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Space and phase resolved electron energy distribution functions in an industrial dual-frequency capacitively coupled radio-frequency discharge[1] JULIAN SCHULZE, TIMO GANS, DEBORAH O'CONNELL, UWE CZARNETZKI, Institute for Plasma and Atomic Physics, CPST, Ruhr-University Bochum, Germany, BERT ELLINGBOE, MILES TURNER, NCPST, Dublin City University, Ireland — The excitation dynamics in a confined dual-frequency plane parallel CCRF discharge (Exelan, Lam Research Inc.), operated at 1.94 MHz and 27.12 MHz is investigated by phase resolved optical emission spectroscopy. The emission from different rare gas lines in a He-O2 plasma with small rare gas admixtures is measured during one low frequency RF-cycle resolving the dynamics within every high frequency cycle with one dimensional spatial resolution along the discharge axis. In a detailed analysis a time dependent model, based on rate equations, is developed, that describes the dynamics of the population density of excited levels. Electron impact excitation out of the ground state, quenching, reabsorption and cascades are taken into account. Based on this model and the comparison of the excitation of various rare gas states, with different excitation thresholds, time and space resolved electron temperature and propagation velocity of the high energetic, directed electrons, heated at the sheath edge, are determined. These parameters reveal the time and space resolved electron energy distribution function.

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