Activity - Exploring Magnetism

Visualizing magnetic field lines of the sun

http://cse.ssl.berkeley.edu/SEGwayed/lessons/exploring_magnetism/exploring_magnetism/index.html

Objective

Students learn about the magnetic field of the Sun by exploring bar magnets.

Materials

- 1 magnetic compass per student (ones with transparent faces work best)
- 1 long Alnico bar magnet
- 1 large sheet of white paper or several sheets of regular paper and scotch tape
- A pencil or marker

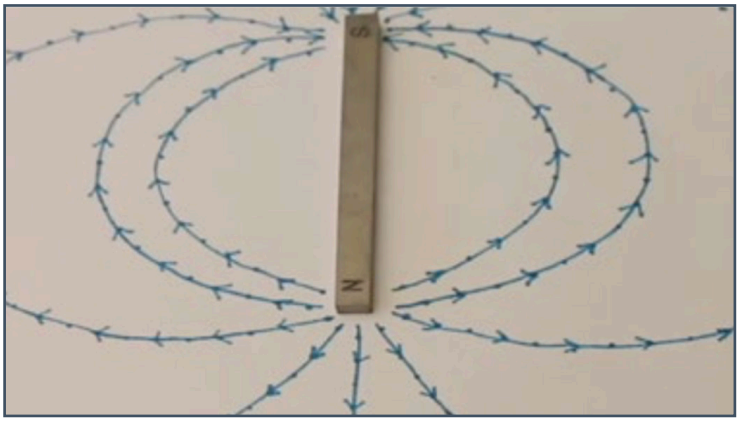
Background

The Sun has a magnetic field like the Earth, Jupiter and magnets on your refrigerator. While there are many intricacies to the behavior of the Sun's magnetic field, its overall structure is just like that of any bar magnet you might have at home. What causes an object to have a magnetic field? All magnetism in the universe ultimately derives from the motion of charged particles. Permanent magnets like the ones on our fridge do this on a quantum mechanical level, but there are other types of magnetism that are easier to explain and all involve a moving charge (also known as a current). For example, junk yards can lift and move cars weighing several tons using electromagnetic cranes. These devices run a very large electric current around in big circles, creating a magnetic field. Similarly, the rotation and convection of negatively charged electrons inside the Sun causes it to have a "magnetic dynamo," which is the name for a magnetic field created by a rotating astronomical body. How does this happen? The Sun rotates, electrons rotate with it, the flow of electrons is an electric current, electric currents generate electric fields.

The Sun's magnetic field has a North and a South pole, just like a bar magnet. Magnetic fields are typically shown by drawing lines that represent the direction a positive charge would move if it were introduced into the magnetic field. These electrons flow from negative to positive and from North to South. The closer together the magnetic field lines are, the stronger the magnetic field is in that region. One of the mysterious things about the Sun's magnetic field, is that it switches orientation every 11 years. Solar scientist are currently trying to figure out the exact mechanisms behind this swap.

Directions

1. Discuss with students that the Sun has a magnetic field and it acts almost like a bar magnet.
2. Have students arrange their compasses around one of the bar magnets. Note how the heads of the compass needles point toward the magnetic south pole and away from the magnetic north pole of the bar magnet.
3. Use the large sheets of paper (or have the students tape together several sheets) and place the bar magnet on top and in the middle of the paper. Tell the students that they will now trace the magnetic field around the bar magnet. Ask them to hypothesize what they think the magnetic field will look like.
4. To make the tracings, draw a dot somewhere near the magnet and place the center of a compass over the dot.
5. Draw a dot at the location of the arrow head (or tail) of the compass needle.
6. Move the compass center to this new dot, and again draw a dot at the location of the compass needle head (or tail).
7. Remove the compass from the paper and draw lines connecting the dots with arrows indicating the direction that the compass points.
8. Continue making new dots until the line meets back up with the magnet or you reach the edge of the paper.
9. Connect the dots with a line and draw in some arrow markers to show the direction of the magnetic field, from North to South.
10. Pick another spot near the magnet and repeat steps 4-9. Continue until the lines are surrounding the magnet, making a dipole pattern of magnetic field.



Watch a video tutorial of this activity on YouTube:
http://bit.ly/ExploringMagnetism

Watch our solar magnetism webcast:
http://bit.ly/Webcast2-TheLayersOfTheSun