



Co-existence of Multiple Decay Instabilities During a Descending Artificial Plasma Cloud Event at Arecibo

E. Nossa*⁽¹⁾, P. A. Bernhardt⁽²⁾, S. Briczinski⁽²⁾, M. Sulzer⁽³⁾, P. Perillat⁽³⁾, and N. Aponte⁽³⁾

(1) National Research Council Postdoctoral Fellow, working at the Plasma Physics Division at Naval Research Laboratory, Washington, DC, USA

(2) Plasma Physics Division, Naval Research Laboratory, Washington, DC, USA

(3) Arecibo Observatory, Arecibo, Puerto Rico, US

The Arecibo Observatory - HF Facility transmits powerful high frequency (HF) waves into the ionosphere. The electrons are energized via resonance interactions between the background ionospheric plasma and the waves. The energized electrons produce an artificial plasma cloud inside the HF beam, approximately 50 km in diameter and 3 km thick. The electrons' behavior is diagnosed using the 430 MHz Incoherent Scatter Radar (ISR) plasma line (PL) spectrum. The ISR detects an increase of the returned echo amplitude, known as HF enhanced plasma line (HFPL), at the altitude where the wave frequency resonates with the ionospheric plasma frequency.

Sometimes the artificial plasma clouds descend in altitude, as was observed during an experiment on the morning of March 15, 2017. The ISR-PL spectrum is used to investigate the behavior of the accelerated electrons and the parametric decaying modes. The spectrum shows a descending plasma cloud and holes in the natural PL profile, as well as the presence of multiple clouds that coexist for short periods of time at different heights.

Multiple decay modes seem to be acting during the event, which changes depending on the background plasma frequency at each altitude. We explore the presence of upper-hybrid, and other decay modes, as the electron plasma frequency varies with the descend of the artificial plasma cloud.

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