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Multi-mode Striations in RF-driven He/2%H2O Atmospheric Pressure Plasma (APP) Discharges[1] EMI KAWAMURA, MICHAEL LIEBERMAN, ALLAN LICHTENBERG, University of California, Berkeley — Previous 1D particle-in-cell (PIC) simulations of 1–4mm gap, He/2%H2O atmospheric pressure plasmas (APP's) showed bulk striations. Assuming the ionization rate coefficient $K_{iz} \propto X^q$ with X the reduced field, a striation model showed that $q < 0$ is a necessary condition for the instability. A local calculation yielded $q > 0$, implying that nonlocal electron kinetics are required for the instability. Wider gaps can fit a wider range of wavelengths λ, resulting in multi-mode striations. Previously, we assumed one mean q value for each APP, and did not calculate q for each mode separately. Here, we develop a wavelength resolved striation model and apply it to PIC simulations of 4 mm gap APP's with $J = 0.04 - 0.30$ A/cm^2 at 27.12 MHz. We first examine the $J = 0.23$ A/cm^2 case and observe a mixture of unstable modes within a window of λ. At shorter λ, the modes are suppressed by diffusion. At longer λ, a transition to locality occurs where q becomes less negative with increasing λ, approaching its local positive value and stabilizing the modes. The unstable modes shift to shorter λ at higher J where they are suppressed by diffusion. At lower J, the decrease in density with decreasing J suppresses the striations.

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