1. **In alternative solar system,** is a star Nus with two planets Htrae and Sram. Htrae orbits Nus at a distance of 1AU, and it takes 3 of our years for Htrae to orbit once around Nus. Sram orbits at a distance of 1.88 AU.

    a. (3 pts.) What principle or law enables you to do parts (b) and (c)?

    Newton's Version of Keplers 3rd Law

    b. (3 pts.) What is the mass of Nus compared with the mass of the Sun?

    $M*P^2=a^3$ ; plugging in the values we know, and solving for M we get:

    $M= 1^3/3^2 = 1/9$

    The mass of Nus is 1/9 solar masses, or one ninth the mass of the sun.

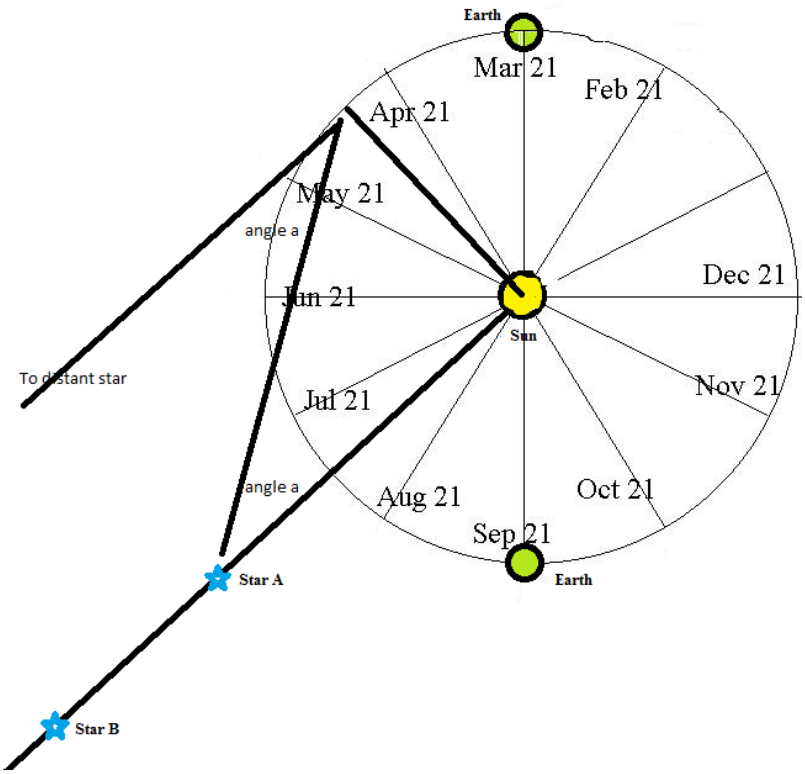
    c. (3 pts.) What is the period of Sram's orbit?

    $M*P^2=a^3$

    Therefor; $P= (1.88)^{3/2} / (1/9)^{1/2} = 3*(1.88)^{3/2} =$ <u>7.73 yr</u>

2. **The distance to star A** is 3.4 pc, and its coordinates are 21 hr + 0°. The distance to star B is 300 pc, and its coordinates are 21 hr + 0°. For this problem, assume the orbit of the earth is along the celestial equator.

    a. (5 pts.) Draw a picture to show the location of the star and the location of the earth on the equinoxes.




Note that the distances of the stars are not to scale. The distance to star A is a million astronomical units. I drew star B on the page, but it is really, really far away.

b. (3 pts.) On which two dates is the parallactic shift between the two stars zero? (That means the two stars are coincident, since their coordinates are identical.) On which date is the parallactic shift largest to the east?

From the picture you can see that the dates of zero parallactic shift are about Aug 5$^{th}$ and Feb 5$^{th}$ (when the earth, the sun, and stars A and B are all in line.) Since 21hr is halfway between 18 and 24hr, one date is halfway between June 21 and Sept 21. Back up 1month and 2 weeks from Sept 21.

It would be largest to the east on May 5$^{th}$. The sun rises in the east, and Earth spins counter clockwise, so you are looking for where star A will appear to be closer to the location of the sun than Star B.

c. (3 pts.) Sketch a plot to show how the parallactic shift changes with time over the course of a year. On the vertical axis, plot a shift to the east as positive and the shift to the west as negative. Plot time on the horizontal axis.

The plot is a sine curve, with its maximum at May 5$^{th}$, its minimum at Nov 5$^{th}$, and crossing zero at Aug 5$^{th}$ and Feb 5$^{th}$.

d. (2 pts.) Calculate the greatest parallactic shift.

Greatest parallactic shift occurs on May 5$^{th}$. The baseline is 1 AU. (See the triangle on the figure.)

a=1/D = 1/3.4 pc = 0.294 arc seconds.