Week 12, with Connie Walker
Assignment 1 and Overview of Assignments 2 and 3

Before we begin, note that some of the activities in this 3-week mini-unit require posting answers and results on the Discussion Board. **In the document below, the Discussion Board assignments are written in green for ease of access**. In order to keep the Discussion Board as orderly as possible, please answer **all** the questions for each assignment in **one** posting and please post to the appropriate thread. This will make it easier for all of us to follow the postings!

Assignment 1 – The Sun's Magnetic Personality (due date: Saturday, April 12)

Here are some fun, fast activities (a. through d.) to illustrate the nature of magnetic fields to tie later into their relationship with sunspots. With your students in mind, the activities provide a connection between the invisible forces measured by the compass and the concept of magnetism. The activities are adapted from "A Teacher's Magnetism Activity Guide: Exploring Magnetism" from NASA and the Center for Science Education at SSL at UCBerkeley.

a. Using the materials sent to you, experiment with compasses and the red and blue bar magnet.

You will not have as many compasses, but set up the compasses so that you can explore how the heads of the compass needles point toward the magnetic south pole and away from the magnetic north pole of the bar magnet.

b. Place the bar magnet on top of a large piece of white paper to trace the magnetic force field shape around the bar magnet. (If you were doing this with your

students, you would ask them to hypothesize first on what they think the magnetic force field would look like before drawing it.)

To make the tracings, draw a dot somewhere near the magnet and place the center of the compass over the dot.

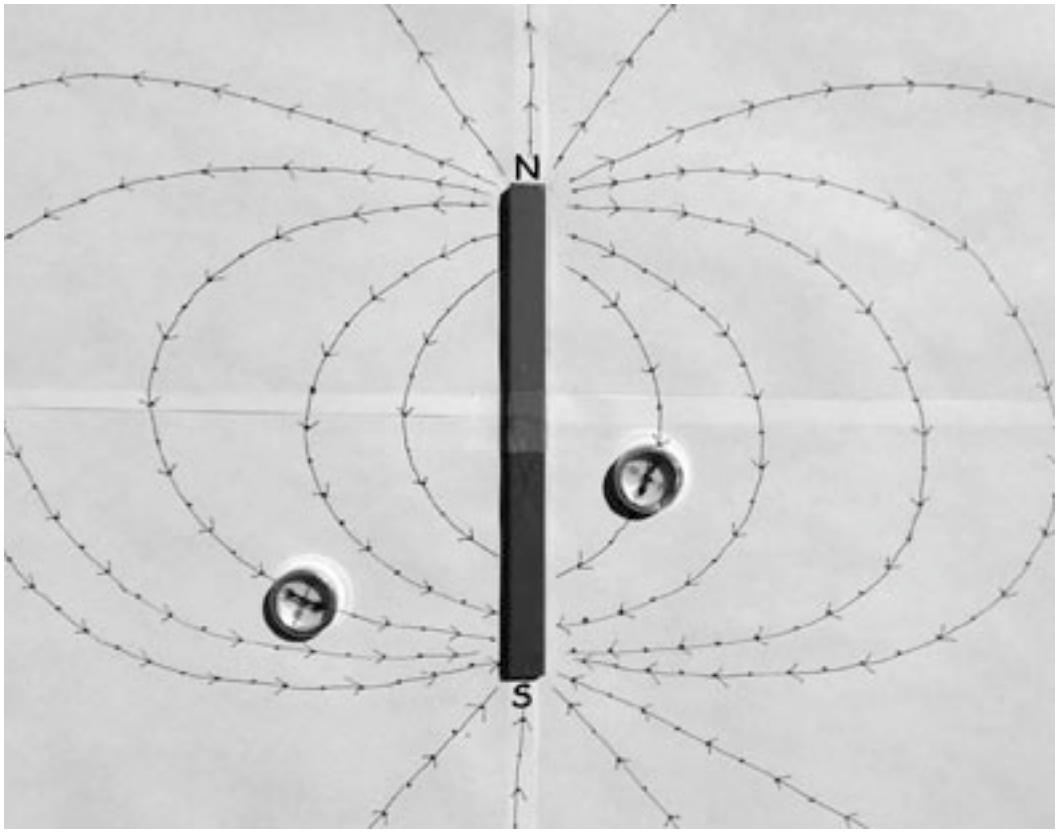
Draw a dot at the location of the arrowhead of the compass needle.

Move the compass center to this new dot and again draw a dot at the location of the arrowhead of the compass needle.

Remove the compass from the paper and draw lines connecting the dots with arrow indicating the direction that the compass points.

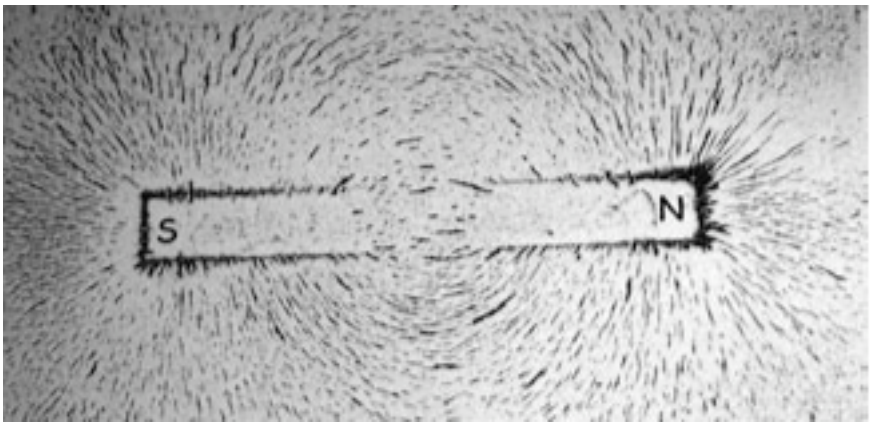
Continue the previous 3 steps until the line meets the magnet or the edge of the paper.

Pick another spot near the magnet and repeat the process until you have lines surrounding the magnet as shown in the next Figure.



c. This next activity uses the iron filings and the same bar magnet. Iron filings are messy and will stick to magnets. It is important to have paper, transparencies or sheet protectors between the filings and the magnets.

Place the paper on top of the bar magnet and trace the outline of the bar magnet, marking one end North and one end South. Lightly sprinkle the iron filings uniformly over the paper and then give the paper some gentle taps to make the filings align with the magnetic field as shown in the photo below.



On the Discussion Board, comment on how the iron filings are behaving. Can you explain why the iron filings behave that way? Did you see the same patterns with the compass tracings?

This sequence of three activities is meant to help students build up to the next activity. Normally there would be a lot of inquiry and hypothesizing in the process.

d. Examine the Magnet Tube.

On the Discussion Board, comment on the 3D orientation of the iron filings and how the orientation relates or not to your previous 2D findings. Take one of the remaining two magnets (the cow magnet or the Alnico magnet) and place one end on the outside of the Magnet Tube. What happens? Explore some more and comment on your observations.

e. To understand and/or review how astronomers characterize the Sun and the role magnetic fields play in the Sun, read Ch. 11 of your textbook (Seeds, "Astronomy: The Solar System and Beyond"). Especially pay close attention to section 11.3 on "Solar Activity". If this material is new to you, don't worry about absorbing it all: we will be returning to these concepts again this summer. Some of the concepts that would be helpful to know for now are:

- What is a sunspot? Why is it dark? What is an umbra and a penumbra? Why does the Sun rotate faster at its equator than at its poles? How can you use sunspots to determine the Sun's rotational period? How are sunspots related to the solar cycle? What information can you glean about sunspots at different wavelengths?

- What is magnetism? What is a magnetic field? How is a magnetic field formed? How do magnetic fields relate to how a sunspot is formed?

- From your readings of Ch. 6 and 12: What is a spectral line? What is wavelength? How does wavelength characterize spectral lines? Where do infrared spectral lines fall in the electromagnetic spectrum? What is a Doppler shift? How would Doppler shifting affect spectral lines? How does a spectrograph work?

- What is Zeeman spectral line splitting, how does it form (talk about energy levels) and how could it determine a sunspot's magnetic field strength?

On the Discussion Board, take one of the bulleted sets of questions above and discuss the answers to those questions as if you are teaching the content area to your colleagues. Make sure each of you takes a different set of bulleted questions so that all the content areas are covered. (First come, first served.) Read the other three sets of responses and ask related questions on their content areas. Be ready to answer questions on your content area.

A week or two before you get to Tucson this summer, keep checking to see what sunspots are present on the Earthside of the Sun or coming around the bend on the eastern limb of the Sun. Visit http://www.solarmonitor.org/. To check out possible candidates on the "farside" of the Sun, have fun visiting: http://soi.stanford.edu/data/full_farside/farside.html.