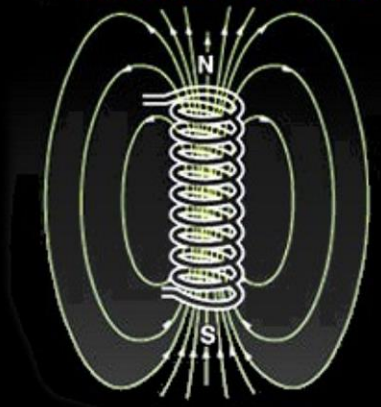

Aurora Australis
George Edward Marston (c. 1909)
Prior to the program, please download this application on your smartphone.
SpaceWeatherLive

The **inherent nature of matter creates** forces: **gravity,** a property of mass **and magnetism,** resulting from either the spin axis alignments of atoms or the flow of charged particles.

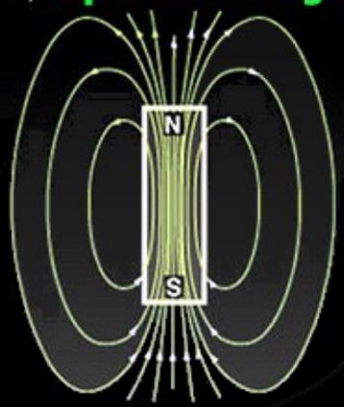
A **field is a force** that goes beyond the matter creating it.

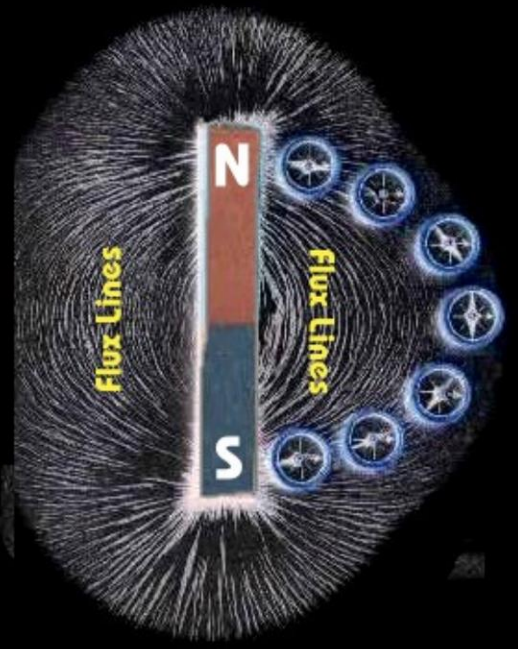
Two Ways of Inducing a Magnetic Field

a) Flow of electrons

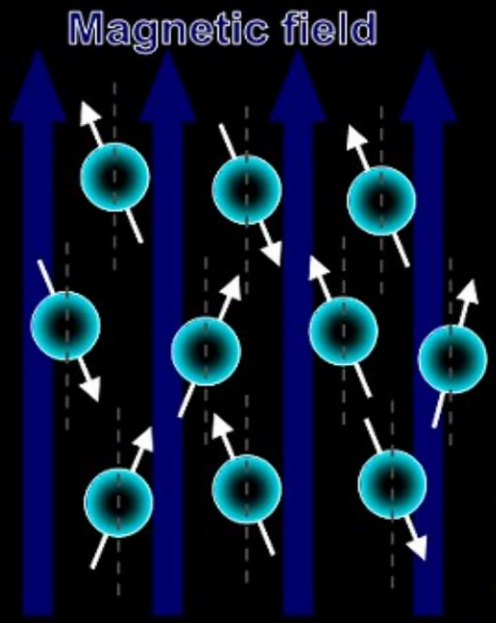


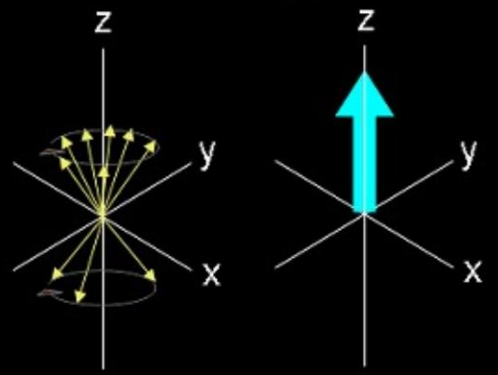
b) Spin axis alignment





Solar Phenomena are all about Magnetic Fields



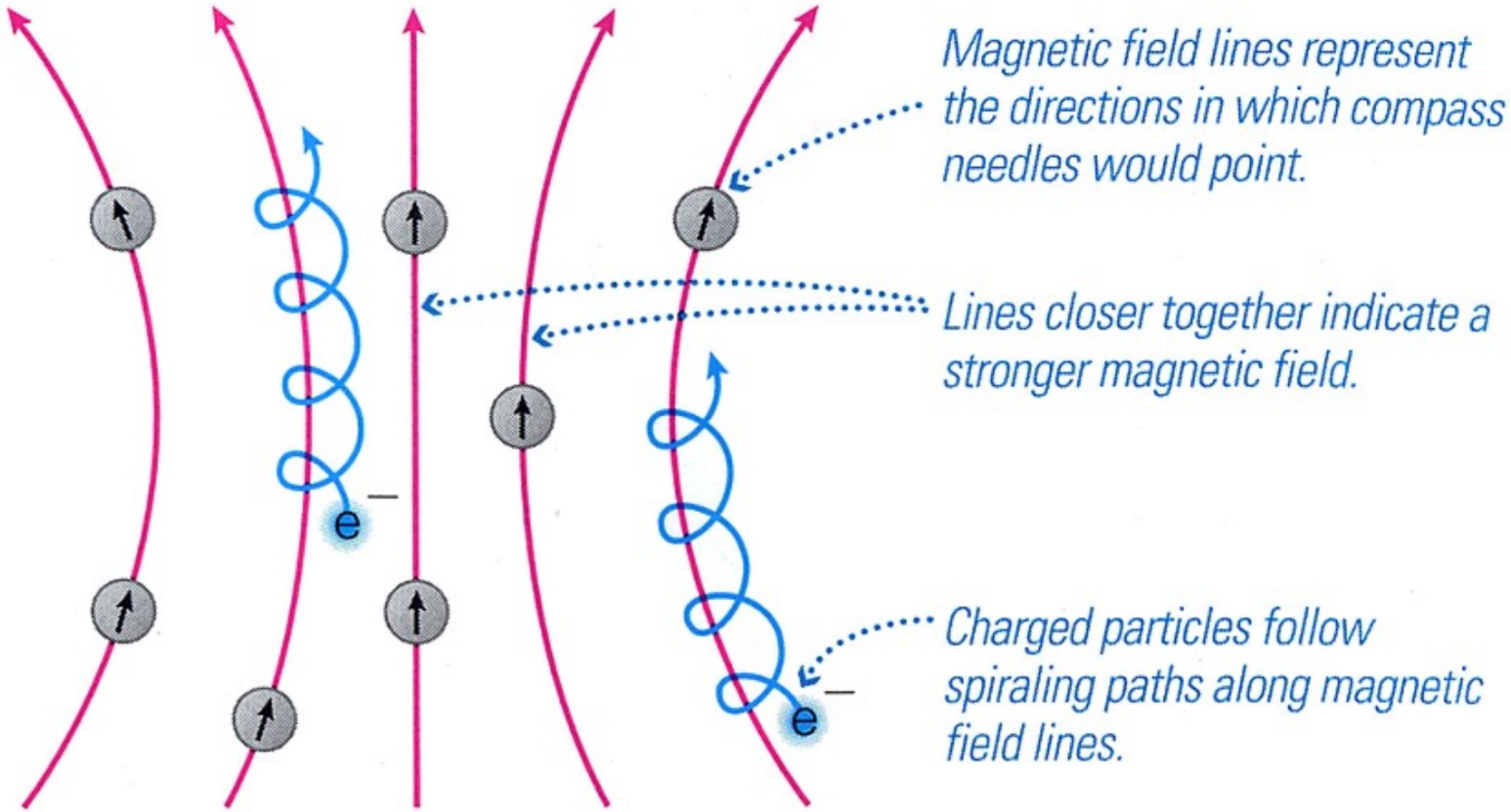


Overall magnetisation of nuclei = Sum of vectors from individual nuclei

A symbiotic Relationship

The flow of charged particles (plasma) induces a magnetic field, that in return affects the motions of other charged particles, as well as the magnetic field created by the plasma flow.

Magnetic Field (Flux) Lines



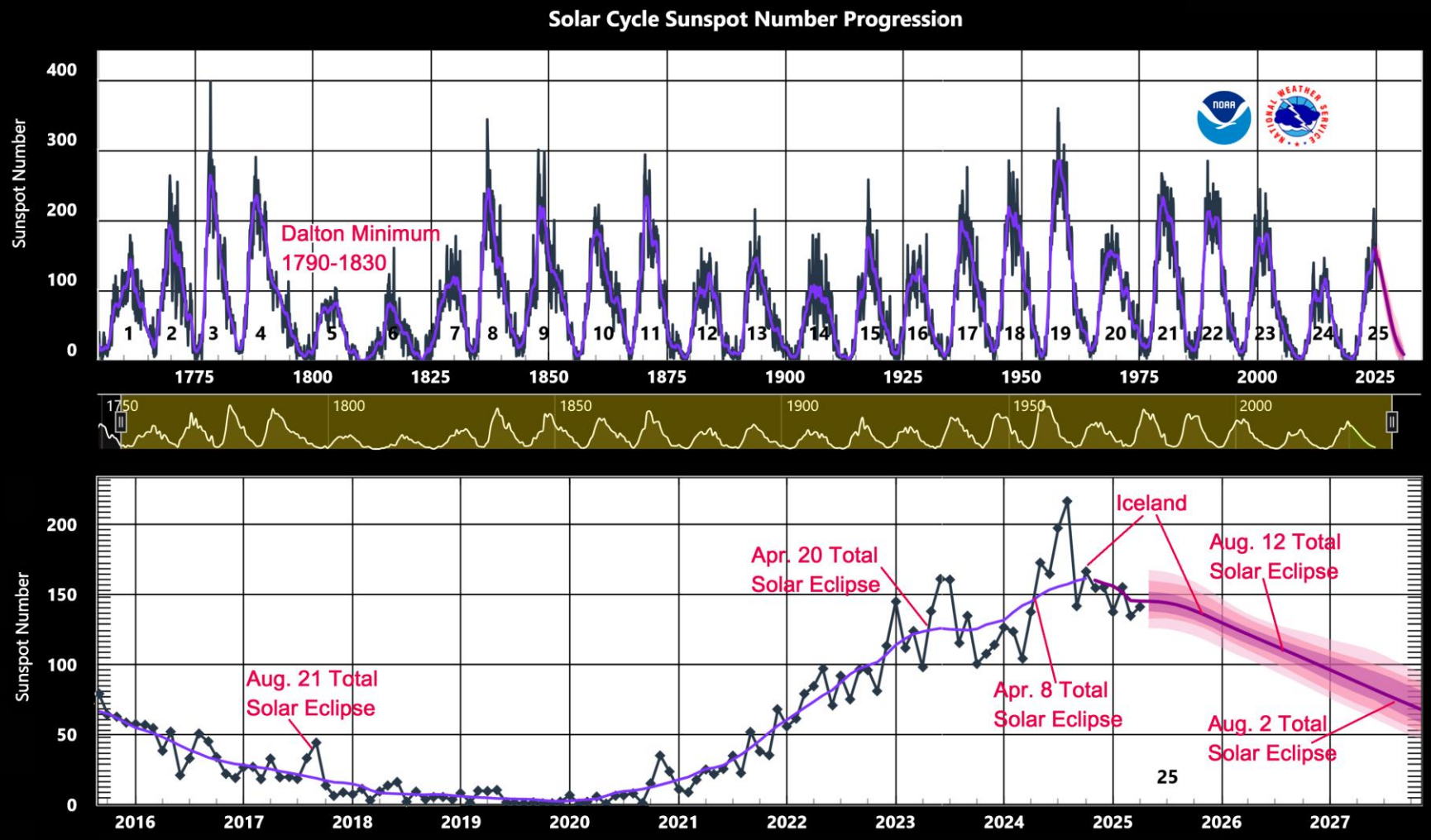
Magnetic field lines represent the directions in which compass needles would point.

Lines closer together indicate a stronger magnetic field.

Charged particles follow spiraling paths along magnetic field lines.

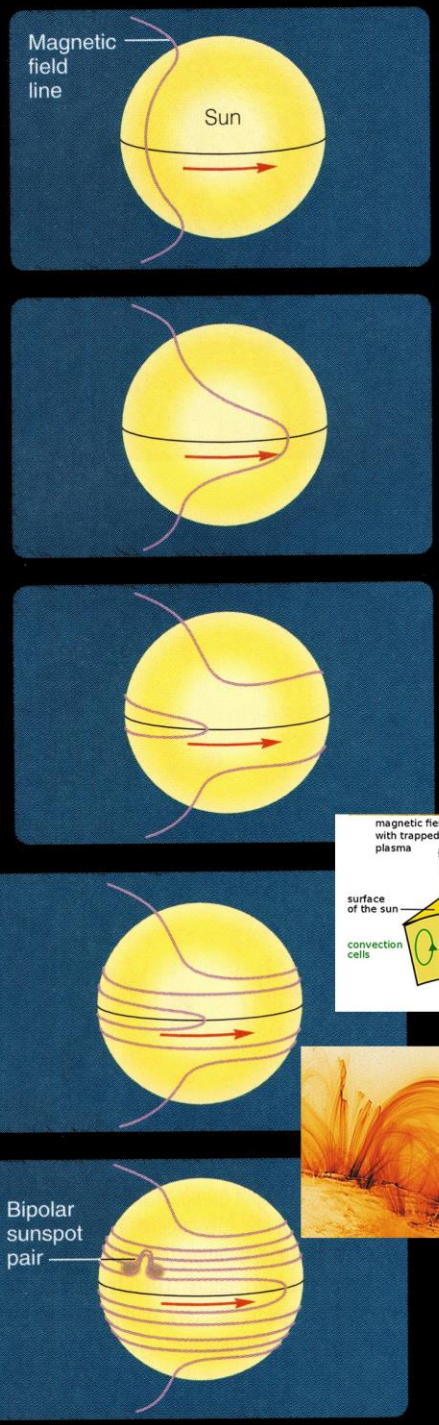
Unknown source

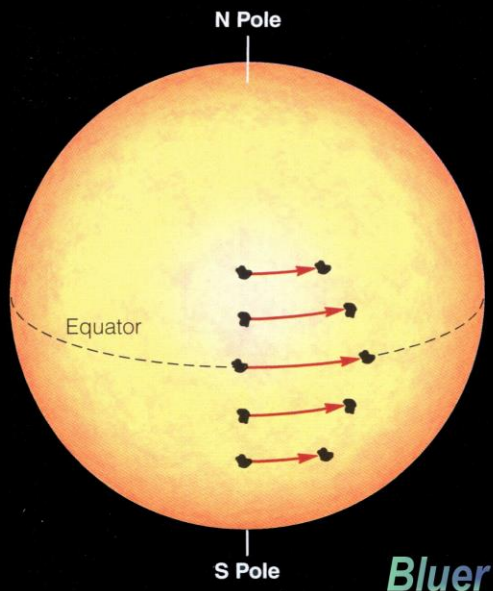
SOLAR CYCLE PROGRESSION

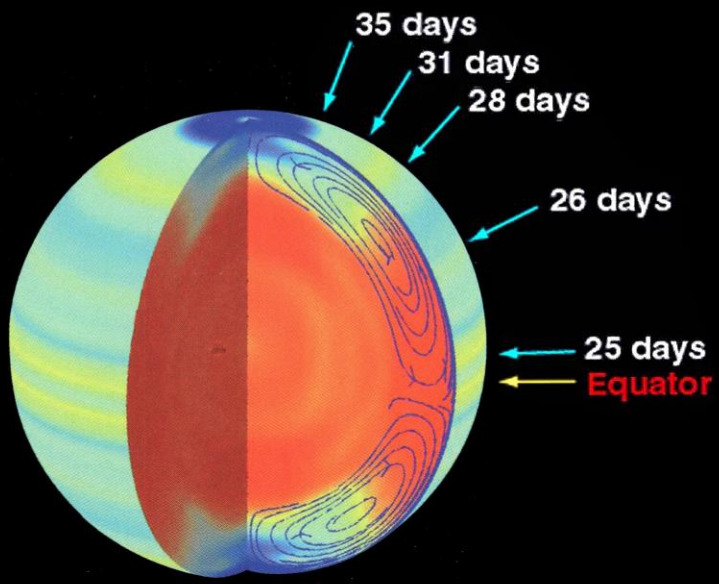


National Oceanic and Atmospheric Administration /National Weather Service

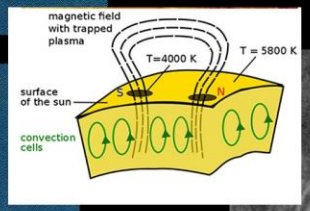
Sunspots and Differential Rotation

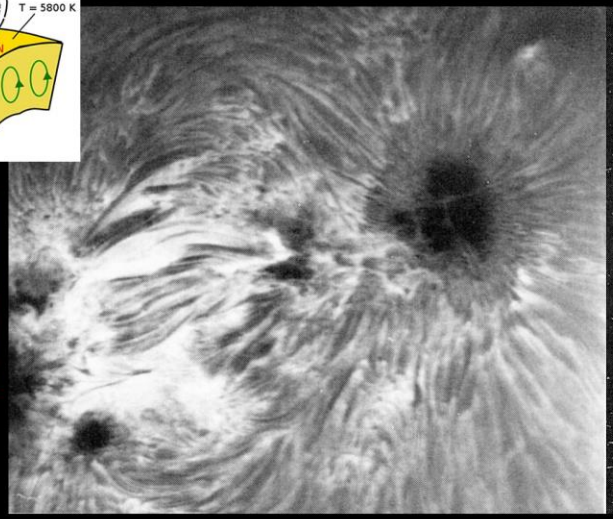


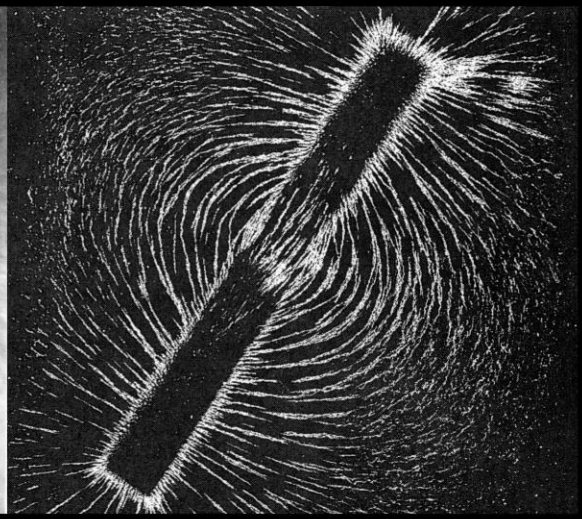




Bluer Slower ROTATION Redder Faster

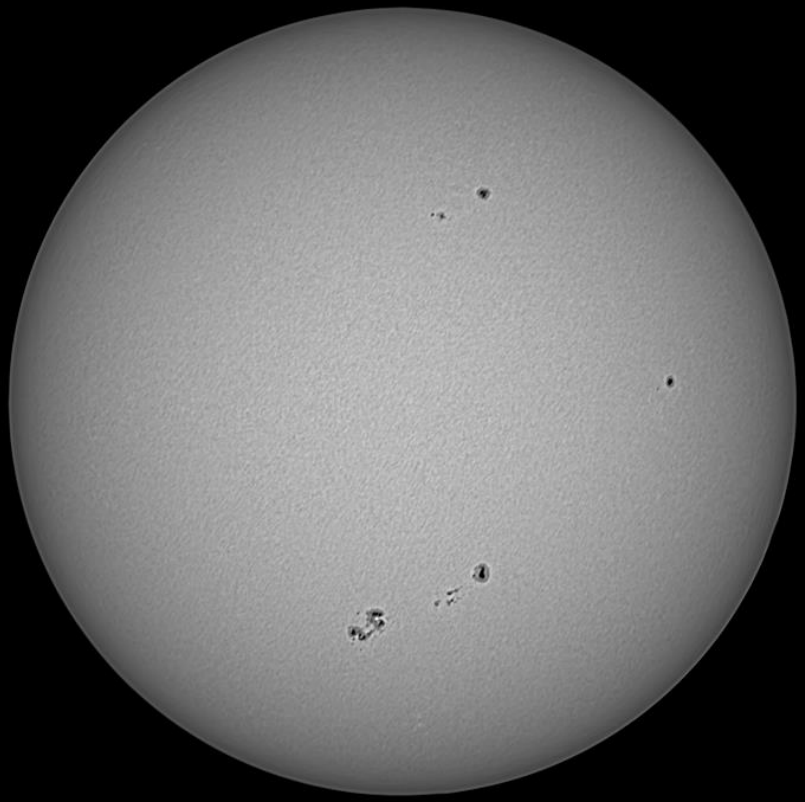


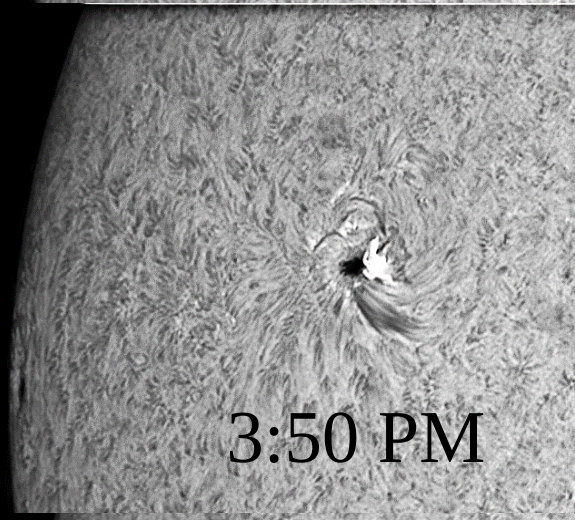




NASA’s Solar Dynamics Observatory

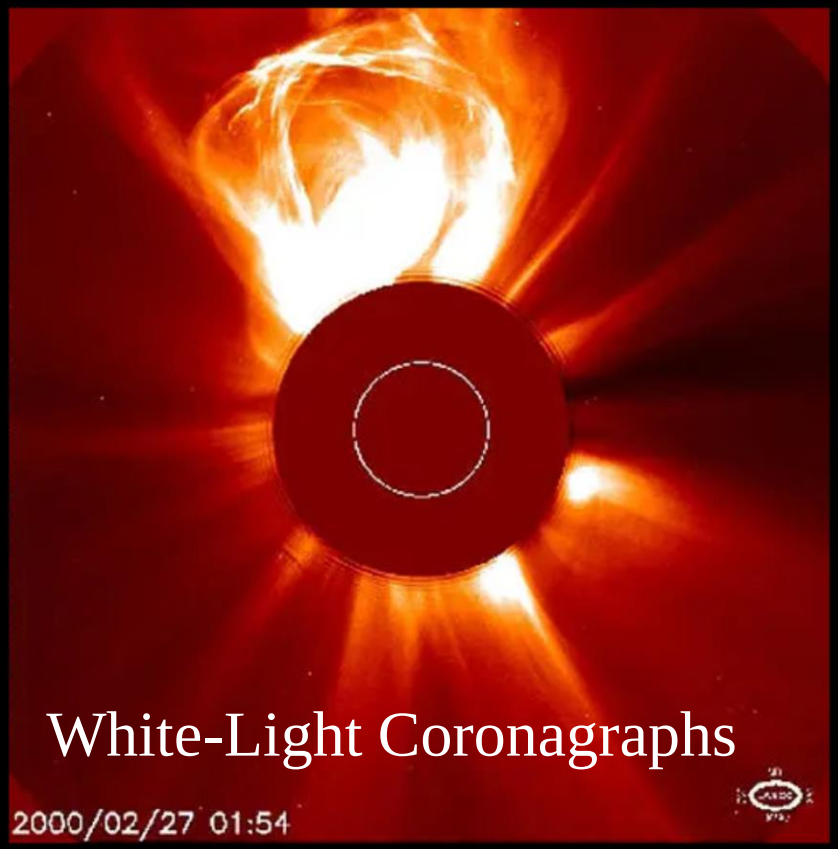
Detterline's Solar Flare

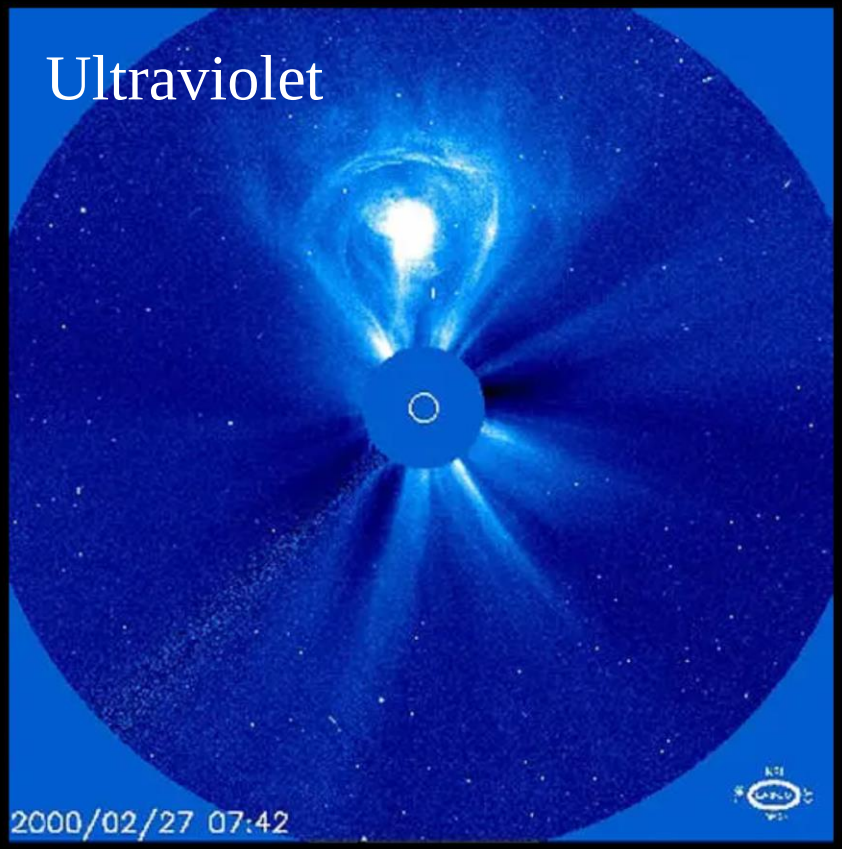




Peter K. Detterline images

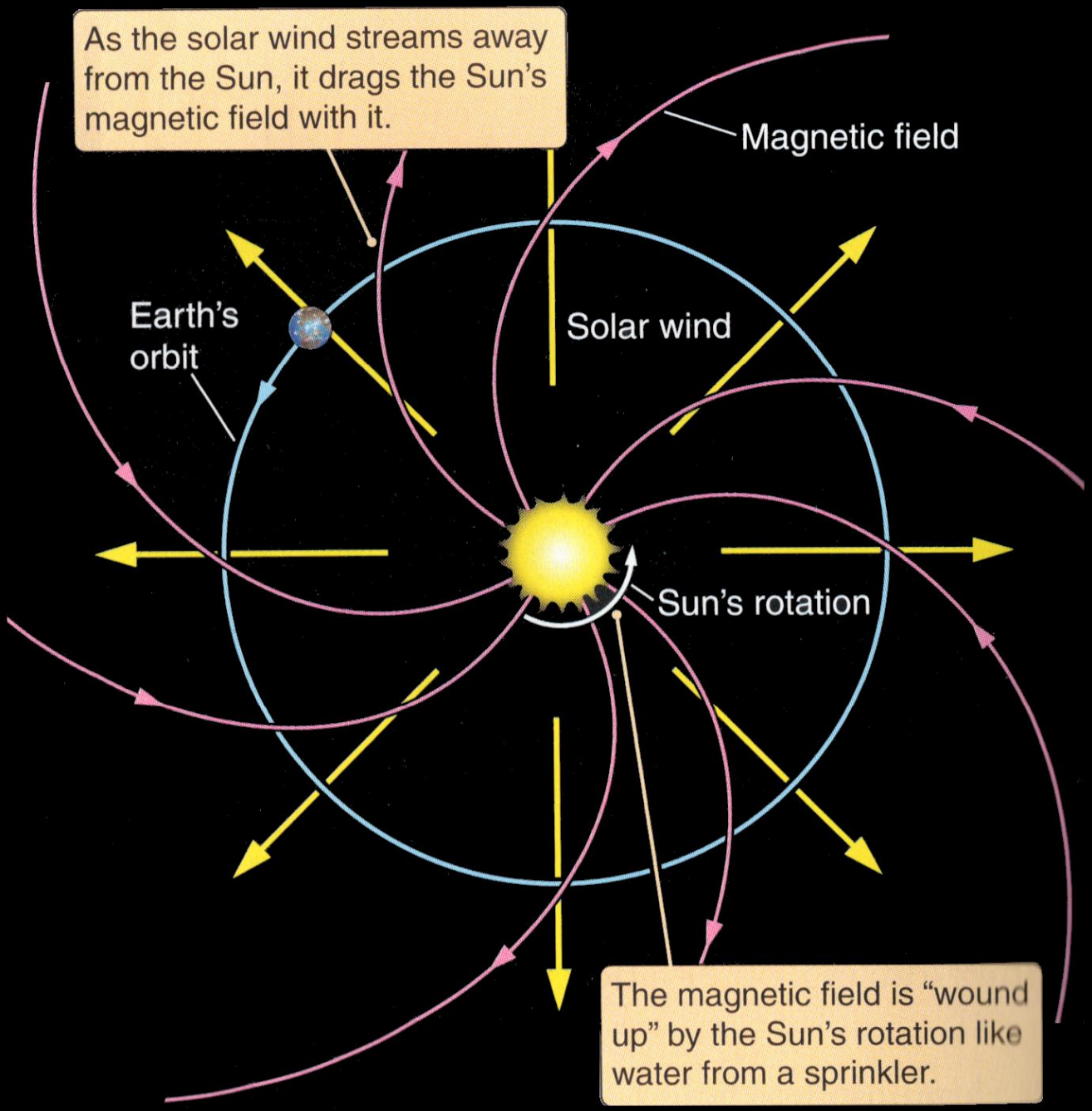
CMEs: Coronal Mass Ejections





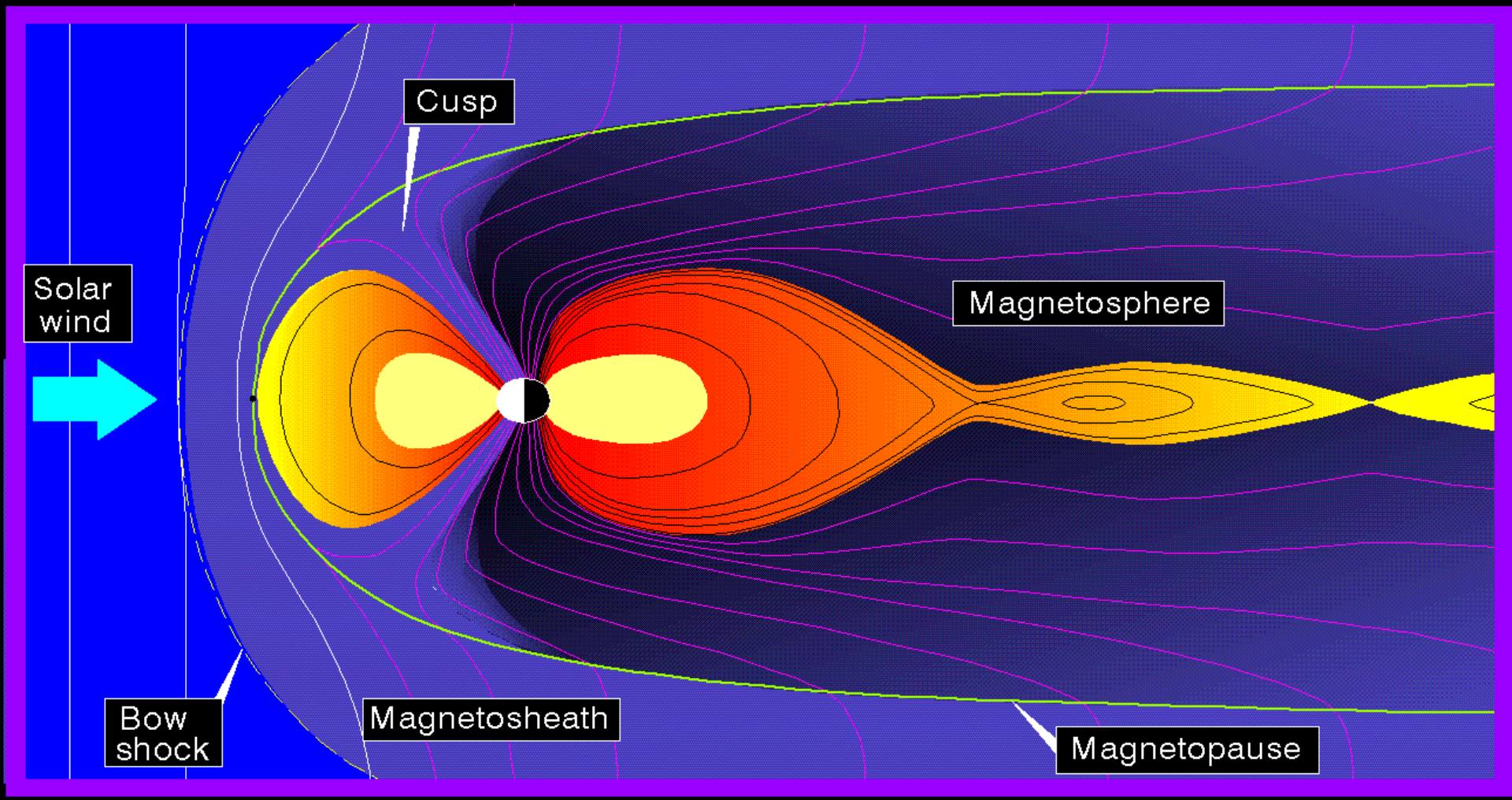
A coronal mass ejection on Feb. 27, 2000 taken by SOHO LASCO C2 and C3. A CME blasts into space a billion tons of particles traveling millions of miles an hour.

SOHO ESA & NASA



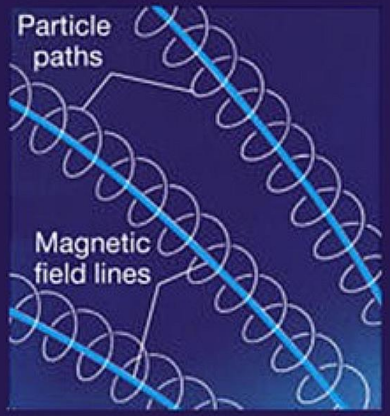
21st Century Astronomy, 2002, p.344

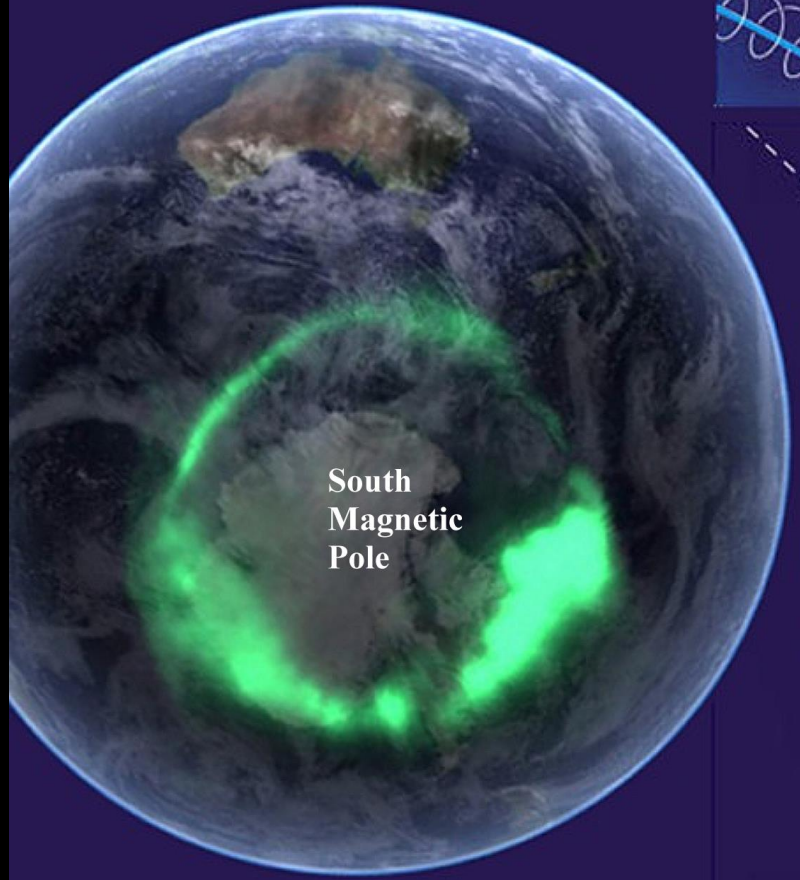
Earth's Magnetic Environment

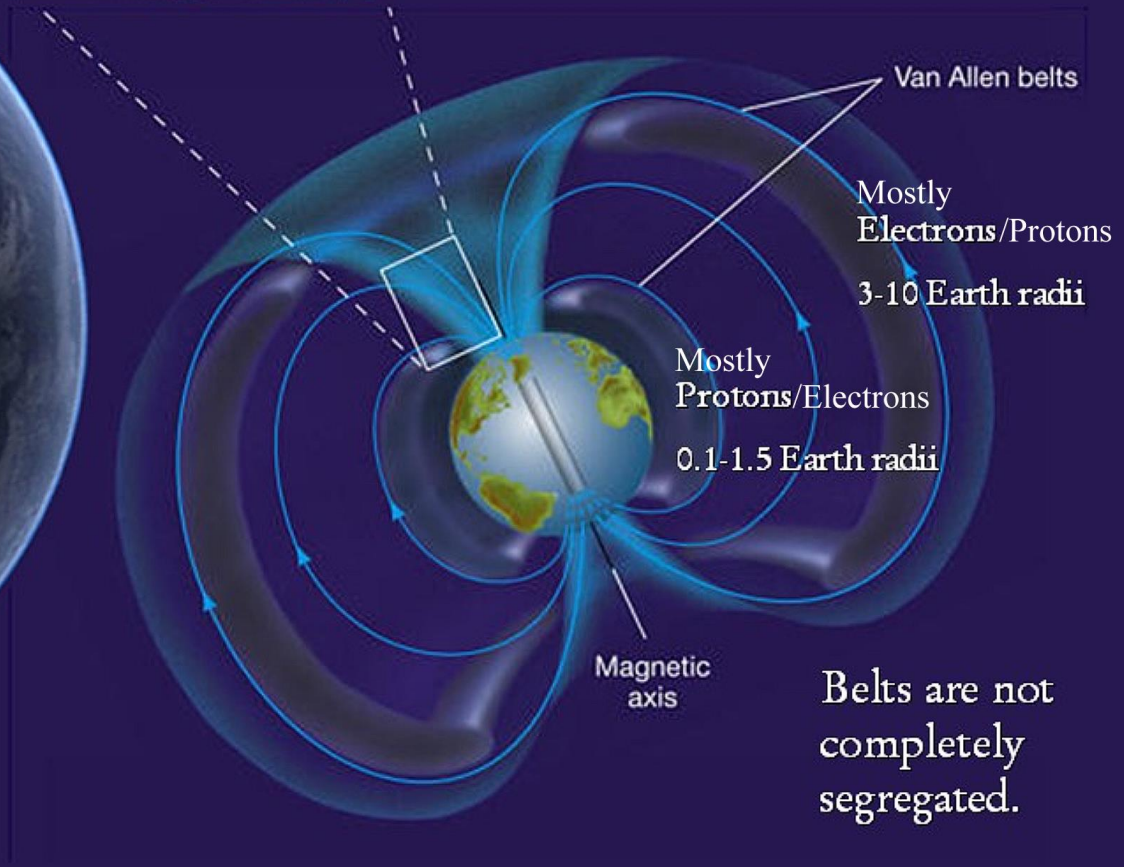


Unknown Source

Van Allen Belts



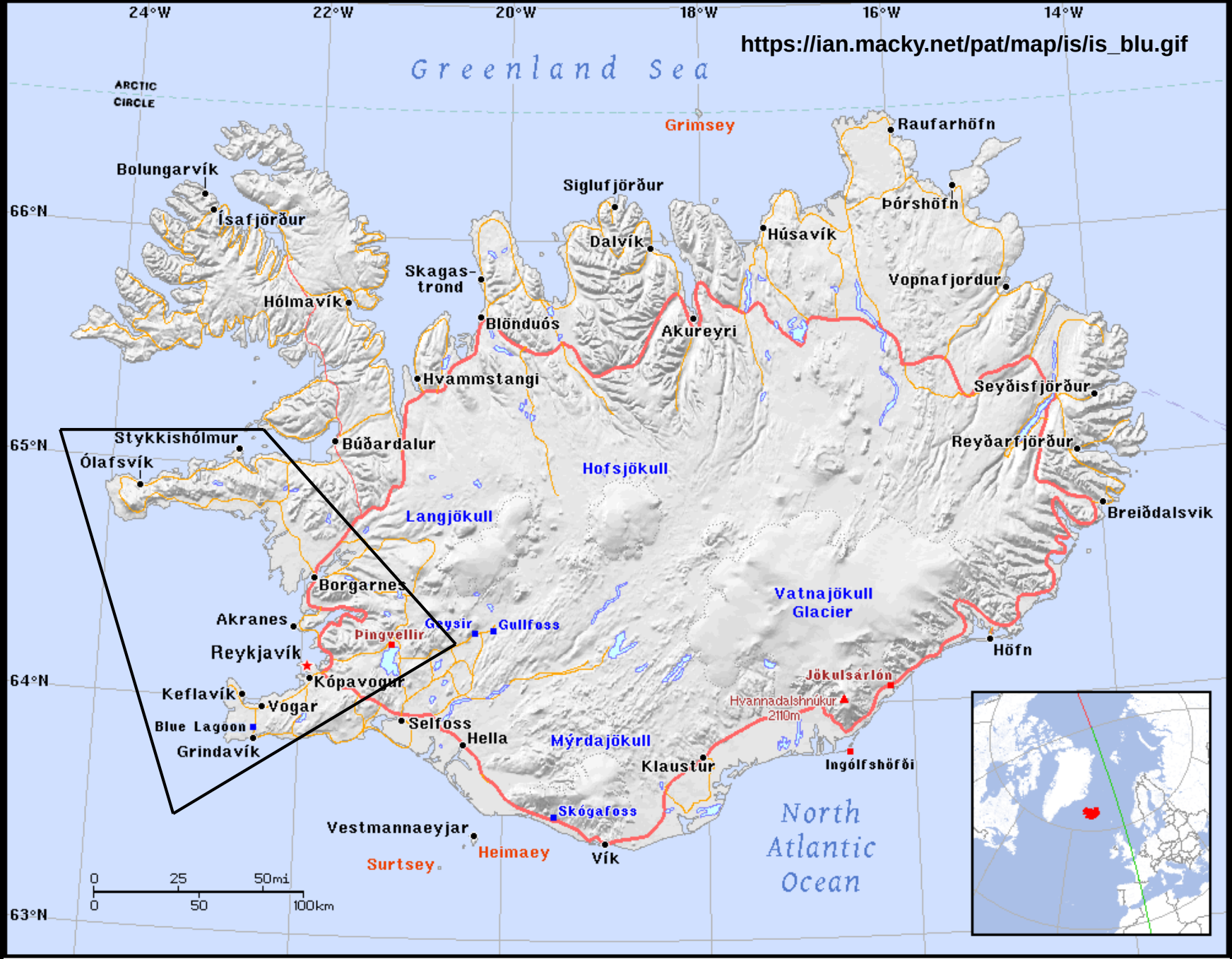




Belts are not completely segregated.

Unknown Source


Aurorae Iceland
Sept 30 - Oct 5 2024
Peter K. Detterline
Gary A. Becker
Peter K. Detterline image



I C E L A N D

2014

Gary A. Becker image

Gary A. Becker image

No wonder everyone speaks English!

Stapafell
Local Volcano

Peter K. Detterline/Gary A. Becker

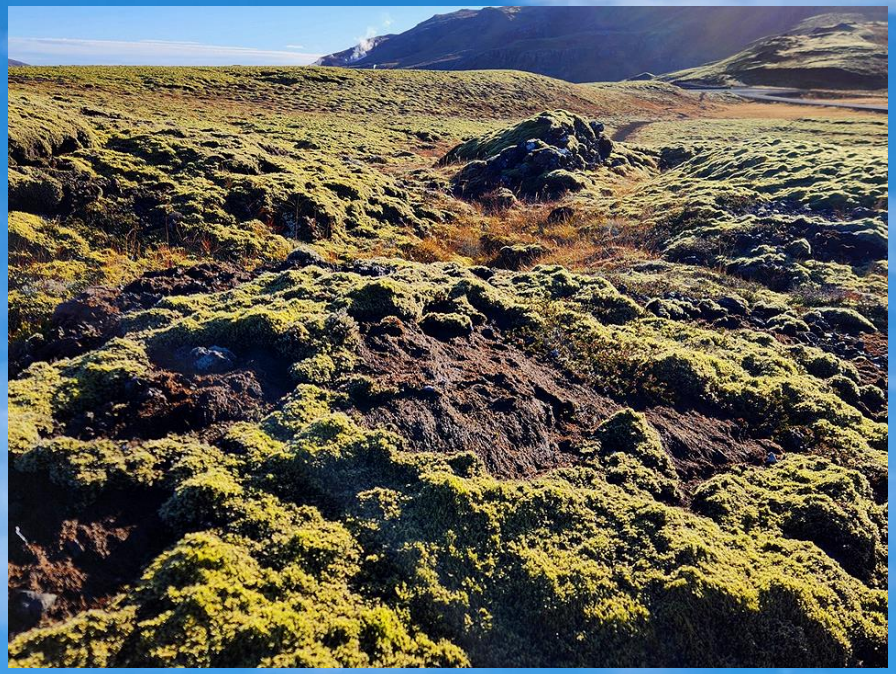
Gary A. Becker image

Gary A. Becker image

Gary A. Becker image

Gary A. Becker image

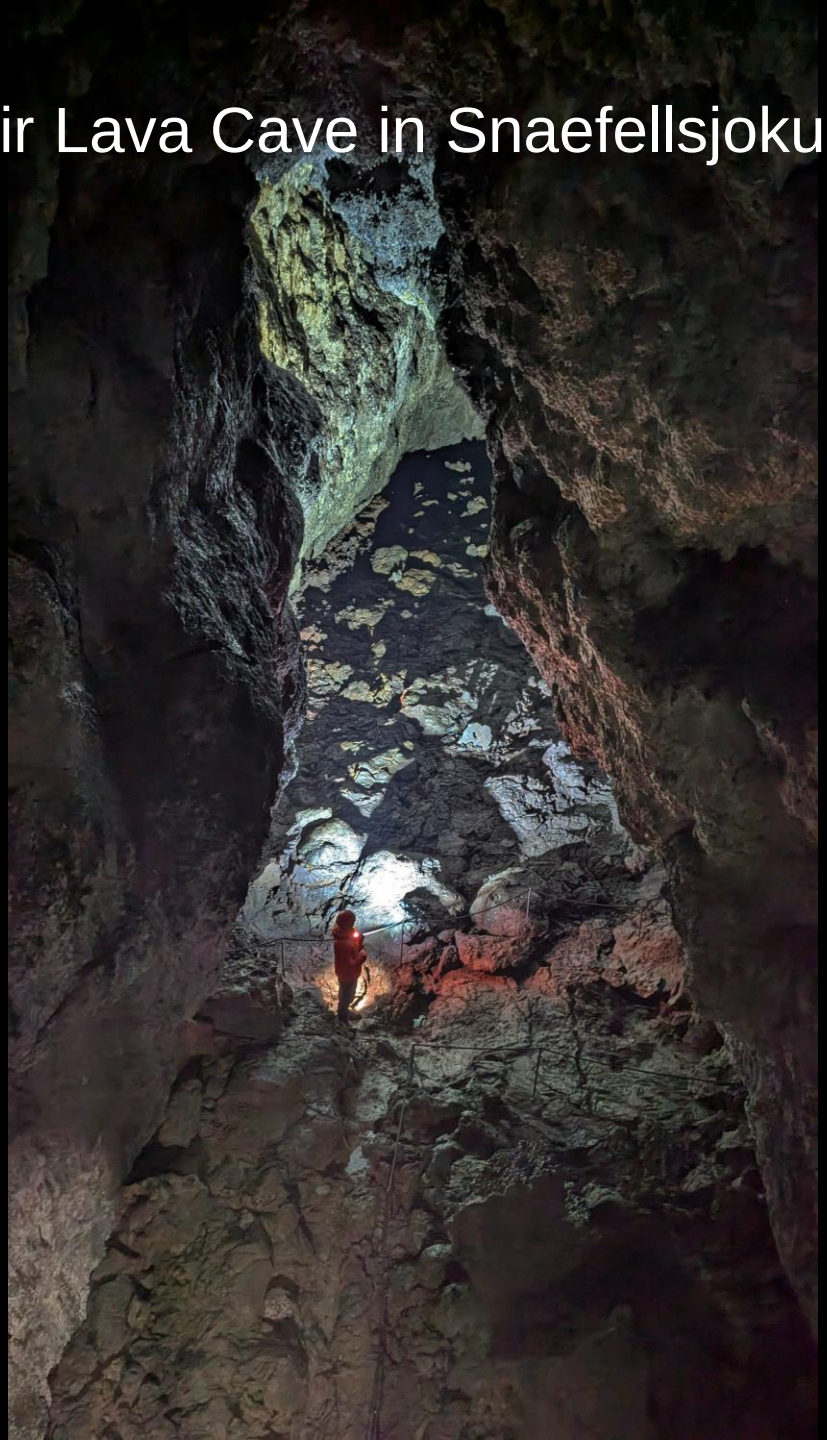
Gary A. Becker image



Snaefellsjokull

Peter K. Detterline images

Vatnshellir Lava Cave in Snaefellsjokull National Park



Gary A. Becker image

Volcanic Caldera/Pit

Peter K. Detterline images

Gary A. Becker image

Gary A. Becker image

Gary A. Becker image

Stykkisholmur

Gary A. Becker images


Gary A. Becker image

The Blue Lagoon

Gary A. Becker image

Gary A. Becker image

Gary A. Becker image

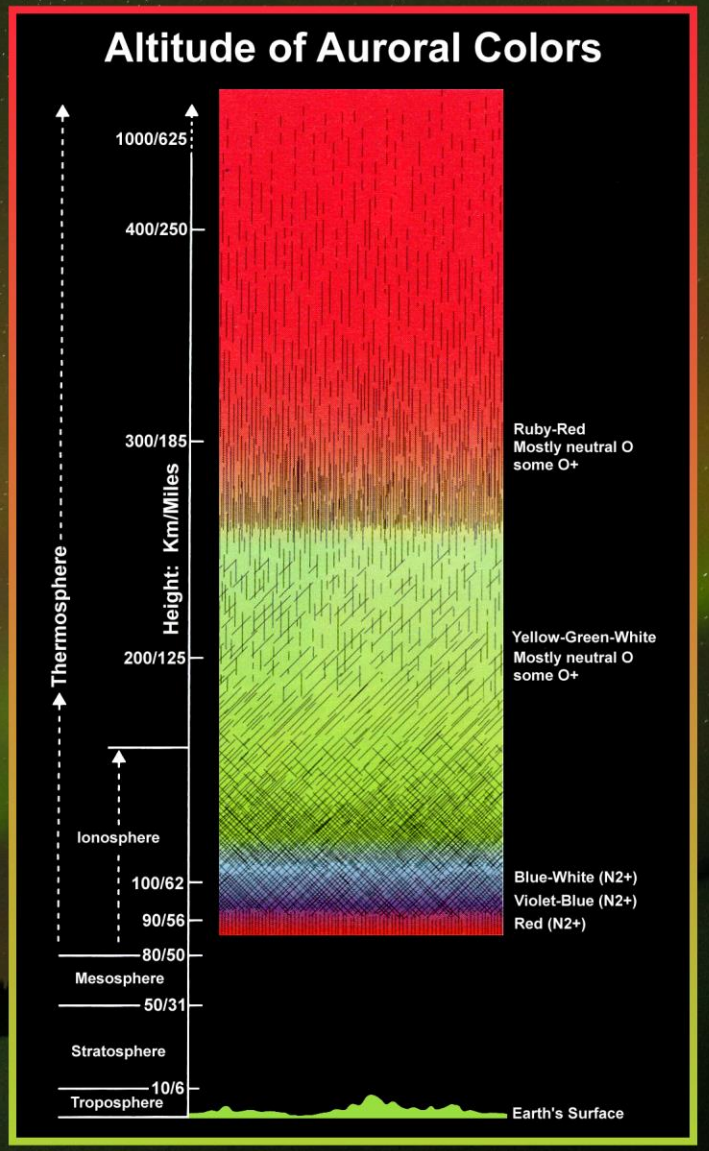
Gary A. Becker image

Gary A. Becker images

Gary A. Becker video

Gary A. Becker image

Colors of the Aurora



Gary A. Becker image/Northern Lights: The Definitive Guide to Auroras, p. 46

COLORS OF AURORA

Excited atomic oxygen at high altitudes

Only visible under intense solar activity due to low concentration of oxygen at high altitudes.

Above 150 miles or 241.4 km

Excited atomic oxygen at lower altitudes

Green light is emitted instead of red due to higher concentration of oxygen.

Up to 150 miles or 241.4 km

Ionized molecular nitrogen

The reaction involve molecular nirogen because atomic oxygen is uncommon at low altitudes. Similar to red, blue and purple is associated with intense solar activity.

Above 60 miles or 96.6 km

Up to 60 miles or 96.6 km

Source:

Canadian Space Agency. (2014, April 29). The colours of the Northern Lights.

Aurora Zone. (n.d.). Why are the Northern Lights sometimes coloured differently?

Space.com. (2017, October 11). Northern Lights: What Causes the Aurora Borealis & Where to See It.

Northern Lights Centre, Canada. (n.d.). Northern Lights.

Made by alienyrox.

Peter K. Detterline imagw/Canadian Space Agency

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N_2 Ionized molecular nitrogen

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Northern Lights Centre, Canada. (n.d.). Northern Lights.

Made by alienyrox.

Peter K. Detterline image/Canadian Space Agency

Visual Appearance Under Normal Conditions

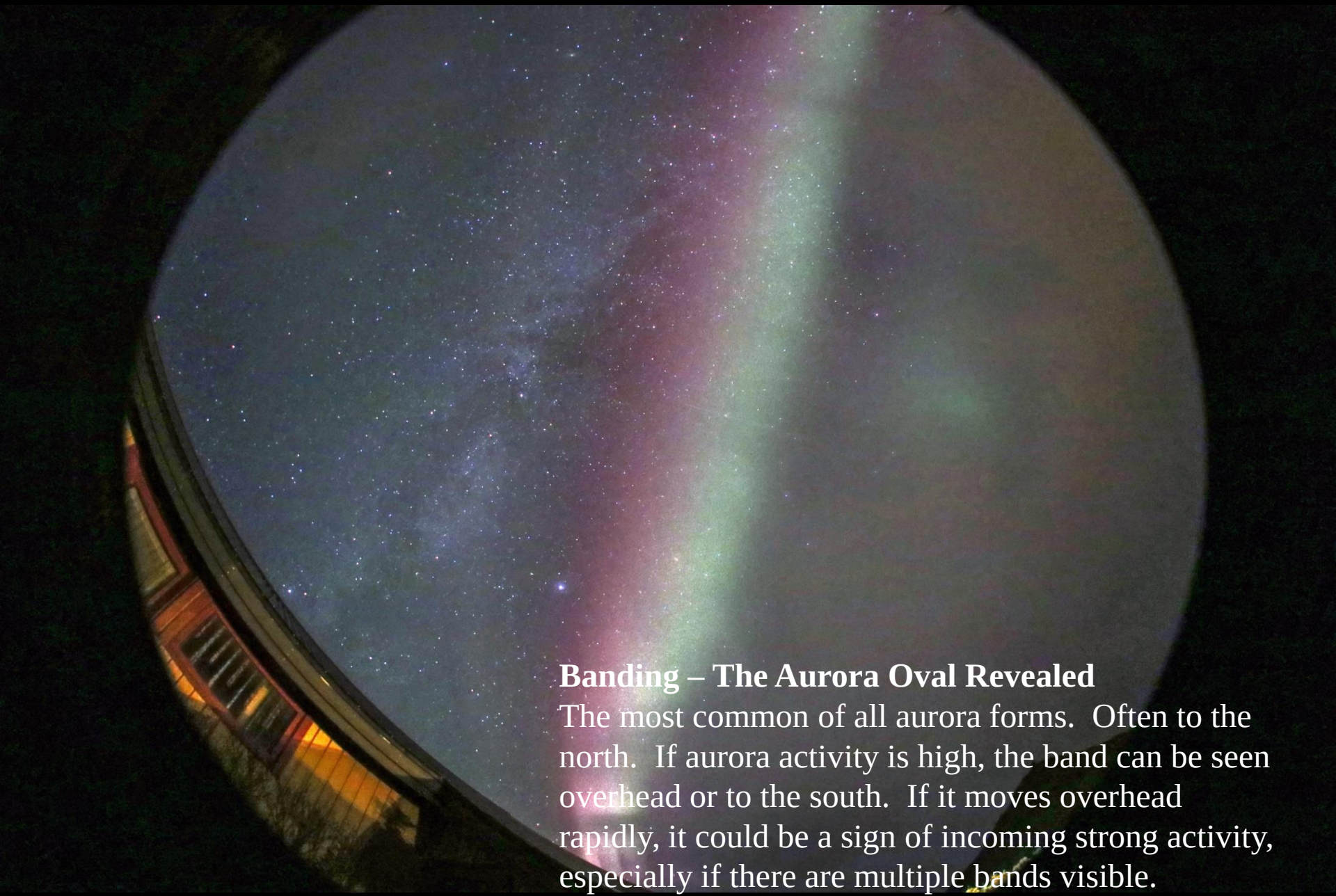
Peter K. Detterline image

Visual Appearance Under Storm Conditions

Peter K. Detterline image

Photographic Appearance Under Normal Conditions

Peter K. Detterline image



Banding – The Aurora Oval Revealed

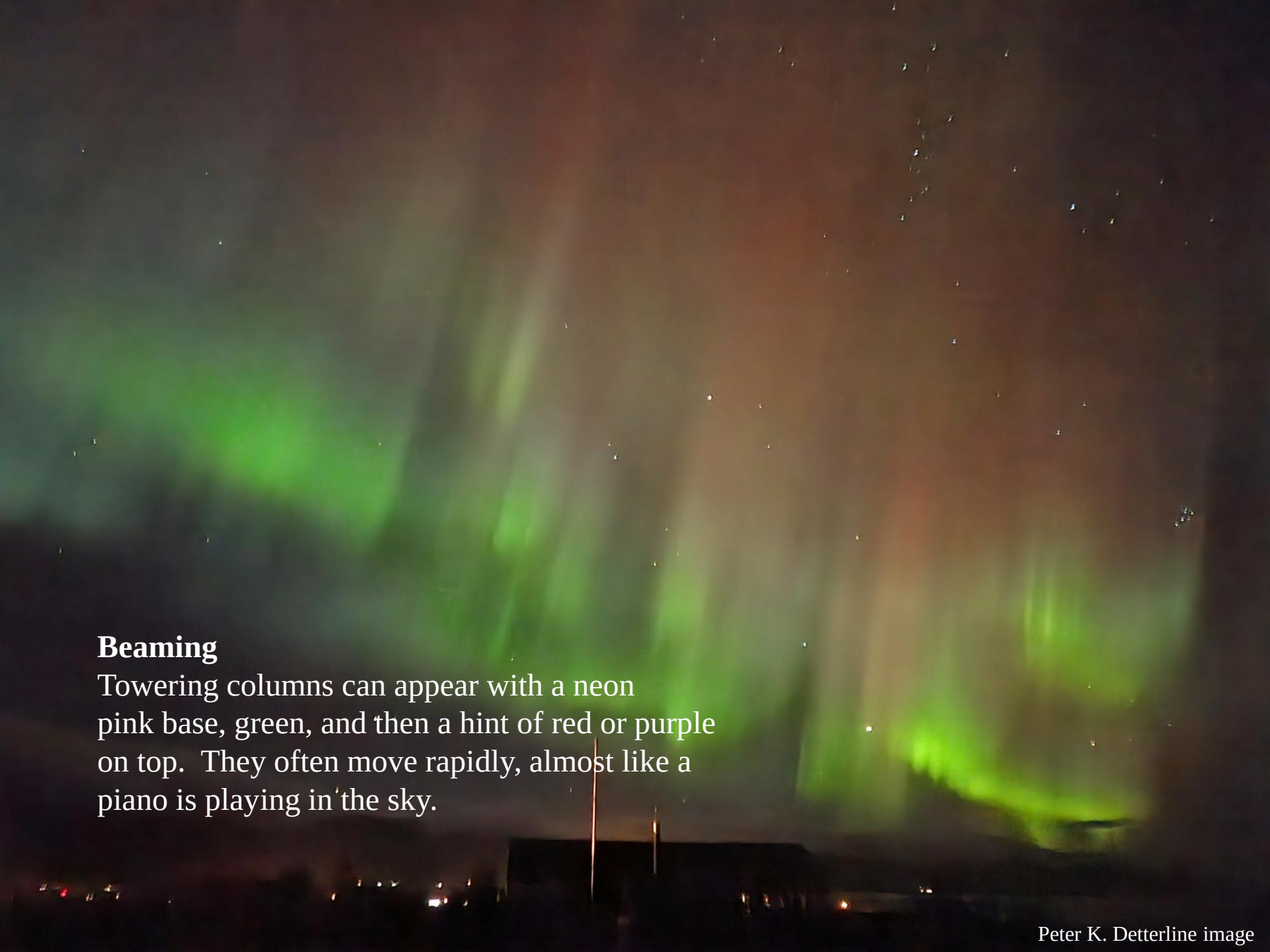
The most common of all aurora forms. Often to the north. If aurora activity is high, the band can be seen overhead or to the south. If it moves overhead rapidly, it could be a sign of incoming strong activity, especially if there are multiple bands visible.

Peter K. Detterline image

Banding – The Aurora Oval Made Visible

The most common of all aurora forms, often seen to the north. If aurora activity is high, the band can be seen overhead or to the south. If it moves overhead rapidly, it could be a sign of incoming strong activity especially if there are multiple bands.

Peter K. Detterline image



Beaming
Towering columns can appear with a neon pink base, green, and then a hint of red or purple on top. They often move rapidly, almost like a piano is playing in the sky.

Peter K. Detterline image

The Corona
As the magnetic beams move downward from overhead, you are looking up into the column of colors. A rapid crown shape pulsates above you, often flaring in many strong colors and distinct shapes.

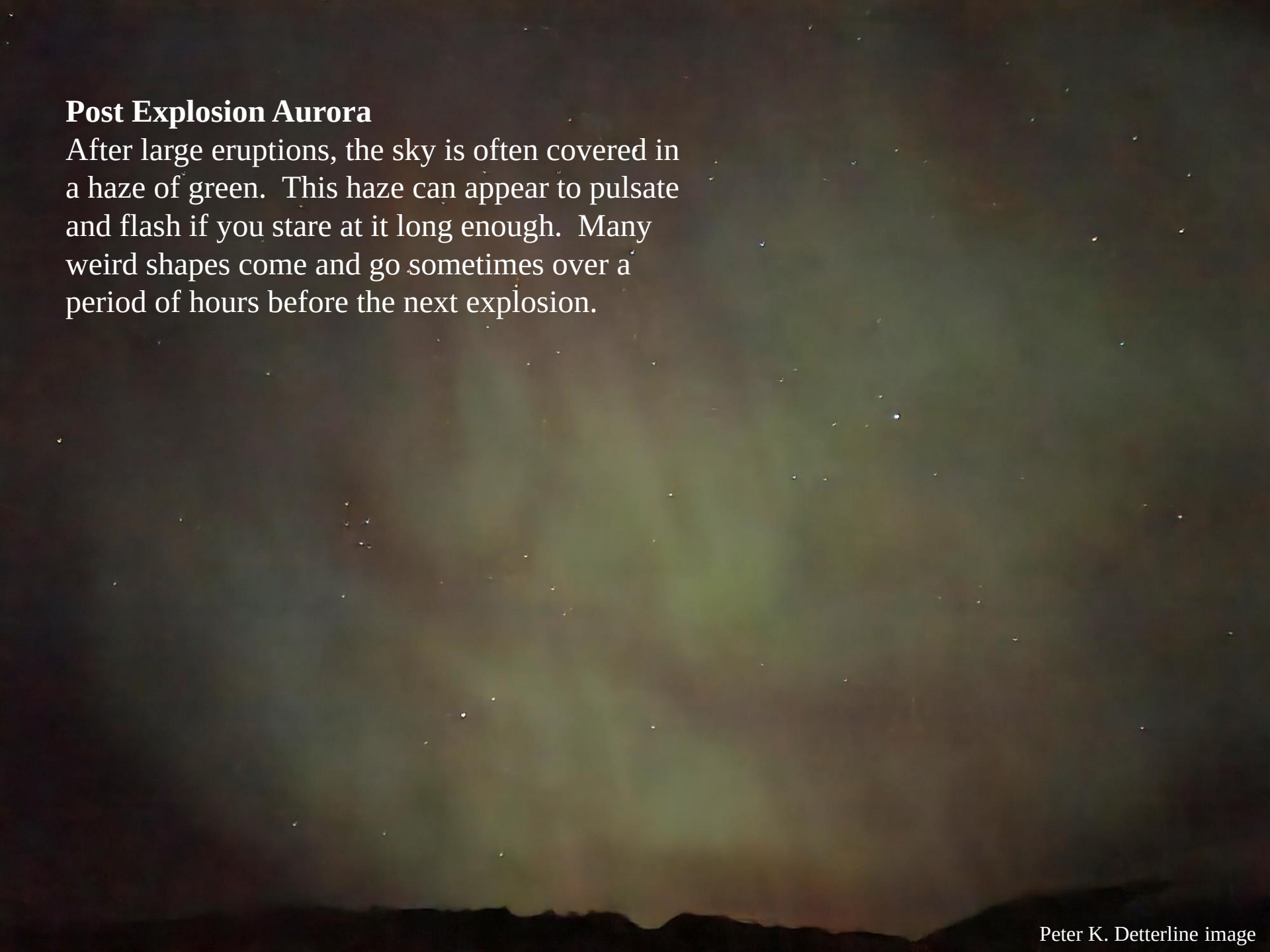
Peter K. Detterline image

Substorm Aurora
The whole sky from north to south can fil
rapidly with fast moving auroras. This ca
coincide with repeated coronas overhead.

Peter K. Detterline image

Swirling
Large swirls can appear in the sky as magnetic lines bend and convolute into different shapes. In some cases all the activity in the sky can be incorporated into one large swirl feature, visibly rotating to the naked eye.

Peter K. Detterline image



Post Explosion Aurora

After large eruptions, the sky is often covered in a haze of green. This haze can appear to pulsate and flash if you stare at it long enough. Many weird shapes come and go sometimes over a period of hours before the next explosion.

Peter K. Detterline image

Aurora
Arnarstapi, Iceland

September 30, 2024

Peter K. Detterline

Night One

Gary A. Becker video

Gary A. Becker video

Gary A. Becker video

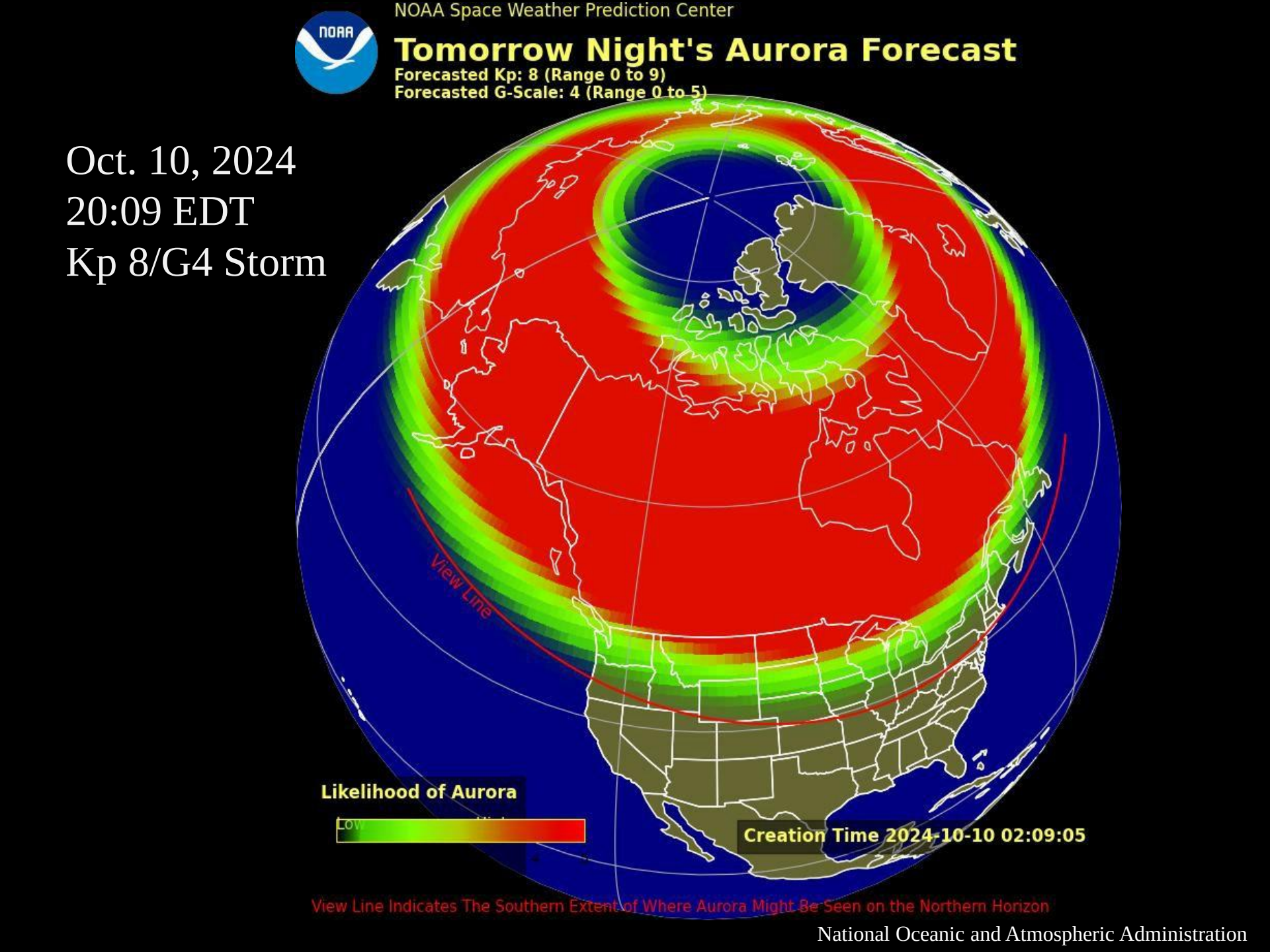

Gary A. Becker video

Aurora FHO

October 8, 2024

Peter K. Detterline


Montana Learning Center, October 10, 2024
Peter K. Detterline


NOAA Space Weather Prediction Center
Tomorrow Night's Aurora Forecast
Forecasted Kp: 8 (Range 0 to 9)
Forecasted G-Scale: 4 (Range 0 to 5)
Oct. 10, 2024
20:09 EDT
Kp 8/G4 Storm
View Line
Likelihood of Aurora
Low
Creation Time 2024-10-10 02:09:05
View Line Indicates The Southern Extent of Where Aurora Might Be Seen on the Northern Horizon
National Oceanic and Atmospheric Administration


Lehigh University near Goodman Field
Jesse Leayman

June 4, 2025-00:44 EDT

SpaceWeatherLive

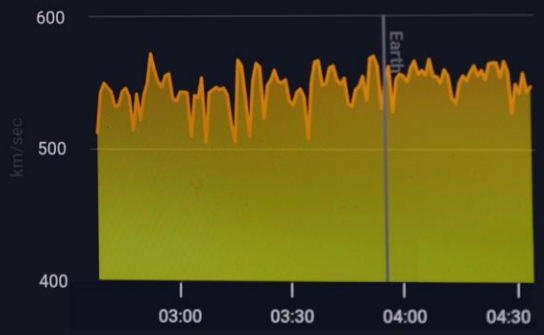
Kp-index

More data | Help | Kp-index forecast

Real Time Solar Wind

With the current speed, it will take the solar wind **45 minutes** to propagate from DSCOVR to Earth.

Solar wind
Speed: 545.6 km/sec



June 4, 2025-00:44 EDT

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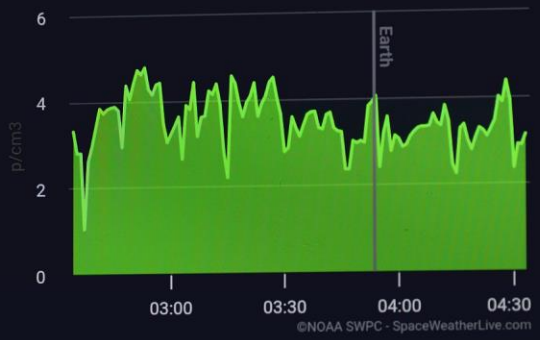
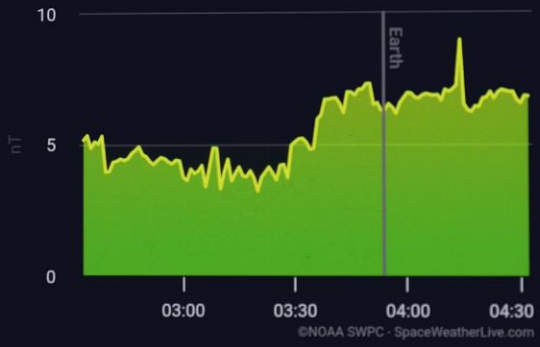
Locally It Was Hazy

SpaceWeatherLive

Density: 3.12 p/cm³



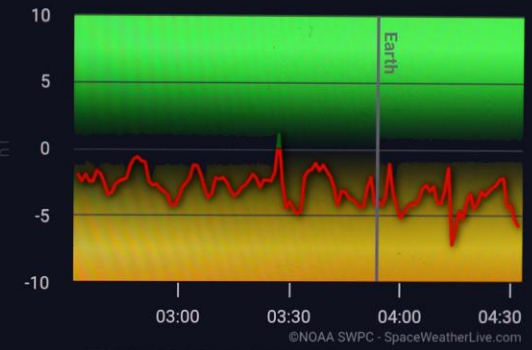
Interplanetary Magnetic Field
Bt: 6.77 nT



June 4, 2025-00:44 EDT

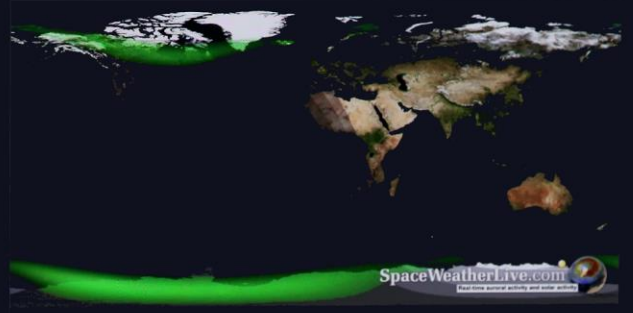
SpaceWeatherLive

Bz: -5.82 nT South



Info | More data | Help

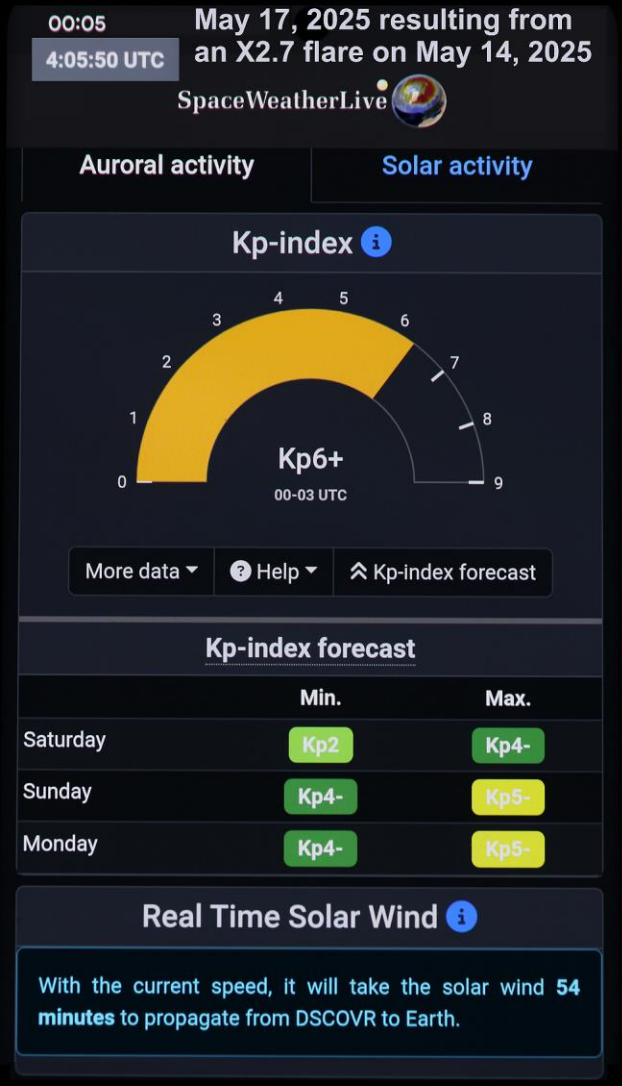
Auroral oval

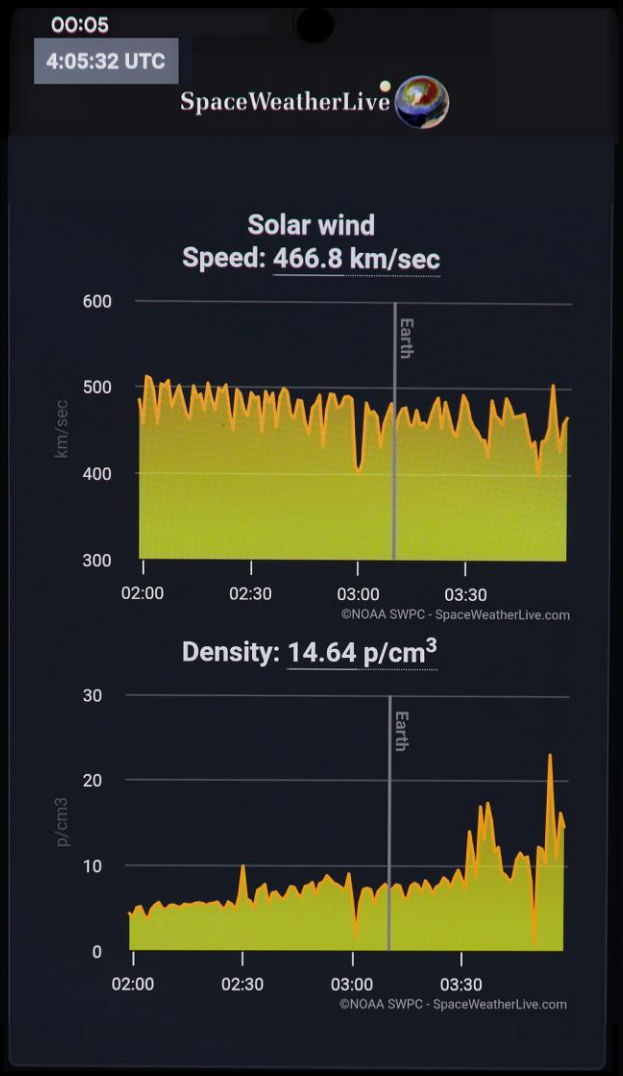


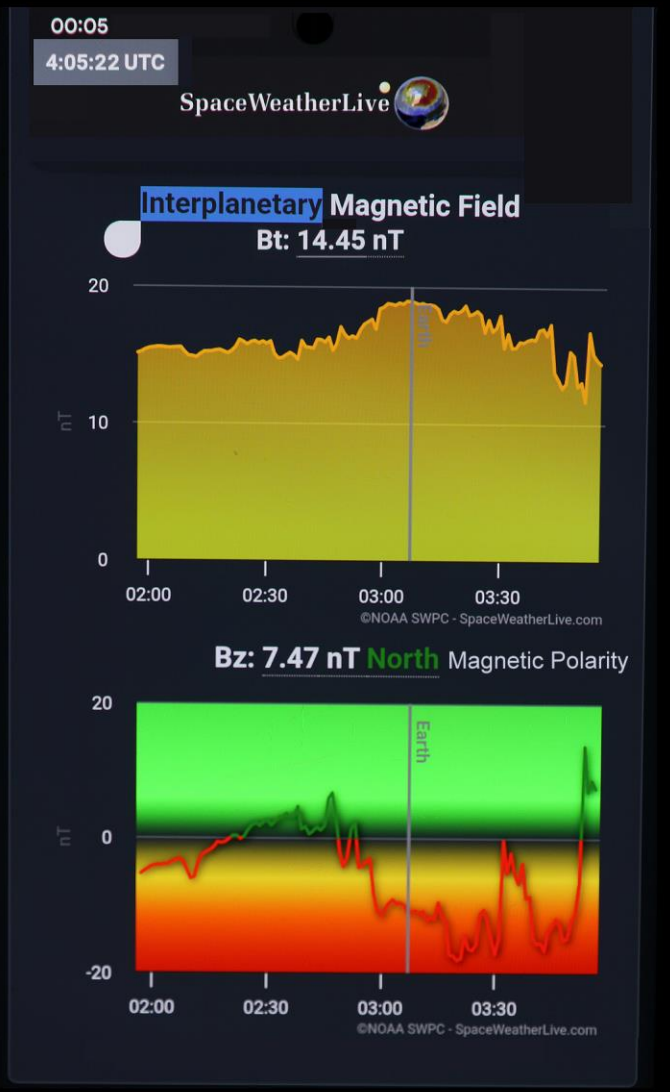
More data | Hemispheric Power

SpaceWeatherLive

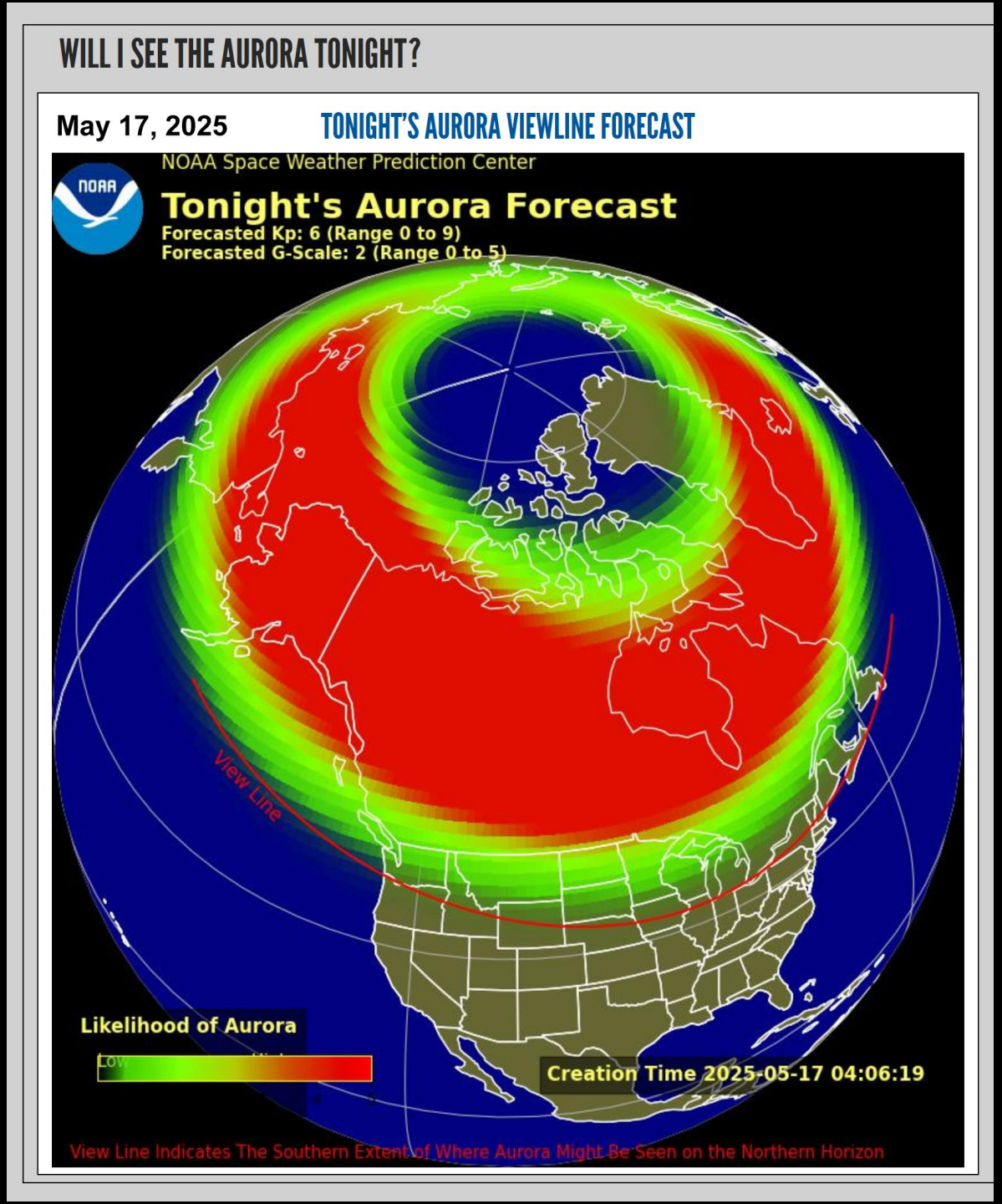
Locally It Was Cloudy







May17, 2025
20:09 EDT
Kp 6.3/G2
Activity



National Oceanic and Atmospheric Administration

12:24 p.m., EDT, June 1, 2025

SpaceWeatherLive

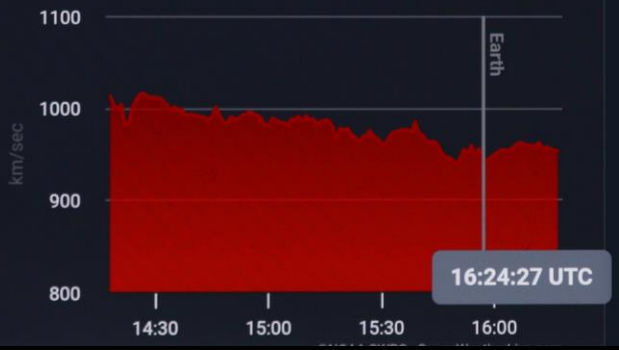
Kp-index

More data | Help | Kp-index forecast

Real Time Solar Wind

With the current speed, it will take the solar wind **26 minutes** to propagate from DSCOVR to Earth.

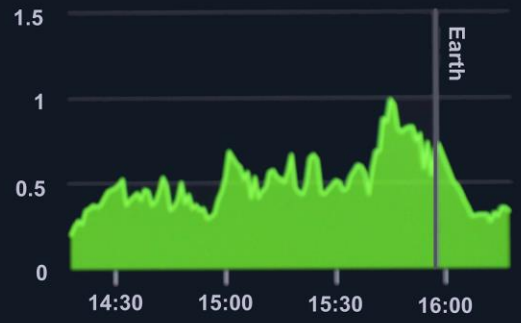
Solar wind
Speed: 952.7 km/sec



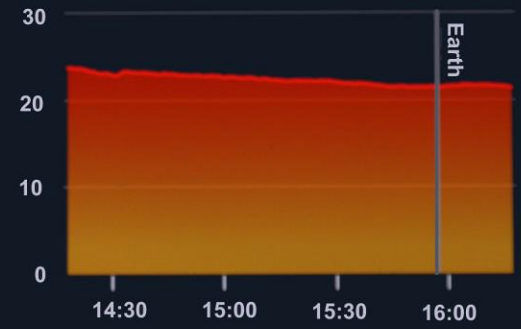
12:24 p.m., EDT, June 1, 2025

SpaceWeatherLive

Density: 0.33 p/cm³



Interplanetary Magnetic Field
Bt: 21:24 nT

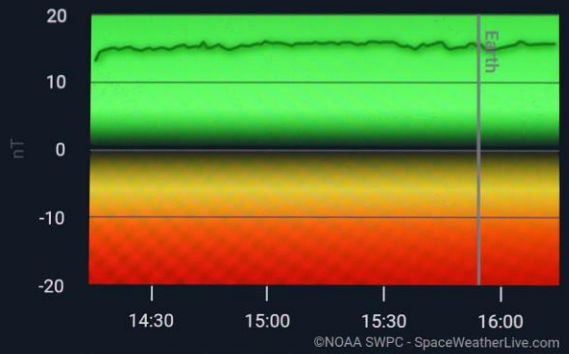


SpaceWeatherLive
Locally It Was Cloudy

12:24 p.m., EDT, June 1, 2025

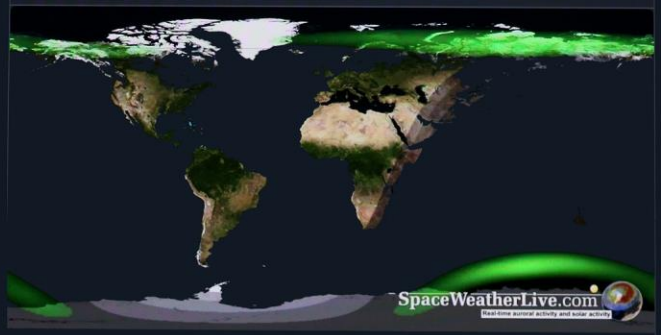
SpaceWeatherLive

Bz: 15.58 nT North



Info | More data | Help

Auroral oval



More data | Hemispheric Power

SpaceWeatherLive/Gary A. Becker

June 2, 2025-21:16 EDT

SpaceWeatherLive

Kp-index

More data | Help | Kp-index forecast

Real Time Solar Wind

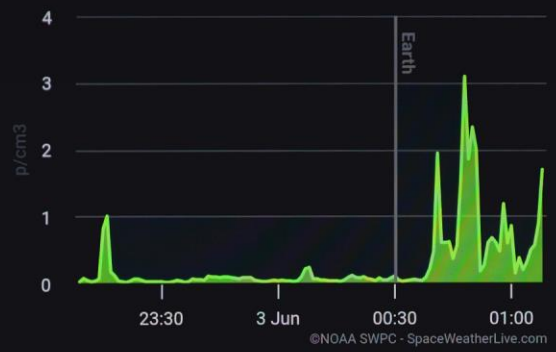
With the current speed, it will take the solar wind **42 minutes** to propagate from DSCOVR to Earth.

Solar wind
Speed: 600.6 km/sec

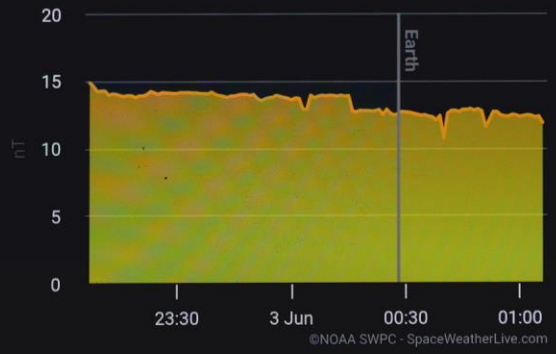
June 2, 2025-21:16 EDT

SpaceWeatherLive

Density: 1.69 p/cm³



Interplanetary Magnetic Field
Bt: 11.83 nT



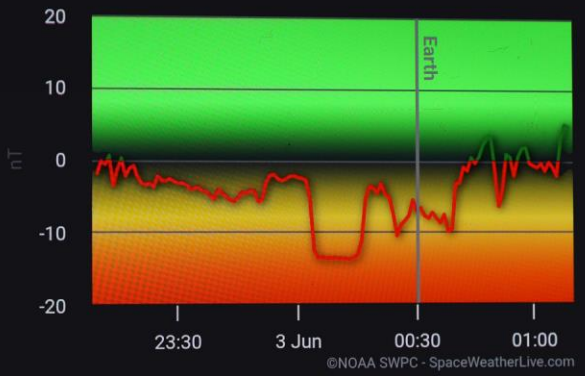
SpaceWeatherLive

Locally It Was Cloudy

June 2, 2025-21:16 EDT

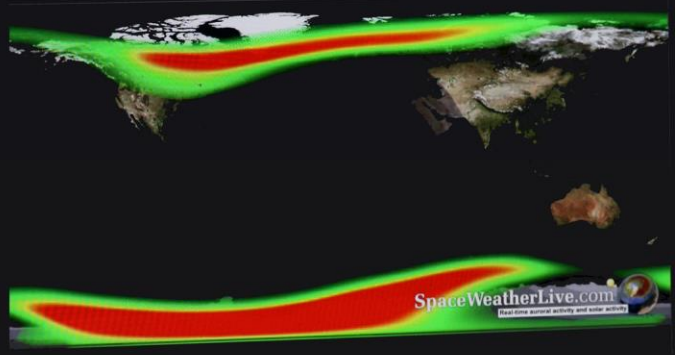
SpaceWeatherLive

Bz: 4.76 nT North



Info | More data | Help

Auroral oval



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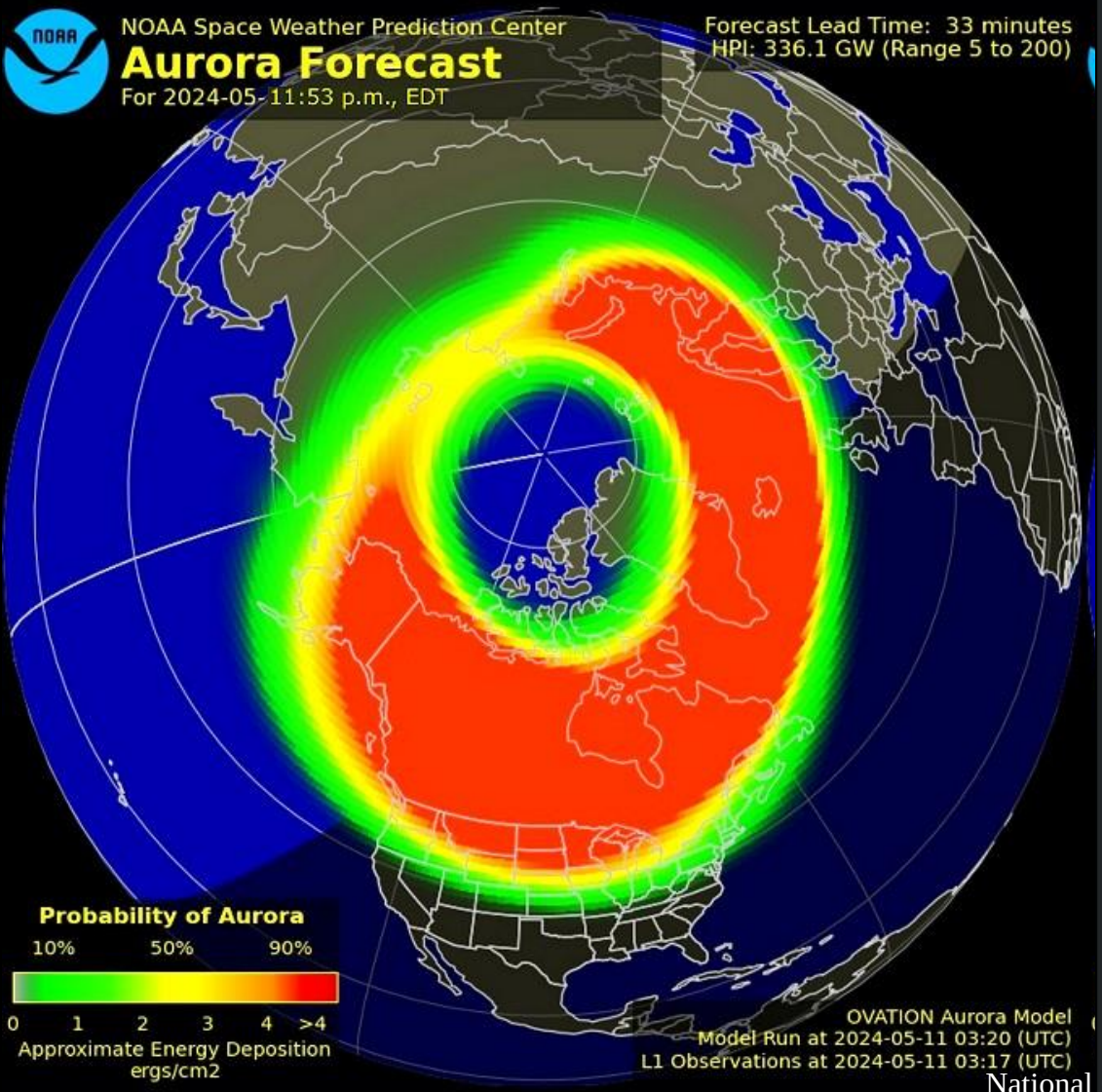
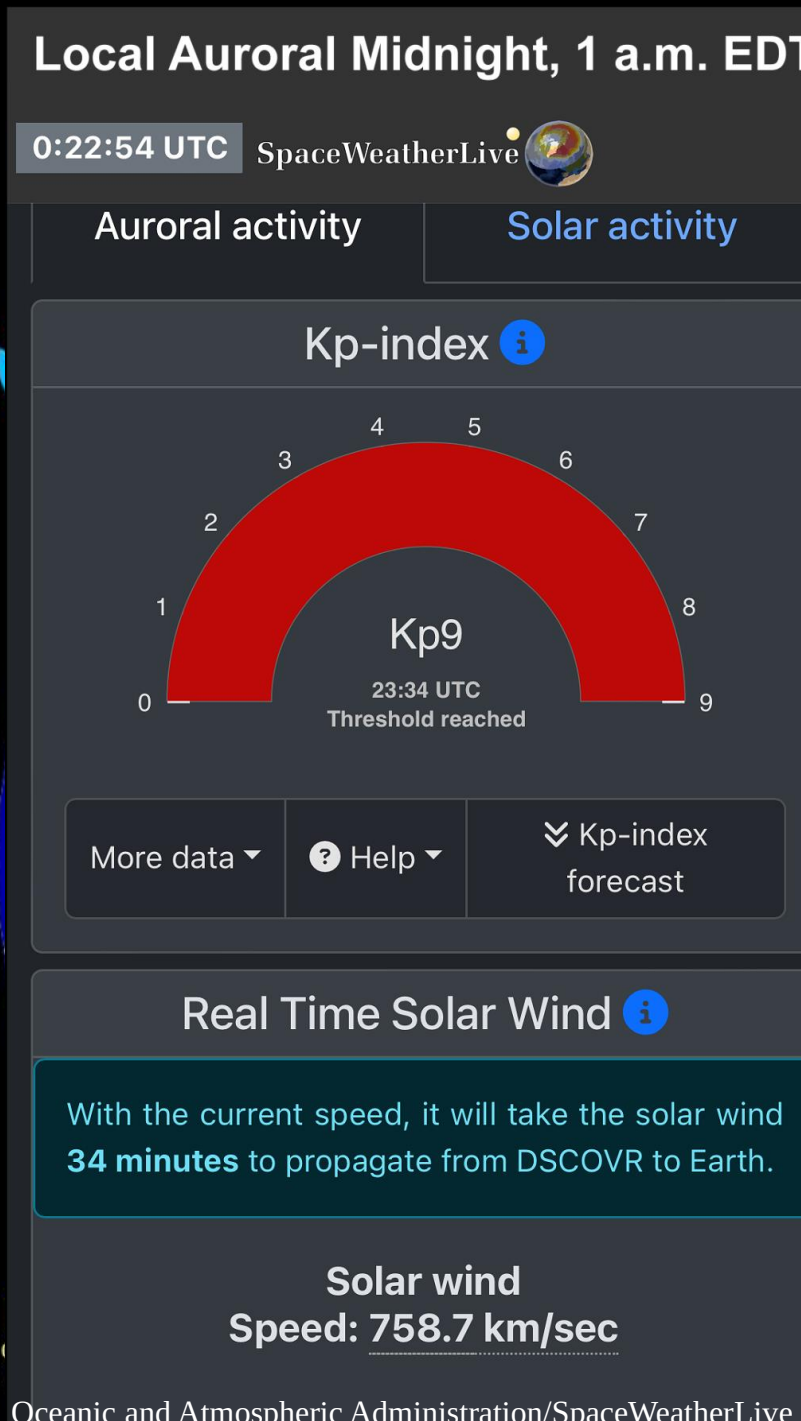
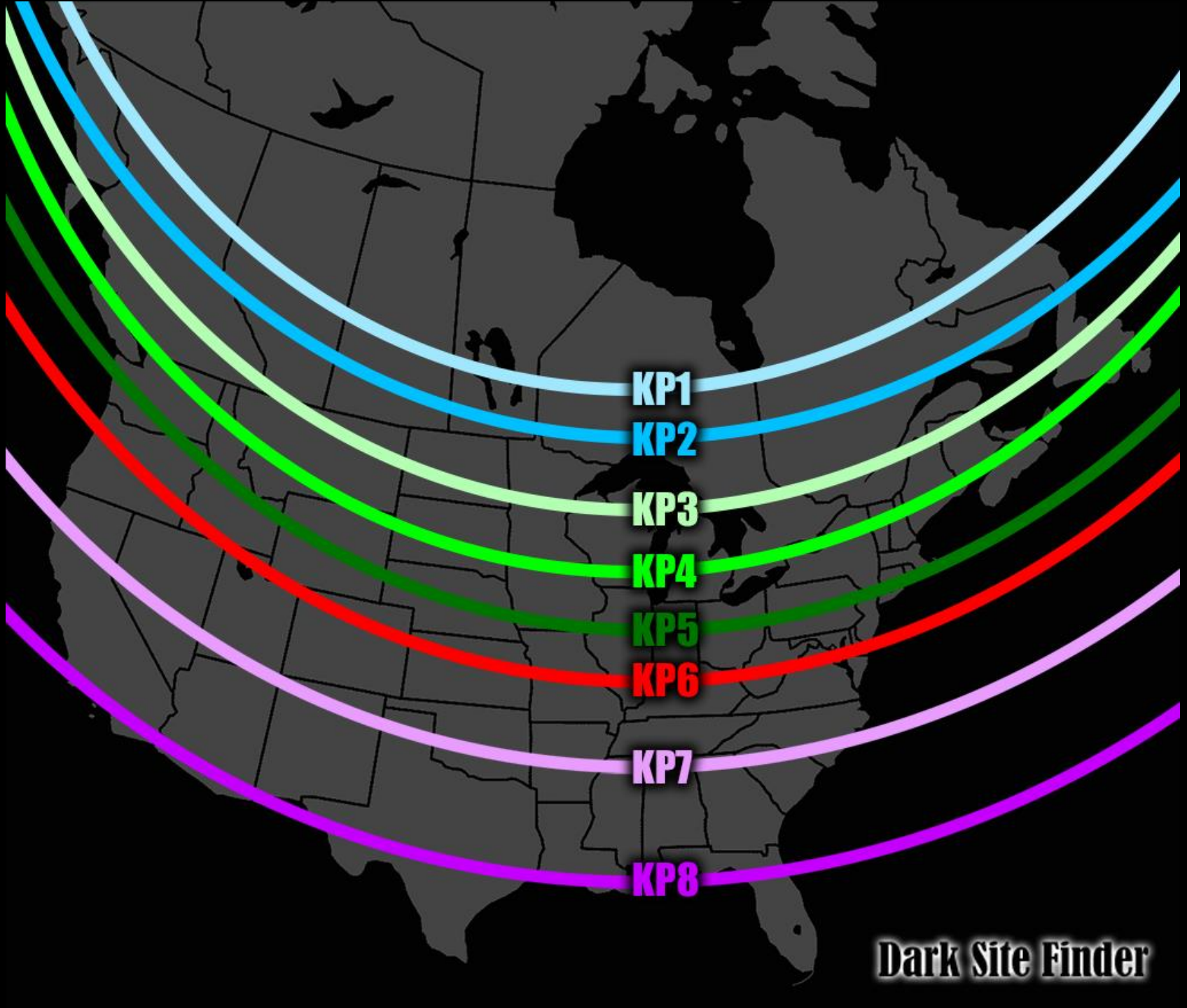
Geomagnetic Storm Of May 10-11, 2024





National Oceanic and Atmospheric Administration/SpaceWeatherLive


KP1
KP2
KP3
KP4
KP5
KP6
KP7
KP8
Dark Site Finder

Flare Intensity and Related Coronal Mass Ejections

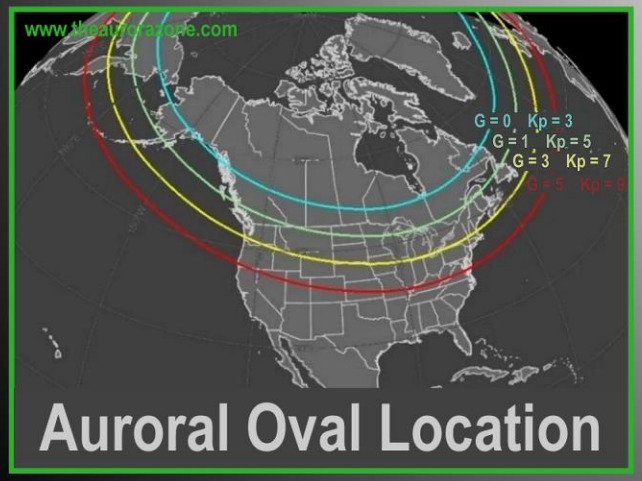
A1-9	Less than 100 nanowatts per square metre
B1-9	Between 100 nanowatts and one microwatt per square metre
C1-9	Between one microwatt and ten microwatts per square metre
M1-9	Between ten microwatts and 100 microwatts per square metre
X1-9	More than 100 microwatts per square metre

Northern Lights: The Definitive Guide to Auroras

Geomagnetic Storms and the Kp Index

G1	Kp5	Minor	Bright auroras at polar latitudes	Approximately 1700 per solar cycle
G2	Kp6	Moderate	Auroras at sub-polar latitudes	Approximately 600 per solar cycle
G3	Kp7	Strong	Auroras at mid-northern latitudes	Approximately 200 per solar cycle
G4	Kp8	Severe	Auroras at mid-southern latitudes	Approximately 100 per solar cycle
G5	Kp9	Extreme	Auroras at tropical latitudes	Approximately 4 per solar cycle

Northern Lights: The Definitive Guide to Auroras



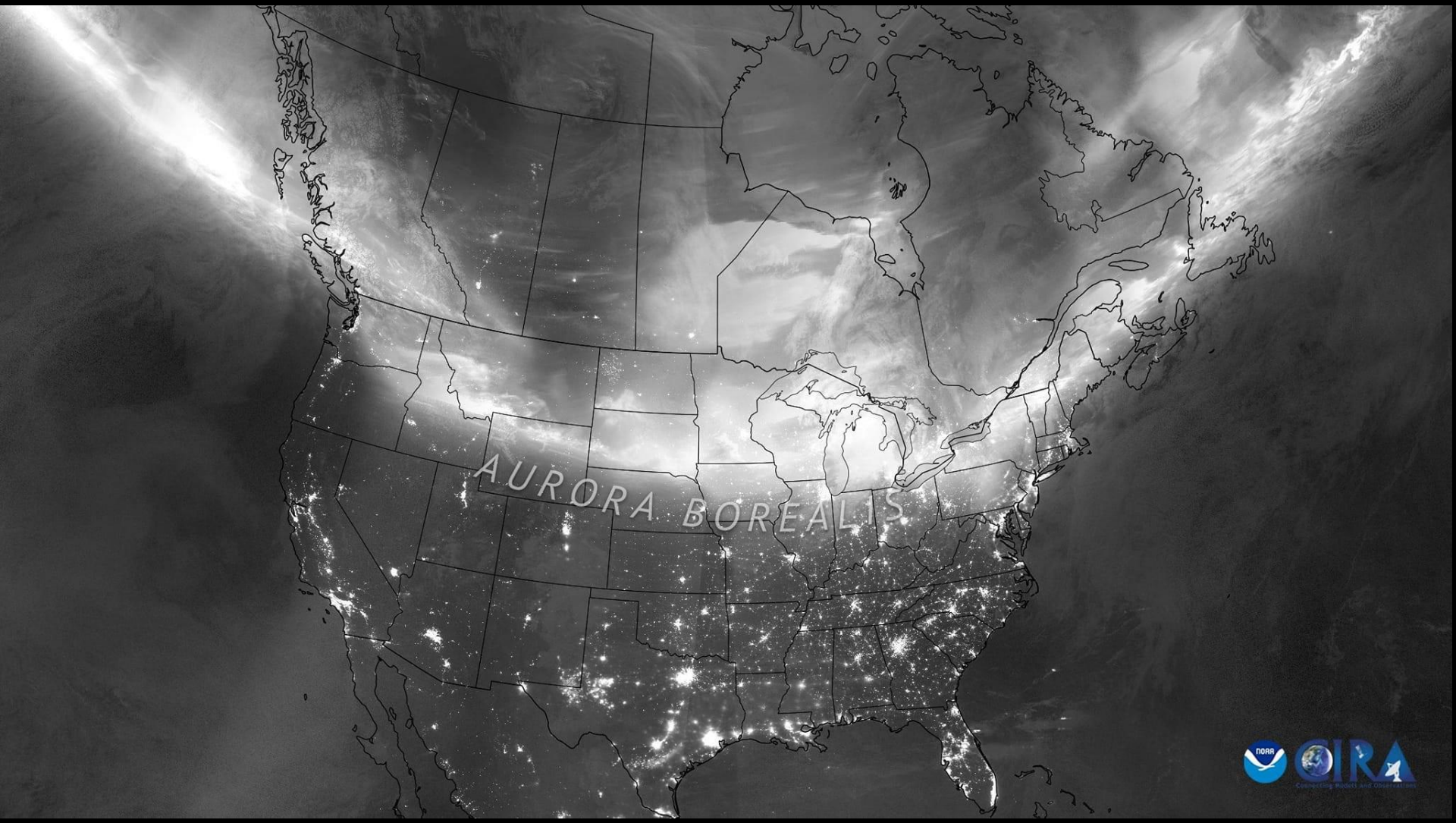
Auroral Oval Location

G-Scale	Kp-Scale	Auroral Activity	Frequency
1	5	Minor Storm	900 days per solar cycle*
2	6	Moderate Storm	360 days per solar cycle*
3	7	Strong Storm	130 days per solar cycle*
4	8	Severe Storm	60 days per solar cycle*
5	9	Extreme Storm	4 days per solar cycle*

www.theaurorazone.com

Gary A. Becker slide

Auroral Oval, May 10, 2024



National Oceanic and Atmospheric Administration

Night One

Gary A. Becker image

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Gary A. Becker image

Gary A. Becker image

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Night Two

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Night Three

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Gary A. Becker image

Gary A. Becker image

Peter K. Detterline image

Finished