2025 Workshop: Continuum Emissions Across Geospace

Long title
Continuum Emissions Across Geospace: From the subauroral region to the aurora and dayside
CEDAR-GEM
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Description

In recent years, reports of continuum emissions observed in the subauroral, auroral oval, and dayside regions have raised new questions about magnetospheric drivers and the associated ionospheric/atmospheric responses and dynamics. Of particular interest, the subauroral region has garnered renewed scientific attention following the discovery of novel optical phenomena, notably STEVE (Strong Thermal Emission Velocity Enhancement). STEVE is an optical signature of intense Subauroral Ion Drifts (SAID), appearing in the night sky as a latitudinally confined continuum emission. While multiple studies have identified key characteristics and potential generation mechanisms of STEVE, its formation remains an open and actively debated question. Additionally, its relationship with other subauroral structures, such as Stable Auroral Red (SAR) arcs, is not well understood. The magnetospheric contributions to STEVE's formation remain elusive, and modeling efforts are limited due to the region's complex dynamics and the localized nature of these emissions. Understanding the formation and evolution of STEVE within the highly coupled magnetosphere-ionosphere-thermosphere (M-I-T) system—and its connection to other subauroral processes—continues to be a compelling challenge for the geospace community. Beyond STEVE, continuum emissions have recently been

observed within the auroral oval and on the dayside, yet their origins remain unclear. Emerging evidence suggests they may be an atmospheric response to particle precipitation, but many questions persist regarding their driving mechanisms and broader geophysical implications. This workshop aims to bring together these multiple frontier questions and will: (1) present the current “state of the science” for STEVE, subauroral dynamics, and continuum emissions; (2) establish the relevance of these phenomena to the broader GEM-CEDAR community through brief scene-setting presentations; and (3) facilitate discussions on the path forward, identifying key open questions and fostering new synergies and collaborations between the two communities.

Agenda

This session will consist of brief ~7–10 minute talks, followed by a community discussion. The tentative agenda is as follows:

1. Vincent Ledvina (UAF): FAEs and Continuum Emissions over Fairbanks, Alaska
2. Rowan Dayton-Oxland (University of Southampton): GHOST: Observations of a new continuum auroral feature over Svalbard
3. Emma Spanswick (University of Calgary): Continuum emissions within the auroral oval--Observations
4. Josh Houghton (University of Calgary): Continuum emissions within the auroral oval--Observations Continuation
5. Jun Liang (University of Calgary): Modeling of auroral continuum structures--Progress and Challenges
6. Brian Harding (UC Berkeley): Continuum emission--Generation mechanisms
7. Cheng Sheng (UTA): GITM STEVE simulations

For virtual participation, please use the login details below:

https://alaska.zoom.us/j/81524127801

Justification

The growing body of research on continuum emissions in recent years, with a variety of theorized drivers, has led to significant efforts to unravel the underlying physics and chemistry of these phenomena. While the community has made substantial progress in understanding key aspects of some of these structures, many questions remain unanswered. The joint GEM+CEDAR workshop presents a unique opportunity

to engage with the broader community and explore the dynamical processes driving these emissions, from the magnetosphere to the atmosphere.
Some of the proposed science questions are:

What are the various drivers of continuum emissions?
Do continuum emissions observed in different regions and magnetic field topologies share common optical characteristics?
Are continuum emissions in different regions associated with similar geomagnetic conditions?
Could these emissions be driven by common chemical processes in the atmosphere?
What role does particle precipitation play in the generation of continuum emissions?
How frequently do continuum emissions occur?
What are the detailed relationships between STEVE, the Picket Fence, and bright SAR arcs? What conditions within the M-I-T system lead to their occurrence and the reported transitions between them?

While these are still open questions, progress has been made by the community in all these topics. This will be addressed by the short (10 minute) scene setting presentations at the beginning of the panel. The approach would allow for the community—especially students and early career scientists—to learn about continuum emissions in a compact yet effective workshop with keen interest to both CEDAR and GEM investigators.

Related to CEDAR Science Thrusts:
Encourage and undertake a systems perspective of geospace
Explore exchange processes at boundaries and transitions in geospace
Explore processes related to geospace evolution
Fuse the knowledge base across disciplines in the geosciences
Workshop format
Panel Discussion
Keywords
MIT Coupling, Continuum emissions, STEVE, Auroral and Subauroral Dynamics
Focus Group and Group Leader

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