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### **Dynamic Contraction of the Positive Column of a Self-Sustained Glow Discharge in Molecular Gas**

**Flow**  
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Contraction of the gas discharge, when current contracts from a significant volume of weakly ionized plasma into a thin arc channel, was attracted attention of scientists for more than a century. Studies of the contraction (also called constriction) mechanisms, besides carrying interesting science, are of practical importance, especially when contraction should be prevented. A set of time-dependent two-dimensional equations for the non-equilibrium weakly-ionized nitrogen / air plasma is formulated. The process is described by a set of time-dependent continuity equations for the electrons, positive and negative ions; gas and vibrational temperature; by taking into account the convective heat and plasma losses by the transverse flux. Transition from the uniform to contracted state was analyzed. It was shown that such transition experiences a hysteresis, and that the critical current of the transition increases when the pressure (gas density) drops. Possible coexistence of the contracted and uniform state of the plasma in the discharge where the current flows along the density gradient of the background gas was discussed. In this talk the problems related to the dynamic contraction of the current channel inside a quasineutral positive column of a self-sustained glow discharge in molecular gas in a rectangular duct with convection cooling will be discussed. Study presented in this talk was stimulated by the fact that there are large number of experiments on the dynamic contraction of a glow discharge in nitrogen and air flows and a many of possible applications. Similar processes play a role in the powerful gas-discharge lasers. In addition, the problem of dynamic contraction in the large volume of non-equilibrium weakly ionized plasma is closely related to the problem of streamer to leader transitions in lightning and blue jets.

- [1] M. N. Shneider, M. S. Mokrov, and G. M. Milikh, Dynamic contraction of the positive column of a self-sustained glow discharge in molecular gas, *Physics of Plasmas* 19, 033512 (2012)
- [2] M. N. Shneider, M. S. Mokrov, and G. M. Milikh, Dynamic Contraction of the Positive Column of a Self-Sustained Glow Discharge in Air Flow, *Physics of Plasmas* 21, 032122 (2014)
- [3] G. M. Milikh, M.N. Shneider, and M. S. Mokrov, Model of Blue Jet Formation and Propagation in the Nonuniform Atmosphere, *JGR* (2014) (submitted)