

Exercise set seven

1 Extrasolar planet detection

Materials

graph of velocity versus time for 51 Peg, and relative flux versus time for HD209458b from <http://www.astro.columbia.edu/~lab/planning/labs/stars/exoplanets/>

Instructions

For 51 Peg:

1. Find the period, P , and half amplitude, v_{\max} , of the star's motion.
2. How big is the shift in wavelength, $\Delta\lambda$ that corresponds to v_{\max} ?
3. Find the radius of the planet's orbit and its mass. Assume the orbit is edge-on, and the stellar mass is $1M_{\text{Sun}}$.
4. How does the mass of the planet compare to the mass of Jupiter? Note: $M_{\text{J}} = 0.001M_{\text{Sun}}$.
5. Where would this planet be in the Solar System if it were orbiting the Sun? In other words, how does the size of its orbit compare to orbits of planets in the Solar System?

For HD209458b

1. The fraction of light from one disk blocked by another (assuming both are very far away) is $(R_{\text{planet}}/R_{\text{star}})^2$. Why?
2. What fraction of the star light is blocked by the planet in this case?
3. What is the radius of the planet compared to the star in this case?
4. If you assume the star has the same radius as the Sun, how does the radius of HD209458b compare to Jupiter. Note: The Sun's radius is 10 times larger than Jupiter's.

2 Explosions from the Sun

Materials

handout from http://nasaexplores.nasa.gov/show_912_student_sh.php?id=050128132940

Instructions

Please answer all the questions from the handout in your lab notebook.

3 Movies of the Sun

Materials

computer with Internet access.

Instructions

Talk to me before going to the Library.

Go to <http://sohowww.nascom.nasa.gov/bestofsoho/>.

Sun-grazing comets

Watch the movies of comets and answer these questions:

1. The comets all show a tail or sometimes multiple tails. Can you figure out any pattern in what direction the different tails point (i.e. ahead of the comet, behind the comet, toward or away from a specific object)?
2. Are comets ever destroyed?
3. Write one interesting thing you noticed in the comet movies.

Solar activity

Watch some of the movies of “Sunspots and solar activity”, “Flares and CMEs” and “Filaments and Prominences” and answer these questions:

1. Which regions of the Sun’s surface show the most activity? Which regions show the least activity? It may help to watch the movie called “Annual increase in solar activity from 1996 to 2001”.
2. After some mass ejections there is sometimes a burst of “static”, random lines and dots that appear in the image. What you are seeing is protons from the ejection event hitting the detector. Why do you think you only see the static after some mass ejections? Hint: is the mass ejected in every direction?
3. Do the protons travel at the speed of light? How can you tell?
4. About how fast do the protons travel? Note: $1\text{au} = 1.5 \times 10^8\text{km} = 8.3\text{ light-minutes}$, meaning that light from the Sun takes 8.3 minutes to reach us. Show your work and tell me which movie or movies your answer is based on.
5. Write one interesting thing you noticed in these movies.