

N87-20083

A Plasma Generator Utilizing the High Intensity ASTROMAG Magnets

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The magnet configuration for the proposed particle astrophysics magnet facility (ASTROMAG) on the Space Station includes a cusp magnetic field with an intensity of a few tesla. With these large magnets (or others) located in the outer ionosphere, many quite interesting and unique plasma physics experiments become possible. First, there are studies utilizing the magnet alone to examine the super-sonic, sub-Alfvenic interaction with the ambient medium; the scale length for the magnet perturbation is ≈ 20 m. The magnetic field geometry when combined with the Earth's and their relative motion will give rise to a host of plasma phenomena: ring nulls, x-points, ion-acoustic and lower-hybrid shocks, electron heating (possible shuttle glow without a surface), launching of Alfven waves, etc. Second, active experiments are possible for a controlled study of fundamental plasma phenomena. A controlled variable species plasma can be made by using an RF ion source; use of two soft iron rings placed about the line cusp would give an adequate resonance zone (ECH or ICH) and a confining volume suitable for gas efficiency. The emanating plasma can be used to study free expansion of plasma along and across field lines (polar wind), plasma flows around the space platform, turbulent mixing in the wake region, long wavelength spectrum of convecting modes, plasma-dust interactions, etc.