



*Celebrating
the Aurora*

**ART
CULTURE
HISTORY
SCIENCE**

Michigan Aurora Chasers

Thank you for sharing your talents!



© Meg Barber

Photo by Meg Barber, Marquette, MI



Photo by Lori McNaughton, Lakeport, MI

*Never apologize
for burning too
brightly or
collapsing into
yourself every
night. That is how
galaxies are made.*

Tyler Kent



www.brainybutterfly.com

About Melissa

- Chasing Aurora for 12 years
- Founder of Michigan Aurora Chasers
- Wrote three books, including “Beyond the 45th Parallel,” a beginner’s guidebook
- Interviewed for USA Today and NPR
- Book includes an excerpt of fiction
- Cover story on rare atmospheric phenomena published in “Minnesota Monthly”
- Article featured in Amateur Astronomy Magazine



... and Science Communicator!

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

- 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

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OCTOBER 20, 2023

New Theory Explains How Magnetic Switchbacks Form in the Solar Wind

A new study led by Dr. Gabor Toth develops a theory of how magnetic switchbacks form in the solar wind near the Sun.



University of Michigan @UMich · Sep 7, 2022

Research conducted by scientists at U-M on the northern lights is expected to help @NASA prevent collisions among satellites and other objects in Earth's upper atmosphere. Aaron Ridley, professor at @UMclasp, discusses this research on @MLive. myumi.ch/7eDNG

"The better we understand how the atmosphere reacts to this energy input, the more precisely we can specify the probability of collision between objects."

Aaron Ridley
Professor, Michigan Engineering
—toured on mlive.com

ALT



Chasing the Aurora

MINNESOTA

WISCONSIN

MICHIGAN

ALASKA

ICELAND

THE NIGHT AURORA CHASED ME

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

Photo by Jessica Ellis Rorman

The 45th Parallel Series

- The 45th Parallel Series:
Aurora Chasing Guidebooks
expanded from Great Lakes to
anywhere in the Mid-latitudes
- Advice Blog:
Aurora Chasing in the U.S.
- Next Up:
Origin Stories & Interviews





ART

The Goddess Aurora

Ceiling fresco by Guido Reni, 1613-14, in the Casino Rospigliosi in Rome.





Frederic Edwin Church, Aurora Borealis, 1865, oil on canvas, Smithsonian Art Museum

Northern Lights in Zenith,
by Harald Moltke, 1900



NORDLYSKRONE I ZENITH. (Akureyri i Jan. 1900.)
(Efter Maleri af Greve Harald Moltke.)



Frontispiece to Fridtjof
Nansen's *In Northern
Mists: Arctic Exploration
in Early Times*, 1911

Goddess of the Dawn

In Greco-Roman mythology, Aurora is the goddess of the Dawn. She is the sister of Helios, the sun, and Seline, the moon, and she races the sun god's chariot into the sky. In Greek, she is called Eos.



Modern Aurora Photography

Featuring the Michigan Aurora Chasers



Photo by Lynne Lombard, Glen Haven, MI



Photo by Wendy Pletcher, Hammond Bay, MI

Corona

May 10, 2024

Photo by Gerry

Beth Buckel,

Fostoria area, MI



Michigan's New International Dark Sky Sanctuary



Photo by Justin
Miller,
JM Naturescapes
Beaver Island, MI

STEVE with the “Picket Fence”



Photo by Cherie Wagensomer, Munising, MI



Photo by Kim Masters Acker, Onkama, MI

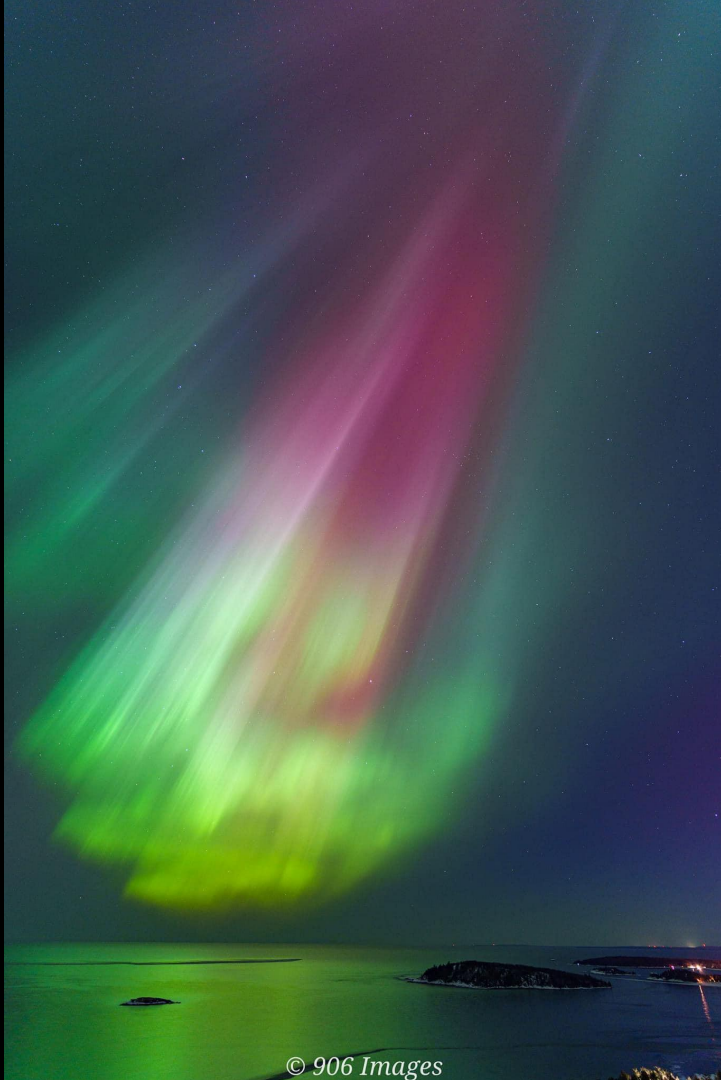
“STEVE,” the Sub-Thermal Emission Velocity Enhancement



Photo by Justin Miller, JM Naturescapes, Beaver Island, MI, Sept. 19, 2023, Silver Lake Dunes

“Beyond the 45th Parallel” Cover Artist

Photo by Shannon Kivi,
906 Images
Marquette, MI





Corona

Photo by Justin Miller
JM Naturescapes
Lansing Area
May 10, 2024



CULTURE

Iceland Myths

Our Icelandic ancestors associated the lights with childbirth.

Aurora would relieve the pain of delivery as long as the expectant mom didn't look at the Aurora during childbirth, or the child would be born cross-eyed.



Arctic Circle Aurora, Alaska, Photo by Melissa Kaelin

Pacific Northwest

In Washington, the Makah Indians thought the lights were fires in the north created by a tribe of dwarves who used it to boil whale blubber.

Cooking was also central to the Mandan people in North Dakota. They said the lights were fires over which warriors boiled their enemies in huge cooking pots.



Photo by David Carr, Near Cleveland, Ohio

Expedition Journals

“The dead suffer no hardship, wherever they may go, but most prefer nevertheless to dwell in the Land of Day, where the pleasures appear to be without limit.”

— Rasmussen, 1929

Folklore and the Aurora

Robert H. Holzworth II

The Aurora Borealis is a natural phenomenon of striking beauty and overwhelming presence in certain parts of the world. It is therefore natural to ask what effect these northern lights have had on the native cultures in the auroral zones. Since the sun, moon, and stars all have a place in the mythology of most primitive cultures, it is not surprising that mention of the aurora is prevalent in the legends and folklore of the people who live within regular view of it.

great variety, and even today the northern lights appear in short stories and ballads such as the works of *Service* [1944].

The body of this paper is mainly the result of an ongoing literature search for specific details as to just what various people believed was the cause of the aurora. This is not meant to be exhaustive but rather to give a wide variety of accounts both in geographic area and in basic content of the myth.

appear to be without limit. Here, they are constantly playing ball, the Eskimos' favourite game, laughing and singing, and the ball they play with is the skull of a walrus. The object is to kick the skull in such a manner that it always falls with its tusks downward, and thus sticks fast in the ground. It is this ball game of the departed souls that appears as the aurora borealis, and is heard as a whistling, rustling, crackling sound. The noise is made by the souls as they run across the frost-hardened snow of the heavens. If one happens to be out alone at night when the aurora borealis is visible, and hears this whistling sound, one has only to whistle in return and the lights will come nearer, out of curiosity.

Variations on this theme include the belief of Angmagsalik Eskimos of east Greenland that the aurora was caused by children who were stillborn or were put to death, and they were believed to be playing ball with their afterbirth [Weyer, 1969].

Other Eskimo explanations of the aurora include that of the Copper Eskimos of the Coronation Gulf, who thought the aurora was a manifestation of the spirits that

Myth from Finnish & Russian Lapps

“They fight battles in the air as men do on earth. They may be heard and seen on clear, frosty nights, advancing and retreating, retreating and advancing against one another...”

— Mackenzie, 1935



Photo by John Clemens, Bay City State Park, MI

Meaning Across Cultures

Finland — Fur of arctic fire foxes

Japan — Fertility, prosperity

China — Fire-breathing dragons

Norway — Old maids dancing

Finnish Lapps — Dead in battle

Sweden — Bountiful fishing

Scotland — Merry dancers

Aboriginal Tribes — Anger of the Great Man

Russian Lapps — Spirits of the murdered

Maori, New Zealand — Fires lit by ancestors



Photo by Anastasia Lundy, McMillan, MI

Meaning Across Cultures

Scotland — “Slaugh,” forever at war
Norse Mythology — Female warriors
Vikings — Fire that burns at the end
of the Earth

Bavaria — Warriors in battle

Medieval Europe — Omen of war

Ancient Greece — Chariot of sister
of Helios & Seline

Greenland — Souls in Paradise

Makah, Pacific Northwest —

Blubber boiling fires



Photo by Jennifer Zakrzewski, Tiscornia Beach, St. Joseph, MI

“Revontulet,” *Fox Fires*

"Revontulet, the Finnish name for the Northern Lights, can literally be translated as 'firefox.' To explain the beautiful lights displayed in the sky, that was only visible during the winter months, it was believed that Finnish Arctic foxes were responsible. They either ran across the snowy mountains so fast that their tails swept snowflakes into the sky, which reflected the light from the moon and stars creating colourful lights in the sky, or their large furry tails brushed against the mountains and created sparks that lit up the sky."





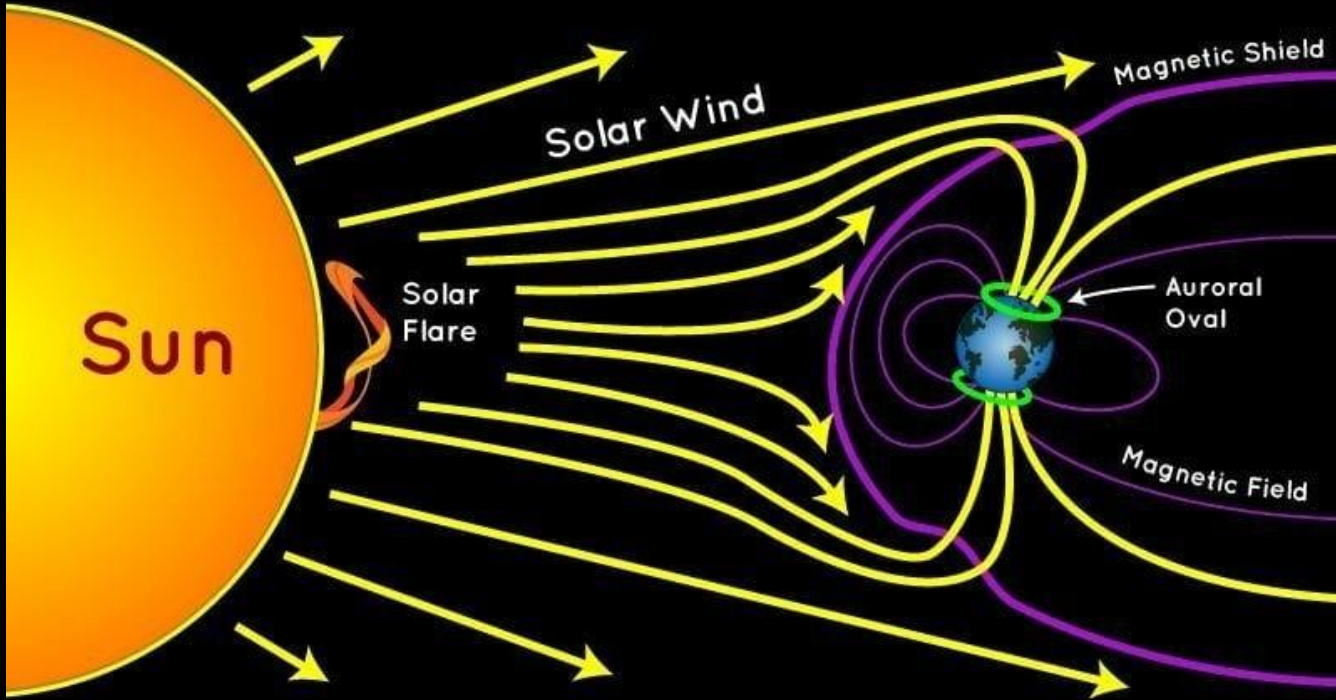
SCIENCE

Originating on the Surface of the Sun

Now we know Aurora is solar matter or plasma that originates from sun spots, solar flares, filaments and coronal holes on the sun's surface.

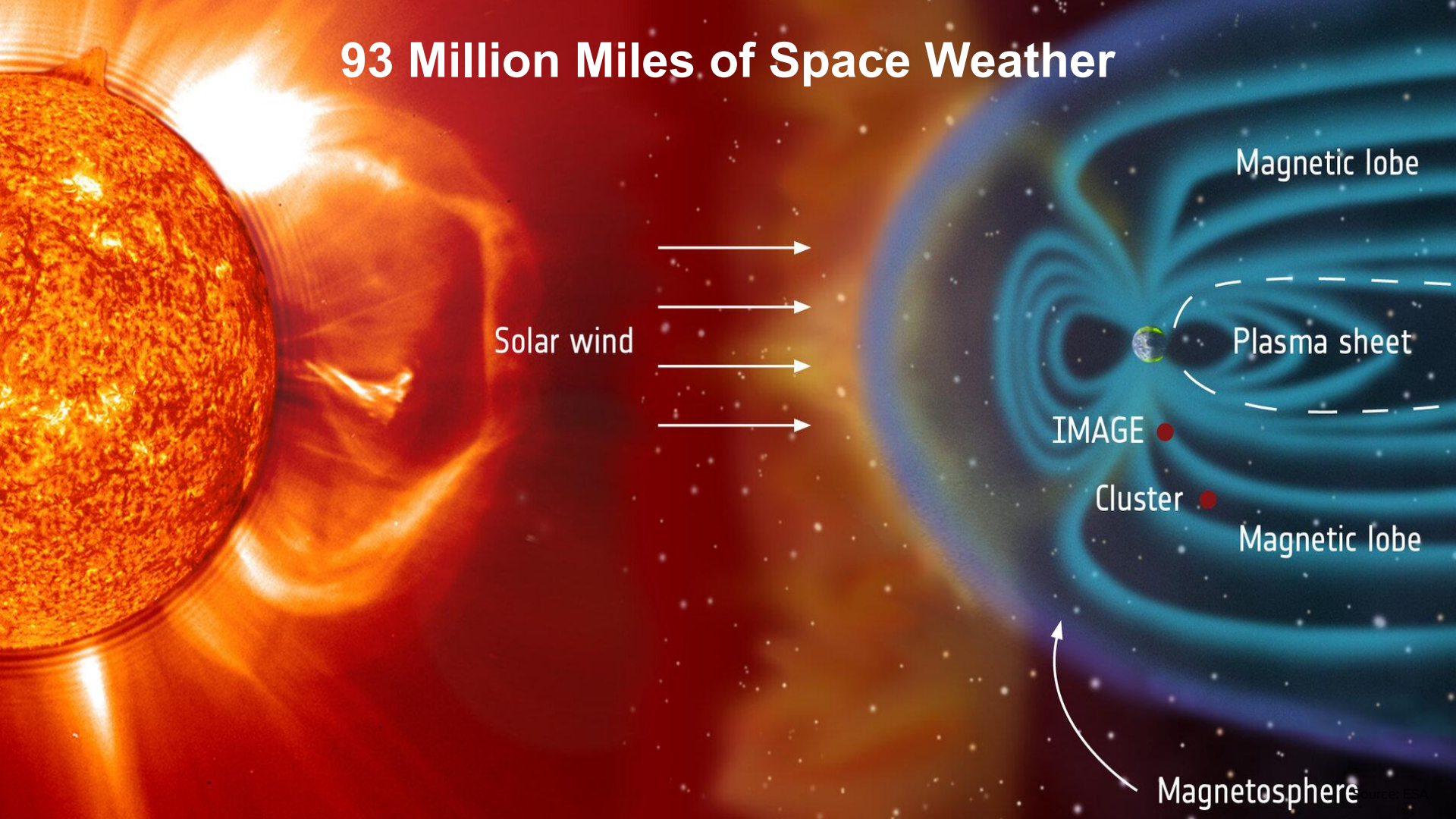


Monitoring Space Weather & Solar Wind

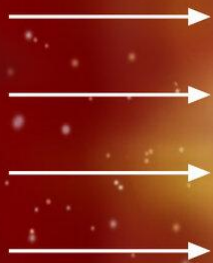


- Solar Flares
- Eruptions
- CMEs
- CH HSS: Coronal Hole High Speed Stream
- Filaments
- Co-rotating Interactive Regions
- The Ever Present Solar Wind

93 Million Miles of Space Weather



Solar wind



IMAGE

Cluster

Magnetic lobe

Plasma sheet

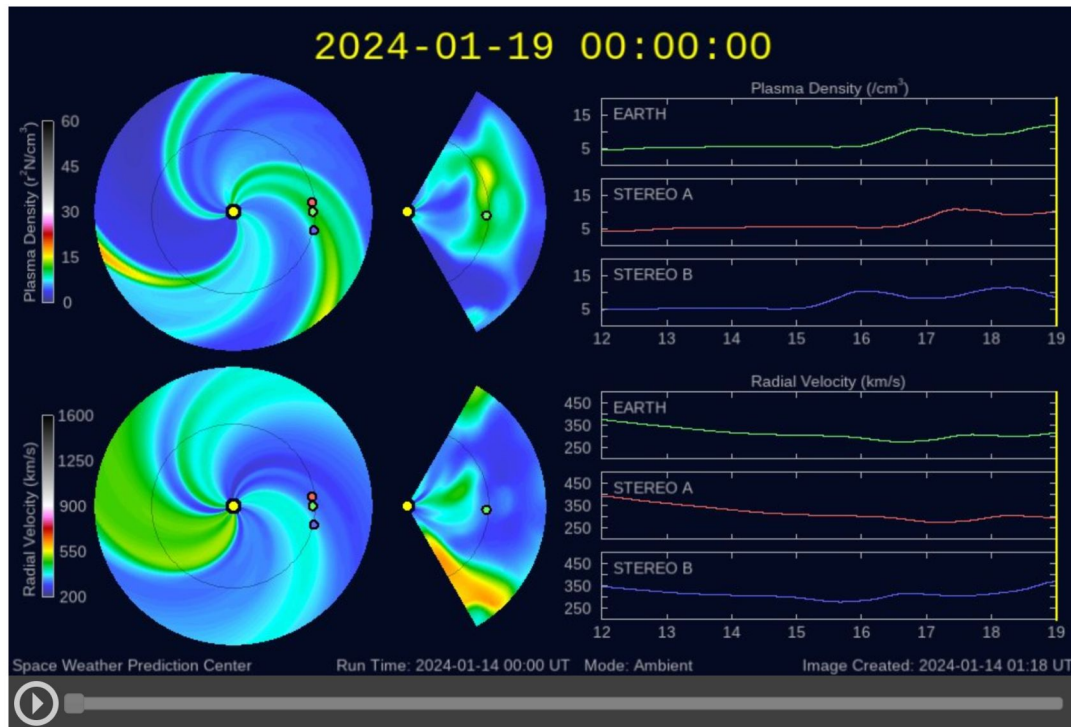
Magnetic lobe

Magnetosphere

WSA-ENLIL Solar Wind Prediction Model

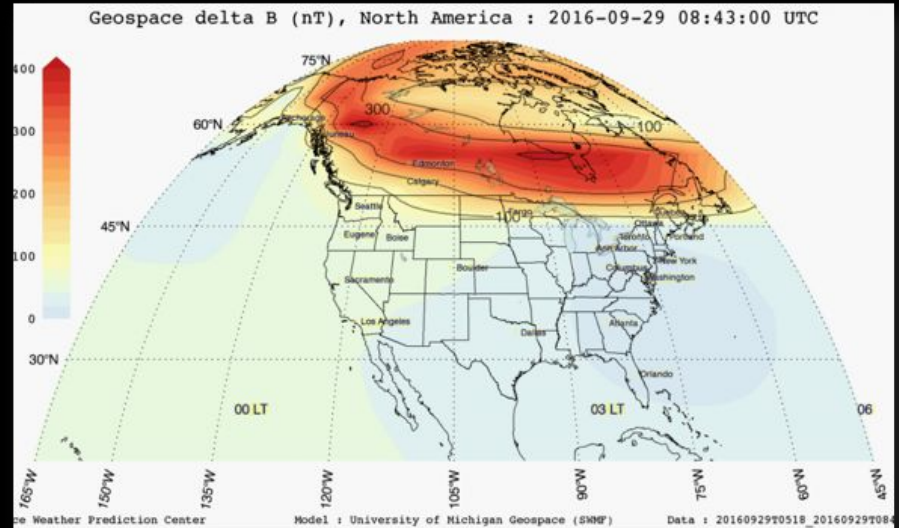
Tracking Coronal Mass Ejections from the minute they leave the sun's surface.

WSA-ENLIL SOLAR WIND PREDICTION



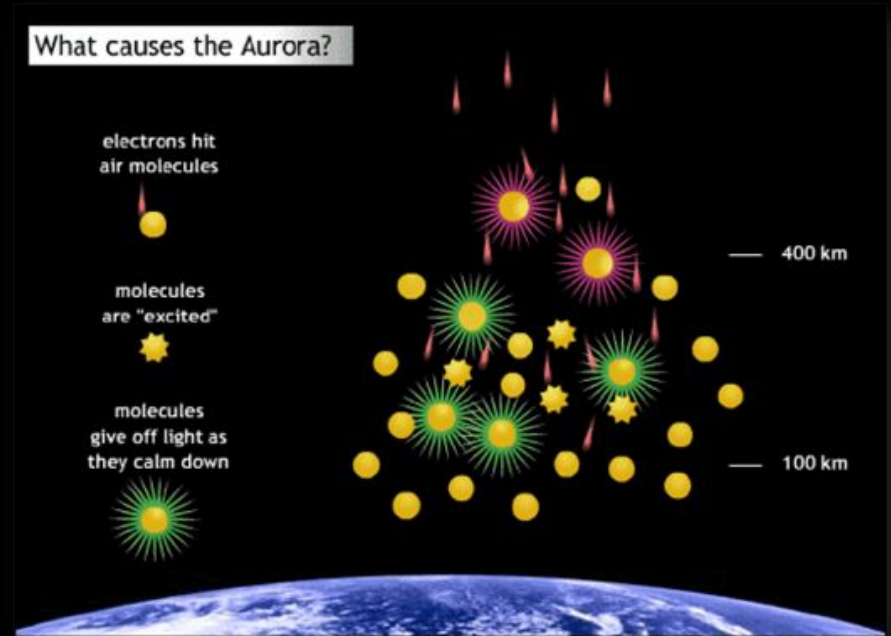
Observing the Impact in Earth's Atmosphere

The electromagnetic surge from the solar wind impacts satellite performance, GPS devices, radio transmissions and electrical grids. But it also creates Aurora Borealis, pictured here, and Aurora Australis.



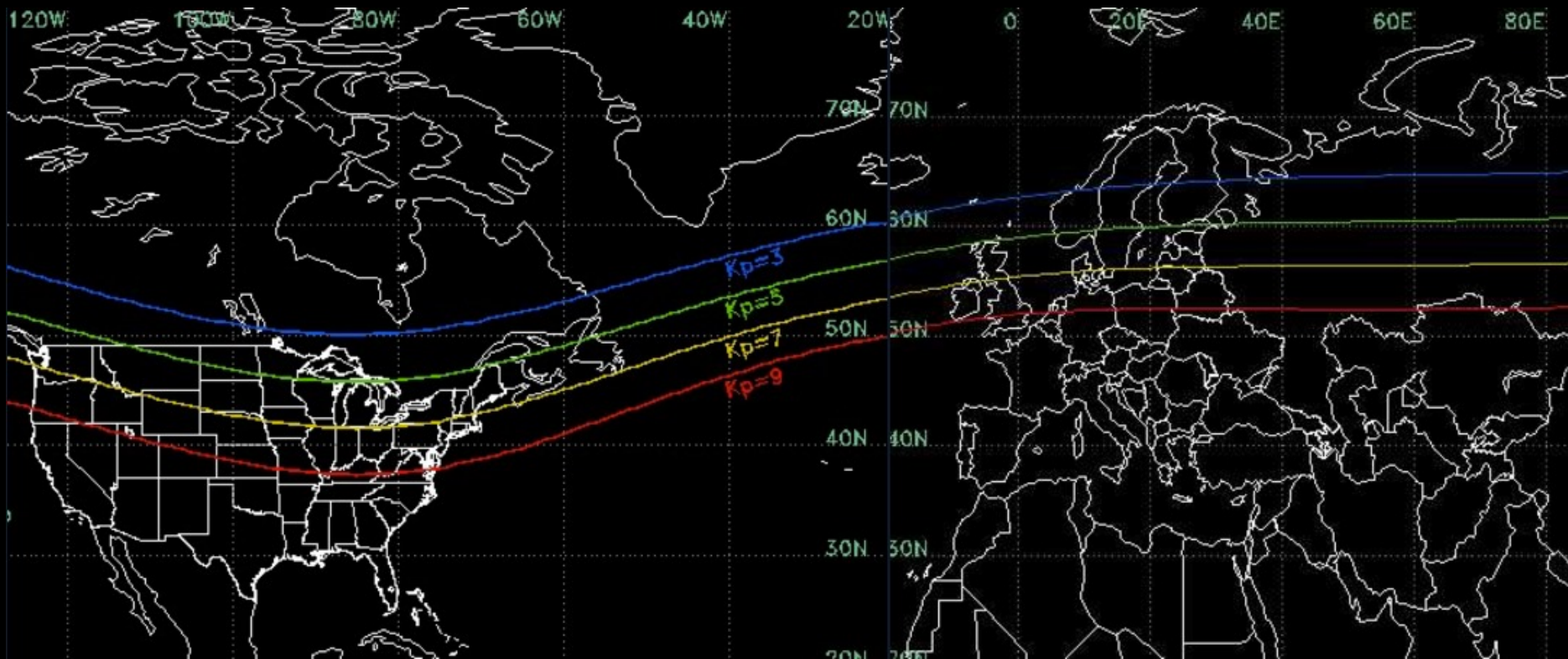
When Charged Particles Create Light

Particles in the solar wind interact with gaseous elements in the atmosphere, emitting light when they react with nitrogen, oxygen and hydrogen.



The K-Index

Evaluating average planetary geomagnetic activity and G-Storms by latitude

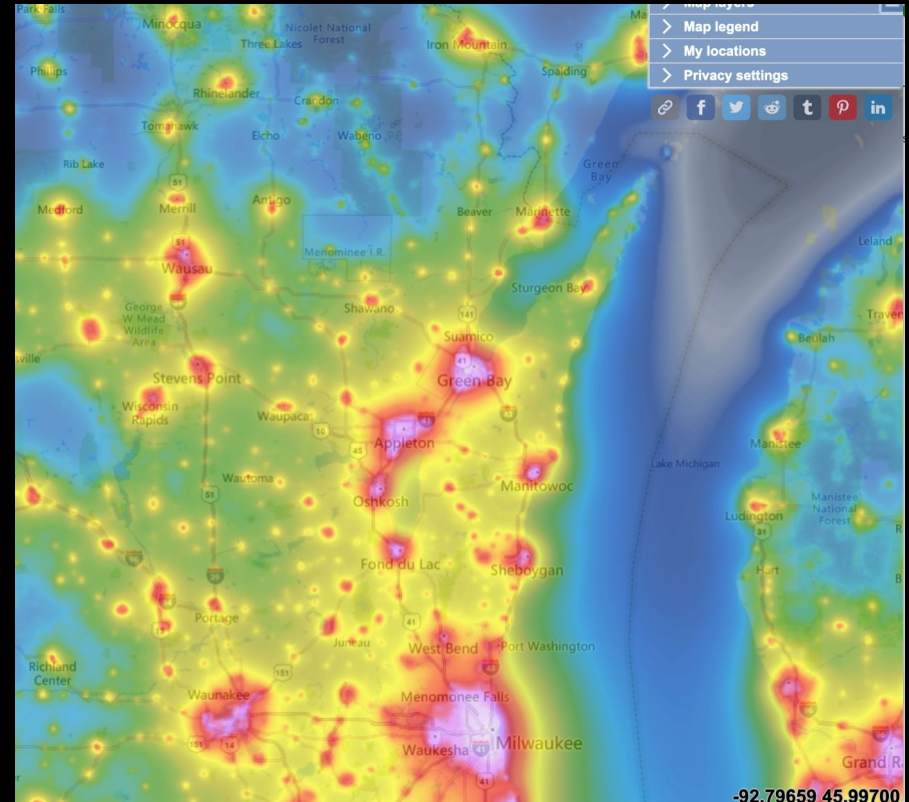
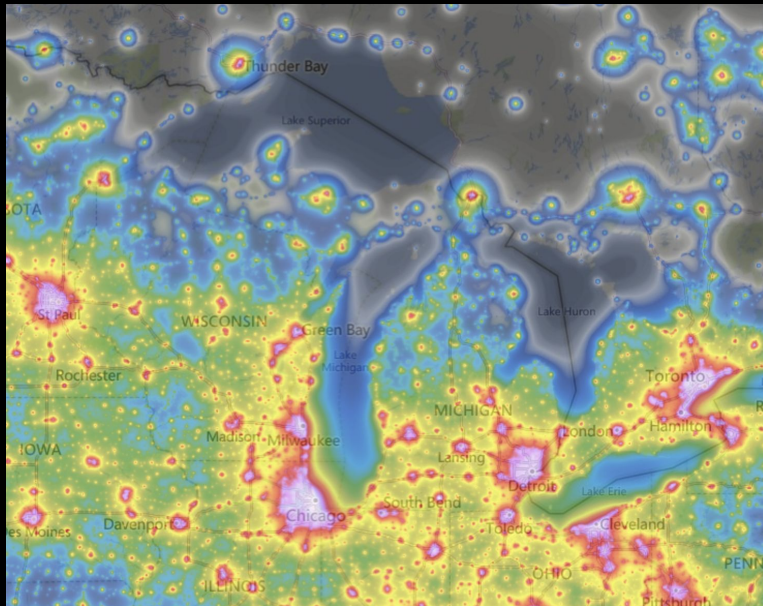


Overcoming Light Pollution to View the Aurora

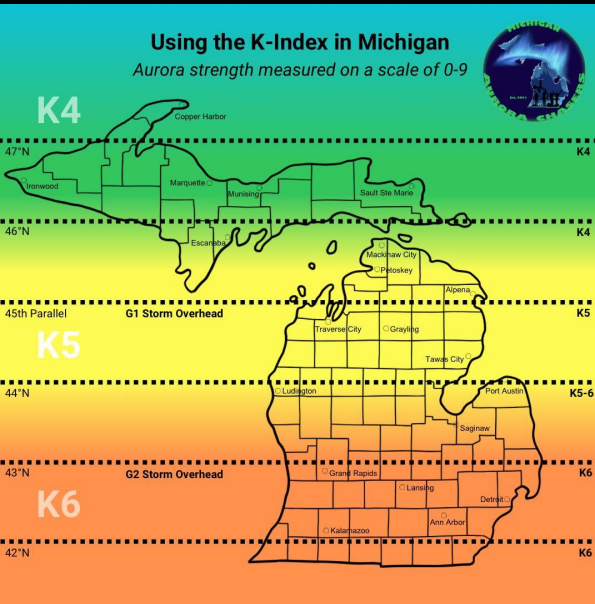
View Light pollution by Location

Search your area at

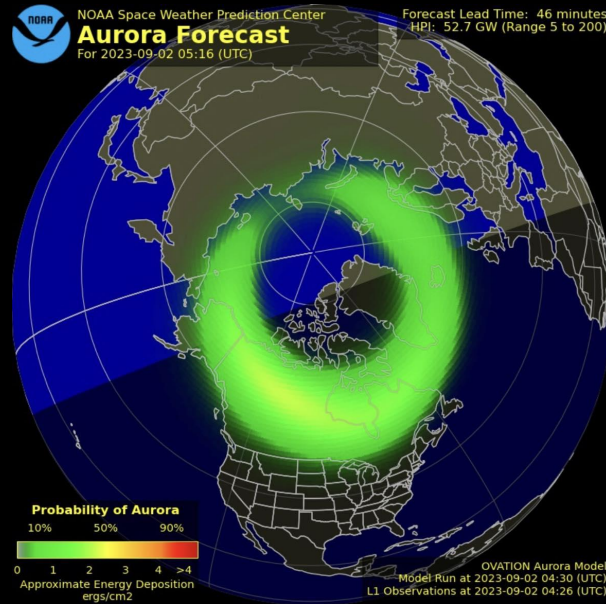
www.LightPollutionMap.info



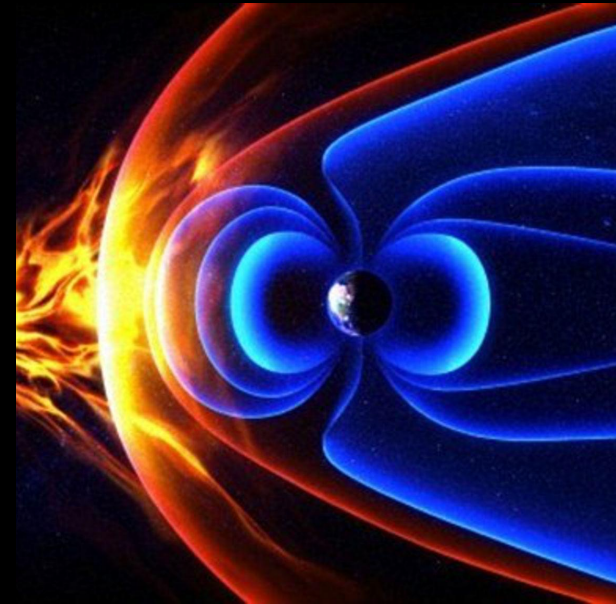
Signs of Aurora Activity Across Entire State of Michigan



K6 Warnings/Watches
(G2 Storm)



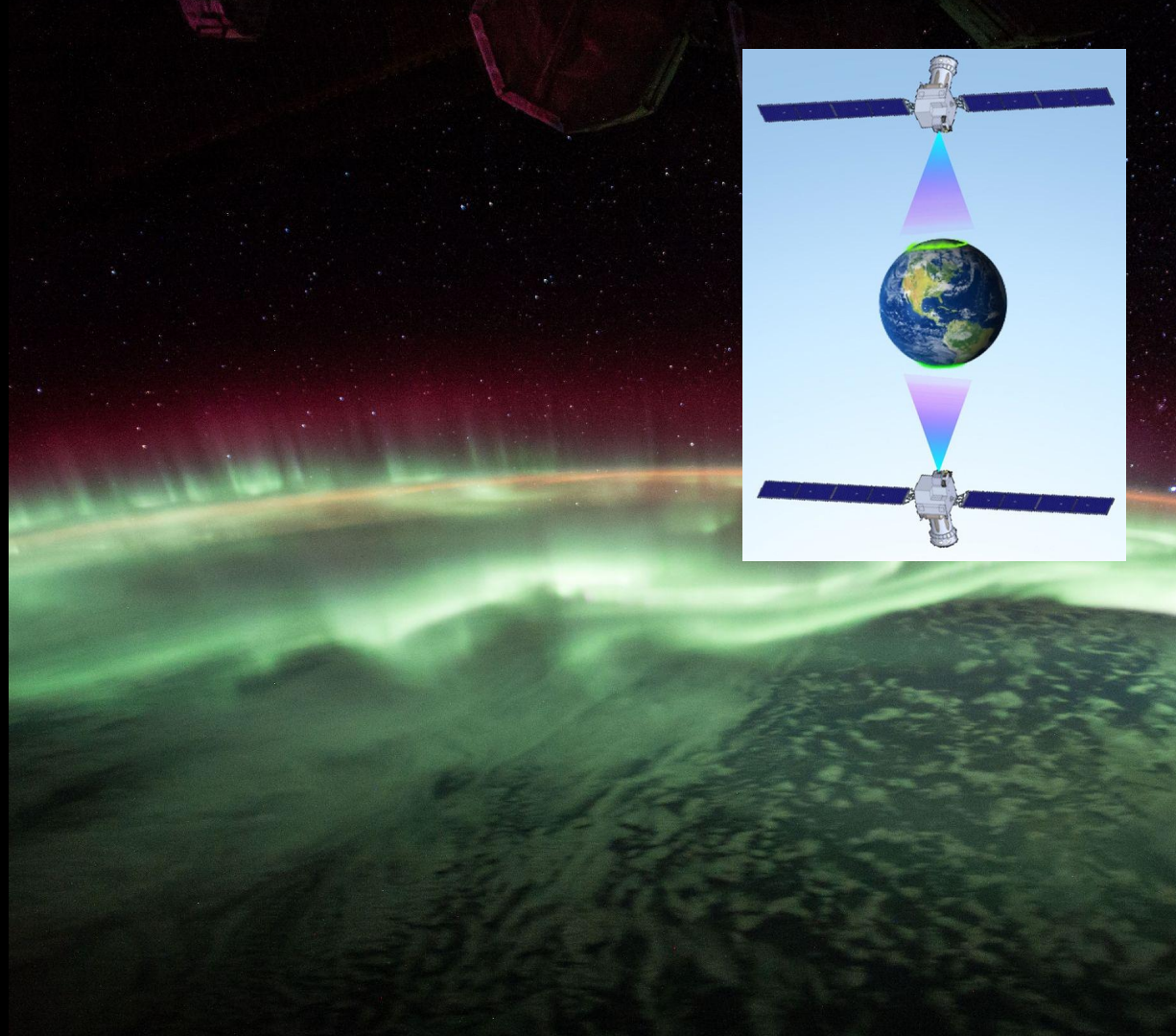
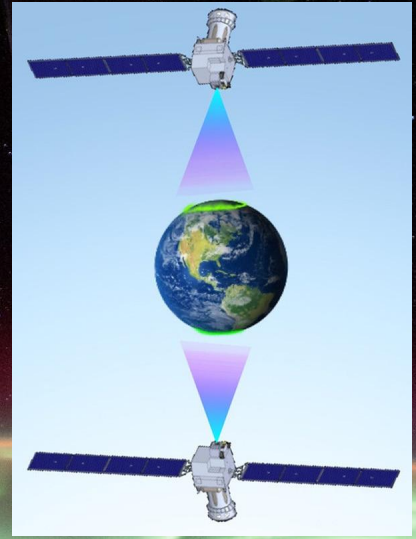
60-90 Gigawatts of Hemispheric
Power
(at least 30gw)



Extremely Low Bz at -10/-15
(at least -4 or -5 usually)

On the Edge of Emerging Science

- Solar Orbiter
- Parker Solar Probe
- Space Physics
Research Lab
- U-M Space Institute



Launching NASA Missions

- SunRISE Mission
- GDC Mission &
- NEMESIS Instrument
- MAAX Mission Concept
- NASA Lessons Learned





NEMISIS Investigation Selected for NASA Geospace Dynamics Constellation Mission

NASA has selected the final investigations for its flagship mission, the Geospace Dynamics Constellation, which include NEMISIS to be led by Prof. Mark Moldwin.

Written by: [Melissa F. Priebe](#)

JANUARY 30, 2023

In January, NASA selected the final investigations for the [Geospace Dynamics Constellation](#) (GDC) Mission. The two investigations for the flagship mission include the Thermal Plasma Sensor and NEMISIS (Near Earth Magnetometer Instrument in a Small Integrated System), led by University of Michigan Prof. Mark Moldwin.



HISTORY

THE CARRINGTON EVENT OF

1859



Notable Solar Storms

September 1859, “Carrington Event”: Most extreme event observed; caused telegraph outage, electrical shocks & fires. Triggered compass needle fluctuations and aurora. Depleted ozone layer by 5%.

May 1921: Extreme storm, low-latitude aurora, burning out fuses, disruptions to phone stations, electrical fires, communication blackouts. Knocked out entire signal & switching system of NY Central Railroad.

March 1989: Most extreme storm of the space age, causing power outage for 5 million in the province of Quebec, Canada for 9 hours and disrupted U.S. power grid. Radio transmissions were scrambled.

October 2003, “Halloween Solar Storm”: Large intensity solar storm that just missed Earth but overloaded satellite sensors measuring it. Blackout in Sweden for 50,000 and damage to transformers in South Africa.

July 2012: Fast CME directed away from Earth with full characteristics of a super solar storm. Considered a near miss of catastrophic proportions.

May 2024: G5 Storm: Strongest geomagnetic storm in 21 years. Low latitude Aurora. Disrupted communications and rerouted commercial airline flights.

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.

A Few Major New Discoveries

2008: Scientists determine what causes sub storms

2012: Scientists find origin of energized particles that create Aurora in the magnetotail

2016: Scientists find evidence Aurora makes noise

2016: Footage of sub-auroral arc STEVE recorded

2016: DSCOVR observatory launched into orbit

2018: NASA launches Parker Solar Probe to study the sun

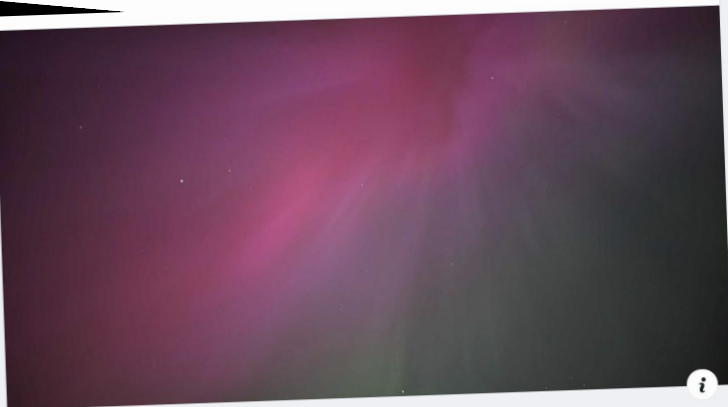
2020: ESA launches the Solar Orbiter to image the sun

Historic G5 Storm

The New York Times

Northern Lights Set to Return During Extreme Solar Storm's 2nd Night

Electrical utilities said they weathered earlier conditions as persistent geomagnetic storms were expected to cause another light show in evening skies.



CLASP.ENGIN.UMICH.EDU

Space Weather Scientist Explains Rare Intensity of Northern Lights - Climate and Space Sciences and Engineering

1 comment 1 share
Dixie J. Burbank, Samuel Warfel and 9 others

1 comment 1 share



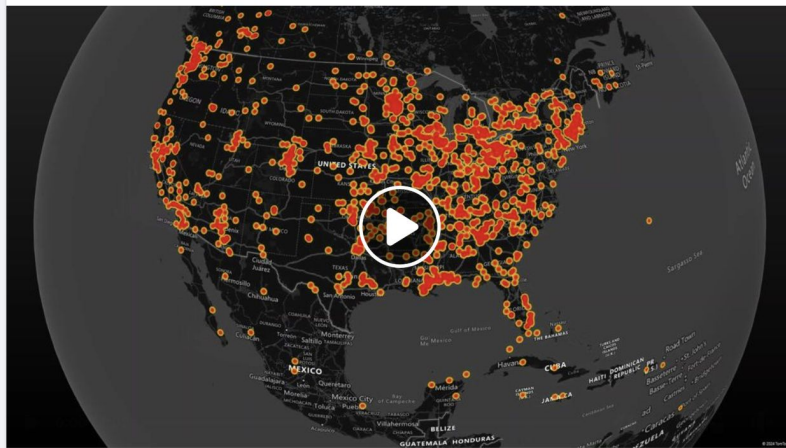
Chris Wicklund

July 31 at 2:52 PM · 🌐

Thanks to my friend [Vincent Ledvina](#) I have discovered a new way to plot the historic G5 aurora event seen across the globe. Look at all those points! I have even submitted my preliminary dataset to a scientific research site where it has obtained a DOI and can be open sourced and used in scientific research. I have been working on this with a small team since the magnificent event in may and have supplied a couple agencies with it. Feel free to share this across platforms.

Fun times! [#aurora](#)

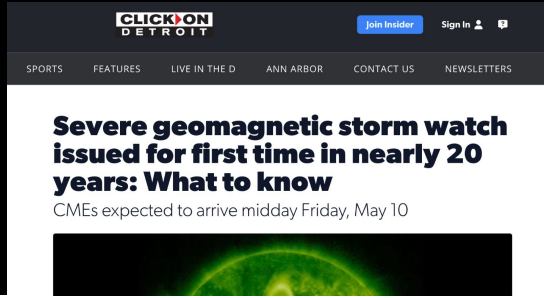
The live map to view is also here: <https://www.google.com/maps/d/edit...>



16

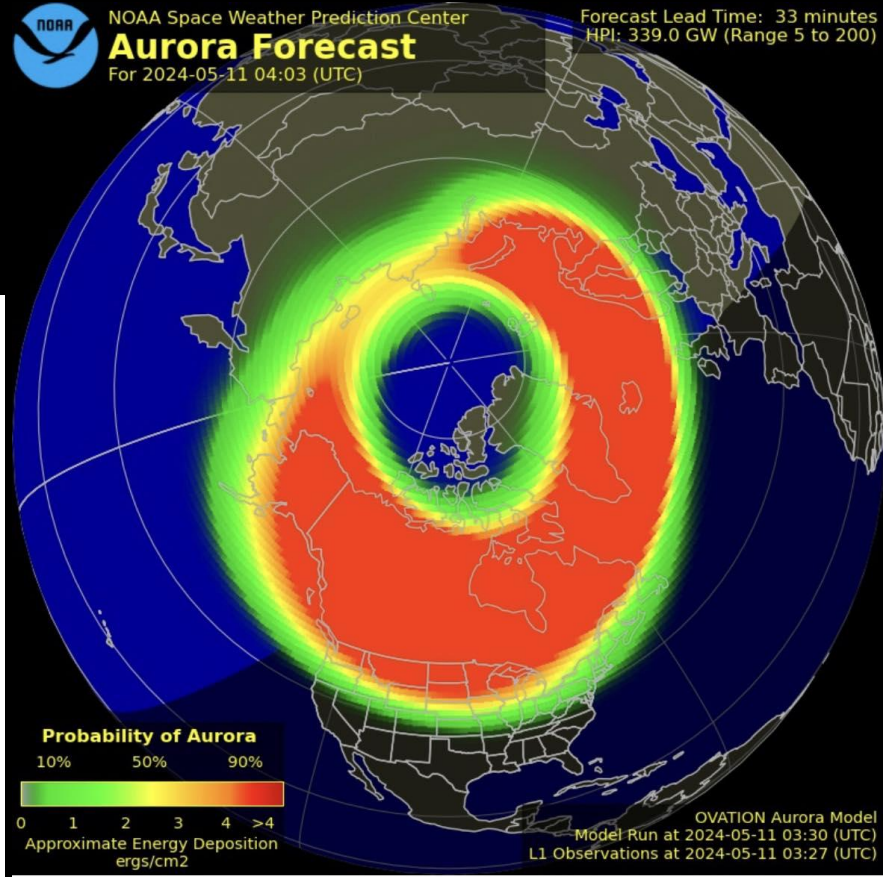
14 comments 13 shares

What did the Ovation Model Show on May 10, 2024?



USATODAY.COM

One week ago, the northern lights stunned America. When will it happen again?



#LiveChase

Led a Live Chase on May 10, 2024, during historic G5 Storm. We celebrated 100K with a Statewide Live Chase, June 10, 2024!



Photo by Patricia Parker



Photo by Lauren Kovich




Photo by Karen Serwatowski



MORE

Guides to the Night & Etiquette

- An Empowered Guide to Viewing Locations
- MI Aurora Resource List
- Advice Blog: Aurora Chasing in the U.S.
- YouTube: Aurora Chasing in Your Backyard



Aurora Chasing in Your Backyard

Melissa, The Aurora Chaser

Public

6 videos 169 views Last updated on Nov 10,...

Find out what it takes to catch the Northern Lights in your backyard! Get Aurora Chasing tips, ...More

▶ Play all

↻ Shuffle



Aurora Chasing

Seven Ways to Find an Aurora Viewing Location

So, you want to see the Aurora! Here are seven ways to find a great Aurora Viewing Location, which are included in my new Empowered Guide.



Aurora Chasing

Five Simple Steps for Tracking Solar Flares

As Aurora Chasers, we love hearing about new solar flares. But many things have to happen for a solar flare to have any visible impact on our night skies.



Aurora Chasing

Make or Break Your Shot: The Beauty of Night Sky Etiquette

Take a few easy steps to ensure everyone around you can enjoy the night sky.



Aurora Chasing

Ask How, Not Where to View Aurora

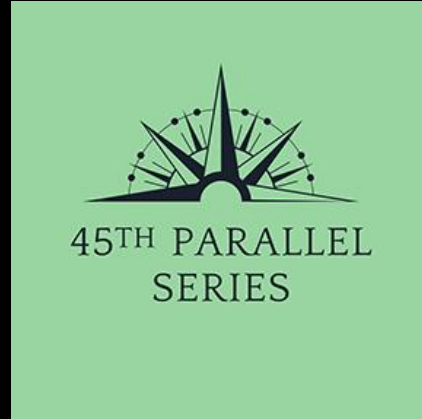
Often, people who chase the Northern Lights can become too focused on WHERE

Aurora Chasing in the U.S.




Chase the Northern Lights, and find out what it takes to catch a view in your own backyard.

An avid Aurora Chaser, I'm excited to share my advice on capturing the Northern Lights in the lower 48 states. Get tips for beginners and overcome the many obstacles to catch an amazing display. If you enjoy the content, subscribe below.



< **Melissa, The Aurora...** 🔍 ⋮



Aurora Chasing with Melissa F. Kaelin



Melissa, The Aurora Chaser
@MelissaTheAuroraChaser
400 subscribers • 8 videos


Chasing the Northern Lights for more than 10 years, Melissa F. Kaelin is a writer, artist and stargazer. She has successfu... >


kaelinart.com and 7 more links



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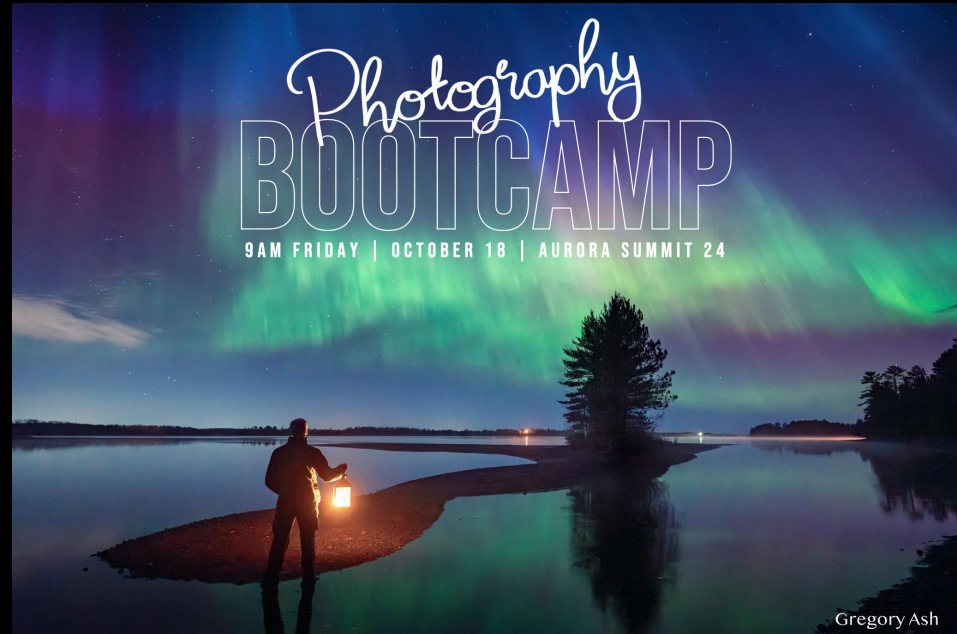
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The Aurora Summit

- Founded in 2017 by a team of three: Dixie J. Burbank, Melissa F. Kaelin & Dr. Mike Shaw
- Celebrating the Art, Culture, Science & Photography of the Aurora
- Registration launches each June
- Sign up by October 1
- Open to the public



Aurora Summit 24

Featuring Dr. Elizabeth MacDonald

October 18-20, 2024 | Red Cliff, Wisconsin

Register: TheAuroraSummit.com

Michigan Aurora Chasers

- Founded January 20, 2021
- Over 128,000 members
- High engagement & sell-out crowds
- Apparel design contests
- Logo created by Admin Patrick Grubba
- MI Aurora Workshop, MI Aurora Social & the #LiveChase
- Collaborate with and donate to International Dark Sky Parks



MichiganAuroraChasers.com

Making the Dream a Reality

Find upcoming events,
advice, tools, techniques,
videos, books and more!

Visit: KaelinArt.com/Aurora



KAELINART.COM