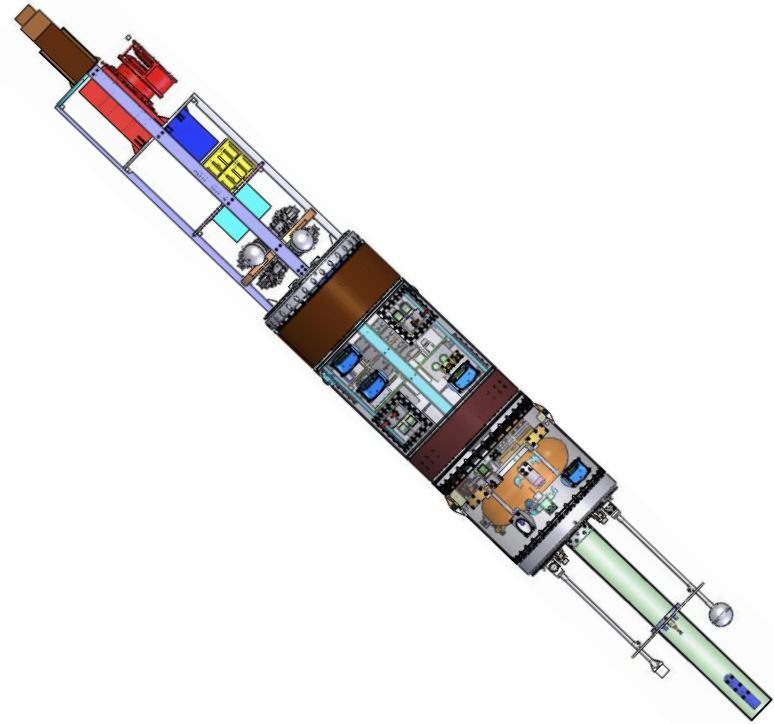


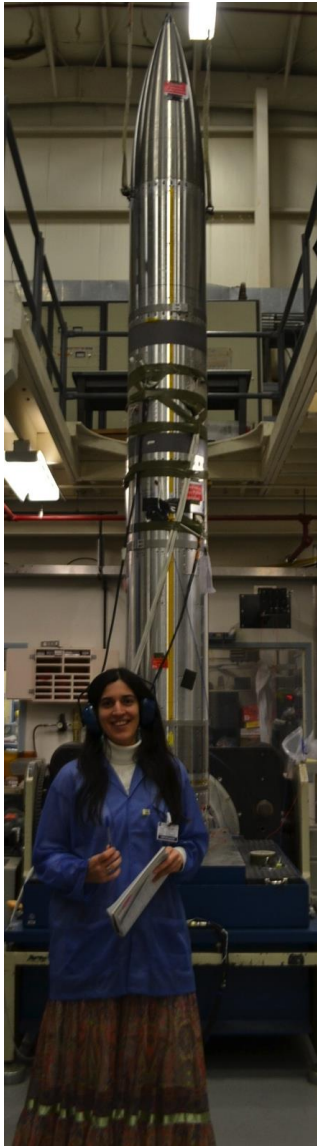
Northern Lights: Rocket Science



Robert Michell & Marilia Samara, Goddard Space Flight Center

Thank you Heliophysics Education Activation Team!

Who we are



What inspires us



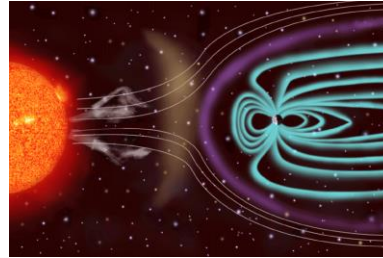


not to scale ☺

Typical flight profile: ballistic -> 5-10 min flight – few min. of prime science data!

Why the aurora?

Space Weather Manifested!



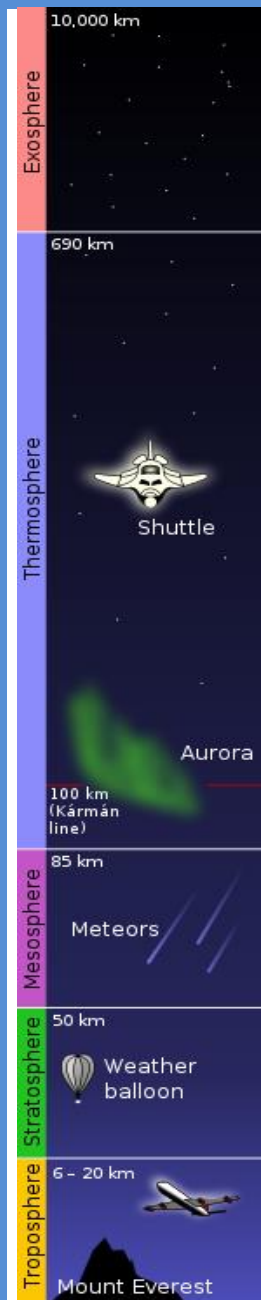
Why Sounding Rockets?

Great for studying the aurora!!

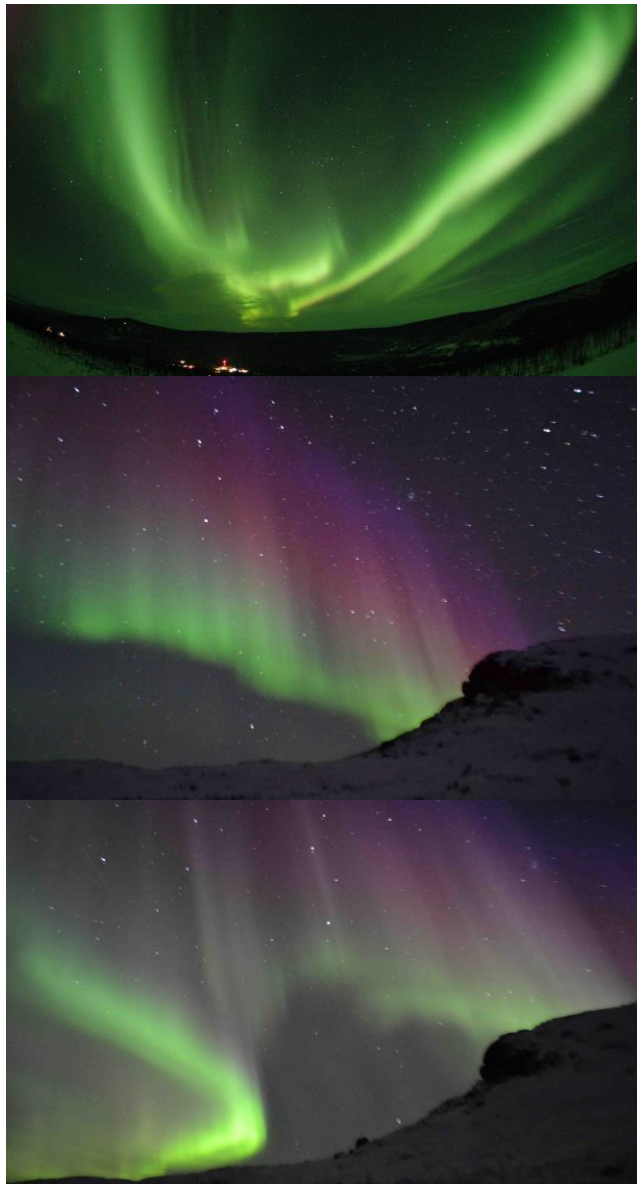
Capture the particles creating it!

get to select the event to within minutes
of when we make the measurements
impossible with satellites!

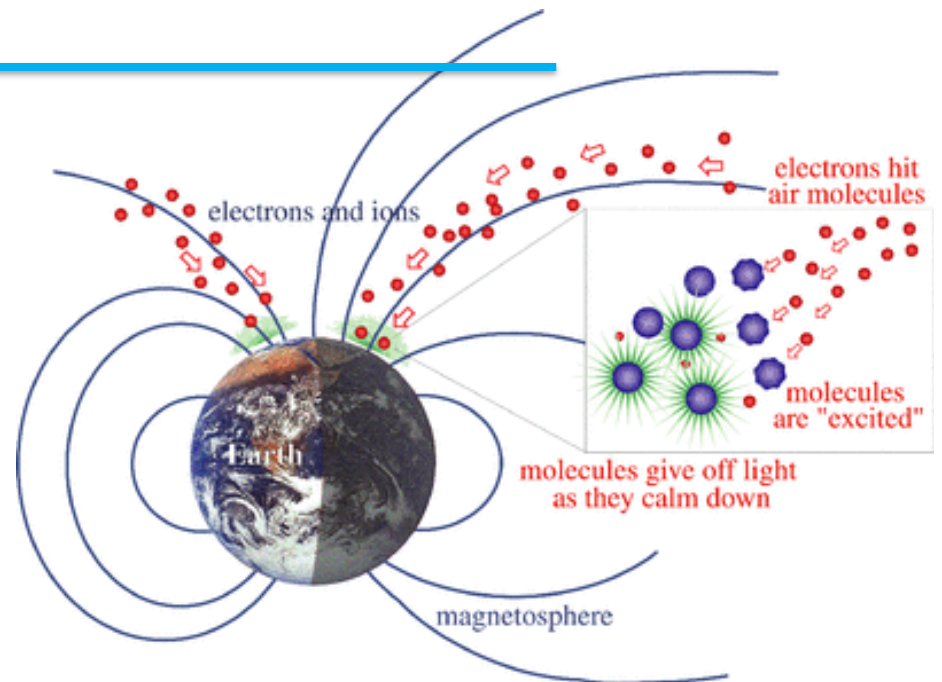
hard to fly satellites in that region – orbital drag
balloons do not even come close



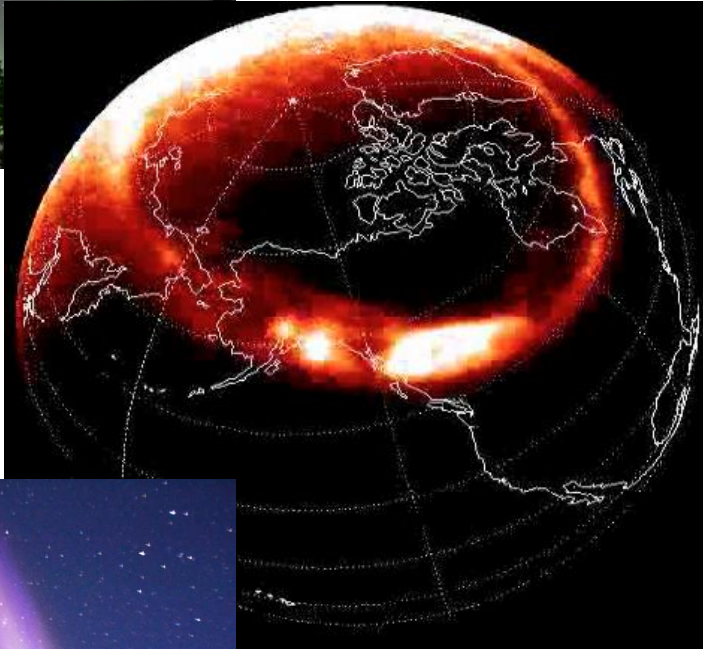
Discrete Aurora



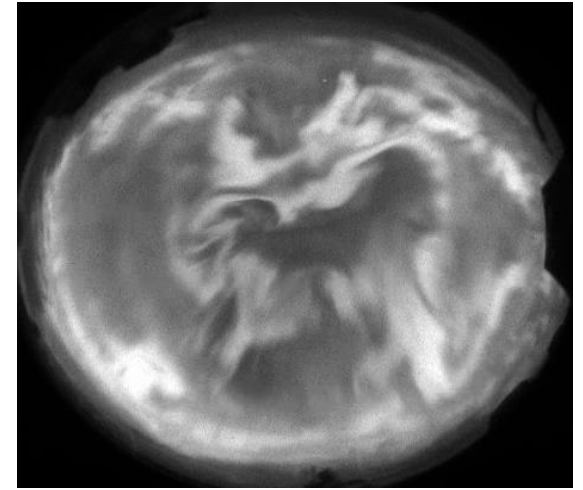
Diffuse Aurora



Not what we mean



What we mean



All-sky (557.7 nm)



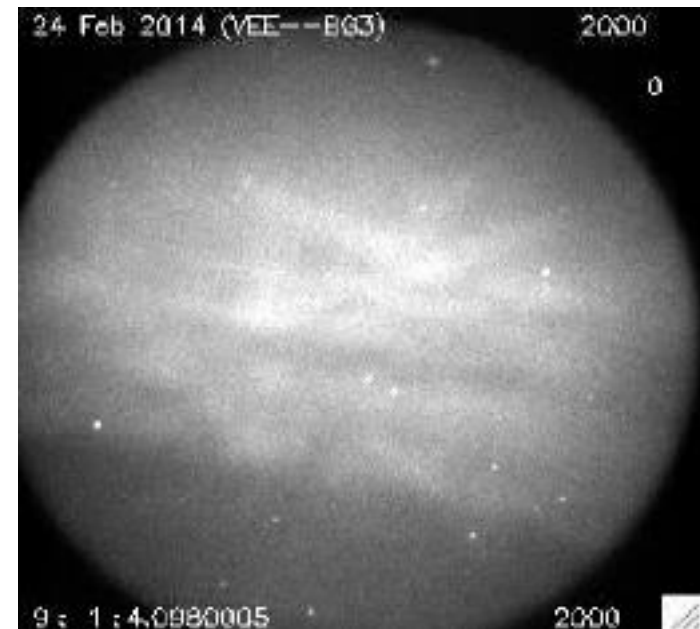
15 deg. FOV (557.7 nm)

Quantitative: 2D Auroral
Photometry, time series.

Science Motivation: One picture – a thousand words

Auroral imaging + precipitating electron spectra at high time resolution ($\sim$ ms)

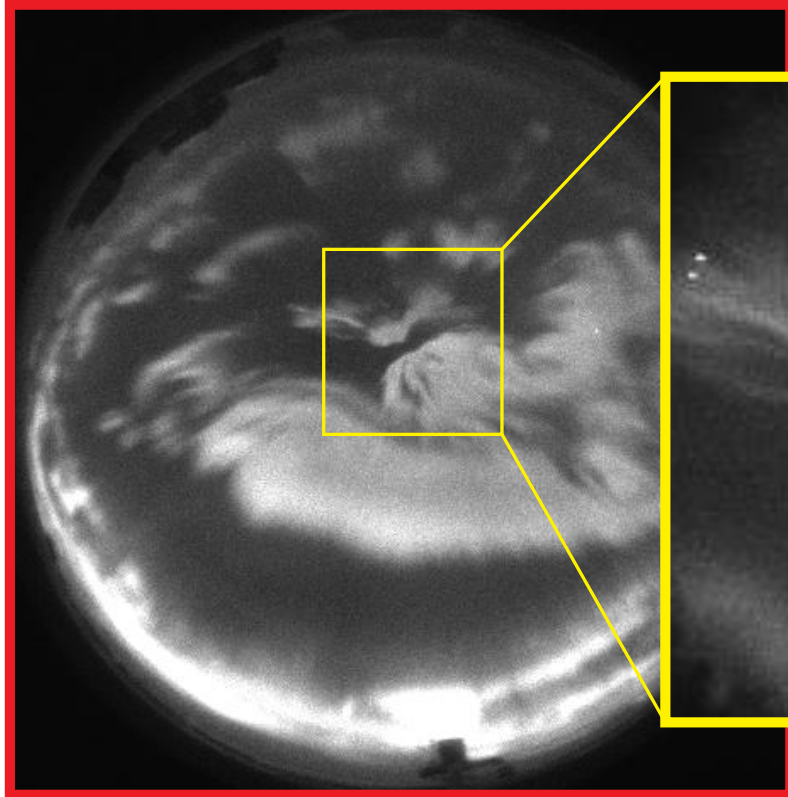
- ✓ Rapid motions of auroral structures $\rightarrow$ curls, apparent fast flows
- ✓ Small spatial scale features ($< \sim 100$ m) $\rightarrow$ black aurora, thin arcs
- ✓ High temporal variability $\rightarrow$ fast pulsating, flickering aurora (10-20 Hz)



Spatial & temporal scales: Small-scale & high time resolution

All-sky imager:

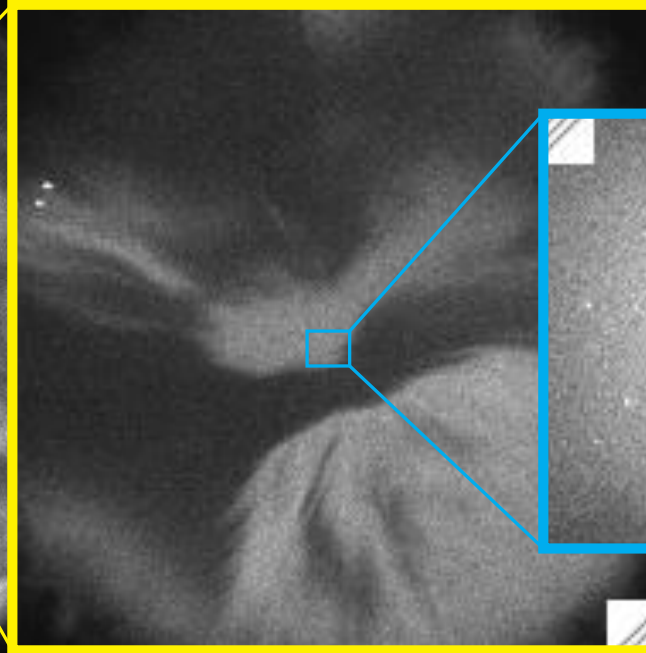
180 deg. FOV, 3.3 Hz frame rate, 557.7 nm



07 Jan 2014 16:26:20 UT Poker Flat, AK

47 deg. FOV

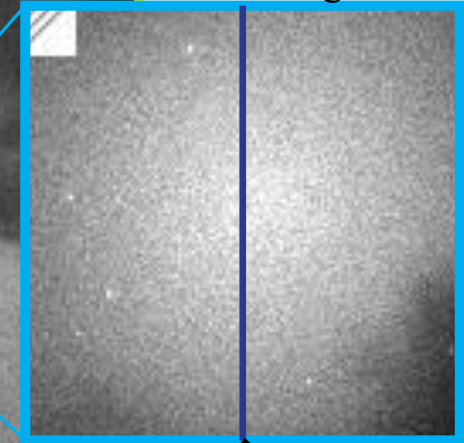
10 Hz frame rate, 557.7 nm



4 deg. FOV

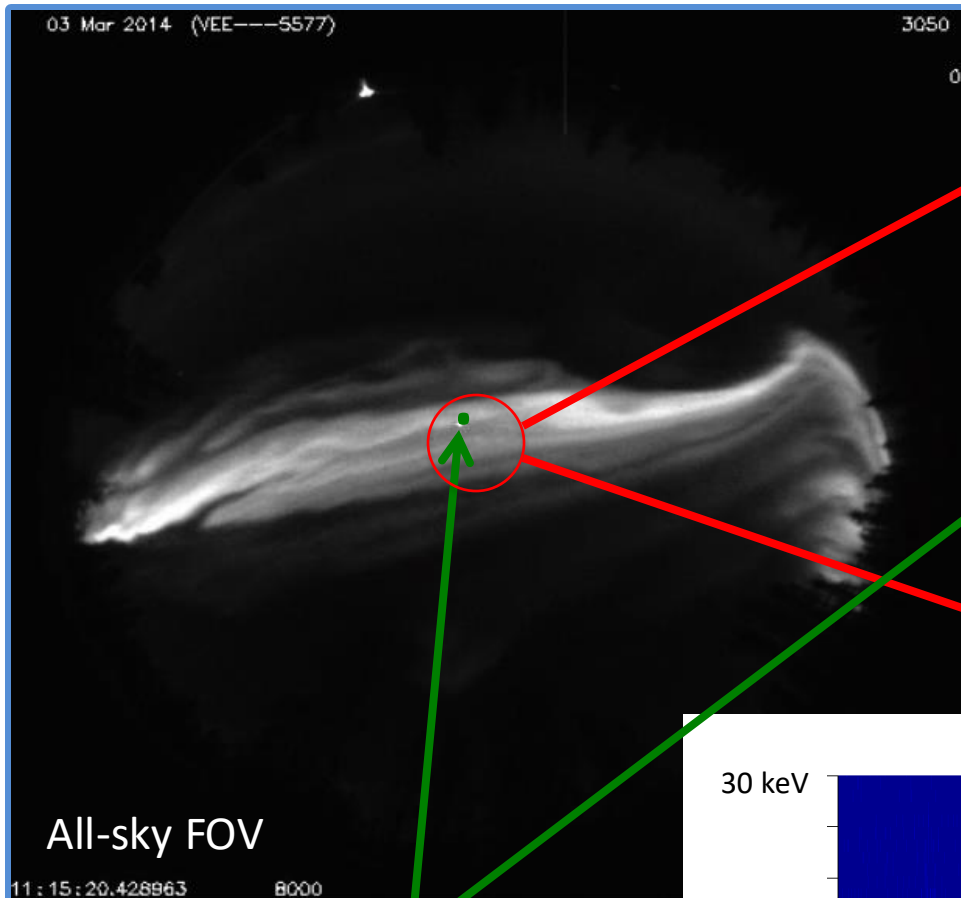
56 Hz frame rate

White light



Location of
keogram cut

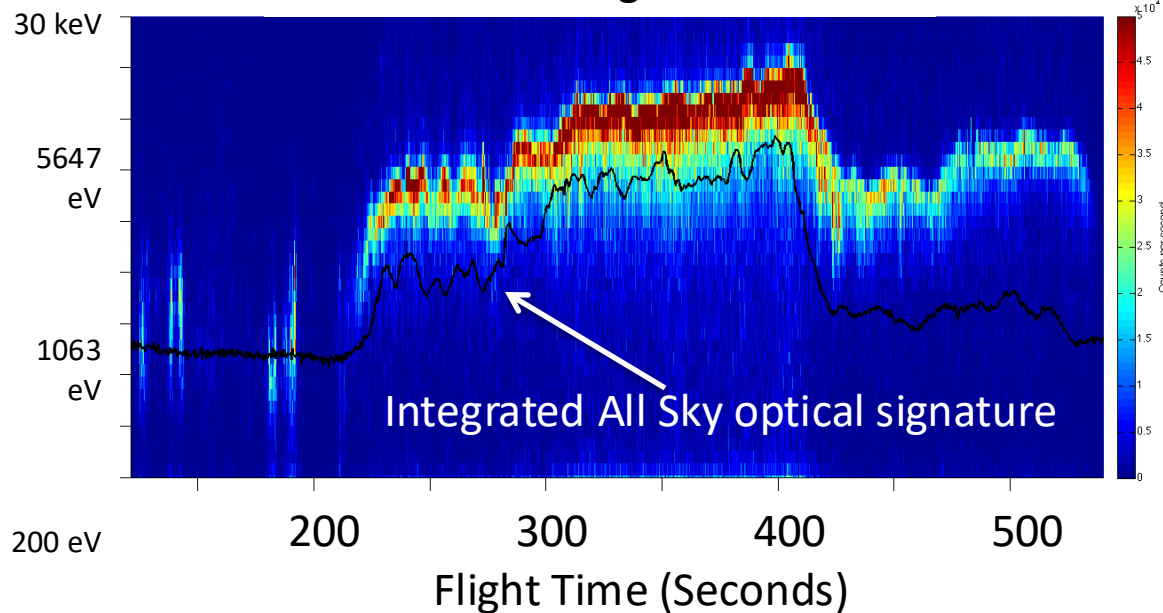
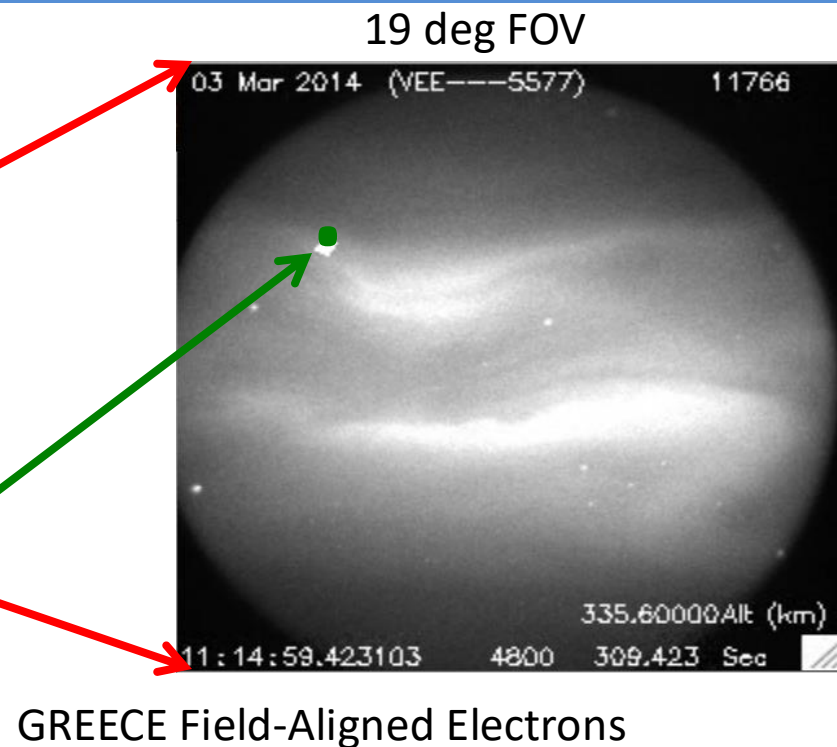
Can not tell from this just what is hidden in the data ☺



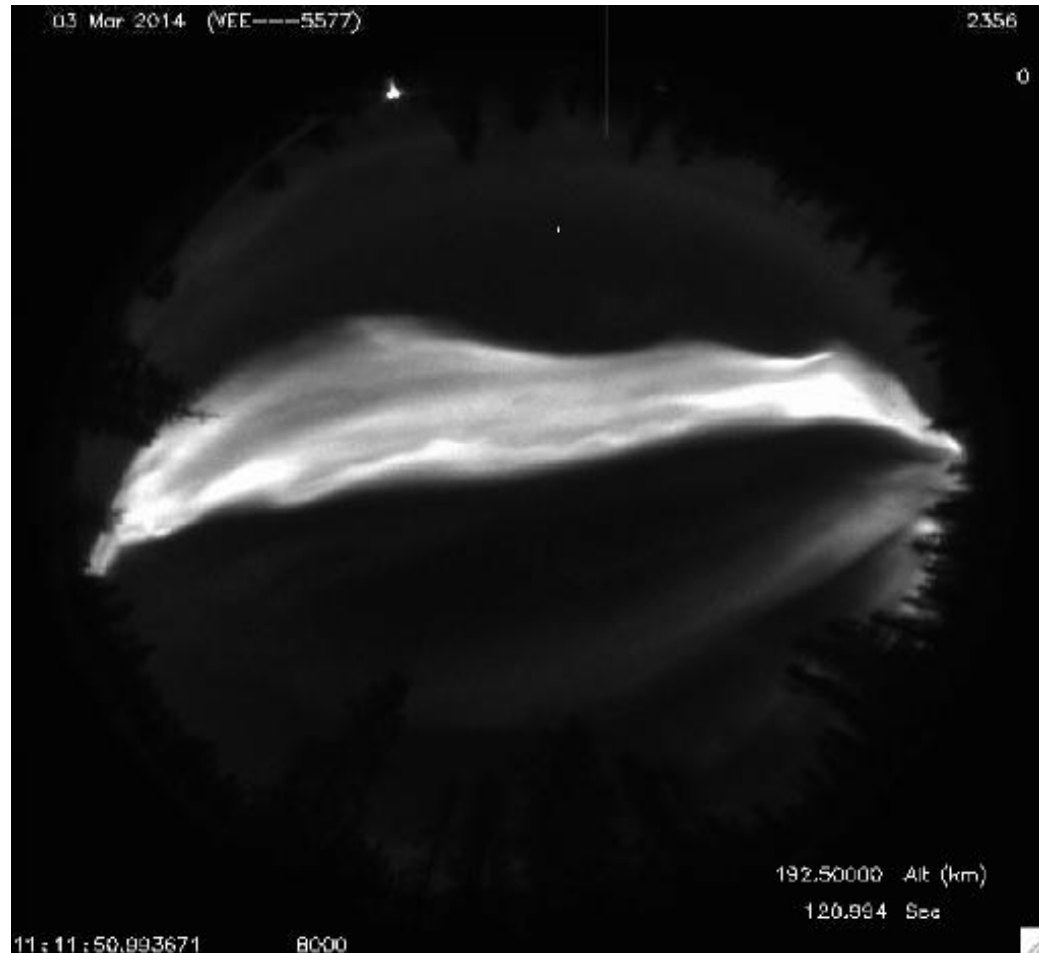
Payload magnetic footpoint
near apogee

Exciting Preliminary Results:
APES instrument electron
spectra closely matching ground
based auroral signature!

02 June 2026



GREECE Data: All-sky (557.7 nm)

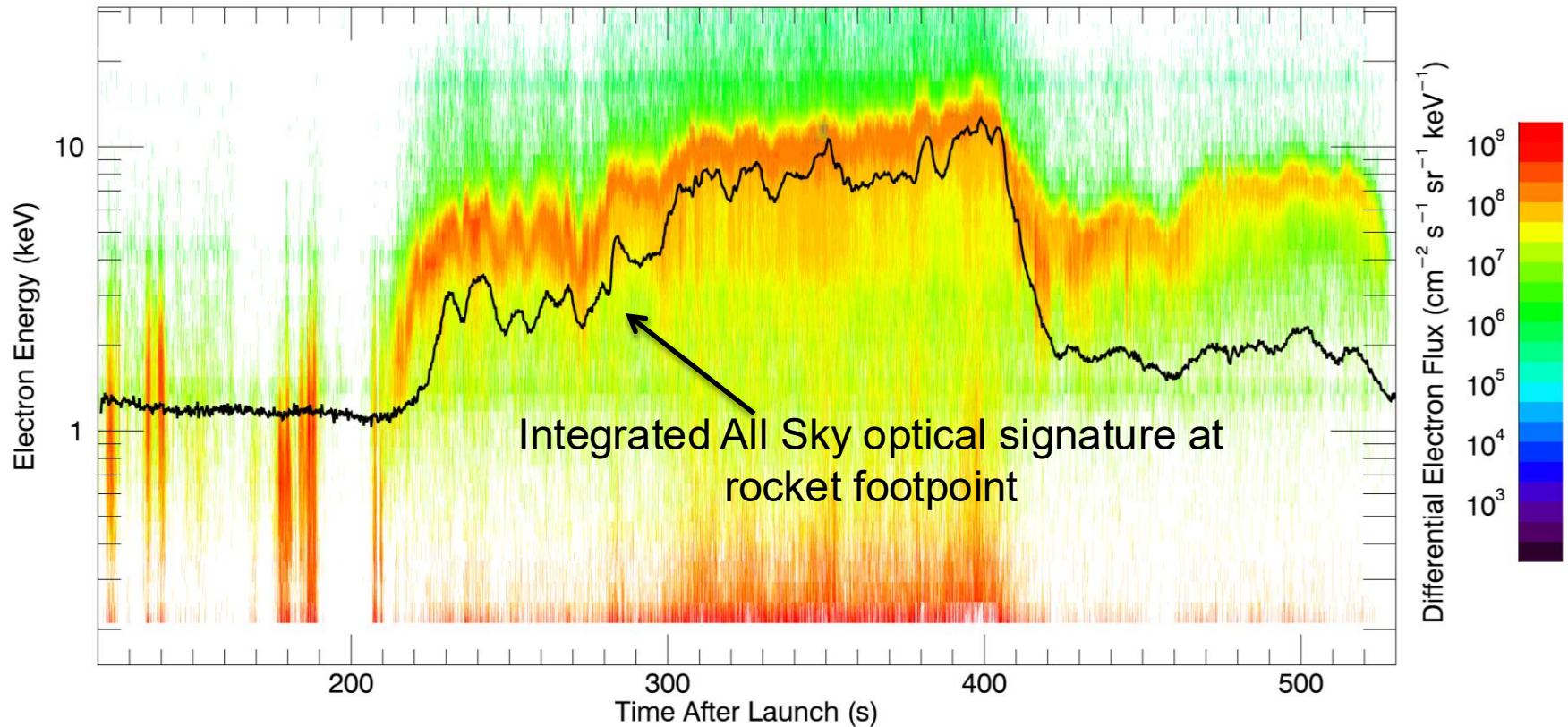


3 Hz Frame Rate

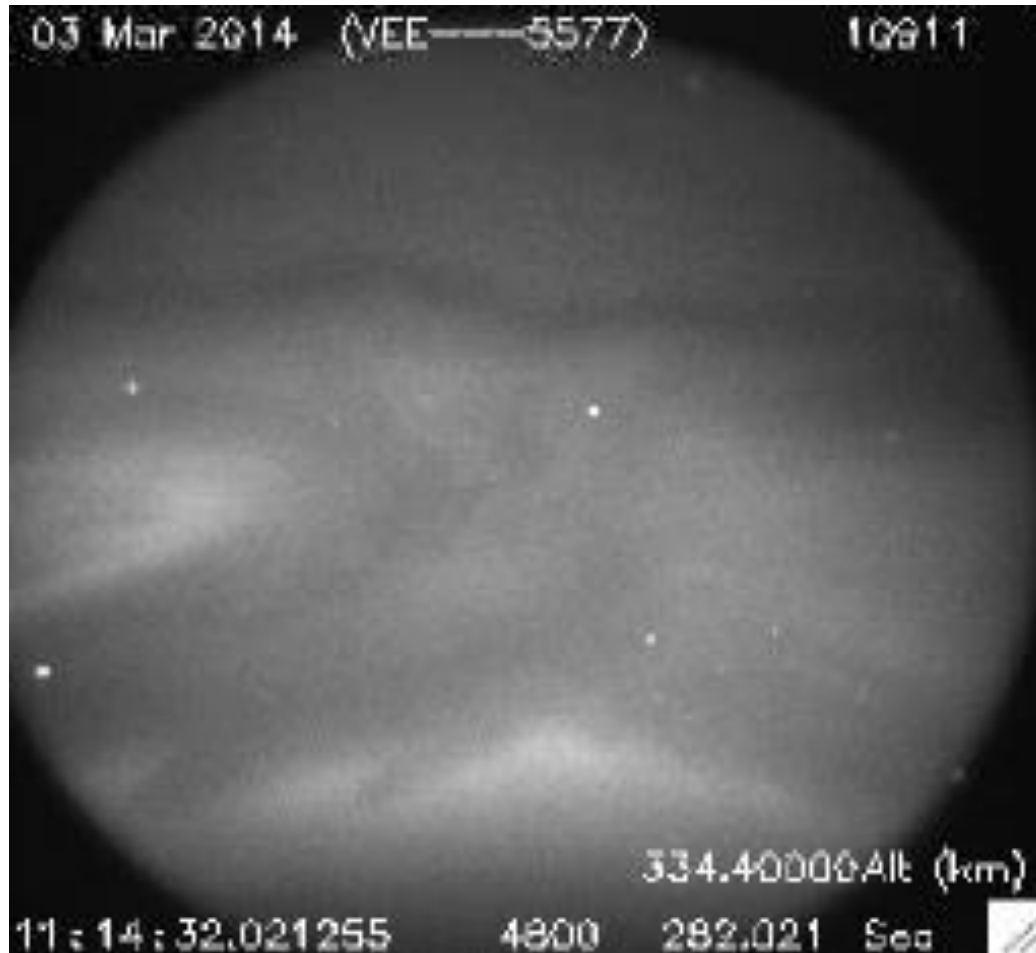
APES electrons + All-sky

GREECE Field-Aligned Electrons

Electron spectra closely matching ground based auroral signature!

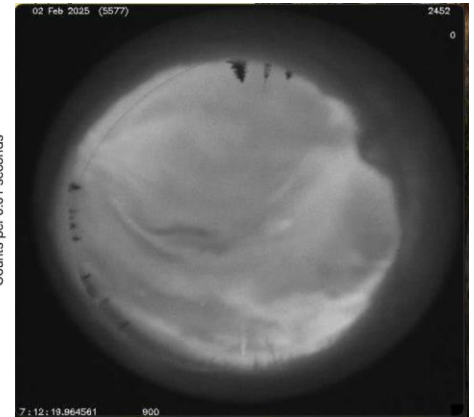
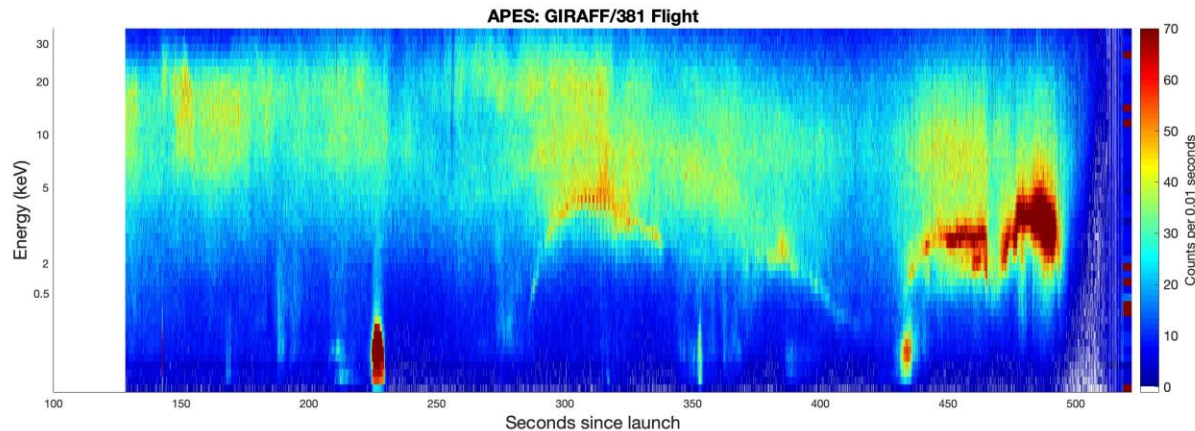


GREECE Data: 19 deg FOV (BG3)

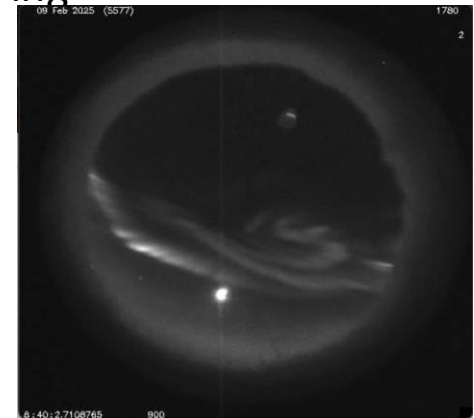
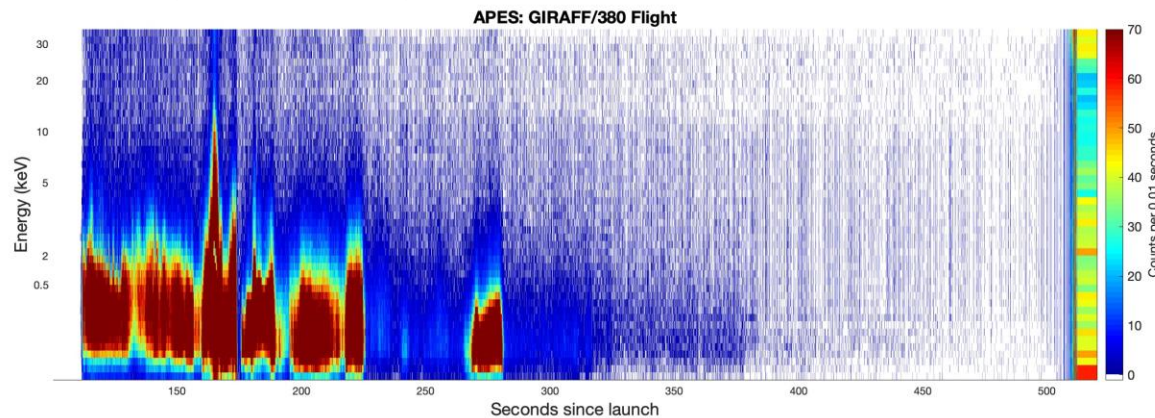


First Light: GIRAFF Rocket Mission Feb 2025

Fast Pulsating Aurora -> Success!



Target: Flickering Aurora -> got some active arcs, but no clear flickering



More Recent: BADASS Launched Feb 2026

Links of Interest: BADASS rocket mission 😊

PI interview: <https://youtu.be/uGTGoC4BCfg?si=tfW9uwr7R4YBELcU>

(by the incredible University of Alaska/Geophysical Institute (UAF/GI) Communications Crew: Rod Boyce, Science Writer and Bryan Whitten, Media Producer)

UAF/GI Press Release (Rod Boyce, Sarah Frazier—Goddard Space Flight Center):

<https://www.gi.alaska.edu/news/three-missions-four-rockets-poker-flat-ready-launches>

A really cool 1ish min video explaining BaDASS in the best way!!

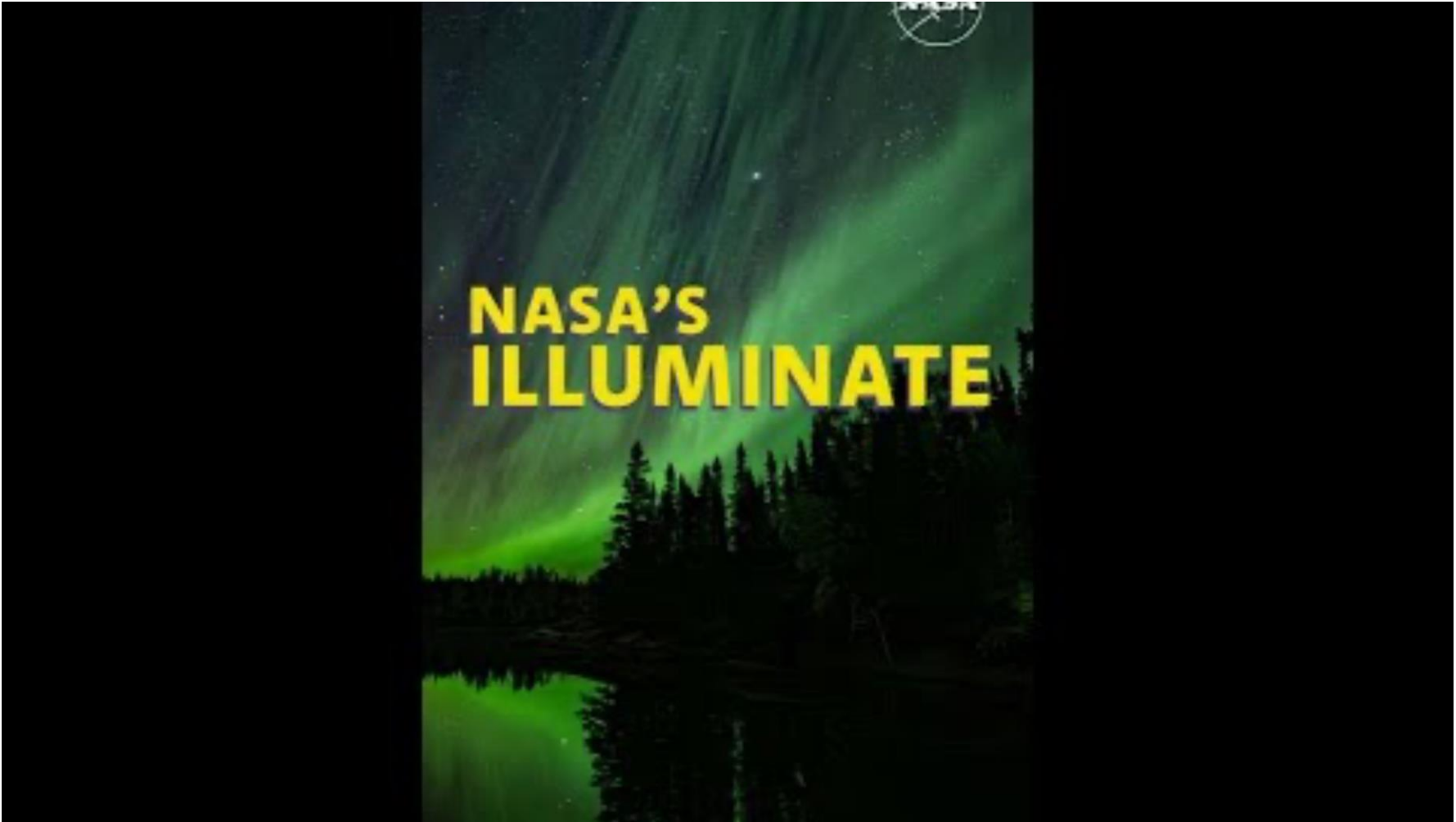
https://youtu.be/IYYXk_yEOcY

With heartfelt thanks to the amazing Lacey Young, Miles Hatfield
& the Helio Communications Team.

We would love to hear from you for ways we can assist with resources for your classroom and input on what kind of website format would be attractive to the public!

marilia.samara@nasa.gov

robert.g.michell@nasa.gov

A vertical poster for NASA's ILLUMINATE project. The background is a dark night sky with vibrant green aurora borealis light streaks. Below the sky, a dense forest of evergreen trees is silhouetted against the light. The title "NASA'S ILLUMINATE" is written in large, bold, yellow capital letters across the middle. In the top right corner, there is a small circular logo with the word "NASA" inside.

NASA'S ILLUMINATE

Lacey Young

THANK YOU!

