The Sun

Astronomy in Palestine

Today we will be doing some cool observing (hopefully). And while this is a really exciting, it is important for us to understand the privileges we have to be able to even do astronomy without worrying about being caught in an airstrike. And as we watch genocide unfold in Gaza, it is also important to tell the story of Palestinians outside of being the subjects of a military occupation. Take 15 minutes or so to read through the articles "Wonder and the Life of Palestinian Astronomy" and "In Gaza, Scanning the Sky for Stars, Not Drones". Remind yourself that our dreams, our wonders, our aspirations...are not any more worthy.

Part 1: Videos

We'll watch a series of videos (http://www.pbs.org/wgbh/nova/labs/videos/#sun) introducing solar science and the Helioviewer. As you watch, discuss with your partner(s) and answer these questions in your lab notebook.

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 often does the Sun's magnetic north and south flip, in a process called magnetic realignment?
4. Does the differential rotation in the Sun's plasma strengthen or weaken the Sun's field lines? How so?
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. Describe the instruments on the SDO (AIA, HMI).
12. 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?
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?

Part 2: 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. Make a table and record your estimates of g, s, and 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)?
4. Based on the solar cycle graph, approximately what is the period of the solar cycle?

Part 3: 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?

Part 4: Open Investigation

For this section, you'll use the beta version of Helioviewer. http://beta3.helioviewer.org/ There are a couple things that might not be immediately obvious. 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.