

# Earth Science Tech Lesson Guide Lite

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“Earth's Attraction”

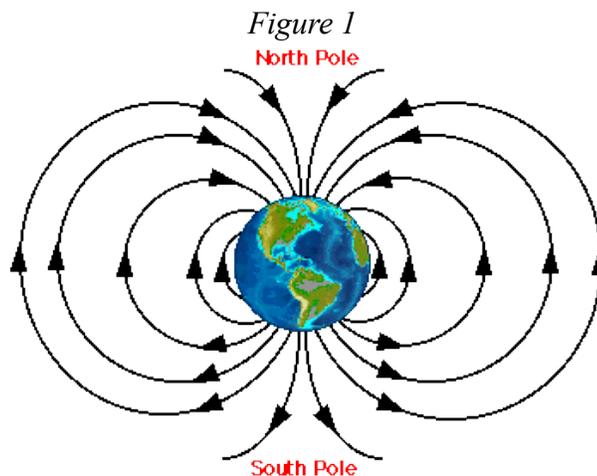


## “Earth's Attraction” - Background:

Both the aurora borealis and the aurora australis are caused by the sun. The incredibly high temperatures of the corona, the sun's outer layer, splits atoms apart. The loose protons, neutrons, and electrons become a part of the solar wind. This wind travels into space in all directions and at very high speeds.

Earth's magnetic field is thought to be caused by the movement of the molten rock inside Earth as the Earth rotates. This magnetic field serves as a protective layer around the Earth that diverts the solar wind away from the equator (see figure 1). When the solar wind hits Earth's magnetic field, the particles are caught in the charged field and are taken to the poles. As the particles (primarily protons and electrons) enter Earth's atmosphere they begin to collide with gas particles such as oxygen, nitrogen, helium, and hydrogen. It is these collisions that cause the colors we know as the aurora. When hit at a certain altitude, each gas produces a particular color, thus the variety of colors in the aurora. The most common color of the aurora is green/yellow and this is caused by the collision of charged particles with oxygen.

The intensity of the aurora varies in accordance with the 11 year solar cycle. When solar activity is high, the aurora will be quite active and although rare, can even extend to the equator. When solar activity is low, the aurora will be difficult to find, even in the north or south.



## Objectives:

In this activity students will observe Earth's magnetic field and the effect the solar wind has on the magnetic field.

## Materials:

- iron filings
- plastic wrap
- bar magnets
- rubbermaid container lid or shoebox lid
- paper and pencil

### Engage:

This activity can be done as a teacher demonstration or in small student groups. If done in small groups, give each group a small amount of iron filings, two bar magnets, a small piece of plastic wrap, and a container lid. Place one bar magnet vertically on the desk (note the location of the north and south poles) and set the container lid on top of it. Gently sprinkle the iron filings on the lid around the location of the magnet. Make sure to sweep back and forth with the filings so that they don't clump together in one area. Students have now made Earth's magnetic field. Ask students to draw the formation they see on their piece of paper. Wrap the second bar magnet in plastic wrap (to prevent the filings from sticking to it). Hold the wrapped magnet about one inch above the iron filings and with the poles opposite to the magnet underneath. Slowly move the magnet from left to right perpendicular to the magnet underneath the lid. Ask students to draw the magnetic field that they observe now.

(idea for activity came from [http://www.pbs.org/wgbh/nova/teachers/viewing/0304\\_02\\_nsn.html](http://www.pbs.org/wgbh/nova/teachers/viewing/0304_02_nsn.html) )

### Explain:

This website contains a picture of the Earth's normal magnetic field and the change caused by the solar wind. Compare the pictures with the students' observations and drawings of the normal magnetic field and the change caused by the solar wind: <http://image.gsfc.nasa.gov/poetry/magnetism/magnetism.html>

To connect this activity to the cause of the northern lights use this website produced by the geophysical institute at the University of Alaska Fairbanks: <http://www.gi.alaska.edu/asahi/>

This site contains a wide variety of information about the aurora, everything from the cause of the aurora to ancient beliefs about the aurora.

### Extend:

To learn more about northern lights and the effect the solar wind has on Earth, watch this short video highlighting high school students in Petersburg, Alaska. This can be viewed at:

<http://www.pbs.org/teachers/connect/resources/6567/preview/>

This short video clip produced by NASA, explains how the solar wind can cause more than just northern lights: <http://www.teachersdomain.org/resource/ess05.sci.ess.eiu.solarwind/>

This clip can always work as a lesson hook as students become especially interested when they hear that the solar wind can cause destruction of human made technology.