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**Nonlinear Plasma Experiments in Geospace with Gigawatts of RF Power at HAARP** J.P. SHEERIN, N. RAYYAN, Eastern Michigan Univ., B.J. WATKINS, W.A. BRISTOW, U. Alaska-Fairbanks, P.A. BERNHARDT, NRL — The HAARP phased-array HF transmitter at Gakona, AK delivers up to 3.6 GW (ERP) of HF power in the range of 2.8 – 10 MHz to the ionosphere with millisecond pointing, power modulation, and frequency agility. HAARP's unique features have enabled the conduct of a number of nonlinear plasma experiments in the interaction region of overdense ionospheric plasma including stimulated electromagnetic emissions (SEE), artificial aurora, artificial ionization layers, VLF wave-particle interactions in the magnetosphere, strong Langmuir turbulence (SLT) and suprathermal electron acceleration. Diagnostics include the Modular UHF Ionospheric Radar (MUIR) sited at HAARP, the SuperDARN-Kodiak HF radar, spacecraft radio beacons, HF receivers to record stimulated electromagnetic emissions (SEE) and telescopes and cameras for optical emissions. We report on short timescale ponderomotive overshoot effects, artificial field-aligned irregularities (AFAI), the aspect angle dependence of the intensity of the plasma line, and suprathermal electrons. Applications are made to the study and control of irregularities affecting spacecraft communication and navigation systems.

J. P. Sheerin
Eastern Michigan Univ.

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