How Big is That Star?

Measuring Binary Stars

Summary
You are going to be measuring the sizes of stars in binary systems.

Background
Look at the sample light curves below. They show the brightness of a binary system as a function of time.

Illustration of the relationship between the dips in the light curve and the stars in a binary. The large red circle represents the larger star in the binary system and the smaller circles represent the smaller star as it moves through its orbit.

In a sentence, describe the relationship between $t_1$ and $d_1$. What does $d_1$ represent?

In a sentence, describe the relationship between $t_2$ and $d_2$. What does $d_2$ represent?

Using this information, data from real binary systems, and the equation $d=v \cdot t$ (distance equals velocity times time), you'll calculate the sizes of a few stars.
H Cas

Work through this example along with your teacher.

Using the graph to the right, determine and record the following (be sure to include units):

\[ t_1: \_\_\_\_\_\_\_\_\_\_\_\_ \]

\[ t_2: \_\_\_\_\_\_\_\_\_\_\_\_ \]

The orbital velocity of HT Cas is known to be 390 km/sec.

Using \( d = v \cdot t \), determine the size of each star in HT Cas. Show your work below, or on additional paper, if you need more room.

Write the size of each star in HT Cas below (make sure to include units):

\[ d_1: \_\_\_\_\_\_\_\_\_\_\_\_ \]

\[ d_2: \_\_\_\_\_\_\_\_\_\_\_\_ \]
X0748-676

Light curve for binary system X0748-676. Note that the plot is cut in the middle, to make it fit. The missing middle section can be assumed to be flat at about zero counts per second.

Using the graph above, determine and record the following (be sure to include units):

\[ t_1: \quad \quad \quad \quad \quad t_2: \quad \quad \quad \quad \quad \]

The orbital velocity of X0748-676 is known to be 500 km/sec.

Using \( d = v \cdot t \), determine the size of each star in X0748-676. Show your work below, or on additional paper, if you need more room.

Write the size of each star in X0748-676 below (make sure to include units):

\[ d_1: \quad \quad \quad \quad \quad d_2: \quad \quad \quad \quad \quad \]
Using the graph above, determine and record the following (be sure to include units):

\[ t_1: \quad \text{and} \quad t_2: \]

The orbital velocity of Vela X-1 is known to be 280 km/sec.

Using \( d = v \cdot t \), determine the size of each star in Vela X-1. Show your work below, or on additional paper, if you need more room.

Write the size of each star in Vela X-1 below (make sure to include units):

\[ d_1: \quad \text{and} \quad d_2: \]