NORTHERN SEWARD PENINSULA IÑUPIAQ

Kiuġiyaq

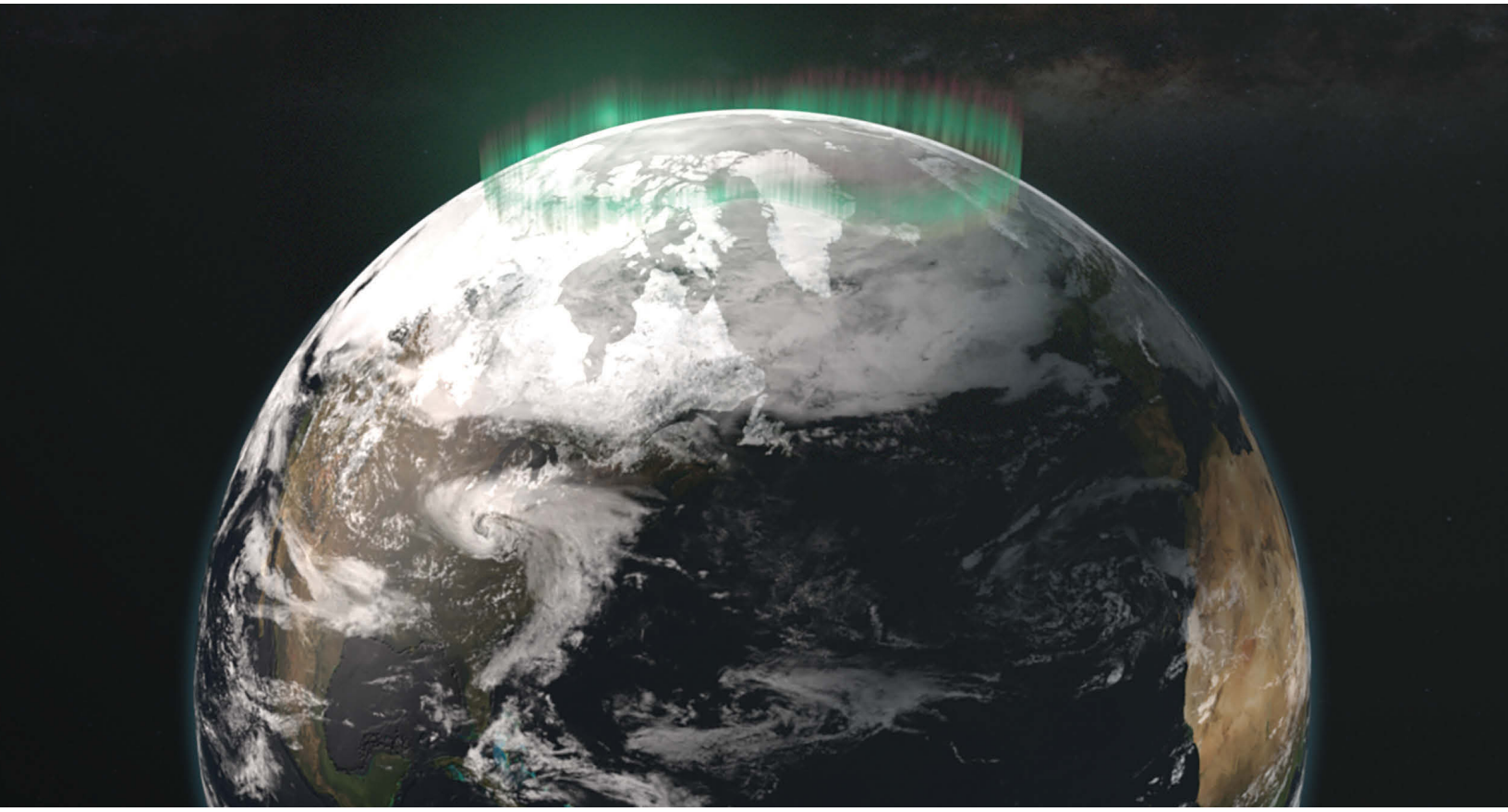
The Northern Lights

Middle School Guide

LEARNING THROUGH
CULTURAL
CONNECTIONS

Kiuġiyat suuvat?

What are the northern lights?



What are the northern lights?

The northern lights, or aurora borealis, are rippling curtains of light that glimmer in the night skies of the far north. The lights form an oval above Earth's circumpolar north. The lights dazzle observers and have sparked centuries of stories and study by those who live beneath their glow. In Iñupiaq, the northern lights are known as **kiuġiyaq**. Have you seen them? Have you heard the stories? What do you know about the **kiuġiyaq**? Have you asked your Elders about the northern lights?

The circumpolar north is the region of Earth that surrounds Earth's geographic north pole.

Ask an Elder:

Iñupiaq values: Respect for Elders

Watch the video: Kiuġuyat: The Northern Lights to learn more about the northern lights. Visit an Elder in your community or invite a group of Elders to your classroom to share their knowledge of the kiuġiyaq.

Iñupiaq Elders May Bernhardt, Jonas Ramoth and Laura Smith, April 2015

Record the interview, if possible.

Write down the name and home community of each Elder who comes to share their knowledge. Ask in Iñupiaq: Sumik kulaiqłiupina kiġiuqzraqmik? (Can you tell me about the northern lights?)

Ask about:

- children's stories about the northern lights
- adult stories and understandings about the northern lights
- where or from whom the Elder learned each story
- songs and dances related to the sun, stars or northern lights
- experiences and observations of the northern lights

Discuss as a class: What did you learn from the Elders? What are some ways that you could pass on what you have learned? How does it relate to what you are learning about the northern lights in class?

Iñupiaq Northern Lights Vocabulary

Iñupiaq values: Knowledge of Language, Cooperation

Would you like to learn more Iñupiaq words and terms related to the northern lights? Work with a classmate or your teacher to practice the vocabulary words and sentences in this booklet using the vocabulary cards provided.

Visit culturalconnections.gi.alaska.edu (Multimedia) to hear and practice vocabulary words.

Kiuġiyat suami pamani itpat?

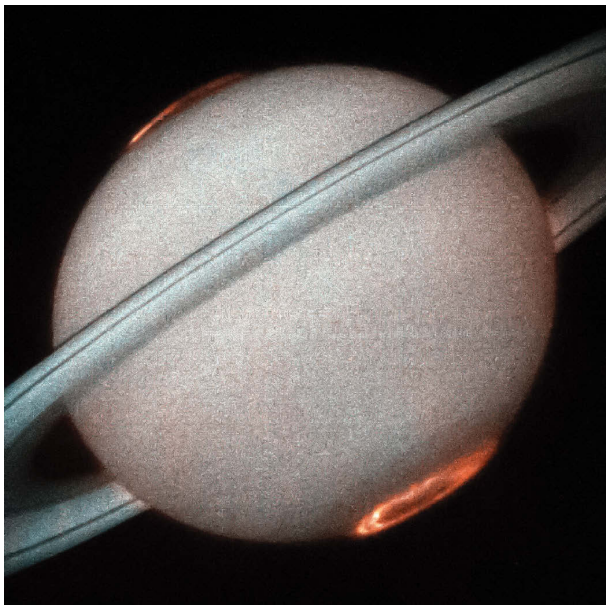
How did the northern lights get there?

photo © Sacha Layos

How did the northern lights get there?

The kiuġiyaq are the result of complex interactions between the sun (mazaq) and Earth (Nunaqpak). Three factors affect the appearance of kiuġiyaq in the sky above a planet.

1. The planet must be in the path of the solar wind.
2. The planets' magnetic field or lack of one influences where the kiuġiyaq appear; and
3. The planet must have a thick atmosphere of gases.



Earth is not the only planet in our solar system that has auroras. Saturn (shown at right), Jupiter, Uranus, and Neptune also have visible auroras.

Hubble Space Telescope image by NASA

Modeling the sun/Earth system:

Iñupiaq values: Cooperation

Use the sun and Earth models in the Learning Through Cultural Connections: The Northern Lights activity kit to set up a scale model of the sun/Earth system. It can be difficult to understand how very large the sun is compared to Earth, and how far away it is. Building a model can help you visualize this concept.

Predict:

How far apart do you think you will have to place the model sun and Earth to create a scale model?

	Actual Diameter	**Model Diameter** (scale 2 billion to 1)
Earth (Nunaqpak)	12,756 km	0.6 cm
sun (mazaq)	1,391,016 km	69.5 cm

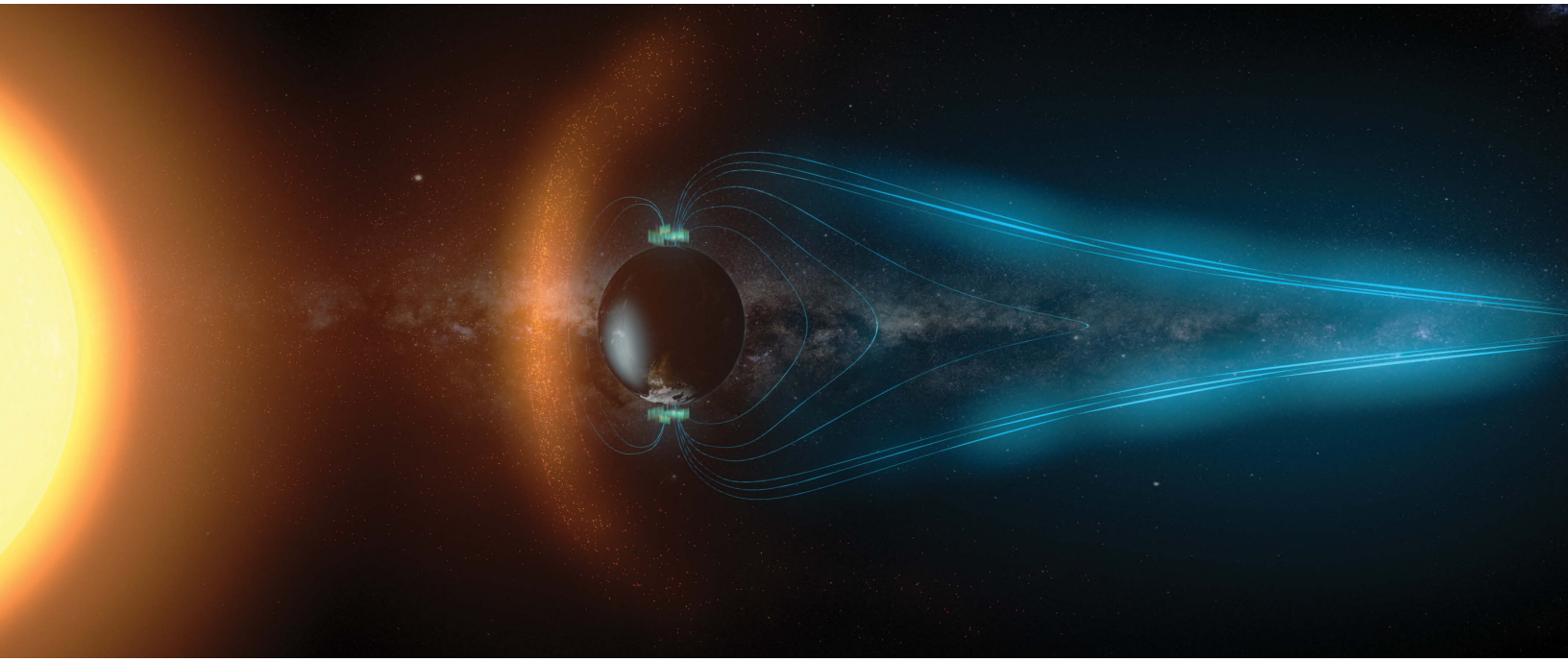
Make your model:

1. Earth is 149,600,000 km from the sun. Divide this distance by 2 billion to calculate how far apart to place the model sun and Earth to create a scale model.
2. There are 1000 meters in a kilometer. Multiply your answer by 1000 m/km to find how far apart, in meters, to place your sun and Earth models.
3. Take the sun and Earth models outside. Use a measuring wheel and work with your classmates to place the sun and Earth models the correct distance apart.

Reflect:

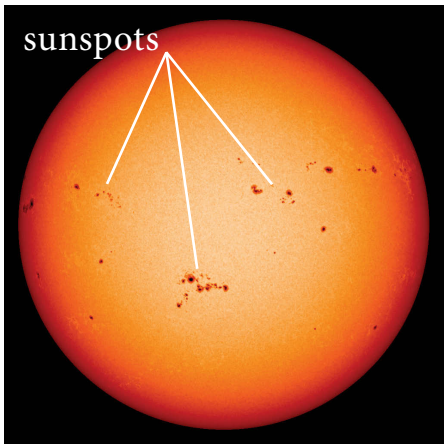
How accurate was your prediction?

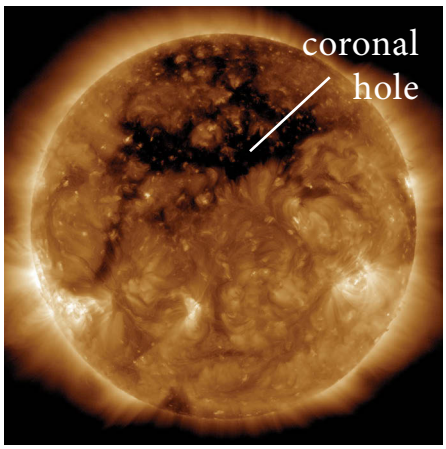
Massam anuġiŋa
Solar wind



What is the solar wind?

Our sun is a super-heated ball made mostly of hydrogen and helium. It looks small because it is very far away, but **mazaq** is actually enormous. The sun is so large that if it were hollow, more than a million Earths could fit inside. Extremely high temperatures cause **mazaq** to emit a constant stream of energized particles from its surface. This highly-charged stream of particles is known as the solar wind, or **massam anuġiŋa** in Iñupiaq. The **massam anuġiŋa** blasts outward in all directions. Violent storms on the surface of the sun can send even more particles erupting into space. These storms often originate from dark spots on the surface of the sun, known as sunspots, or large dark regions on the sun, known as coronal holes. The sunspots and coronal holes are temporary. Sunspots usually last about a week, while coronal holes often last a year. Some of the particles from solar storms and from the **massam anuġiŋa** travel toward Earth. These energized particles are an essential ingredient for Earth's northern lights.

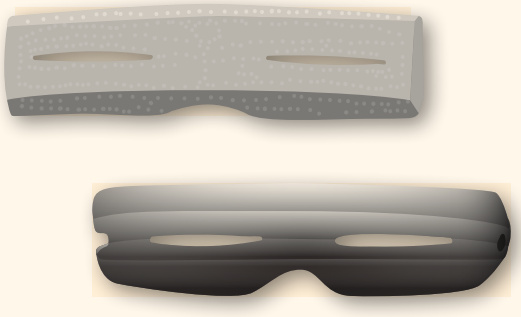




NASA images

Sunspot Viewer:

Iñupiaq values: Cooperation, Respect for Nature



Snow goggles

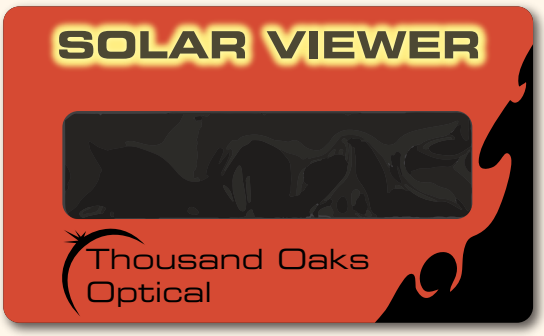
It is not safe to look directly at the sun. Very bright light can damage your eyes. Iñupiaq hunters have been aware of this for centuries. Traditional snow goggles limit the amount of light that can enter the eye, protecting it from the bright sunlight reflected off the snow.

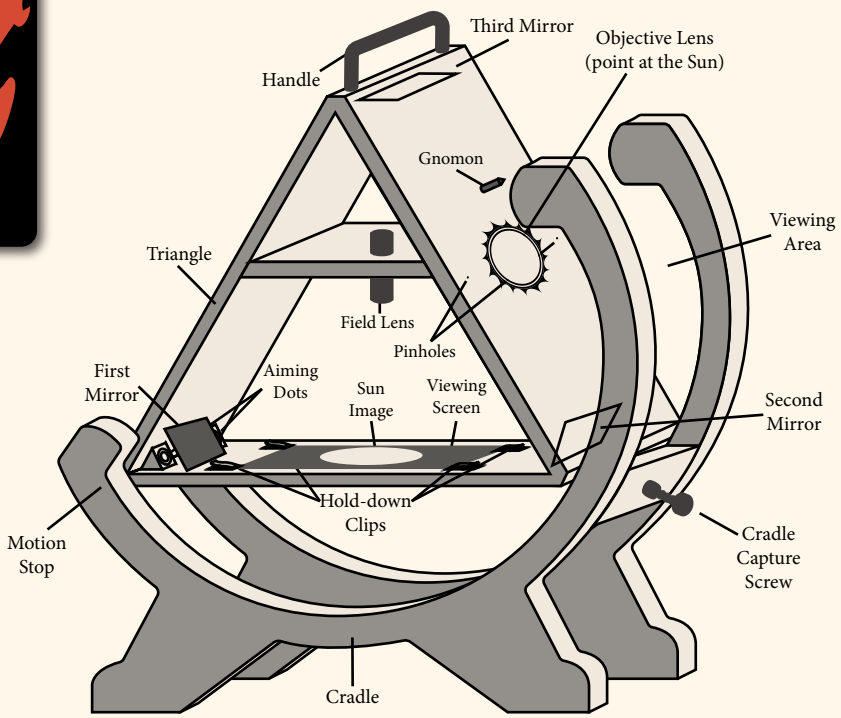
Visit culturalconnections.gi.alaska.edu and try the Sun multimedia activity to learn more about the role of the sun and sunspots in creating the northern lights.

Use a sunspotter or a solar viewer to safely observe the sun. A sunspotter will allow you to safely observe the surface of the sun, by projecting an image of the sun onto a piece of paper. A solar viewer allows you to safely observe the sun through a filter that protects your eyes. With both tools, you will be able to see sunspots, where solar storms often originate.

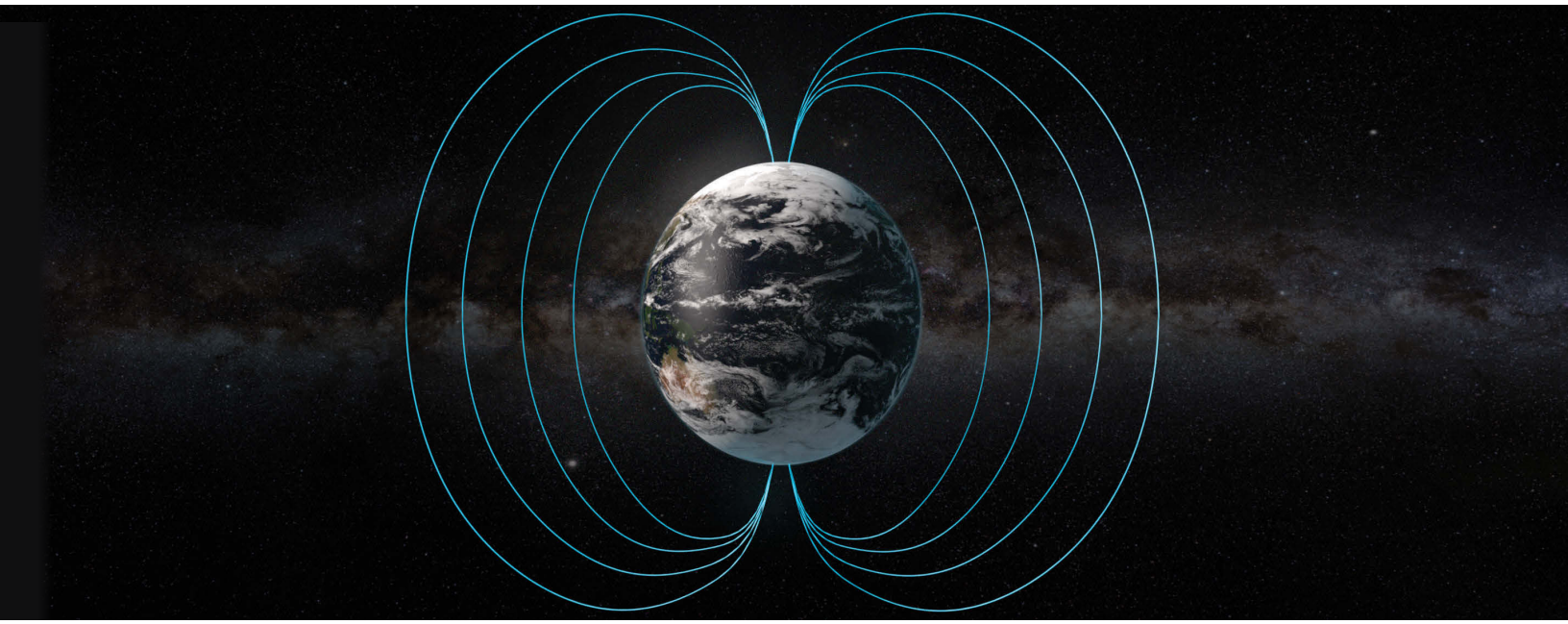
Record your observations by drawing the sun image that you see. Identify the sunspots on your drawing.

Discuss: If you looked at the sun again in a few days, what changes could you expect?





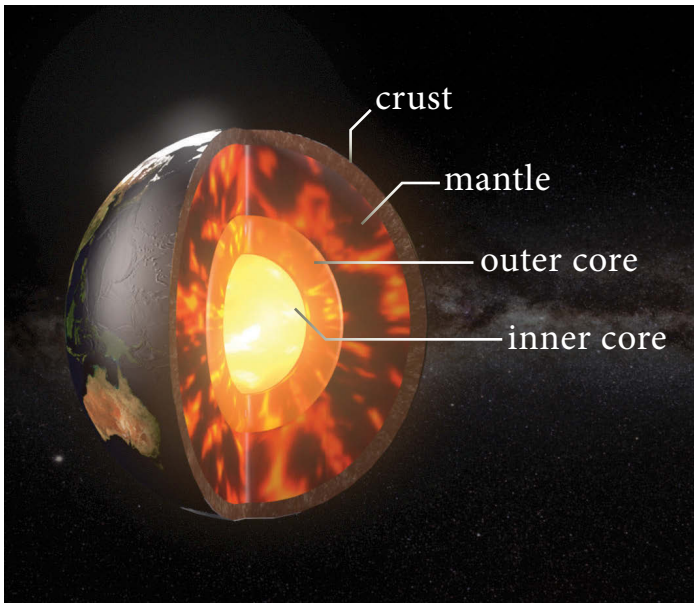
Earth's Magnetic Field



What is a magnetic field?

Earth, or Nunaqpak, is surrounded by a powerful magnetic field. Earth's magnetic field is generated from deep within its layers. The outermost layer of Nunaqpak is the known as the crust. The plains, riverbeds and ocean floors are part of Earth's crust. Beneath the crust is a thick mantle, a liquid outer core, and a solid inner core. Earth's liquid outer core is composed of molten iron and nickel. These magnetic liquids move and generate a powerful magnetic field around Nunaqpak. The field is similar in shape to the field around a bar magnet.

Earth's magnetic field extends far into space. It acts as a barrier to the energized particles that travel toward Nunaqpak on the solar wind. The particles constantly bombard the magnetic field, compressing it on the side closest to the sun, and stretching it into a long tail on the side of Nunaqpak that faces away from the sun. Most of the charged particles are deflected around Earth by the magnetic field. Some of the particles are not deflected around Nunaqpak, and instead get caught in the magnetic field and travel along the magnetic field lines toward Earth's poles. As the charged particles get close to Earth, they enter Earth's atmosphere.



Invisible Magnetic Fields:

Iñupiaq values: Sharing, cooperation

What shape is Earth's magnetic field? How does it protect Earth? Visit culturalconnections.gi.alaska.edu. Try the Magnetic Earth multimedia activity to learn more about Earth's magnetic field.

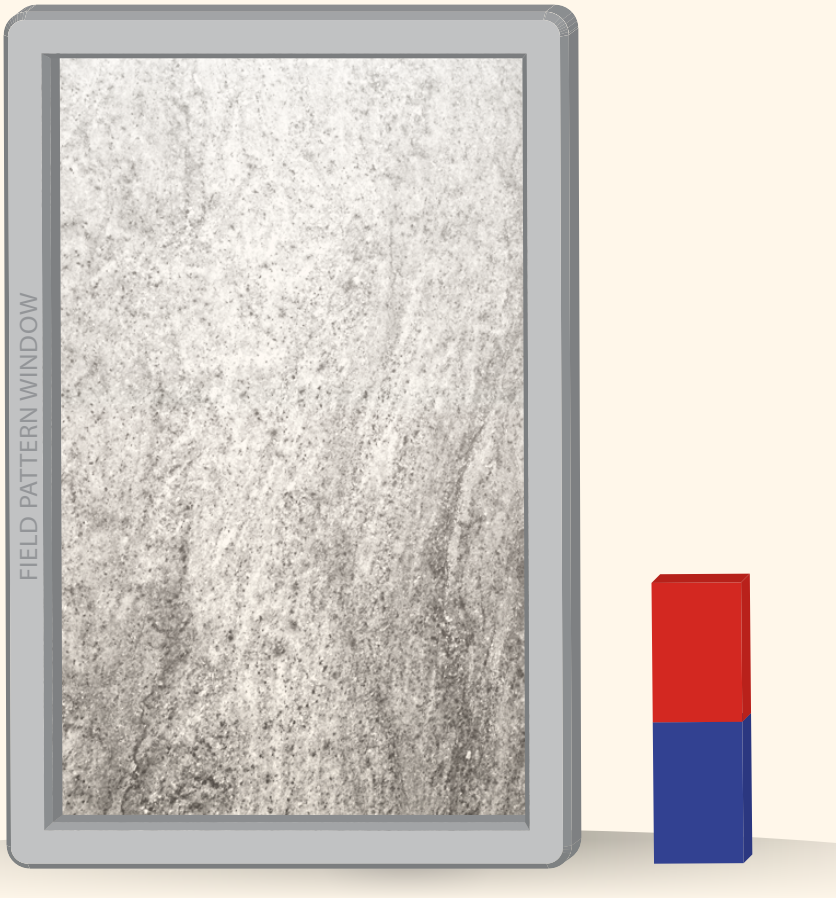
Earth's magnetic field is similar to the magnetic field around a bar magnet. Discover the invisible magnetic field around a bar magnet using a magnetic field observation window and the magnets in your Learning Through Cultural Connections: The Northern Lights Activity kit.

Materials:

- Magnetic field observation window
- Bar magnets
- White paper, light box or LED light pad (optional)

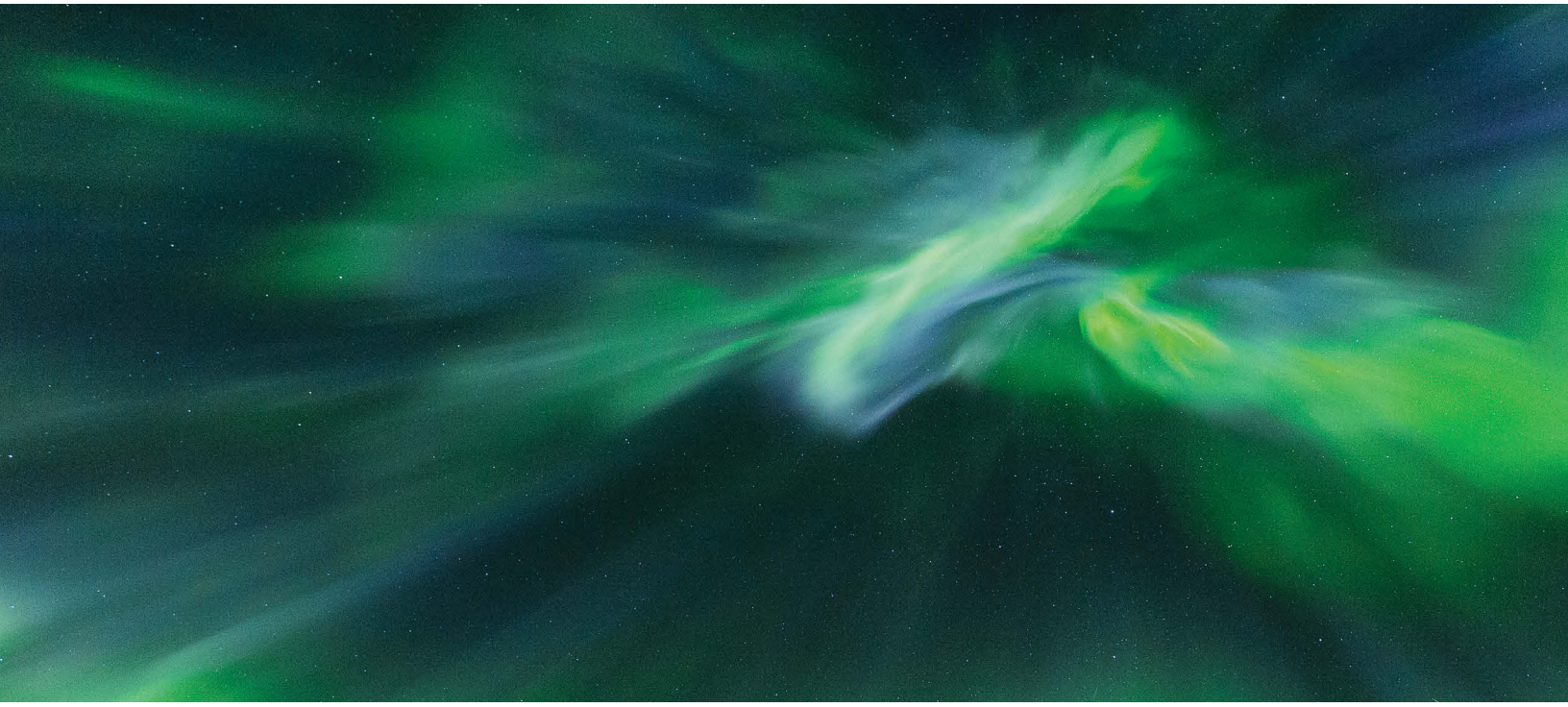
Procedure:

1. Work with a partner or small group. Tip the observation window so the iron filings settle to the bottom.
2. Place a bar magnet in the center of the window. Hold it in place and flip the window so that the iron filings flow past the magnet. Watch the iron filings move to reveal the magnetic field!
3. Without moving the magnet, set the window on a white surface or a light pad.
4. Sketch what you see. Where is the magnetic field the strongest? What shape is it? How is this similar to the magnetic field around Earth? How is it different? How does Earth's magnetic field relate to the northern lights?



Sila
Atmosphere

photo © Sacha Layos



What is the atmosphere?

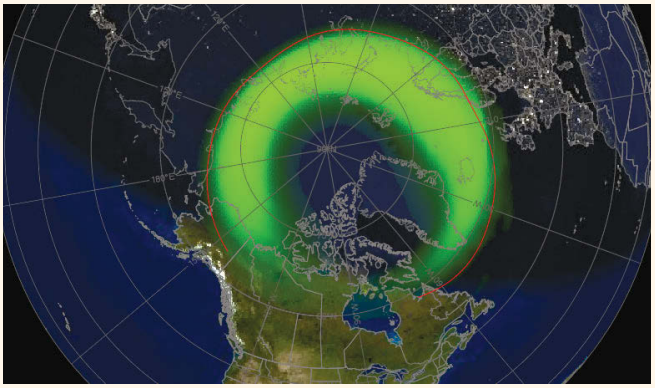
Earth's atmosphere is a thick blanket of gases that surrounds **Nunaqpak**. The Iñupiaq word for atmosphere is **sila**. The **sila** is made mostly of nitrogen and oxygen. When charged particles carried by the solar wind collide with gas particles in the **sila**, some of the energy from the solar particles is transferred to the gas particles. This excites the gas, causing it to glow with a light that we know as the northern lights. Different gases produce different colors. Red and green are caused by energized oxygen at different altitudes. Pale purple, which can appear white or light blue to the human eye, is caused by energized nitrogen.

ACTIVITY 6

Aurora Ovals

Iñupiaq value: Respect for Nature

Visit culturalconnections.gi.alaska.edu (Multimedia) to learn more about why the aurora forms an oval over Earth's geomagnetic north pole.



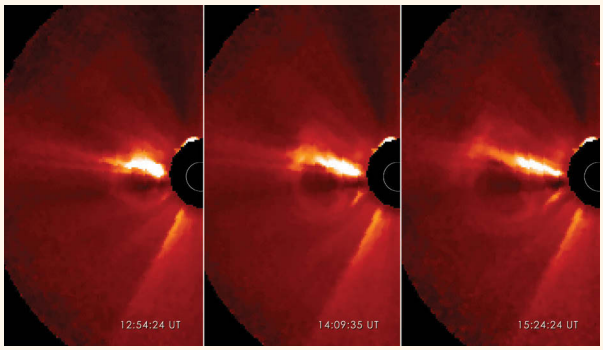
NOAA/POES

Be an Aurora Forecaster

Iñupiaq value: Respect for Nature

We can predict when the northern lights are likely to occur by monitoring solar activity. When a solar storm such as a coronal mass ejection occurs on the side of the sun facing Earth, scientists at NASA use satellites to detect the storm and determine how fast the particles are traveling. You can use this information to predict when the particles will reach Earth and create an aurora. It takes 1-4 days for highly charged solar particles to reach Earth.

NASA/STEREO

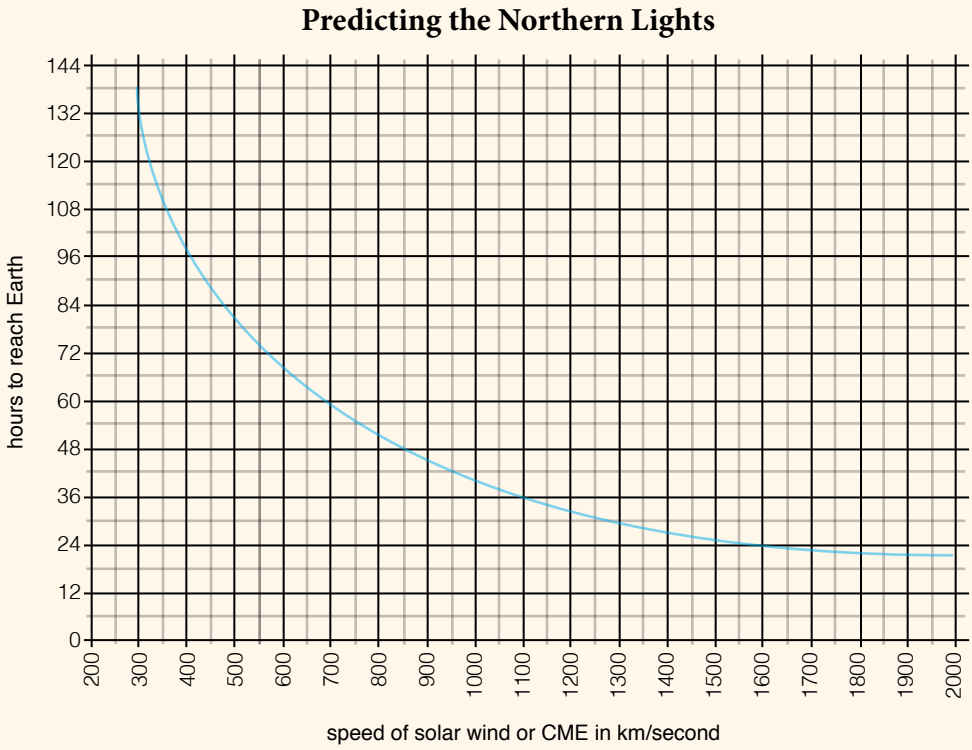


This triptych shows a coronal mass ejection, or CME, as it burst off of the sun on January 13, 2013. The images were captured by NASA's Solar Terrestrial Relations Observatory (STEREO).

Try it!

On January 13, 2013 at 2:24 AM Eastern Standard Time, the sun erupted with an Earth-directed coronal mass ejection or CME. The CME left the sun at speeds of 531 kilometers per second. (Karen Fox, NASA Goddard)

Use the graph: Find the speed of the CME on the graph to find how long it will take to reach Earth



Make your prediction: When do you predict that the CME will reach Earth and cause northern lights displays? Hint: Add the number of hours on you found on the graph to the day and time the CME left the sun.

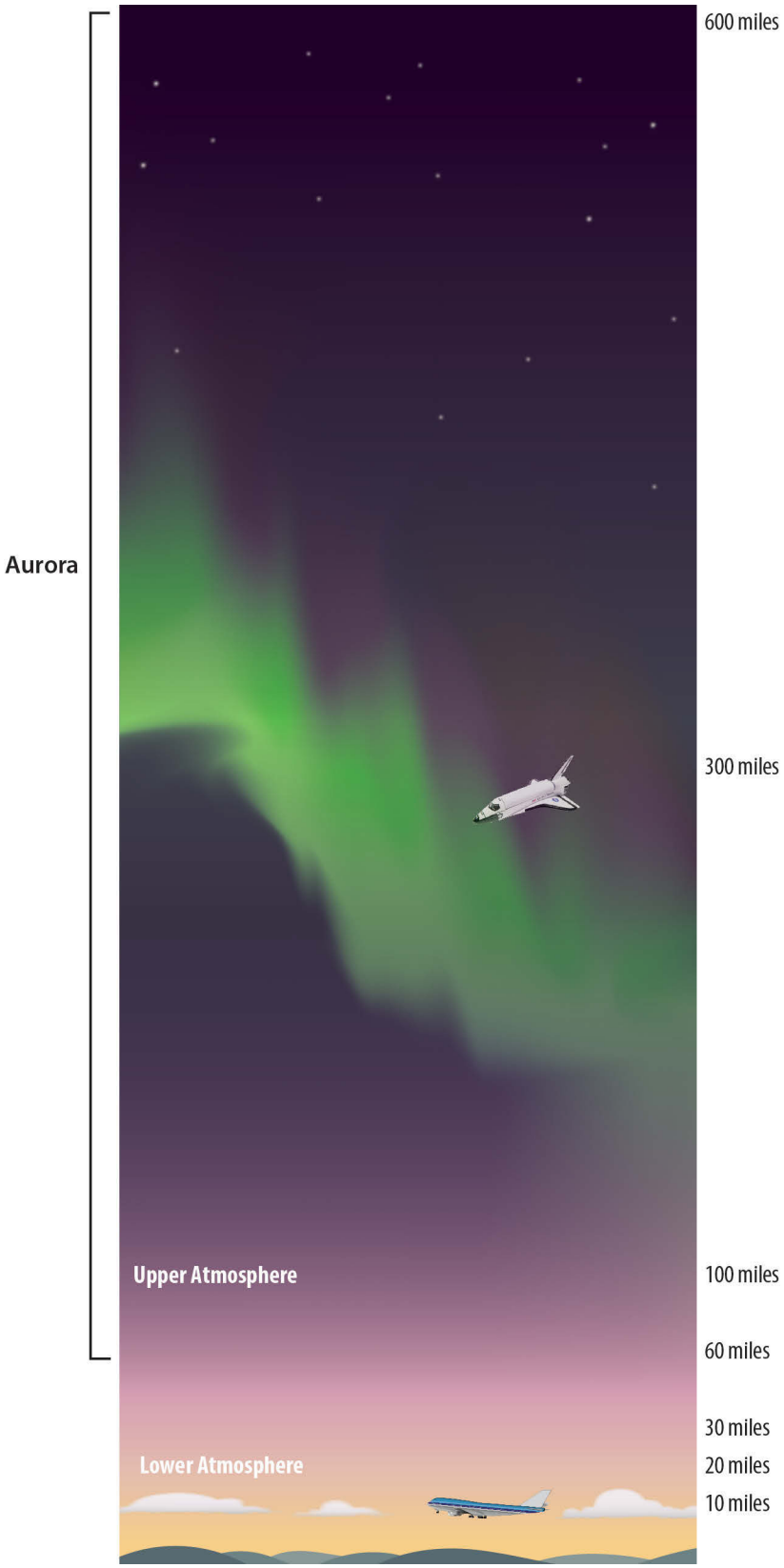
Unipkaaġniq
Storytelling

What traditional knowledge of the northern lights do Iñupiaq Elders share?

According to Iñupiaq lore, the kiuġiyaq are the spirits of ancestors, playing a game of kickball in the sky. The lights ripple and swirl with the movements of the game. Traditional stories warn children that the kiuġiyaq can swoop down to earth and cut off people's heads to use as the kickball! Elders share this and other spiritual understandings of the northern lights.

Iñupiaq elders also share knowledge of the northern lights based on observation and experience. During the dark winter, when the northern regions of Nunaqpak (Earth) are tilted away from the sun for weeks or months at a time, the kiuġiyaq are sometimes used as indicators of cold weather. Since the northern lights are located high in the sila (atmosphere), they can only be seen from Nunaqpak (Earth) when the sky is clear. The clouds that trap warm air near Nunaqpak during winter also block the kiuġiyaq from view. In the far north, clear skies often mean it is very cold outside.

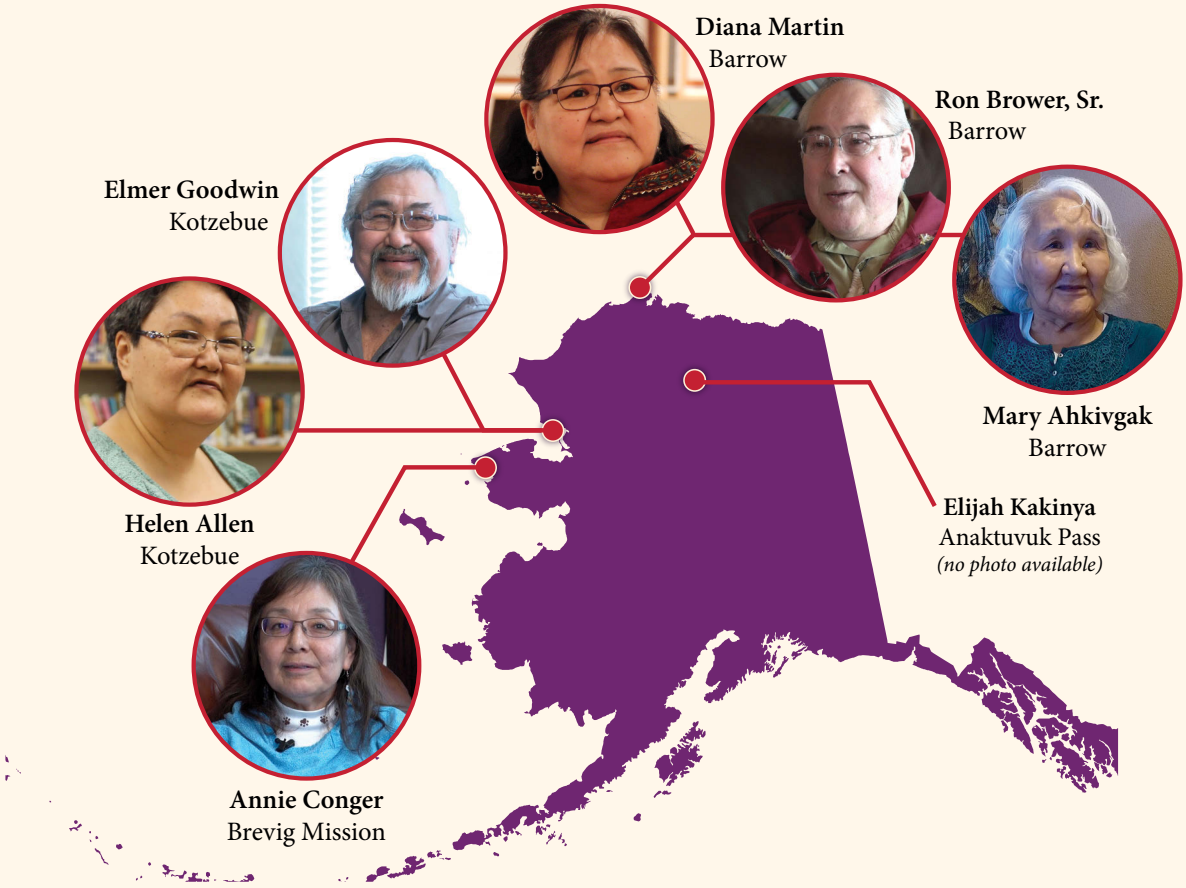
The kiuġiyaq also serve as a welcome source of light for winter travel. When they are active, the glow of the northern lights reflects off of the snow to light the trail. However, elders caution against relying on the kiuġiyaq to illuminate the trail due to their intermittent nature.



Traditional Knowledge and Stories of the Kiuġiyaq

Iñupiaq value: Love for Children, Respect for Elders

Visit culturalconnections.gi.alaska.edu (Multimedia) and listen to Iñupiaq elders and others share their knowledge based on experience as well as spiritual stories about the kiuġiyaq. Read Elijah Kakinya's story about the northern lights.



Discuss: What do the stories have in common? How are they different? Which are spiritual, and which are based on experiences? How can travelers make use of the northern lights when they appear during travel? What can the northern lights often indicate about the weather? What do these stories tell you about Iñupiaq spiritual understanding of the northern lights?

Try it: Go outside and observe the sky, weather and environment around you. Describe your observations and experience. Include: time of day, what you saw in the sky (northern lights, clouds, sun, moon, stars etc), and weather descriptions (snowing, windy, cold, clear etc).

Pass it on: Learn to retell or develop a song or dance about one of these stories in the traditional Iñupiaq style. Present to an audience. Be sure to introduce yourself, and share where you learned the story.

Aurora Shapes

What shapes occur during a northern lights display?

The kiuġiyaq come in a dazzling array of shapes. The shapes often occur in a similar pattern. First a quiet arc stretches like a ribbon across the sky. Next, rayed bands of light curl and dance. If the kiuġiyaq are directly overhead, rayed bands appear as a corona--a starburst of light that can fill the entire sky. As the rayed bands fade, patches of kiuġiyaq, resembling puffs of smoke or faint clouds, light the night. Finally, long aurora rays appear as vertical bars of light, signaling the end of the show. What shapes have you seen in the night sky?

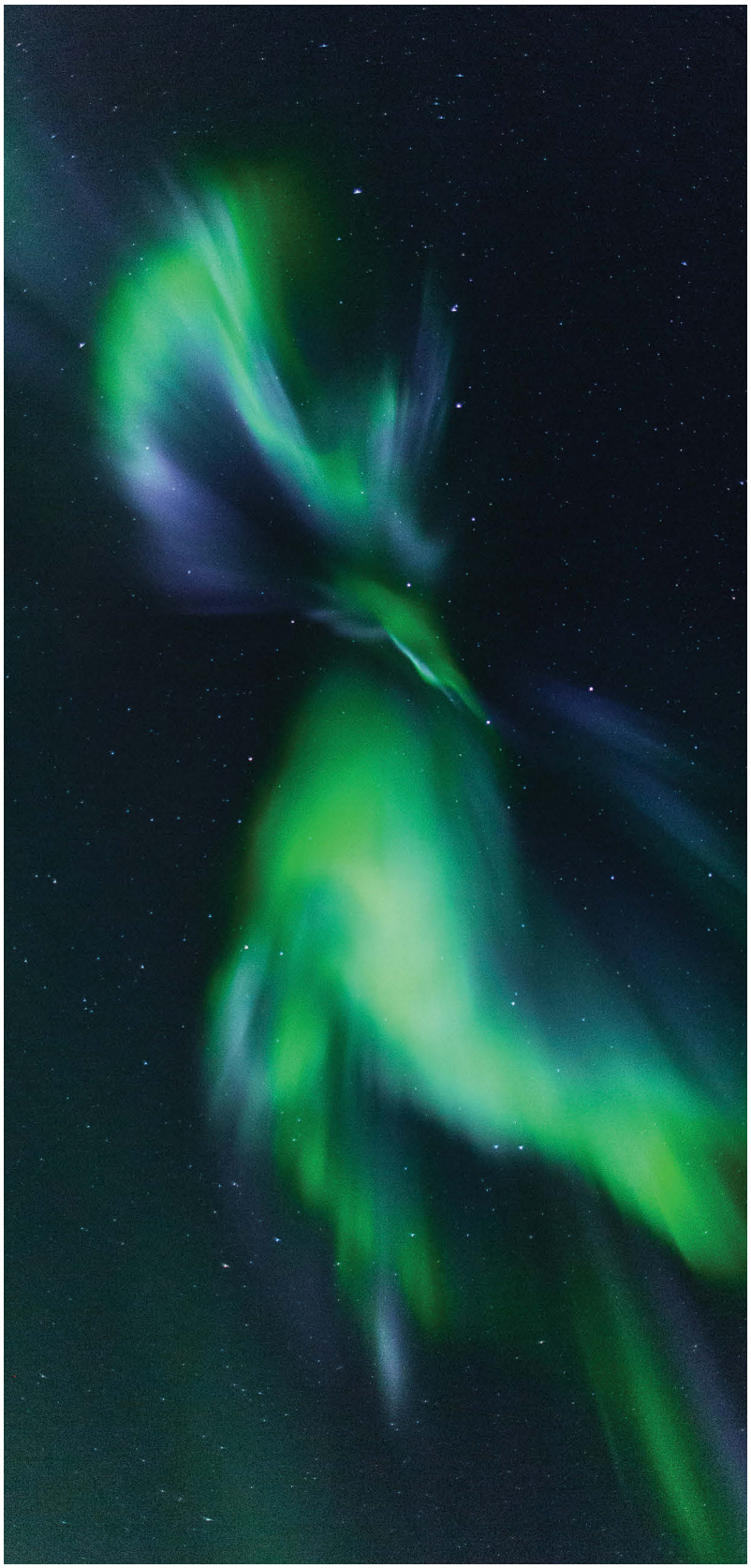


photo © Sacha Layos

Aurora Artwork

Iñupiaq values: Sharing

What shapes have you seen in the kiuġiyaq? How would you describe them? Use the materials below to illustrate the rayed bands aurora shape.

artwork by Putt Clark

Materials:

- Black paper
- Oil or chalk pastels
- Scissors
- Scrap paper
- Lined paper

Procedure:

1. Cut a strip of scrap paper into a rounded or zig-zag shape, as though you are illustrating hills or mountains.
2. Select the pastels that you would like to use to illustrate the kiuġiyaq. Use them to color the edge of your cut paper.
3. Lay the cut paper on top of your black paper, in the area of the paper that you would like to use to illustrate the sky.
4. Holding the cut paper in place with one hand, use a finger on your other hand to smear the pastel from the cut paper upward onto the black paper.
5. Lift the scrap and see the rayed band of northern lights that you have created on your black paper.
6. Illustrate the landscape beneath the kiuġiyaq to represent the area and season when you most commonly see the northern lights.
7. Using your lined paper, write a paragraph sharing science and cultural information that you learned about the northern lights.

Share:

Hang your illustration and paragraph about the northern lights in an area where others can enjoy and learn from it. Discuss what you have learned about the kiuġiyaq with friends and family.

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