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AURORA IS NATURAL COLOURFUL LIGHT DISPLAYS IN EARTH'S NIGHT SKY AS *AURORA BOREALIS* AND *AURORA AUSTRALIS* AS NORTHERN OR SOUTHERN LIGHTS

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ABSTRACT

An aurora primarily refers to the natural, colorful light displays in Earth's night sky, known as the Northern or Southern Lights. The word originates from Latin, translating to "dawn.

1. The Natural Phenomenon

Also known as polar lights or aurora polaris.

Northern Lights: Technically called *Aurora Borealis*.

Southern Lights: Technically called *Aurora Australis*.

Caused by charged particles from the Sun colliding with Earth's magnetic field.

The collisions excite atmospheric gases, producing dynamic curtains of green, red, and purple light.

2. Roman Mythology: Aurora is the ancient Roman goddess of the dawn. In mythology, she travels across the sky each morning to announce the arrival of the Sun. This mythological tie is where the atmospheric light displays get their name.

KEYWORDS: aurora, light, dawn, aurora borealis, aurora australis, magnetic field, arctic cycle.

INTRODUCTION

The aurora borealis (Northern Lights) occurs in a band called the "auroral zone," which wraps around Earth's magnetic North Pole. The most reliable viewing spots are in regions near or above the Arctic Circle, including.

- **Norway:** Tromsø, Alta, and the Lofoten Islands. Tromsø and the Lofoten Islands are world-famous viewing spots.
- **Iceland:** Reykjavik and the surrounding countryside. Offers widespread viewing opportunities due to its location.
- **Sweden:** Abisko and Swedish Lapland. Ideal aurora-watching locations within the Arctic Circle.
- **Finland:** Finnish Lapland (e.g., Rovaniemi and Utsjoki).
- **North America:** Alaska (Fairbanks), Northern Canada, and Greenland. Prime North American destinations for seeing the lights.

Best Time: The statistical peak months are September/October and March/April, ideally between 11 p.m. and 2 a.m.

Solar Activity: Auroras are driven by space weather. With the sun currently near its peak 11-year activity cycle, geomagnetic storms are frequent, pushing auroras to lower latitudes.

Sky Conditions: You need clear, dark skies far from city light pollution.[1-3]

Figure-1: Aurora borealis.

The aurora borealis, commonly known as the northern lights, is a spectacular natural light display in the night sky. This phenomenon primarily occurs in high-latitude regions near the Arctic. Caused by charged particles from the Sun colliding with Earth's magnetic field, the interaction excites atmospheric gases to produce vibrant waves of color. The vibrant colors you see in an aurora depend entirely on which gas is being struck and at what altitude the collision happens. The spectacular colors of the aurora depend on the type of gas being struck and the altitude at which the collision takes place.

Science and Colors

The Mechanism: Solar winds carry charged particles from the Sun toward Earth.

Magnetic Funnel: Earth's magnetic field redirects these particles toward the magnetic poles.

Atmospheric Collision: Particles crash into oxygen and nitrogen atoms.

Green: The most common color, produced by oxygen at lower altitudes. The most common color. It is caused by energized oxygen atoms colliding at altitudes of about 60 to 150 miles.

Red: A rarer color, emitted by high-altitude oxygen. A rarer color, typically caused by high-altitude oxygen (over 150 miles up) during periods of high solar activity. Rare; produced by collisions with high-altitude oxygen at altitudes above 150 miles.

Blue/Purple: Generated by energized nitrogen. Caused by interactions with nitrogen molecules in the atmosphere.

Best Places to View

Lower Latitudes: Very rarely, intense solar storms and geomagnetic storms cause the lights to stretch toward the equator.

The aurora borealis (Northern Lights) is best viewed in countries that fall within the "aurora zone"—a band between 65° and 75° latitude near the Arctic Circle. The top, most reliable countries to see them include.

Norway: Tromsø and the Arctic Circle are universally regarded as some of the most consistent places in the world for sightings.

Iceland: Offers the unique experience of viewing the aurora against volcanic terrain and glaciers.

An aurora is a natural light display in Earth's sky caused by charged particles from the sun colliding with gases in our upper atmosphere. The phenomenon gets a different name depending on which of Earth's hemispheres it occurs in.

Hemispheric Names

***Aurora Borealis* (Northern Lights):** Occurs in Earth's Northern Hemisphere.

***Aurora Australis* (Southern Lights):** Occurs in Earth's Southern Hemisphere.

The Lights: Both hemispheres share identical, mirroring auroral ovals that encircle the magnetic poles.

Geography: The Northern Hemisphere offers many accessible, populated regions to view the lights. Conversely, the Southern Hemisphere's auroral zone primarily covers remote, icy stretches of Antarctica and the Southern Ocean, making the Southern Lights harder to observe.

Viewing: Auroras are typically concentrated at high latitudes, but intense solar activity can push them toward the equator in both hemispheres.

The *aurora borealis* (Northern Lights) occurs in the Northern Hemisphere. It is predominantly visible in high-latitude regions near the Arctic Circle, including countries like Alaska, Canada, Iceland, Norway, Sweden, Finland, and Russia.

The corresponding phenomenon in the Southern Hemisphere is called the *aurora australis* (Southern Lights). Both are collectively referred to as polar lights, which occur as charged solar particles interact with Earth's magnetic field.[4,5]

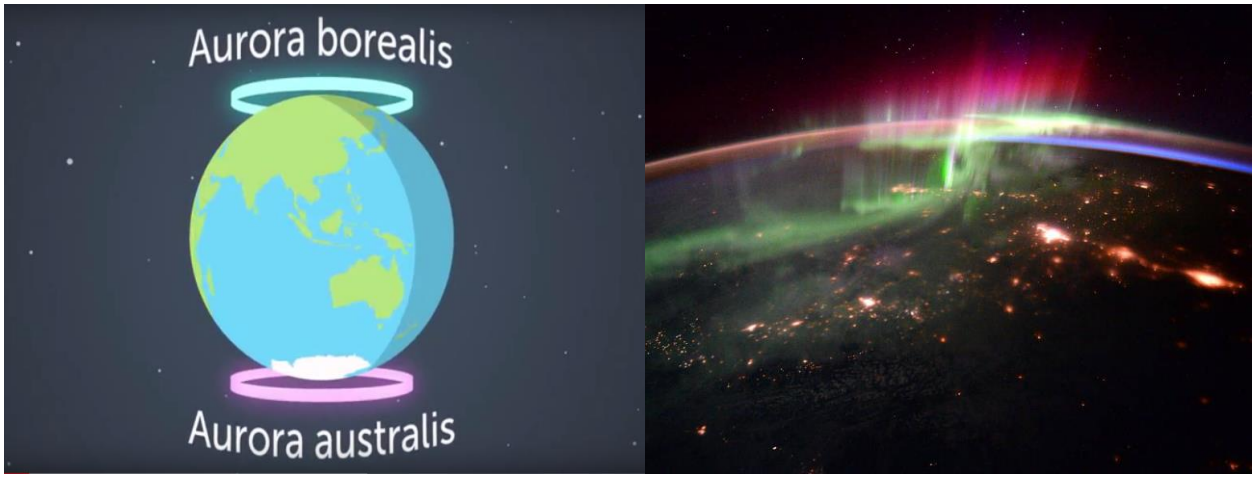

Figure-2: ***Aurora borealis/Aurora australis.***

Finland: Famous for its long, dark winters and glass igloos specifically designed for aurora viewing.
Sweden: Abisko National Park is renowned globally for its clear, microclimate skies that maximize visibility.
Canada: The Northwest Territories (like Yellowknife) and the Yukon provide vast wilderness with minimal light pollution.
United States (Alaska): Fairbanks sits perfectly beneath the auroral oval, offering intense displays.
Greenland: Provides pristine, uninterrupted views across icy landscapes.
Russia: The Kola Peninsula (near Murmansk) is a strong viewing spot during long polar nights.
Norway: Tromsø and the Arctic Circle are universally regarded as some of the most consistent places in the world for sightings.
Iceland: Offers the unique experience of viewing the aurora against volcanic terrain and glaciers.

Finland: Famous for its long, dark winters and glass igloos specifically designed for aurora viewing.

India rarely experiences visible auroras, but high-altitude regions in Ladakh have a chance tonight. Hanle, home to the Indian Astronomical Observatory, is the most promising location. It previously witnessed a rare aurora in January 2026.

The aurora borealis (commonly called the northern lights) is a dazzling natural light display in the night sky, primarily visible in high-latitude regions. It is caused by electrically charged particles from the Sun colliding with gases in Earth's upper atmosphere, creating a glowing, dancing spectacle.

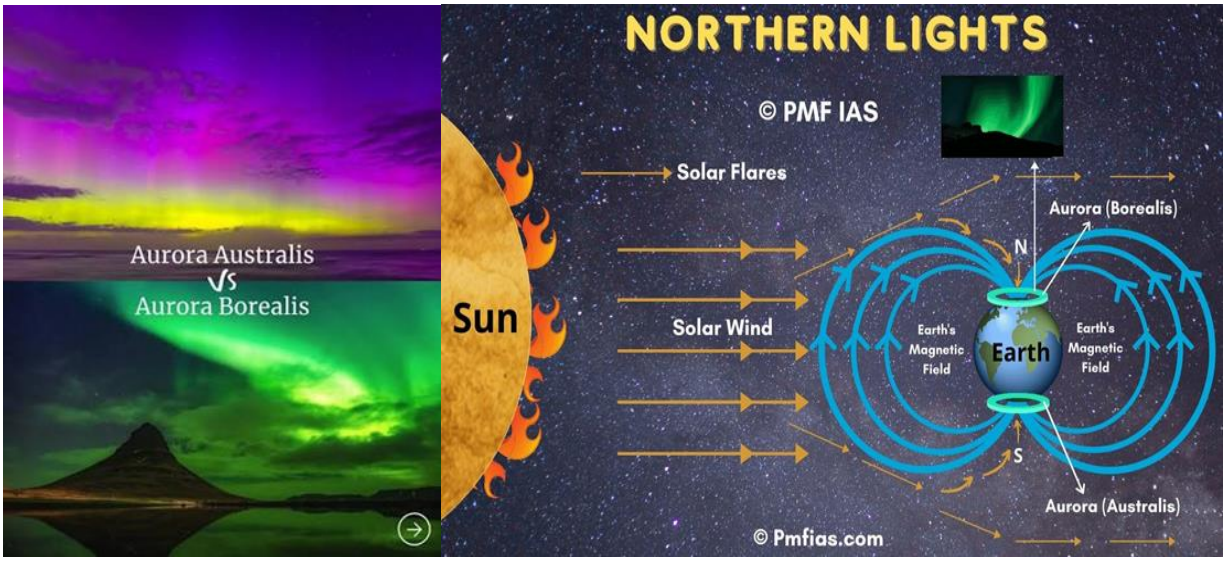

Figure-3: Earth's magnetic field.

The Solar Wind: The Sun constantly emits a stream of charged particles (electrons and protons) known as the solar wind. When the Sun is more active, it ejects denser clouds of these particles.

Earth's Magnetic Field: As these particles reach Earth, they encounter our planet's magnetic field. The magnetic field deflects most of the particles, but it acts as a funnel, directing them toward the North and South magnetic poles.

The Collision & Glow: When the charged solar particles funnel down into Earth's atmosphere (about 60 to 150 miles above the surface), they slam into atmospheric gases like oxygen and nitrogen. These collisions transfer energy, causing the gas molecules to light up and glow, much like an electrified neon sign.

While the same phenomenon occurs in the Southern Hemisphere (called the aurora australis or southern lights), the northern lights are much more accessible to observe because they occur over populated landmasses.

Where: The "aurora zone" forms a ring around the magnetic North Pole. Prime viewing locations include northern Scandinavia (Norway, Sweden, Finland), Iceland, Alaska, and northern Canada.

When: The best time to see the aurora is during the winter months when nights are long, dark, and clear.

The Aurora Borealis, or Northern Lights, are a spectacular natural light display created by the collision of charged particles from the Sun with gases in Earth's upper atmosphere. These energized particles travel along Earth's magnetic field lines and enter the atmosphere near the North and South Poles, causing atmospheric gases to glow in vibrant colors.

How the Northern Lights Happen

The creation of the Northern Lights is a complex but fascinating chain reaction across space. The phenomenon involves a few key steps.

Solar Wind Emission: The Sun constantly emits a stream of highly energetic, charged particles (electrons and protons) known as the solar wind.

Deflection: Earth's magnetic field (the magnetosphere) acts as a shield, deflecting most of these particles away from the planet.

Pole ward Funneling: The magnetic field is weakest at the North and South Poles. Charged particles are redirected and funneled into the atmosphere in a ring around the poles, known as the "auroral oval.

Collisions: The solar particles slam into gases in Earth's atmosphere at incredibly high speeds.

The Glow: These collisions transfer energy to the atmospheric gases, causing them to light up like a giant neon sign.

An aurora (pl. aurorae or auroras) is a natural light display in Earth's upper atmosphere caused by charged particles from the Sun colliding with atoms in the atmosphere. These collisions excite oxygen and nitrogen, which then emit light of different colors such as green, red, and purple. When observed in high-latitude regions they are called polar lights and *aurora polaris*. In the Arctic they are called the northern lights or aurora borealis; in the Antarctic, the term southern lights or *aurora australis* is used. Auroras display dynamic patterns of radiant light that appear as curtains, rays, spirals or dynamic flickers covering the entire sky. The aurora australis or 'southern lights' are the shimmering curtains of green, red and sometimes violet light, appearing in the night sky, around the south magnetic

pole. In the northern hemisphere they are called the aurora borealis or 'northern lights'.[6-8]

Physics: The aurora borealis is a natural light display governed by plasma physics, electromagnetism, and atomic excitation. It is driven by the interaction between the solar wind and the Earth's magnetosphere. Ultimately, the phenomenon operates similarly to a massive neon sign in the upper atmosphere. The aurora borealis is a natural light display driven by space weather and electrodynamics. It occurs when highly energetic, charged particles from the Sun interact with Earth's magnetic field and upper atmosphere. This collision transfers energy to atmospheric gases, which subsequently emit visible light through atomic de-excitation—the same fundamental physics principle behind a neon lamp.

Solar Wind Generation: The Sun emits a continuous stream of plasma called the solar wind. This plasma consists primarily of free electrons and protons. Solar storms and flares expel these particles at speeds up to 1.5 million mph. Solar Emission (The Solar Wind) Plasma generation: The Sun's corona is so hot that gases exist as a plasma, consisting of free electrons and protons. This plasma is continuously ejected into space at speeds up to 1.5 million miles per hour as the solar wind.

Solar storms: Disturbances like coronal mass ejections (CMEs) release massive, highly energized bursts of these charged particles.

Interaction with Earth's Magnetic Field: The Earth's core generates a global magnetic field that traps these charged particles. Instead of striking the planet directly, the particles are deflected and guided along magnetic field lines. These lines funnel the particles into ovals over the magnetic North and South Poles.

Atomic Excitation and Light Emission: The particles plunge into the upper atmosphere (ionosphere) at altitudes of 60 to 250 miles (100 to 400 km).The electrons collide in elastically with atmospheric oxygen and nitrogen atoms. The collisions transfer kinetic energy, bumping the atmospheric electrons into higher energy orbits. When these electrons decay back to their ground state, they release the excess energy as photons (light).

Magnetic Funneling (The Magnetosphere)
Deflection: Earth's intrinsic magnetic field acts as a shield, deflecting most of the solar wind around the planet.

Acceleration: During periods of high solar activity, magnetic reconnection allows energetic particles to penetrate the magnetosphere.

Lorentz force: Charged particles (like electrons and protons) enter Earth's magnetic field and experience the Lorentz force.

Spiraling: This force causes the particles to spiral along magnetic field lines toward the North and South Poles, where the field lines converge and enter the atmosphere.

Atmospheric Excitation and Emission
Inelastic collisions: Spiraling charged particles plunge into the ionosphere (100 to 400 km above Earth) and strike atmospheric atoms (mostly oxygen and nitrogen).

Energy transfer: In inelastic collisions, the incoming solar particles transfer their kinetic energy to the bound electrons of the atmospheric gases

Color Physics
Green (Oxygen, ~60 miles/100 km high): The most common color, resulting from specific atomic transitions.
Red (Oxygen, ~150 miles/240 km high): A rarer emission occurring higher in the atmosphere where oxygen is less dense. **Blue and Purple (Nitrogen):** Emitted when energetic particles strike nitrogen molecules.
Pink (Nitrogen): A rare blend caused by lower-altitude nitrogen being energized during extreme solar storms.

Chemistry: The aurora borealis is a natural light display driven by the excitation and relaxation of atmospheric gases. High-speed charged particles from the solar wind collide with neutral oxygen and nitrogen molecules in the thermosphere. These collisions transfer energy, pushing atomic electrons into higher energy orbits. When the electrons fall back to their ground state, they release this energy as visible light.

Colour Chemistry
Green: Caused by high-energy collisions with atomic oxygen at lower altitudes (60 to 150 miles). This is the most common auroral color.
Red: Produced by atomic oxygen at high altitudes (above 180 miles). This requires highly energetic solar activity.
Blue: Emitted by ionized nitrogen molecules reacting with high-energy electrons.
Purple/Pink: Occurs when blue light mixes with deep red or violet light emitted by nitrogen.

The Underlying Atmospheric Physics
Solar Wind: The Sun emits a continuous plasma stream of electrons, protons, and alpha particles.
Magnetic Deflection: Earth's magnetic field funnels these charged particles toward the magnetic poles.
Ionization and Excitation: Collisions strip electrons from atmospheric atoms or kick them into higher energy levels. **Photon Emission:** De-excitation occurs when electrons drop to lower energy states, emitting specific wavelengths of light.

CONCLUSION

The northern lights (*aurora borealis*) are a natural light show in the night sky. They happen when electrically charged particles from the sun crash into gases in Earth's atmosphere at high speeds. Our planet's magnetic field funnels these particles toward the poles, creating the glowing, dancing waves of color. Auroras are spectacular, dynamic natural light displays that occur in Earth's upper atmosphere. The northern lights are known as the *aurora borealis*, while the southern lights are the *aurora australis*. Both phenomena are caused by the same space weather mechanics, mirroring each other at opposite ends of the globe. *Aurora Borealis* (Northern Lights): This occurs in the Northern Hemisphere. It is primarily visible in high-latitude regions such as Alaska, Canada, Iceland, Scandinavia, and northern Russia. *Aurora Australis* (Southern Lights): This occurs in the Southern Hemisphere. Because the Southern Hemisphere has far less accessible landmass near the magnetic pole, it is typically visible from Antarctica, Patagonia, New Zealand, and Tasmania.

Simultaneous Activity: The auroral ovals in the north and south expand and contract simultaneously. When a massive solar storm hits Earth, both auroras can become visible at much lower latitudes than normal.

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