2017 Workshop: RF and chemical ionospheric modification

Long title
Active Experiments Workshop
Conveners
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Description

Ionospheric modification experiments are a well-established way to learn about plasma physics with many newly discovered results. The study of plasma interactions is a key to understanding the physics of the upper atmosphere. Commonly, plasma experiments have been confined to laboratory set up. However, the ionosphere is another environment to realize those experiments. Ionospheric modification experiments can generate artificial aurora or airglow, HF-enhanced plasma and ion lines observed with radar, induce radio scintillations or affect radio propagation by creating plasma density irregularities due to complex interactions between the powerful HF transmissions or chemical releases with the natural ionosphere.

During the last two years, two facilities are restarting operations, HAARP at high latitude and Arecibo at mid-latitude. HAARP is the most powerful and flexible instrument, with sweeping frequencies and multi-beam modes. Arecibo has the largest gain up to 26 dB and an advantage of being (1) located below a dense ionosphere that does not vanish after sunset, and (2) collocated next to the Arecibo incoherent scatter radar and other sensible radio and optical instrumentation. Also, chemical experiments using sounding rockets or satellites have been conducted in the past with Arecibo and will be conducted in the future with both Arecibo and HAARP using chemical injections from satellites or rockets.

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

Agenda

10:00 David Hysell – The role of high-power ionospheric modification in advancing ionospheric/thermospheric research

10:20 William Bristow – HAARP Status

10:35 Eliana Nossa – Arecibo - HF facility update (pdf)

10:50 Gareth Pery – CASSIOPE/e-POP support for active experiments

11:05 Christopher Fallen – Outreach opportunities for ionospheric modification research

11:20 Natasha Jackson – Preliminary results from the Arecibo Heating Experiment (HEX): from HF to GPS (pdf)

11:35 Herb Carlson – HF Heating Experiment Options at High vs Mid Latitudes

11:50 Louise Gentle – Chemical release experiments: MOSC and White Sands

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 vapor injections 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.

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