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Filamentary Discharges: on the Physics of Plasma Globes[1] M.J. BURIN, G.G. SIMMONS, L. SAUCEDO, CSUSM, A. NAGY, S.J. ZWEBEN, PPPL — Filamentary structures have been observed in many types of plasma discharges, in both natural and industrial systems. However, some fundamental aspects of their physics remain unclear. A common example can be found within a commercial plasma globe, in which a neon-based gas mixture clearly displays filamentation when driven with a RF high voltage transformer. Recent work has provided the first characterization of these plasma globe filaments [Campanell et al. 2010]. We are now extending this initial work by quantifying filament properties with respect to voltage waveform, ambient pressure, and gas composition, using a custom apparatus with a programmable high voltage supply. Initial results using high-speed photography include significant asymmetry between positive and negative discharges, with the former being more structured than the latter. We also note significant waveform effects on filament number and morphology (see undergraduate poster at this meeting by G.G. Simmons et al., session 14.2). System memory/hysteresis effects are also explored. Our results are discussed in light of theory and observations regarding discharge structures/striations found in planetary atmospheres (e.g. lightning leaders and sprites) and in dielectric barrier discharges.

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