Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Electron rings around magnetized electrodes[1] REINER STENZEL, J. MANUEL URRUTIA, Retired and Recalled — When a permanent dipole magnet is biased strongly negative (-800 V) in the presence of sufficient neutrals (> 5 mTorr) a ring of light, i.e. hot electrons, is formed in the equatorial plane of the dipole. The phenomenon has been explained by the physics of a magnetron discharge: Energetic ions impact on the magnet, release secondary electrons, which are confined by the magnetic field, $\mathbf{E} \times \mathbf{B}$ drift, efficiently ionize and gradually diffuse toward the anode to close the discharge current. Time-resolved measurements have shown that a weak electron ring forms on a fast time scale compared to ion transit or electron diffusion times. It oscillates coherently near the ion plasma frequency ($f \simeq 1$ MHz) and exhibits the characteristics of an ion-rich sheath instability. In contrast, under steady-state conditions the instability becomes broadband and turbulent wave packets propagate in the $\mathbf{E} \times \mathbf{B}$ direction. While the focus is on the basic physics sputtering applications will also be addressed. The cold-cathode discharge can be operated in reactive gases.

[1]Work supported by NSF/DOE and AFRL.

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Date submitted: 10 Jul 2012 Electronic form version 1.4