Abstract Submitted
for the GEC08 Meeting of
The American Physical Society

Modeling of the propagation of streamers in methane-air mixtures using the 3-group SP_3 photoionization model[1] N.Y. LIU, V.P. PASKO, A. BOURDON, S. CELESTIN, P. SEGUR, E. MARODE, Florida Tech — Non-thermal plasma assisted ignition and combustion receives increasing attention recently [e.g., Starikovskaia, J. Phys. D, 39, R265, 2006]. Experimental and numerical work has shown that the application of transient plasma discharges (including the stages of streamer propagation and streamer-to-spark transition) in the ignition of propane-air or methane-air mixtures significantly reduces the ignition delay time [e.g., Pancheshnyi et al., IEEE Trans. Plasma Sci., 34, 2478, 2006; Naidis, J. Phys. D, 40, 4525, 2007]. In this work, we study the propagation of streamers in methane-air mixtures. We have recently developed a photoionization model based on radiative transfer theory, called 3-group SP_3 model, for the simulation of streamer discharges in air [Bourdon et al., Plasma Sources Sci. Technol. 16, 656, 2007; Liu et al., Appl. Phys. Lett., 91, 211501, 2007]. In this talk, we show it is straightforward to apply the 3-goup SP_3 model to the simulation of streamers in methane-air mixtures. We report the modeling results on the propagation of streamers in methane-air mixtures and the associated heating of the gas mixtures. We also discuss the effects of addition of methane to air on the dynamics of the streamer.

[1]This research was supported by the PSS Department of Florida Tech and by NSF ATM 0725360 grant to Penn State University.

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Date submitted: 16 Jun 2008 Electronic form version 1.4