Abstract Submitted
for the GEC05 Meeting of
The American Physical Society

Observations of Ionization Waves in Argon Glow Discharges using a Microwave Hairpin Resonator NICHOLAS SIEFERT, BISWA GANGULY, Air Force Research Laboratory WPAFB — We use optical and electrical diagnostic tools, as well as the hairpin resonator, to observe large-amplitude fluctuations in light emission, electric field and electron number density due to traveling ionization waves in argon glow discharges. The location of maximum production of ionization and the location of maximum electron number density are over 180^o out of phase in ionization waves under our discharge conditions. The production rates of electrons peaks where the electric field is greatest; however, the electrons accumulate where the electric field is near its minimum. To measure the changing electron number density in these waves, we have revisited the hairpin resonator technique [R.L. Stenzel Rev. Sci. Instrum. 47, 603 (1976)]. We solve the wave equation with electron-neutral collisions and show that correction to the electron number density is less than 5% for pressures at or below 1 Torr. The wave frequency varies from 2 kHz to 5 kHz, depending on pressure and current. The data shows that both the light emission and the electric field are in phase with each other, but they are out of phase with the electron number density by 185^o-265^o. This is consistent with the current continuity equation. The effect of pressure and current on both the phase difference and the peak electron number density will be presented.

Biswa Ganguly
Air Force Research Laboratory

Date submitted: 27 May 2005 Electronic form version 1.4