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The Largest Ionospheric Disturbances Produced by the HAARP HF Facility

Abstract:

The enormous transmitter power, fully programmable antenna array, and the agile frequency generation of the High Frequency Active Auroral Research Program (HAARP) facility in Alaska has allowed production of unprecedented disturbances in the ionosphere. Using both pencil beams and conical (or twisted) beam transmissions, artificial ionization clouds have been generated near the 2nd, 3rd, 4th, and 6th harmonics of the electron gyro frequency. The conical beam has been used to sustain these clouds for up to 5 hours as apposed to less than 30 minute durations produced using pencil beams. The largest density plasma clouds have been produced at the highest harmonic transmissions. Satellite radio transmissions at 253 MHz from the NRL TACSat4 COMMX experiment have been severely disturbed by propagating through artificially plasma region showing greater than 16 dB scintillations and an S4 index of unity. Similar propagation experiments with the ePOP CERTO beacon with signals aligned with the geomagnetic field show 25 dB scintillations at 150 MHz and 20 dB Scintillations at 400 MHz. Previous attempts to produce scintillations with ionospheric heating have been limited to 3 dB or less. Finally, optical emissions from HAARP have intensities exceeding 1 kR has been produced with both large scale uniform patches and small scale field-aligned filaments. The goals of future HAARP experiments should be to build on these discoveries to sustain plasma densities larger than that of the background ionosphere for use as ionospheric reflectors of radio signals.