

Astronomy 301 – Fall 2019

Homework 5

Due Date: Wednesday, October 9, 2019, 9:00 AM

You must turn in your homework answers electronically via Canvas. A .pdf or .docx file would be best, but if you can get a good image of your hand-written homework, a .jpg or .png file would okay also. Make sure your name and eid appear at the beginning of your homework.

We encourage you to work together on the homework but you are not allowed to copy from each other. You must write out the answers in your own words.

1. How do we identify the presence of elements and compounds (molecules) in stars? How do we know that some elements in stars are ionized? The element helium was discovered in the sun in 1868, more than 25 years before it was discovered on the Earth (“helios” is the Greek word for “sun”). How do you think it was discovered?
2. The spectrum of a main-sequence star has strong hydrogen absorption lines, strong lines of ionized metals, and no helium lines. What is the spectral type of the star? What is its approximate temperature? Suppose that the absorption lines of iron are much stronger than normal for a star of this spectral type. What might you conclude?
3. Clouds of hot gas in space generally have hydrogen in them and produce spectra with emission lines of hydrogen. The hydrogen emission line with a wavelength of $4861 \text{ \AA}$ is observed in several clouds of gas. Calculate the radial velocities of the three clouds in which the wavelength is observed to be (a) $4891 \text{ \AA}$; (b) $4861 \text{ \AA}$; and (c) $4831 \text{ \AA}$. State whether the cloud is traveling towards or away from us for each case.
4. Sirius, the brightest star in the sky, is a double star. One star is a normal main-sequence star and the other is a white dwarf. The orbital period is 50.1 years and the semi-major axis of the relative orbit is 19.6 AU. What is the sum of the masses of the two stars? If the main-sequence star has a mass of $2.00 M_{\odot}$, what is the mass of the white dwarf?