Lab 6: The Sun

Videos

We'll watch a series of videos (they are all listed here: `http://www.pbs.org/wgbh/nova/labs/videos/#sun`) introducing solar science and the Helioviewer. As you watch, answer these questions in your lab notebook. Feel free to discuss with your neighbors!

1. How long does it take a photon to travel from the core of the sun, where it's produced, to the surface?
2. Describe the 3 forces that are most relevant in the sun.
3. How long does it take the sun to rotate once on its own axis?
4. Do your best to draw the magnetic field lines around the sun in your lab notebook.
5. Name two events that can be caused by a magnetic reconnection.
6. Why do sunspots look darker than the rest of the sun?
7. What protects the Earth from solar flares?
8. What causes auroras?
9. Why are we humans more vulnerable to exceptionally big solar storms than we were in 1859?
10. Is the following statement true or false? "The longer its wavelength, the more energy light carries." Explain why.
11. Why is it useful for solar research to have instruments that can look at wavelengths besides the visible that we can see with our eyes?
12. Describe the instruments on the SDO (AIA, HMI).
13. If you want to look at a hotter part of the solar atmosphere, do you want to look at smaller or larger wavelength light?

Solar Cycle

Click on the Solar Cycle tab on this page and follow the instructions while answering the following questions: `http://www.pbs.org/wgbh/nova/labs/lab/sun/research`

1. Record your estimates of R and the "scientific estimates."
2. How do your estimates of R compare to the scientific estimates? Why do you think that various estimates are different?
3. After completing your five estimates, how do your estimates relate to the solar cycle graph (note the orange highlighted data points are the dates you were shown)?

Storm Prediction

Click on the Storm Prediction tab on this page and follow the instructions while answering the following questions: `http://www.pbs.org/wgbh/nova/labs/lab/sun/research`

1. What does the size of a sunspot tell us about the Sun's magnetic field and how does it help us predict solar storms?
2. What does the complexity of sunspots tell us?
3. What does rapid sunspot growth tell us about the Sun's magnetic field?
4. How does the mixing of magnetic fields help us to predict solar flares or CMEs?
5. While observing the chromosphere and corona of the Sun, scientists often observe bands of plasma, called filaments. What can these filaments tell us about the possibility of a solar storm?

Open Investigation

For this section, you'll use the Helioviewer `http://helioviewer.org/` and "Open Investigation" section from the Sun Lab. There are a couple things that might not be immediately obvious in the Helioviewer. First, the "measurement" values are wavelength of the filter used to obtain the image, in Angstroms. Second, if the date/time turns red, that means there is not data of the requested type taken close to the date/time you asked for. Even if the date/time is green, it's best to check to see what time is actually being displayed, as opposed what time you input.

I want you to generate possible investigation questions about the sun. For example, what features in the sun develop before a flare, and how do the details of those features determine the properties of the flare and its aftermath? Are the same features seen for other flares? If not, what's different about those flares? Be a scientist; explore the data for a while, ask questions, and if you have time, begin to try to answer those questions with the data.

1. Record at least 3 questions, and explain how you would investigate these questions.

Conclusion

- What was the most interesting fact/open question you learned today?
- Is anything still unclear?