2018 Workshop: Active Experiments Workshop

Long title
Active Experiments Workshop
Conveners
Eliana Nossa
Paul Bernhardt
Christopher Fallen
Louise Gentile
David Hysell
Alireza Mahmoudian
Description

Ionospheric modification experiments are a relatively new way to learn about plasma physics. The study of plasma interactions is a key to understanding the physics of the upper atmosphere and magnetosphere. Typically, plasma experiments have been confined to a laboratory where it is difficult to replicate conditions in the ionosphere. However, the ionosphere itself is another environment to realize many of those experiments through various active experiments. Ionospheric modification experiments using high-power HF radio waves, chemical releases from sounding rockets, or particle beams from satellites can induce upper atmosphere phenomena that are observed only sporadically in the natural undisturbed ionosphere, if at all.

High-power HF radio waves incident on the ionosphere can generate artificial aurora or airglow, HF-enhanced plasma and ion lines observed with radar, induce scintillations or otherwise affect radio propagation by creating plasma density irregularities due to complex interactions between the powerful HF transmissions. During the last years, two HF facilities have restarted operations on US territory, the HAARP facility in Alaska at high latitude and the Arecibo Observatory in Puerto Rico at mid-latitude. HAARP is the most powerful and flexible ionosphere heating facility, with sweeping frequencies and multibeam modes. Arecibo has the largest gain up to 26 dB and an advantage of being collocated next to the Arecibo ISR. Both facilities provide diagnostic optical and radio instrumentation for detecting ionosphere modification effects.

Chemical releases from rockets into the natural ionosphere can also induce scintillation and even airglow, in addition to other unique effects. For example, recent experiments include the Metal Oxide Space Clouds (MOSC) experiment and the Charged Aerosol Release Experiment (CARE). MOSC was designed to provide an opportunity for the first comprehensive diagnosis of an artificially plasma cloud generated by the release of Sm vapor in the upper atmosphere and it demonstrated that artificial ionospheric layers could be created through chemical release. CARE is designed to study artificial charged particulate (or dusty plasma) layers in the upper atmosphere and their effects on ULF, S-band, and L-band radars.

This workshop will convene experimentalists to present results and explore the potential of new operations at the two facilities and of chemical release experiments in the ionosphere.

Agenda

16:00 - "Arecibo Observatory - HF Facility Update". Mike Sulzer – Arecibo Observatory

16:08 - "HAARP Update". Christopher Fallen – UAF

16:16 - "Plasma line overshoot at Arecibo". Anthea Coster – MIT

16:29 - "HF Radar Ionospheric Observations During Arecibo Heating Campaign in March 2017". Julio Urbina – Penn State

16:42 - "Variations of HF links during the March 2017 Arecibo heating campaign". Natasha Jackson – QuinetiQ

16:55 - "(TBD)". Stan Briczinski – NRL

17:08 - "Spectral Analysis of an Unexpected ePOP-RRI Observation during Arecibo HF Heating Experiments". Ashanthi Maxworth – University of Saskatchewan

17:21 - "Observations of Acoustic Waves in the Ionosphere". Justin Mabie – NOAA

17:34 - "New Active Experiments Using Electron Beams in Space". Geoffrey Reeves – Los Alamos National Laboratory

17:47 - "Diagnosis of Charged Dust Phenomena in Mesosphere using High-power Radio Transmission". Alireza Mahmoudian - Inter American University of Puerto Rico

18:00 - Adjourn

Justification

The 2012 Decadal Survey for Solar and Space Physics prioritized the Ionospheric Modification facilities as a way to use the ionosphere as a "laboratory without walls" to explore complex plasma interactions that could not be studied in a confined lab and that regulate most of the natural ionospheric phenomena. Two facilities are now operating on US territory: HAARP at high-latitude and Arecibo at mid-latitude. On top of that, experiments of chemical ionospheric modifications had been performed. This workshop will be the report of the work done during the last years as well as a way to promote this new area of knowledge.

Question to be addressed:

How to understand the different plasma irregularities in the ionosphere and the interaction of radio waves and chemical agents with the ionosphere plasma.

How the associated questions will be addressed:

Experiments that artificially modify the ionosphere are being performed, addressing different plasma irregularities. At the workshop, the facilities will present updates on their operations; users will report about the experiments as well as future ideas of how this new research area could be defining new knowledge frontiers.

How progress should be measured.

By the numbers of new experiments, projects, users proposed in the following year.

Workshop format
Short Presentations
View PDF