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 JAMES FRANEK, SAM NOGAMI, VLADIMIR DEMIDOV, MARK KOEPKE, West Virginia University, ED BARNAT, Sandia National Laboratory — Temporal measurement of electron density, metastable-atom density, and reduced electric field are used to infer the dynamic behavior of the excitation rates describing electron-atom collision-induced excitation in the positive column of a pulsed argon discharge plasma by invoking plausible assumptions regarding the shape of the electron energy distribution function (EEDF), specifically, inelastic electron-metastable collisions produce high-energy electrons and electron-electron collisions will cause the EEDF to become more Maxwellian [1]. Direct observation of these excitation rates have been used to predict the temporal behavior of metastable-atom density in the post-transient stage of a pulsed plasma discharge [2]. Ignoring the Maxwellianizing effect of electron-electron collisions allows for the examination, in this poster, of correlations between the aforementioned quantities in the transient stage of the discharge. We conclude that the observed line-emission ratio and the predicted line-emission ratio are in quantitative agreement with each other in the transient phase of the discharge and qualitatively agree with each other in the initiation phase of the discharge. Ignoring electron-electron collisions allows insight into hard-to-measure or expensive-to-measure plasma conditions and their time dependence in the transient phase of the discharge. [1] Pitchford et al., J. Appl. Phys. 92, 6990. [2] Franek et al., Plasma Sources Sci. Technol. 24 (2015) 034009.

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