Abstract Submitted
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Correlating Metastable-Atom Density, Reduced Electric Field, and Electron Energy Distribution in the Early Stages of a 1-Torr Argon Discharge[1] J.B. FRANEK, S.H. NOGAMI, M.E. KOEPKE, V.I. DEMIDOV, W Virginia Univ, E.V. BARNAT, Sandia Nat'l Labs — Temporal measurement of electron density, metastable-atom density, and reduced electric field are used to approximate certain reaction rate constants [1] for electron-atom collision excitation in a 1-Torr positive column of argon plasma. This allows us to relate the observed 420.1nm to 419.8nm line-intensity ratio to plasma parameters by invoking a plausible assumption regarding the shape of the electron energy distribution function (EEDF) throughout the discharge [1]. We show that these reaction rate constants agree well with experimental observations in the late stages of the pulse, but we do not emphasize the late-stage behavior here. Instead, we address discrepancies in the initiation and transient phases of the discharge. We examine three assumptions made in the model to see if the assumptions are violated in these two stages of the discharge: (1) The stepwise excitation from the 1s4 and 1s2 resonant states is negligible; (2) The numerical model designed for a 5-millitorr plasma is applicable to our 1000-millitorr plasma; and (3) The EEDF is bi-Maxwellian and is modified only slightly due to the presence of electrons or metastable-atoms in the discharge. We conclude that diagnostic signatures for electron density, metastable density, and reduced electric field can be quantitatively interpreted by this correlation at all stages of the discharge. [1] Adams et al. Phys. Plasmas 19, 023510 (2012) *also St. Petersburgh Univ.

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James Franek
West Virginia University

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