

## **New Observations of the HF Plasma Line Overshoot at the Arecibo Observatory**

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In the 1970's and 1980's, enhanced plasma waves were frequently detected with the 430 MHz radar at the Arecibo Observatory within 2 to 8 msec after the HF heater had been turned on (Showen, 1975). The enhanced plasma wave phenomenon is best described as a rapid increase in the return power level of the plasma line by one or two orders of magnitude, followed by a slow decay back to a lower "steady state" value associated with HF heating. The formation of short scale striations has frequently been cited as a plausible explanation of the plasma line overshoot. The idea is that as the striations form, they absorb or scatter energy from the HF heater wave. This diminishes the amount of power available to excite the plasma waves detected by the 430 MHz radar. Short scale striations are thought to form at the altitude where the frequency of the HF wave matches the upper hybrid resonance – below the altitude of HF reflection. In 1981, the decay of the plasma line overshoot was correlated with the rise of the short scale striations utilizing an HF pulse rate of 4 seconds on/off, with the HF transmitter tuned to 5.1 MHz, and an estimated E.R.P. of 38 MW (Coster et al., 1985). In July 2017, a series of HF heating experiments designed to examine the enhanced plasma line with the new Arecibo Observatory HF facility and the improved diagnostics of the modern system. These experiments were designed to study possible mechanisms responsible for the formation and decay of the plasma line overshoot. In the experiment, the HF heater was cycled on and off at various cycles: 8 min on/off, 4 min on/off, and 2 min on/off, and enhanced plasma lines were detected throughout the experiment. We report on significant findings from this experiment, including newly analyzed GPS observations.

Showen, R.L., Time variations of HF induced plasma waves, PhD thesis, Rice University, Houston, Texas, 1975.

Coster, A. J., F. T. Djuth, R. J. Jost, and W. E. Gordon, (1985). "The Temporal Evolution of 3-m Striations in the Modified Ionosphere," JGR, vol. 90, No A3, p. 2807-2818, 1 March 1985.