven, NL, JUDITH GOLDA, VOLKER SCHULTZ-VON DER GATHERN, Ruhr Universitat Bochum, DE — Two-photon Absorption Laser-Induced Fluorescence (TALIF) is a well-established technique to measure relative (and with appropriate calibration techniques, absolute) densities of atoms in plasmas and flames. The excitation line profiles can provide additional information, but this is usually overlooked due to the mediocre spectral resolution of commercial pulsed dye laser systems. We have investigated O-atom TALIF excitation line profiles using a house-built narrow line-width pulsed UV laser system, based on pulsed Ti:Sa ring laser seeded by a cw infrared diode laser. The observed Doppler profiles allow unambiguous measurement of gas temperature with high precision in O_2 and O_2 DC glow discharges. Sub-Doppler measurements, performed by reflecting the laser beam back through excitation zone, allow the pressure-broadened line shapes to be observed, both in a pure O_2 DC discharge (up to 10 Torr pressure) and in an atmospheric pressure RF plasma jet in He/O_2 . Pressure broadening coefficients of the $3p^3P_J$ state of O were determined for O₂ and He bath gases, and were found to be an order of magnitude bigger than that predicted from the measured quenching rate.

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