

Technical Page

Proposal Type: Urgent
 General Category: Terrestrial Aeronomy
 Sub-Category: Radar
 Observation Category: Ionosphere
 Total Time Requested: 80 Hours

Proposal Title: Guided Whistler Wave Propagation and Interactions with Ionospheric Plasmas during Spread F Events

ABSTRACT:

We have theoretically demonstrated that the radio signals at 40.75 kHz, emitted from the Naval (NAU) transmitter in Puerto Rico, can effectively interact with the radiation belts and ionospheric plasmas over Arecibo, after they are guided by naturally occurring ionospheric ducts during "spread F events". These intense NAU radio waves, after entering the ionosphere in the form of whistler waves, can interact with ionospheric plasmas and excite lower hybrid waves and tens of meter-scale field-aligned plasma density irregularities over Arecibo. The subsequent heating of electrons and ions by the lower hybrid waves is expected to yield a chain of ionospheric plasma effects, such as airglow, short-scale density depletion, and enhanced plasma lines in a broad range of altitudes. The NAU 40.75 kHz whistler waves continuing propagation into the radiation belts at $L = 1.35$ can interact with local charged particles, causing energetic particle precipitation and then producing anomalous ionization layers and airglow in the lower ionosphere over Arecibo. We propose to carry out Arecibo experiments this winter for 10 days by a team of MIT graduate students and undergraduate students, led by the Principal Investigator: Prof. Min-Chang Lee in collaboration with the co-Principal Investigator: Dr. Michael P. Sulzer of Arecibo Observatory to test the theories. In addition to Arecibo 430 MHz radar and ionosonde, we will deploy MIT's All-Sky Imaging System (ASIS), VLF/LF and HF receiving systems for the experiments.

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Service Observing Request

- None
- All of the observing run.
- Part of the observing run.
- Queue Observing

Remote Observing Request

- No
- Maybe
- Yes

Instrument Setup

430 CH radar

Atmospheric Observation Instruments:

Ionosonde

Description of Observer Equipment: MIT All Sky Imaging System (ASIS), VLF/HF/VHF receiving systems

Special Equipment or setup: none

RFI Considerations

Frequency Ranges Planned

N/A