Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Space as an open plasma laboratory KONSTANTINOS PAPADOPOULOS, University of Maryland — Ionospheric heaters supplemented by ground and space based diagnostic instruments have for a long time being used to conduct plasma physics, geophysical and radio science investigations. The recently completed HF transmitter associated with the High Frequency Active Ionospheric Research Program (HAARP), far exceeds the capabilities of previous ionospheric heaters and allows for new frontier research in plasma physics, geophysics and radio science. The transmitter radiates 3.6 MW of HF power in the 2.8-10.0 MHz frequency range. The beam-width varies from 15-5 degrees, corresponding to 20-30 dB gain and resulting in Effective Radiating Power (ERP) between .36 – 4.0 GW. The antenna can point to any direction in a cone of 30 degrees from the vertical, with a reposition time of 15 degrees in 15 microseconds resulting in super-luminous scanning speeds. The transmitter can synthesize essentially any desired waveform in linear and circular polarization. We present a number of HAARP experiments that used space as an open plasma laboratory. The experiments cover the areas of (i) Artificial ULF/ELF/VLF generation and injection in the magnetosphere (ii) Studies of wave-particle interactions in the magnetosphere (iii) Langmuir turbulence, parametric instabilities, electron acceleration and optical emissions (iv) Artificial ionization. Work supported by MURI ONR N00140710789 and DARPA-DSO HR0011-09-C-0099.

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Date submitted: 11 Jul 2011 Electronic form version 1.4