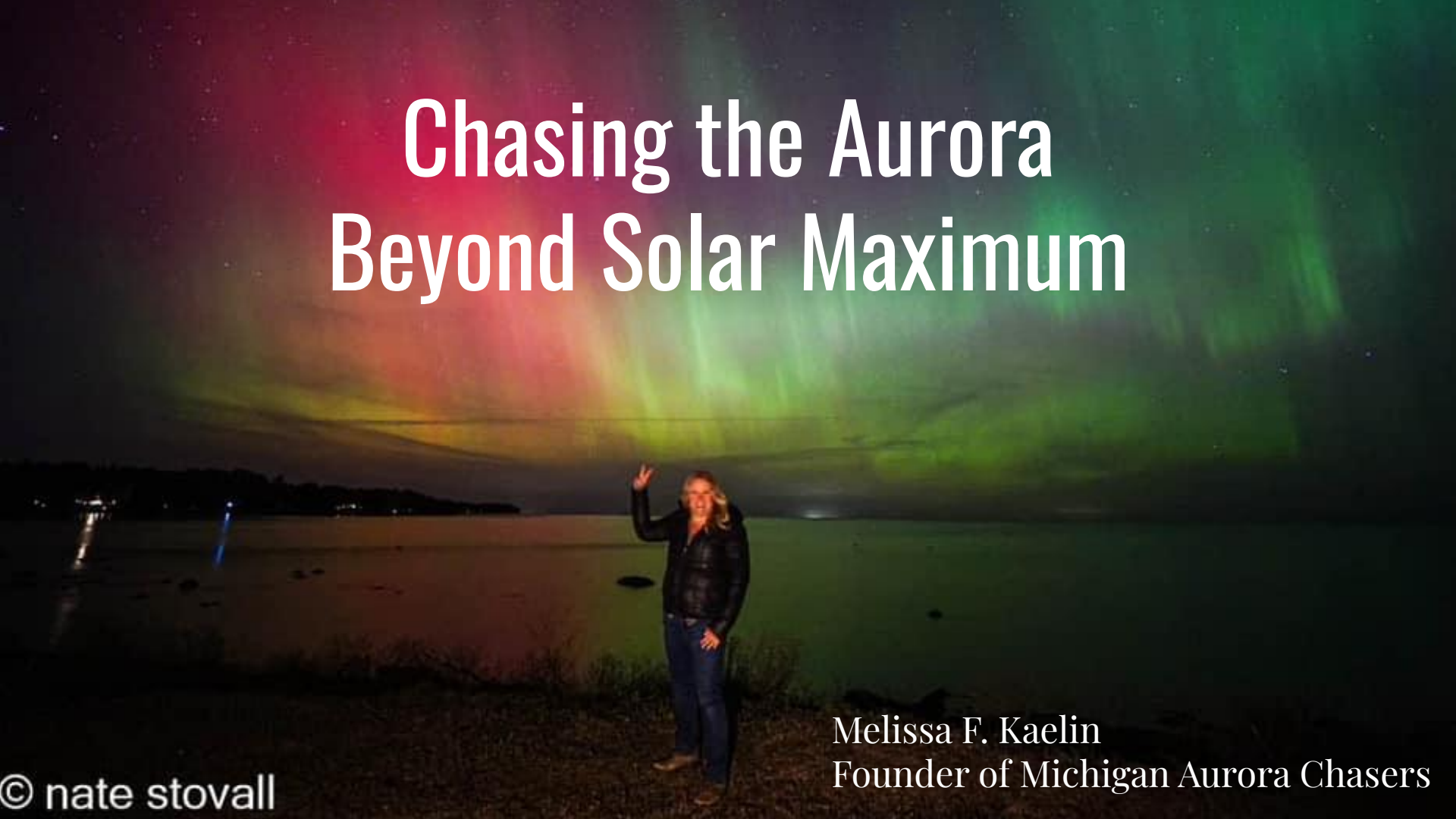
Chasing the Aurora
Beyond Solar Maximum



Melissa F. Kaelin
Founder of Michigan Aurora Chasers

About the Author

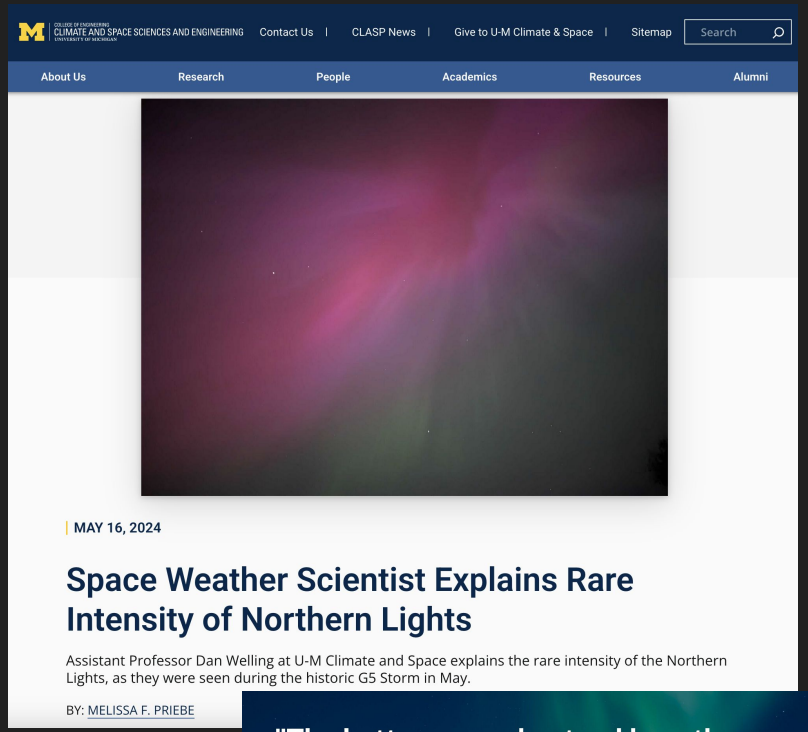
- Chasing the Aurora for 14 years
- Wrote the Book “Beyond the 45th Parallel: The Beginner’s Guide to Chasing Aurora”
- Aurora Columnist, Amateur Astronomy Magazine
- Tour Guide for U-M Alumni Association
- Founder of Michigan Aurora Chasers, established January 2021
- NASA Social Media Ambassador, Solar Orbiter
- Writer at heart, lover of nature
- B.A. in Journalism, Miami University, Ohio
- Co-Founder of annual Aurora Summit: Celebrating the Art, Culture, Science and Photography of the Aurora, 2017

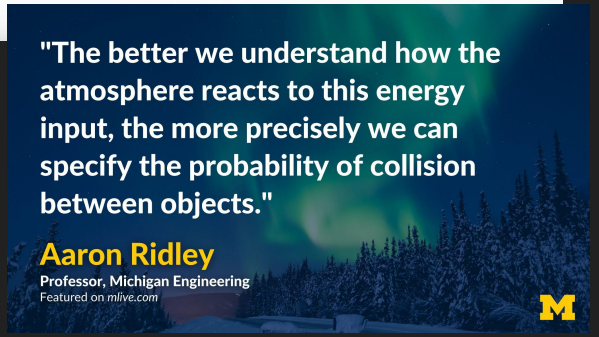
Melissa F. Kaelin
KaelinArt.com

… and Science Communicator!

In the office, Melissa works as Manager of Marketing & Communications for the **University of Michigan Department of Climate & Space Sciences & Engineering.**

- Interviews researchers in fields of space weather & climate change
- Writes breaking news in partnership with NASA, NOAA and other agencies
- Manages websites, social media, marketing and press relations at U-M





THE NIGHT AURORA CHASED ME

Driving home from the Inaugural Upper Peninsula Dark Sky Festival along Lake Superior's Shore in Michigan's Upper Peninsula, April 23-24, 2023.

Photo by Jessica Ellis Rorman

Aurora Alerts Only

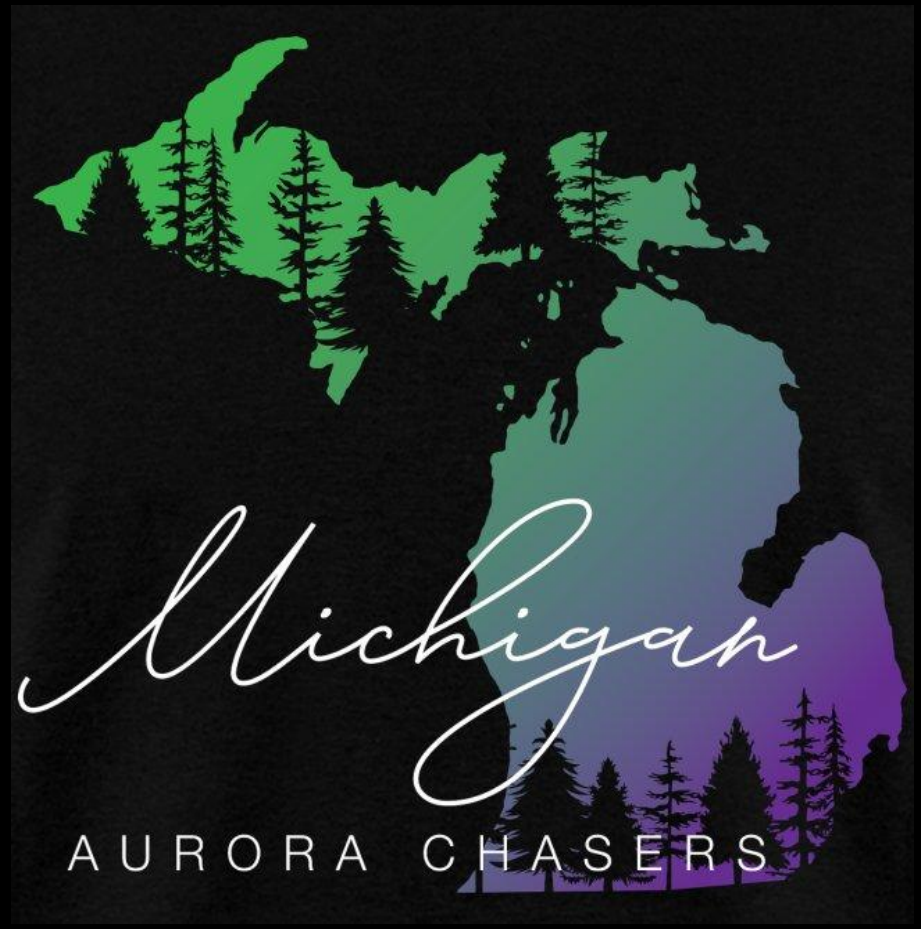
- Download the Free Telegram App
- Subscribe to @MichiganAuroraAlerts

Photo by Michele Aucello

Michigan Aurora Chasers

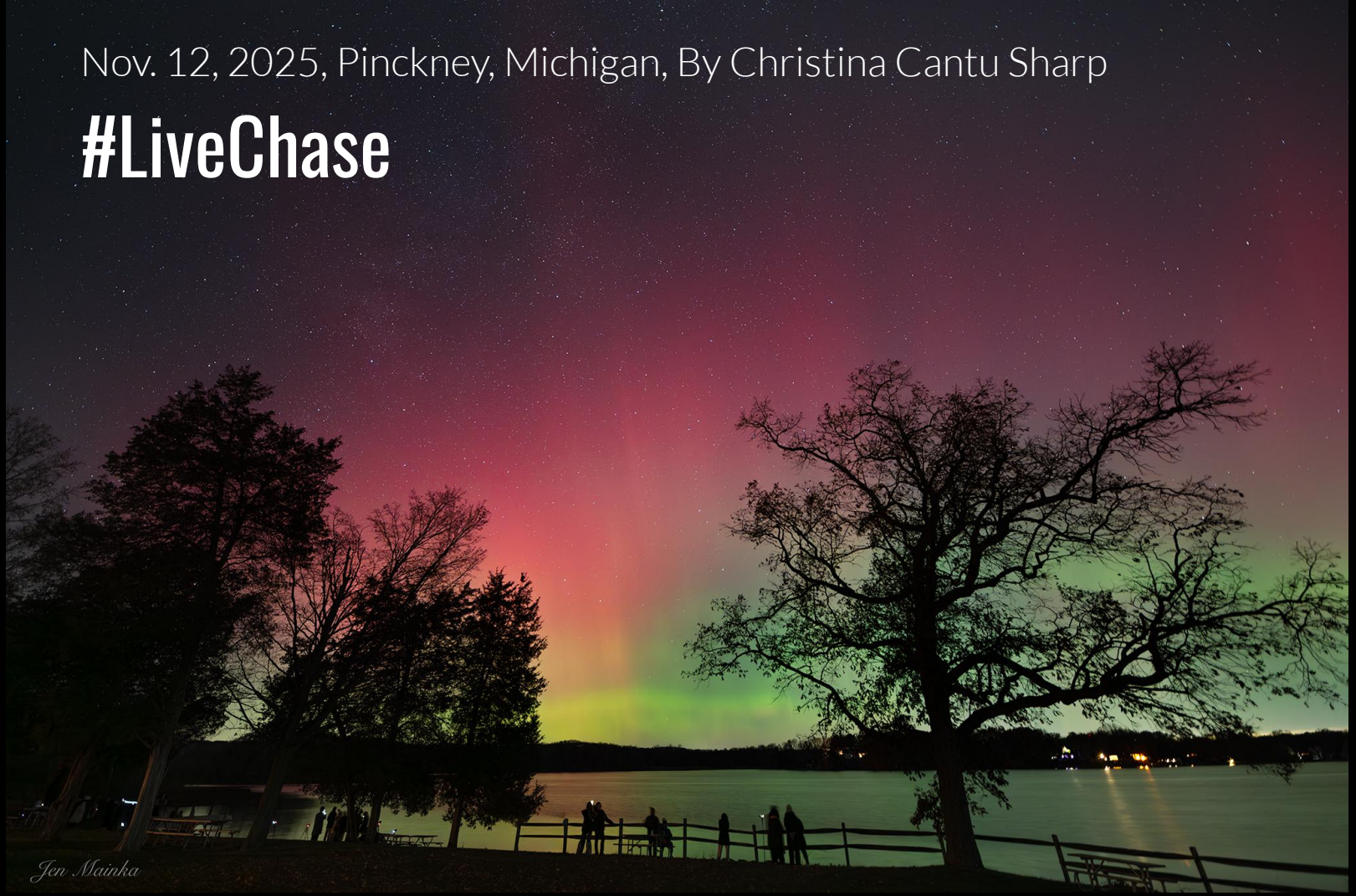
- Est. 2021
- Guides & Resources
- Workshops & Events
- MI Aurora Experience

MichiganAuroraChasers.com



Nov. 12, 2025, Pinckney, Michigan, By Christina Cantu Sharp

#LiveChase



A Journey into Space

From Gusts of Solar Wind to the L1 LaGrange Point

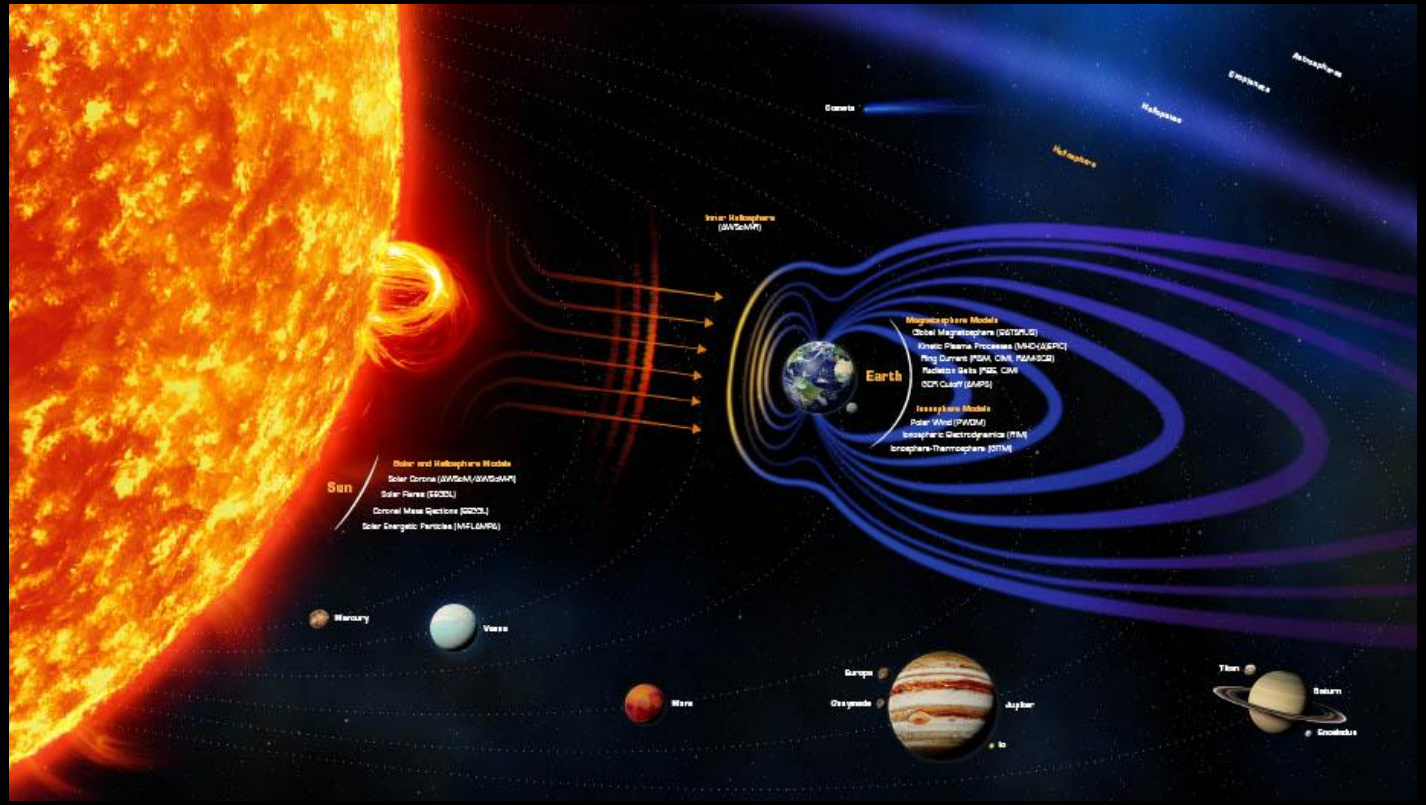
Imagine Standing under Space Rain

Great Lakes Shoreline, Michigan | Photo by Christina Cantu Sharp

The Force Behind Aurora: The Solar Wind

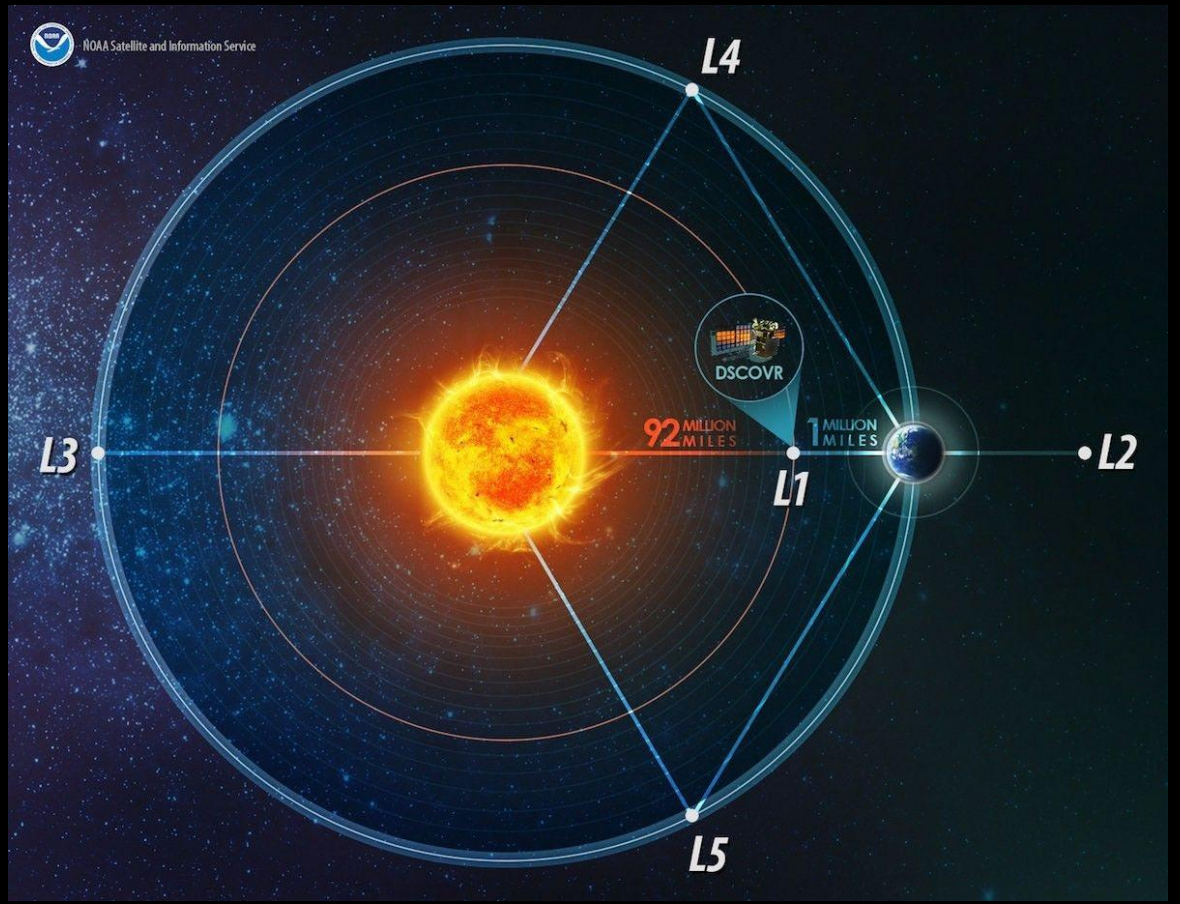
Solar Activity

- Solar Plasma
- Eruptions
- CMEs
- Coronal Holes
- Filaments
- Co-rotating Interactive Regions
- Ever Present Solar Wind



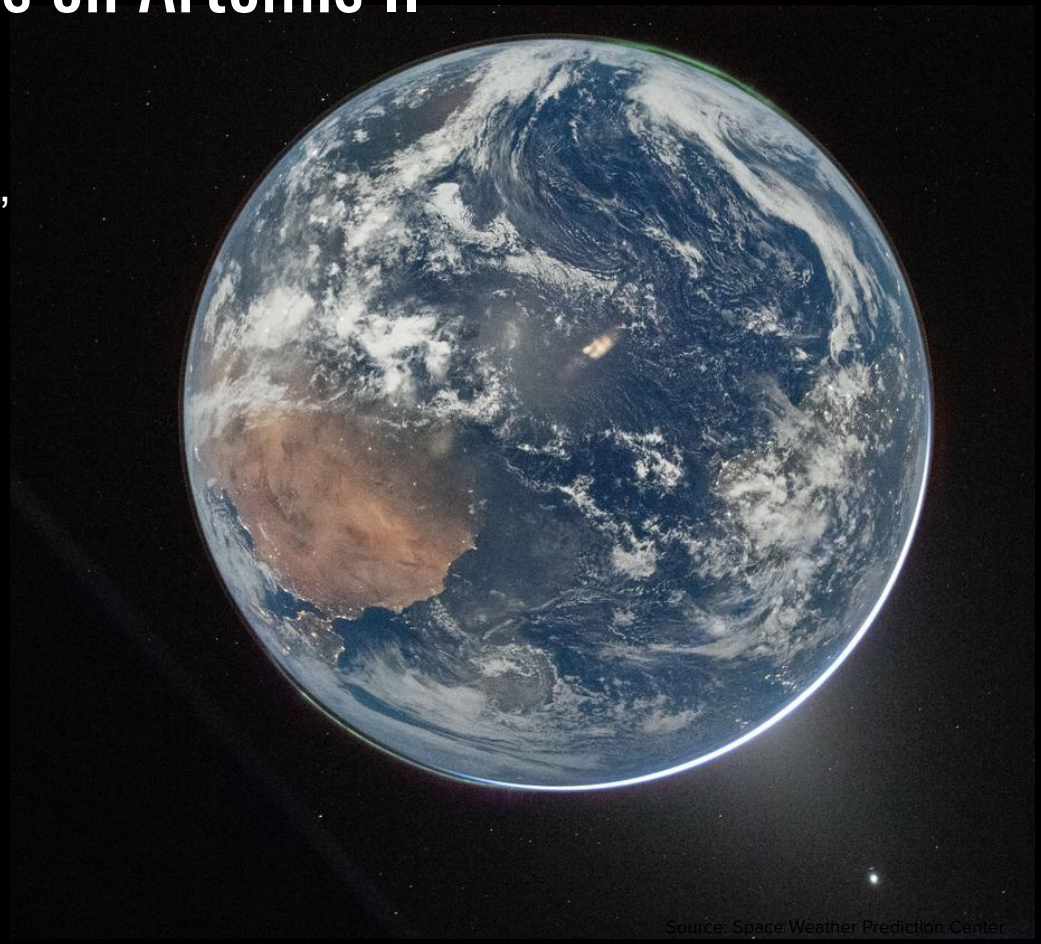
L1 LaGrange Point

- Many satellites positioned between Sun & Earth
- ACE
- DSCOVR
- SOHO
- Measure solar wind data
- Deliver data to Aurora apps



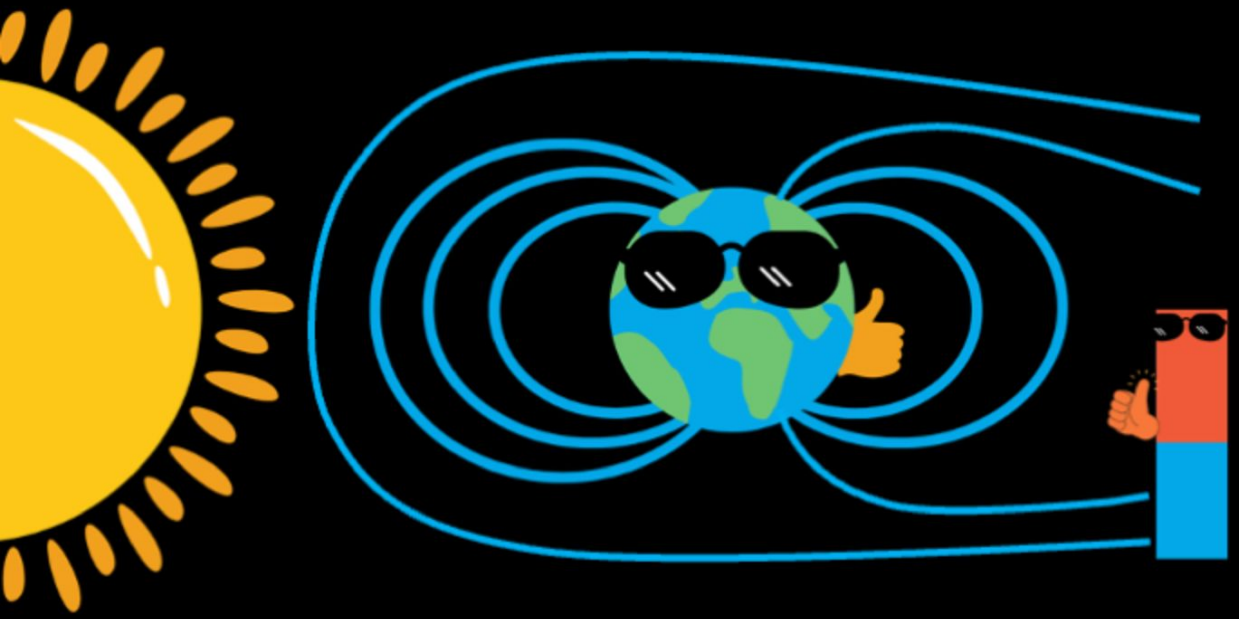
“Hello, World” — Astronauts on Artemis II

- Aurora Borealis, “Northern Lights”
- Aurora Australis, “Southern Lights”
- Moonlit Earth
- Zodiacal Light
- Venus
- This image was taken by Commander Reid Wiseman after the trans-lunar injection burn on April 2, 2026
- Photograph courtesy of NASA



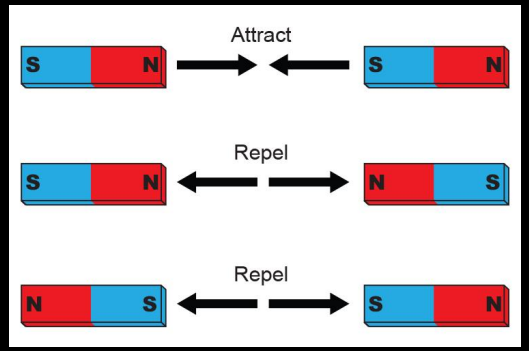
Source: Space Weather Prediction Center

What is the “Bz”? Meet the “Gatekeeper”



- Southward Bz
- More Negative
- Oscillate back and forth: This is what we want!
- Like an open gate

#ThatPeskyBz



Award-winning image courtesy of EGU Blog

When Particles Collide & Dance

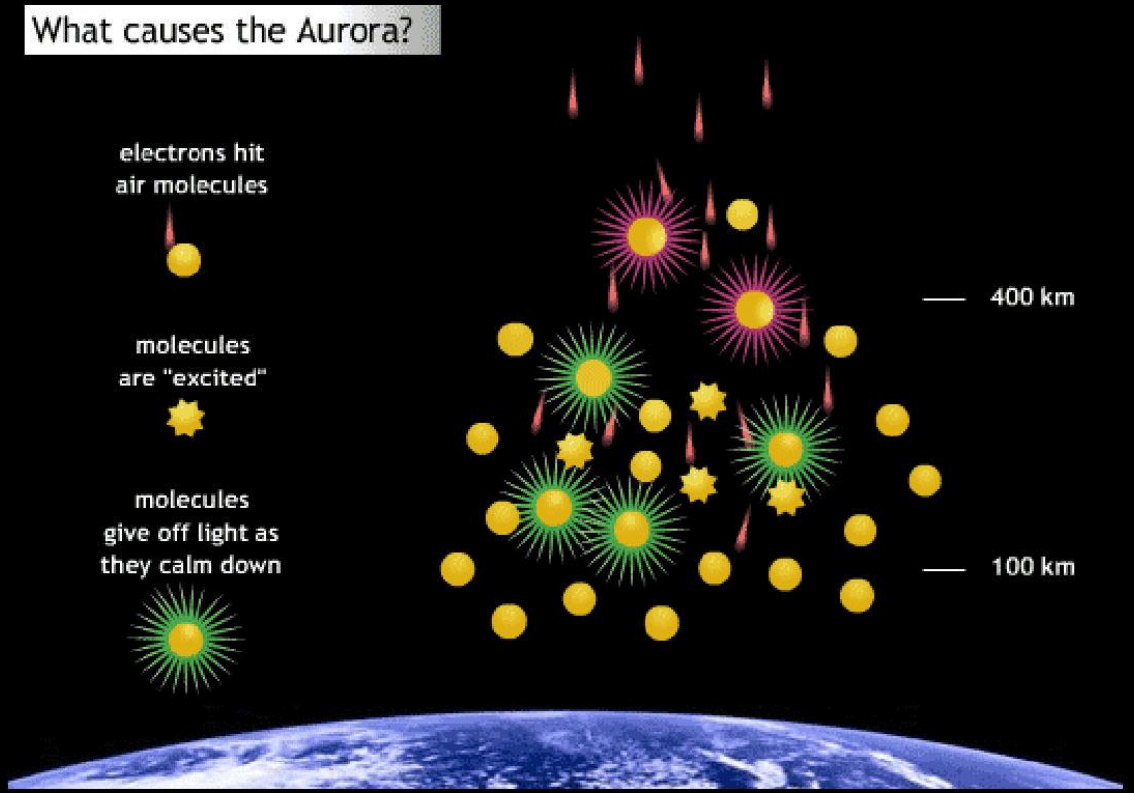
Colors emerge when excited particles or **electrons** in Earth's atmosphere interact with air molecules like oxygen and nitrogen to emit light.

Oxygen - High Altitude: Red

Hydrogen, Helium: Purple, Pink

Oxygen - Low Altitude: Green

Nitrogen: Blue



SolarMaX Mission

- April 1-4, 2025, Ground Support Team
- First human spaceflight over the poles
- Worked with Fram2 Astronaut: Vehicle Commander Jannicke Mikkelsen

Next Level

Finding the Dancing Electrons in Geomagnetic Storms

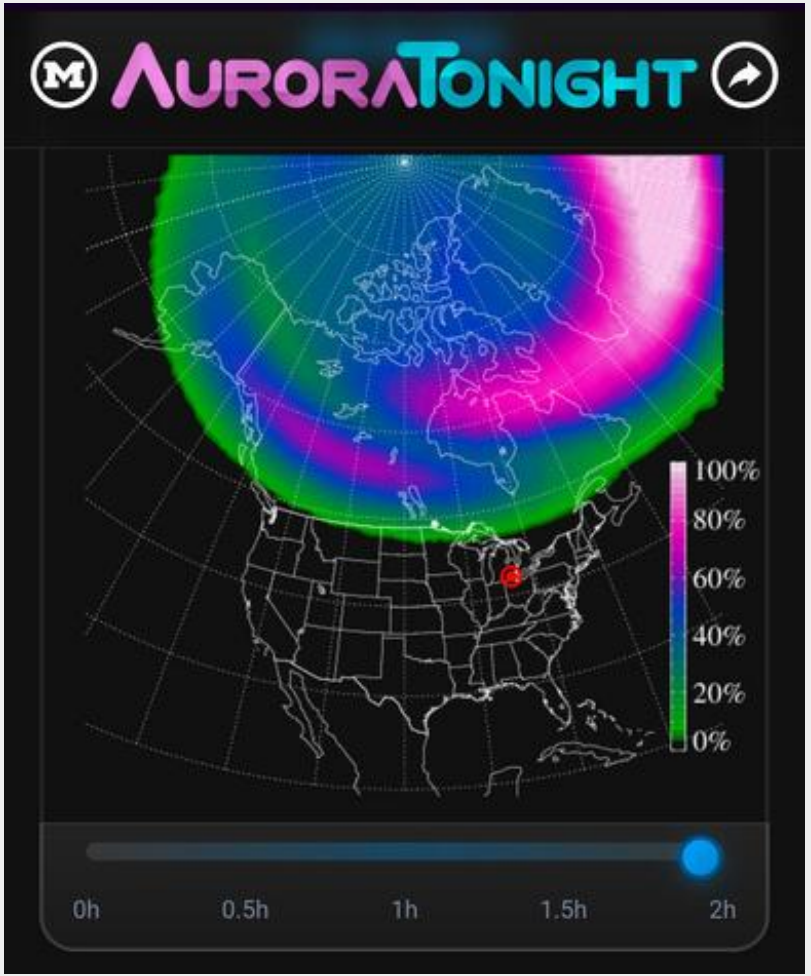
Methods for Predicting Aurora

Beginner	Apps, Kp Alerts, Webcams
Beginner	K-Index, Predictions, Ovation Model, HPI
Intermediate	Space Weather Live, Real Time Solar Wind
Intermediate	Coronographs, SolarHam, Ap-Index
Advanced	WSA-Enlil, CME Scoreboard, Magnetometer Plots
Advanced	Analyzing CMEs, Understanding Flux Ropes

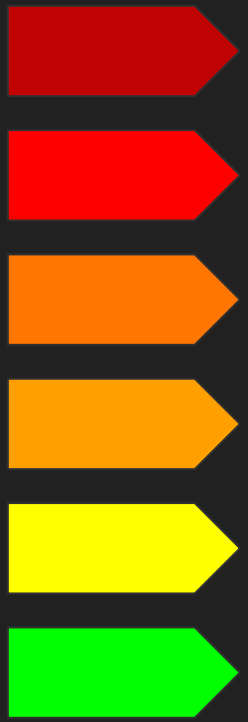
Best Aurora Forecasting Apps

- **Glendale App** - Aurora Alerts UK (web app)
  Download it here:
  https://aurora-alerts.uk/
- **Space Weather Live**
  Find it here or in the app store:
  https://www.spaceweatherlive.com/
- **Aurora Tonight!**
  – University of Michigan (web app)
  Download it here:
  https://aurora.umich.edu/

Favorite Aurora Chasing Hacks:
KaelinArt.com/Aurora



The K-Index, G Storms & Planetary Averages



Kp 9 • G5 Storm	Extreme Geomagnetic Storm
Kp 8 • G4 Storm	Severe Geomagnetic Storm
Kp 7 • G3 Storm	Strong Geomagnetic Storm
Kp 6 • G2 Storm	Moderate Geomagnetic Storm
Kp 5 • G1 Storm	Minor Geomagnetic Storm
Kp 4 or Less	Below Storm Levels

Geomagnetic Storm Impact Scale

G1 Minor

Weak power grid fluctuations and minor impacts on satellites are possible.

Migratory animals are affected at this and higher levels.

Aurora is commonly visible at high latitudes.

G2 Moderate

Transformer damage is possible with long duration storms.

Corrective actions to spacecraft orientation may be required; may affect orbit predictions.

Aurora may be seen as low as New York and Idaho.

G3 Strong

Power system voltage corrections may be required.

Satellite and LF radio navigation problems may occur. HF radio may be interrupted.

Aurora may be seen as low as Illinois & Oregon.

G4 Severe

Possible widespread voltage control problems on the power grid.

HF radio sporadic, satellite navigation degraded for hours, LF radio navigation issues.

Aurora may be seen as low as Alabama and northern California.

G5 Extreme

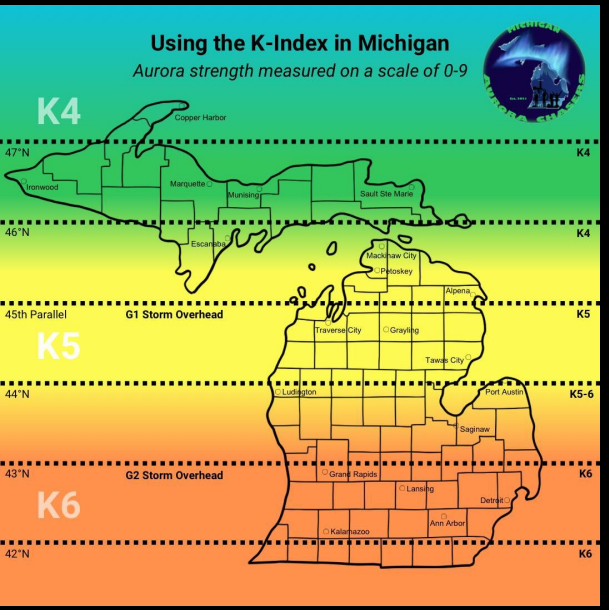
Blackouts or complete collapse of power grids possible.

Navigation systems may be out for hours or days.

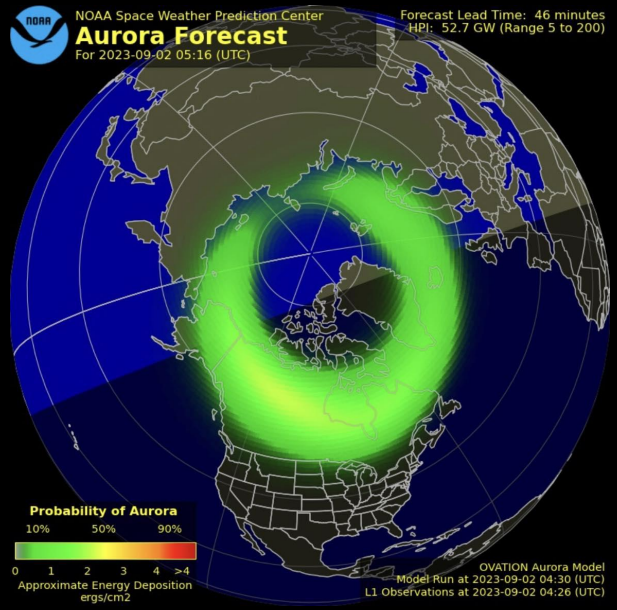
Aurora may be seen as low as Florida and southern Texas.

spaceweather.gov

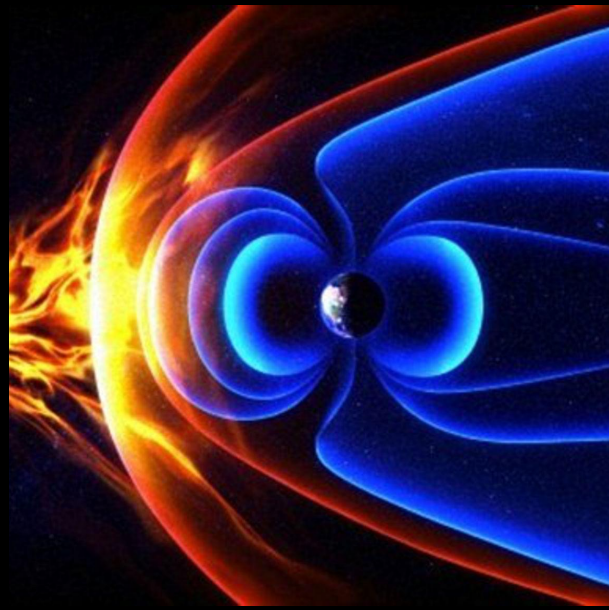
Signs of Aurora Activity Stretching Farther South



K6, K7, K8 Warnings/Watches
(G2 Storm or Higher)



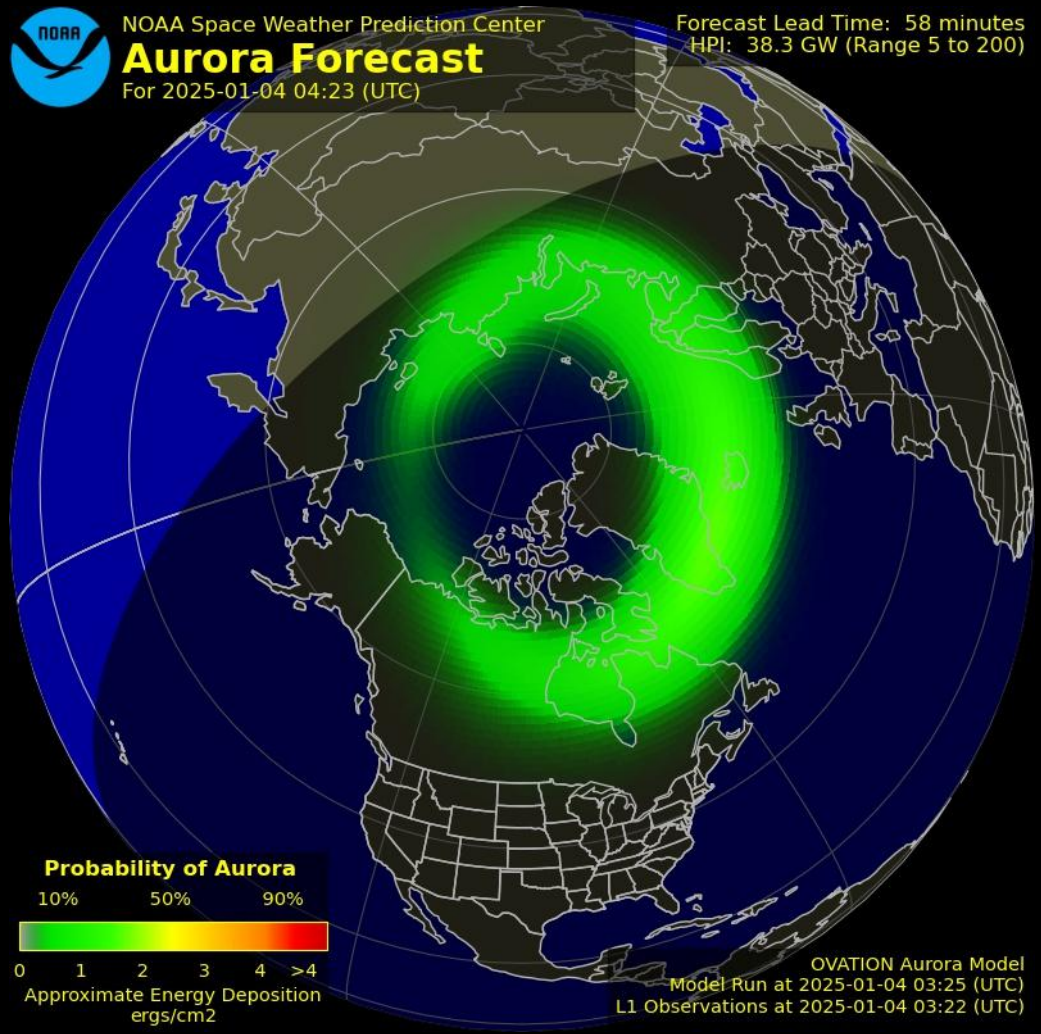
90-100 Gigawatts of
Hemispheric Power
(at least 60gw or so)



Favorable Solar Wind Data:
Speed 500 km/sec
Density 10 /cm3
Bz -10/-15 (at least -5)

The Ovation Model & Hemispheric Power

- Auroral Oval rotates around the poles following night time
- Deepest portion stretches over the Great Lakes region
- “Needs more gigawatts!”



Peak Conditions & Beaver Island International Dark Sky Sanctuary

Peak Year:
Solar Maximum 2024

Peak Season:
September-April

Peak Times:
2 Hours before/after local magnetic midnight

Sub-Auroral Phenomena

The Magic Is All Around You

“STEVE,” the Sub-Thermal Emission Velocity Enhancement

Photo by Justin Miller, Sept. 19, 2023, Silver Lake Dunes, Michigan

STEVE Meets “The Picket Fence”

Photo by Clayton Adams, Upper Peninsula, MI

Photo by Pamela Hofacker Teachout, MI

Stable Aurora Red (SAR) Arc

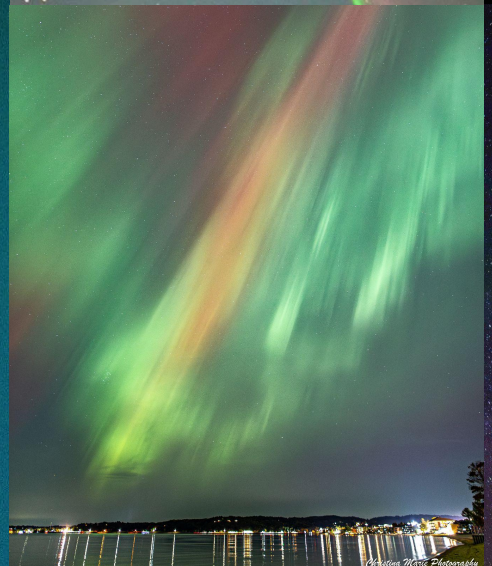
Photo by Patrick Grubba

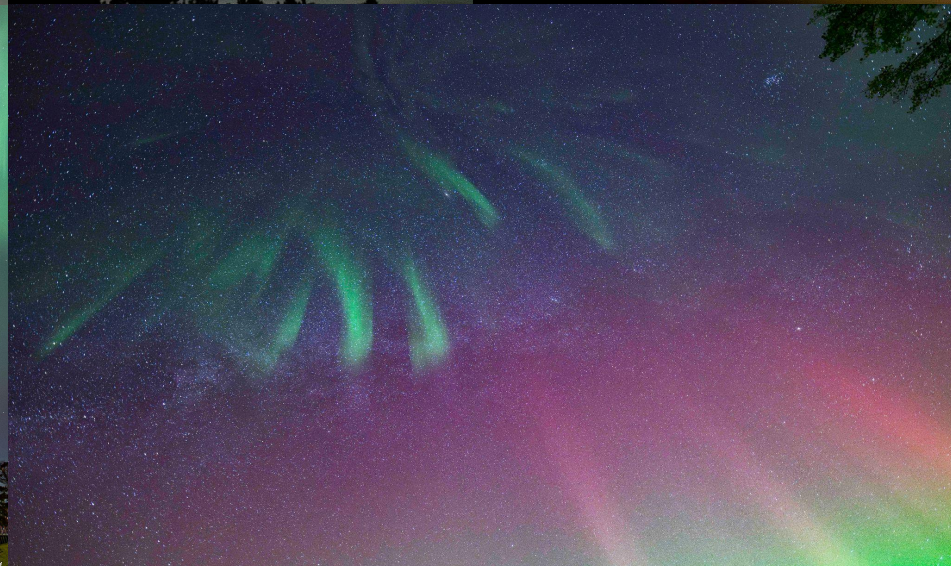
Continuum Emission

Photo by Patrick Grubba, Mackinaw City Area, Michigan

AURORAL FORMATIONS

Clockwise from top left:
S.T.E.V.E. (Strong Thermal Emission Velocity Enhancement),
The Picket Fence,
Stable Aurora Red (SAR) Arc,
Streaks,
Continuum Emission





Michigan Aurora Chasers
Photography by:
Nate Stovall
Pamela Teachout
Joanne Furton
Michele Aucello
Christina Cantu Sharp

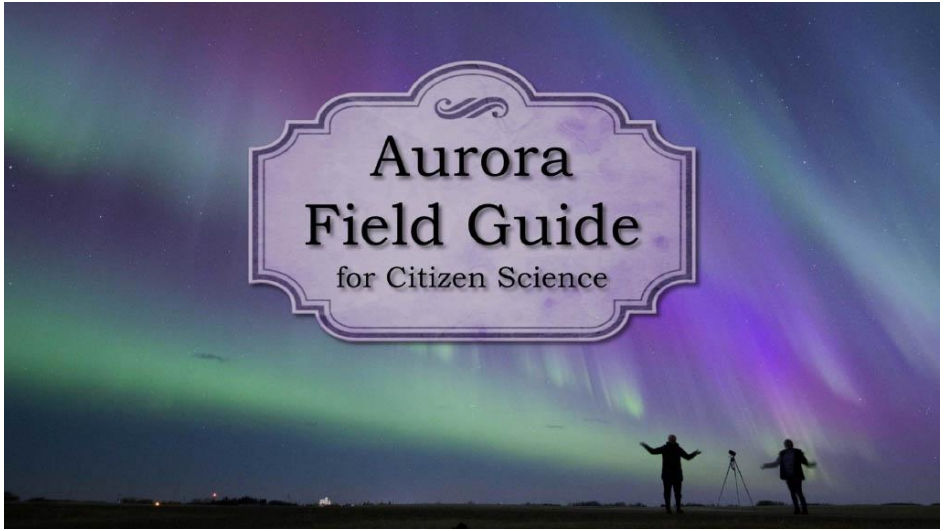
Citizen Science

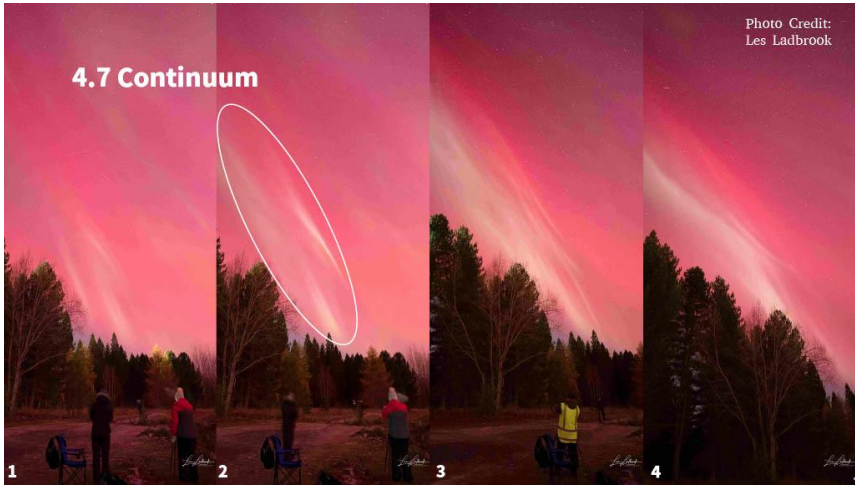
- *Catch rare sightings*
- *Submit your findings!*
- *SkyWarden*
- *Aurorasaurus.org*

Photo by Michele Aucello

Aurora Field Guide

- Identify & Classify
- “Gotta Catch ‘Em All!”





“Holy Grail” The Corona

Photo by Nate Stovall, October 10, 2024, Port Austin, Michigan


Jen Mainka
Leading You to the Dance
Guided Aurora Chases and Dark Sky Experiences
The Michigan Aurora Experience
Our #LiveChase
Annual Michigan Aurora Workshop
The Aurora Summit
Festivals, Programs & Talks
Photo by Jen Mainka

A Wild Nocturnal Subculture

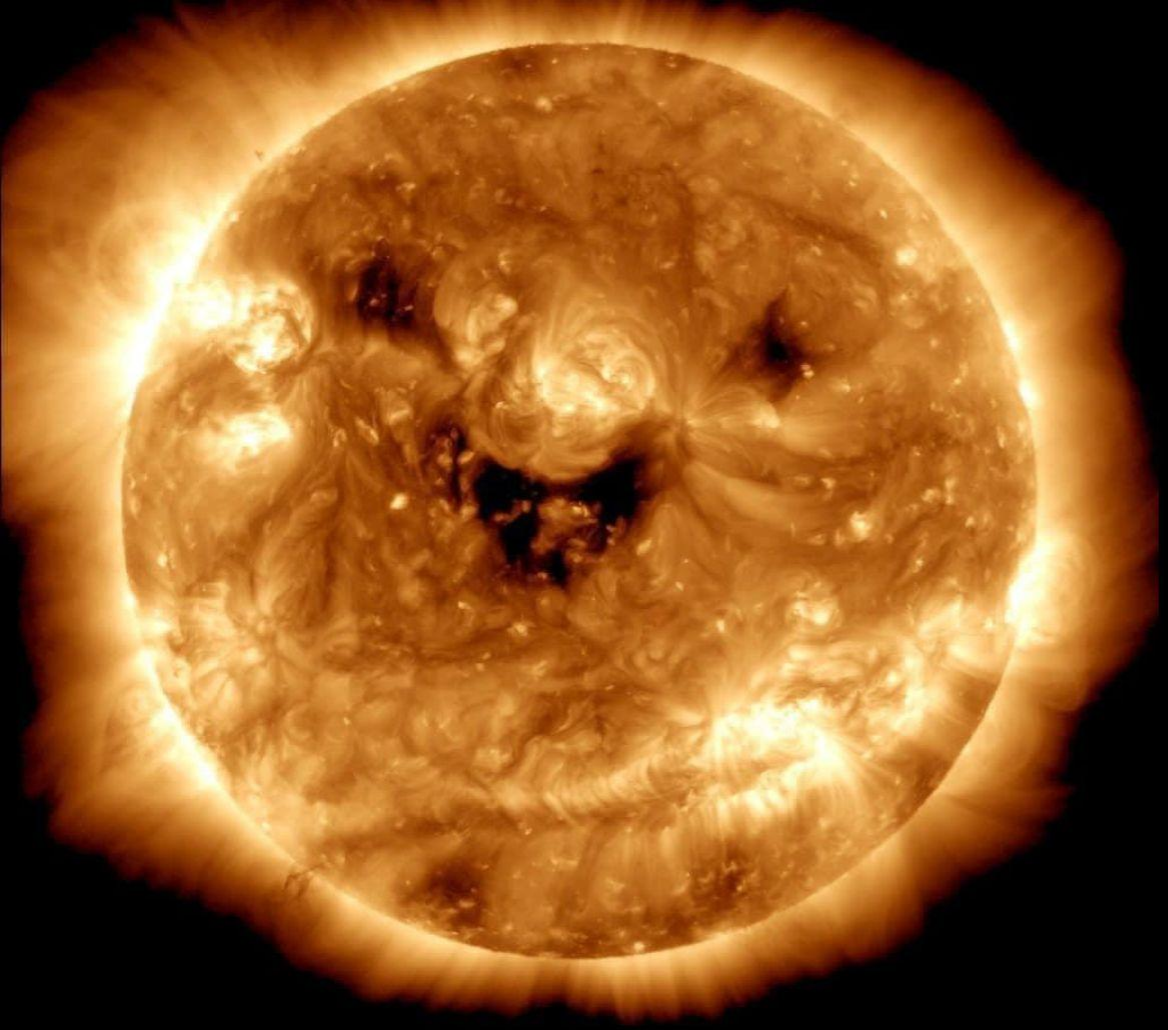
Standing on the Ice Roads in -28°F

Photo by Cristiano Saturno
YELLOWKNIFE, CA

Beyond the 45th Parallel: Aurora Chaser & Author

- Aurora Advice Blog
- Events & Guides
- 45th Parallel Series

KaelinArt.com



Happy Chasing!

@MiAuroraChasers