2018 Workshop: CUSP GCI Rocket Campaign

Long title
Cusp-Grand Challenge Initiative: An eleven sounding rocket campaign using space and ground-based instruments to investigate the polar cusp
Conveners
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Description

The polar cusps provide a unique window on solar wind-magnetosphere-ionosphere interaction through their magnetic connection to the dayside magnetopause. It is therefore possible to probe fundamental coupling phenomena such as dayside reconnection by measuring particles and fields and associated effects in the ionosphere. Furthermore the cusp presents significant mysteries such as enhanced neutral densities and associated effects, the causes of which are still unknown.

The Cusp-Grand Challenge Initiative (Cusp-GCI) is an ongoing international program designed to advance the common understanding of cusp region space physics through coordinated experimental and theoretical research using ground based instruments, modeling, sounding rocket investigations, and satellite based instruments.

At the center of the program are eight experiments involving eleven rocket launches from Andoya and Ny Alesund: TRICE-2 (USA/NASA, PI: Craig Kletzing) studying the dynamics of magnetic reconnection in the cusp VISIONS-2 (USA/NASA, PI: Doug Rowland) studying ion outflow in the cusp using neutral atom imaging ICI-5 (Norway, PI: Joran Moen) studying the generation of ionospheric irregularities in strong shear flows in the cusp SS-520 (Japan/JAXA, PI: Yoshifumi Saito) studying ion outflow in the cusp CAPER-2 (USA/NASA, PI: James LaBelle) studying wave-particle interactions at low and high frequencies C-REX-2 (USA/NASA, PI: Mark Conde) studying causes and effects of neutral density enhancement in the cusp AZURE (USA/NASA, PI: Miguel Larsen) studying high latitude neutral winds G-CHASER (multinational, PI: Chris Koehler) university student rocket

The program also involves the EISCAT and CUTLASS radars, as well as multiple ground-based optical sites (including the Kjell Henriksen Observatory among others).

This workshop is an opportunity for CEDAR participants to learn about the Cusp-GCI program and its various components; to explore participation through measurements, modelling, or theory; and to contribute ideas and discussion to enhance the program. Student participation is especially encouraged.

Agenda

CUSP Grand Challenge Initiative Rocket Campaign Preliminary list of presentations

Presentations will be short with time for questions and discussion

further presentations welcome from attendees!

Spicher, Ground-based measurements relevant to launch criteria

Conde, Cusp-region experiment-2 (C-REX-2)

Larsen, Auroral Zone Upwelling Rocket Experiment

Moen, ICI-5 Investigation of Cusp Irregularities

Rowland Visualizing ion outflow via neutral atom sensing

Kletzing Twin Rockets to Investigate Cusp Electrodynamics

LaBelle Cusp Alfven and plasma electrodynamics rocket

Saito Sounding rocket targeting ion outflow over cusp region

Pfaff, Results from 2002 cusp rocket launched from Ny Alesund

Justification

This workshop relates to a significant ongoing international program of eleven sounding rocket launches and related ground-based measurements focused on the cusp ionosphere over Norway/Svalbard. The campaign is in progress, with one mission underway in Spring 2018, and others scheduled for later in 2018 and 2019. The workshop is a key opportunity to update the CEDAR community on this

important campaign,encourage involvement by CEDAR community members and students, and elicit ideas and discussion to enhance or enrich the science output of the program.

The workshop, as well as the rocket campaign, is closely aligned with both CEDAR strategic thrusts 1 and 2. Through its connection to dayside reconnection sites on the magnetopause, the cusp is key to understanding solar wind, magnetosphere, and ionosphere as a system. Many Cusp-GCI experiments address the mission under strategic thrust 2, “To understand the transformation and exchange of mass, momentum and energy at transitions within the ITM and through boundaries that connect with the lower atmosphere and the magnetosphere.”

Strategic thrusts 4 and 5 are also directly relevant to this workshop, in particular the implementation under strategic thrust 4, "Coordinate multi-platform observational campaigns that take advantage of existing and new instrumentation and facilities," and the promotion of broad, interdisciplinary participation emphasized in Strategic thrust 5.

Different science questions are raised by each of the eleven rocket missions which compose Cusp-GCI and are addressed in this workshop, including studying the dynamics of magnetic reconnection in the cusp, cusp ion outflow and particle interactions with low- and high-frequency waves, the generation of ionospheric irregularities in strong shear flows in the cusp, and the dynamics of neutral density and winds associated with the cusp.

This workshop may have some overlap with that proposed by Cheryl Huang et al., "Challenges in high-latitude system dynamics," which focuses on specific questions related to high latitude geospace in general, whereas our workshop focuses on the cusp.

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