



When the Sky Turns On

Follow the Sun's breath all the way to Earth's dancing lights.





What's inside

1	The Sun Sends a Secret	4
2	The Shield Starts to Glow	9
3	The Lights Have Many Homes	14



CHAPTER 1

The Sun Sends a Secret

The northern and southern lights begin far from any snowy field—at the Sun. Our star looks calm from Earth, yet its surface twists, boils, and sends material outward. Follow that secret trip, and you will discover why Earth’s sky can glow.

IN THIS PICTURE

Charged particles stream outward from the Sun in the solar wind.

A Wind of Tiny Sparks

The Sun constantly releases a solar wind. It is not wind like the kind that lifts your hair. It is a stream of charged particles—tiny bits of matter carrying electric charge—flowing through space. Imagine dust blowing from a campfire, except the dust is far too small to see and travels far beyond the planets nearby. This stream spreads in every direction from the Sun. Earth sits inside it all the time. Most days, our planet's invisible magnetic shield handles the flow quietly.

WOW FACTS

Solar wind is always flowing, even when the Sun looks peaceful from Earth.



IN THIS PICTURE

A giant CME surges outward beside the Sun's steady solar wind.



When the Sun Throws a Storm

Sometimes the Sun sends much more than its usual solar wind. A giant cloud can blast away from its outer atmosphere. Scientists call it a coronal mass ejection, or CME: a huge moving cloud of plasma, super-hot charged gas, carrying magnetic fields with it. Picture a puff from a dandelion beside a whole armful of seeds released at once. A CME can carry about a billion tons of plasma and move around a million miles per hour. But it does not always aim at Earth. Auroras need solar material and magnetic fields to arrive in just the right way.

WOW FACTS

A CME can carry about a billion tons of plasma.

IN THIS PICTURE

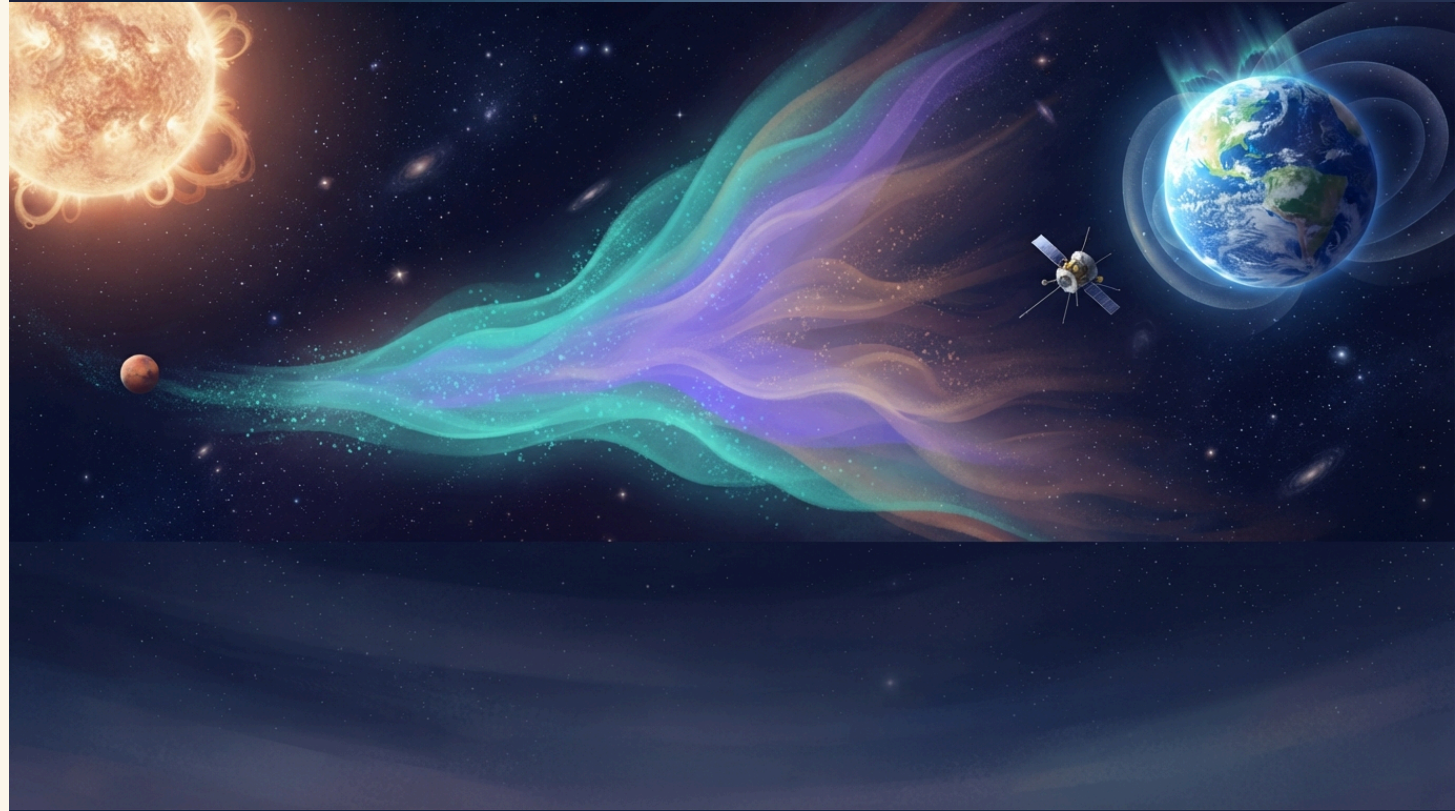
Solar material races across the wide space between Sun and Earth.

Across the Dark to Earth

Space is huge, even for fast particles. If a CME heads our way, it may arrive in only a few hours, or it may take about three days. That sounds quick, but imagine racing across the darkness between worlds with no roads at all. The cloud spreads and changes as it travels. Scientists watch the Sun and spacecraft measurements to learn whether a solar storm is likely to meet Earth. So a bright solar eruption does not automatically mean auroras tonight. First, its material and magnetic fields must reach our planet in a helpful arrangement.

WOW FACTS

A CME can reach Earth in a few hours or take about three days.





Earth's Invisible Bubble

Earth acts a little like a giant bar magnet, but its magnet is invisible. Its magnetic field reaches into space and makes a protective region called the magnetosphere. When solar wind arrives, much of it bends around this bubble, like water splitting around a smooth stone in a stream. On the Sun-facing side, the bubble is squeezed closer to Earth. On the far side, it stretches into a long magnetic tail. This shield does not stop every particle. Later, you will see how some are guided toward the polar skies—high above the ground, never falling onto it.

IN THIS PICTURE *Earth's magnetic bubble bends much of the solar wind around the planet.*



CHAPTER 2

The Shield Starts to Glow

Earth's magnetic shield is not a solid wall. It is more like a huge invisible set of curving slides in space. Near the magnetic poles, some speedy electrons are guided down those slides. Then the very high air begins to shine. You are about to see why the brightest sky lights gather in rings around our planet's ends.



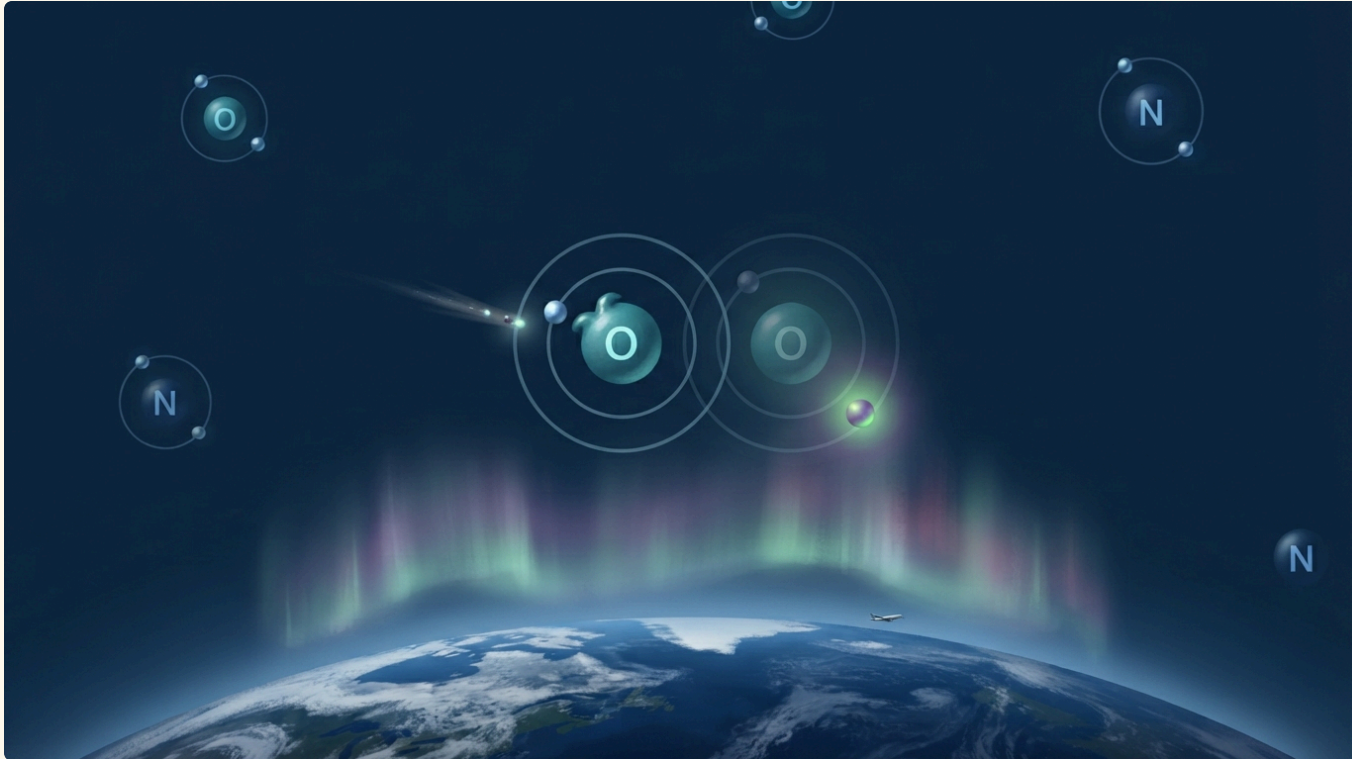
Down the Magnetic Slides

Imagine Earth wrapped in invisible playground slides. These are magnetic field lines: curved paths made by Earth's magnetism. Energetic electrons, tiny particles carrying electric charge, spiral along them instead of flying straight on. The paths bend toward both magnetic poles. There, many electrons enter the upper atmosphere in broad ring-shaped zones called auroral ovals. So the lights do not happen only at the North Pole. A matching oval circles the south magnetic pole, too.

WOW FACTS

The northern lights are aurora borealis; the southern lights are aurora australis.

IN THIS PICTURE *Electrons spiral along magnetic paths into glowing rings near both poles.*



Crash, Calm, Glow

At the end of their magnetic ride, electrons meet the upper atmosphere. An electron can bump into an oxygen or nitrogen atom. That bump gives the atom extra energy, like a shaken bell holding a tiny ring inside. Scientists call this excited. The atom cannot keep that energy forever. As it settles, it releases a speck of light. Countless atoms doing this together make a curtain bright enough for you to see from the ground. The colored particles are not falling down; they are making the air glow.

IN THIS PICTURE *An electron excites an air atom, which gives off light while calming.*

IN THIS PICTURE

Green oxygen glow shines far above an airplane and Earth's weather.

Why Green Wins

Green is the aurora color you will see most often. It usually comes from oxygen about 100 kilometers above the ground. That is far beyond an airplane's usual cruising height and near the edge of space. Between roughly 100 and 200 kilometers up, oxygen often has just the right conditions to release green light after an electron collision. Think of the sky as a giant, thin lamp shade: the light is made high inside it, not painted on its surface. The curtain may seem close, but it is astonishingly far overhead.

WOW FACTS

Auroras usually form about 80–500 kilometers above Earth—far above airplanes.



IN THIS PICTURE

Different gases and heights help color one auroral curtain.



Red Above, Purple Below

Aurora colors are clues about where the glowing air is. Oxygen higher than about 200 kilometers can make a faint, wide red glow. Lower down in the curtain, nitrogen can add blue and purple. Sometimes these colors blend, like light shining through layers of colored glass. But the gases are not dyed red, green, or purple. Each gas gives off certain colors when excited electrons bump it. Watch a real aurora closely and you may spot a red top, a green middle, and violet-blue fringes below—one sky show, made by different air gases.



CHAPTER 3

The Lights Have Many Homes

You have followed the lights from the Sun to Earth's high air. Now zoom far out. Our planet can wear two glowing crowns at once—one around each magnetic pole. You will meet sky stories, visit giant auroras on other worlds, and make your own gentle plan for watching the night.

IN THIS PICTURE

A fox crosses snowy ground beneath an aurora over a Finnish village.

Fox Fires, Sky Stories

People have watched auroras for a very long time and made stories for their mystery. In Finland, the northern lights are called revontulet, or “fox fires.” One Finnish story says an arctic fox swept its tail across snow or mountains, sending sparks skyward. What a picture to carry into a cold night! Science tells a different kind of story: particles from space bump oxygen and nitrogen high above Earth, making those gases glow. A story shares wonder; science tests how the glow happens. Both begin with people looking up carefully.

WOW FACTS

The word revontulet is often translated as “fox fires.”



Bigger Lights in the Solar System

- 1 Astronauts can see auroras sideways as glowing layers and curtains around Earth's atmosphere.
- 2 During stronger geomagnetic storms, Earth's auroral ovals can expand, letting people farther from the poles see them.
- 3 Scientists monitor space weather so they can track changing conditions around Earth.
- 4 Jupiter's auroras can cover an area larger than Earth and are hundreds of times more energetic than ours.



TRY IT!

How to Catch the Sky Turning On

With an adult, make a warm, patient plan for an aurora-watching night.

- 1 With an adult, check a trusted space-weather forecast and choose a clear night with as little city light as possible.
- 2 Dress in warm layers, and bring a thermos, a snack, and a blanket or seat.
- 3 Ask an adult to take you to a safe, familiar viewing spot; stay together and away from roads, water, and steep edges.
- 4 Use a dim red flashlight if you need one, then let your eyes adjust as you watch the northern or southern sky.
- 5 Wait patiently. The lights may be faint, change slowly, or not appear—and the stars are still a wonderful prize.

Do this together with a grown-up.



Check your wonder

1 What is the best explanation for how an aurora begins?

- A. Charged particles from the Sun meet Earth's magnetic shield and some are guided toward the polar sky.
- B. Clouds collect sunlight at night and reflect it near the poles.
- C. Colored dust rises from the ground during cold weather.

2 Why can an aurora glow green, red, blue, or purple?

- A. The particles from the Sun arrive already painted different colors.
- B. Oxygen and nitrogen in the high atmosphere glow after being energized by particles.
- C. The ocean reflects different colors onto the sky.

3 Where are auroras most likely to form?

- A. In oval-shaped regions around both magnetic poles.
- B. Only directly over the North Pole.
- C. Along the equator, where sunlight is strongest.

4 What is a safe, useful plan for looking for an aurora?

- A. Watch from a dark place with a grown-up, dress warmly, and be patient.
- B. Stand on a tall metal object so the lights can reach you.
- C. Look toward the Sun at night without checking the forecast.

ANSWERS 1-A 2-B 3-A 4-A

1. The Sun sends charged particles through space, and Earth's magnetic field guides some high into the polar atmosphere. 2. Energetic particles bump into oxygen and nitrogen, and each gas can release particular colors of light. 3. Earth's magnetic field guides particles into two great auroral ovals, one near each magnetic pole. 4. Auroras are safe to watch from the ground, and dark skies, warm clothes, patience, and space-weather forecasts can help.

New words

aurora

A glowing light show high in the sky, made when particles from space energize gases in Earth's air.

coronal mass ejection (CME)

A huge blast of hot charged gas and magnetic fields from the Sun.

magnetosphere

Earth's invisible magnetic bubble, which helps shield our planet from solar particles.

auroral oval

A giant ring-shaped region near a magnetic pole where auroras often glow.

nitrogen

The most common gas in Earth's air; it can add blue and purple to an aurora.

solar wind

A steady stream of charged particles flowing out from the Sun.

charged particle

A tiny piece of matter, such as an electron, that has electric charge.

magnetic field line

An invisible curved route around Earth that charged particles can spiral along.

oxygen

A gas in Earth's air that can glow green or red in an aurora.

space weather

Changing activity from the Sun that affects the space around Earth.

Where we looked

This book was researched using NASA and NOAA science resources, including Space Weather Prediction Center information about the Sun, Earth's magnetosphere, and auroras.

Solar Activity | NESDIS | National Environmental Satellite, Data, and Information Service

nesdis.noaa.gov

Auroras - NASA Science

science.nasa.gov

Aurora Tutorial | NOAA / NWS Space Weather Prediction Center

spaceweather.gov

Aurora Mysteries Unlocked With NASA's THEMIS Mission - NASA

nasa.gov

Aurora | NOAA / NWS Space Weather Prediction Center

spaceweather.gov

NASA's Webb Reveals New Details, Mysteries in Jupiter's Aurora - NASA Science

science.nasa.gov

APOD: 2025 December 12 - Northern Fox Fires

apod.nasa.gov

Joint Solar Maximum Announcement from NASA and NOAA | NOAA / NWS Space Weather Prediction Center

swpc.noaa.gov

Now you know that the sky can turn on when the Sun, Earth's magnetic shield, and our high atmosphere work together. You know those shimmering colors are glowing gases, far above the ground, around both poles. Keep looking up—and keep wondering what invisible forces might be at work overhead.



THE END

*What part of the Sun's breath might be racing toward
tonight's sky?*



Make this book about your child

Free to try. Scan the code or visit

littlestorybook.ai/books/when-the-sky-turns-on

LITTLE STORYBOOK

littlestorybook.ai