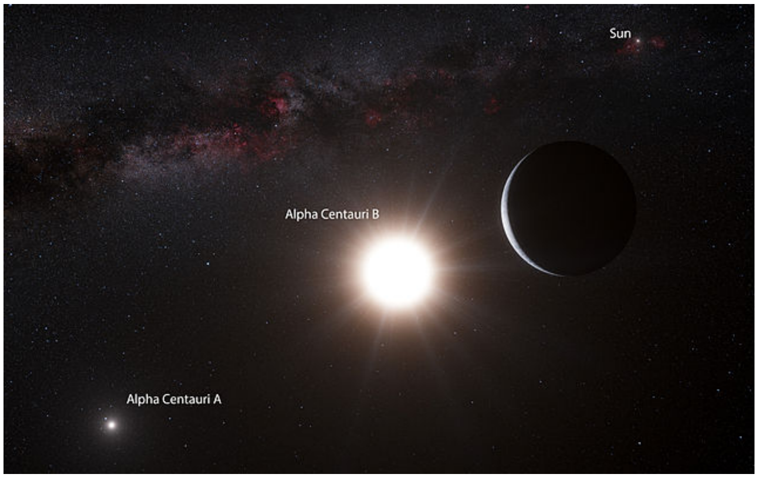


Artist rendition courtesy ESO/L. Calçada/N. Risinger (skysurvey.org)

Alpha Centauri is a binary star system located 4.37 light years from our sun. The two stars, A and B, are both sun-like stars, but they are older than our sun by about 1.5 billion years.

Astronomers have used the European Space Agency's 3.6 meter telescope at La Silla in Chile to detect the tell-tail motion of Alpha Centauri B caused by an earth-sized planet in close orbit around this star.

The planet, called Alpha Centauri Bb, orbits at a distance of only six million kilometers from its parent star – closer than Mercury is to the sun. The planet is bathed in unbearable heat, and has a surface temperature of 1,200 Celsius (2,200 F or 1,500 Kelvin). This is hot enough that its surface must be mostly molten lava. Its tight orbit means a year passes in only 3.2 Earth days.

The astronomers made hundreds of measurements of the speed of the Alpha Cen B star to search for a periodic change it its speed through space. They found a change (amplitude) of about 50 cm/sec that increased and decreased with a precise period, which would only be expected from an orbiting object.

This discovery is still being confirmed through independent observations by other astronomers.

We can check the numbers in the information box ourselves. Here are a few of the measurements made of the star's speed:

Time (hours)	Speed (cm/sec)	Time (hours)	Speed (cm/sec)
6	170	48	50
10	150	56	70
21	110	71	130
33	60	83	170

Problem 1 – Graph the speed data. Draw a smooth curve through the data (which need not go through all the points) and estimate the period (in days) of the speed curve to get the orbit period of the proposed planet.

Problem 2 – Kepler's Third Law can be used to relate the period of the planet's orbit (T in years) to its distance from its star (D in Astronomical Units) using the formula

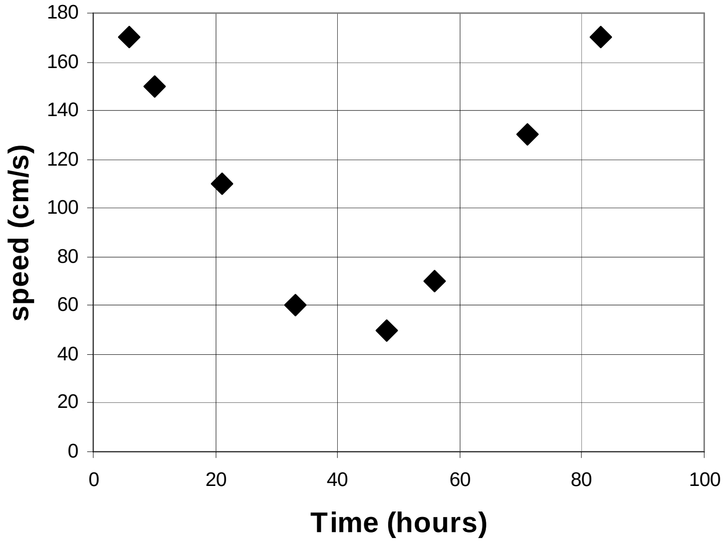
$$T^2 = D^3$$

where 1 Astronomical Unit equals the distance from Earth to our sun (150 million km). Using your estimated planet period, what is the orbit distance of the new planet from Centauri B in A) Astronomical Units? B) kilometers?

Problem 3 – What is the temperature T (in kelvins) of the new planet if its average temperature at a distance of D Astronomical Units is given by the formula:

$$T = \frac{310}{\sqrt{D}}$$

Problem 1 – Graph the speed data. Draw a smooth curve through the data and estimate the period of the speed curve to get the orbit period of the proposed planet. Answer should be about 77 hours or **3.2 days.**



Problem 2 – Kepler's Third Law can be used to relate the period of the planet's orbit (T in years) to its distance from its star (D in Astronomical Units) using the formula

$$T^2 = D^3$$

where 1 Astronomical Unit equals the distance from the earth to our sun (150 million km). Using your estimated planet period, what is the orbit distance from Centauiri B in A) Astronomical Units? B) kilometers? Answer: T = 3.2 days or in terms of earth-years T = 3.2/365 = 0.00877 years. Then $D^3 = (0.00877)^2$, $D^3 = 7.69\times10^{-5}$ $D = (7.69\times10^{-5})^{1/3}$ **D = 0.043 Astronomical Units**. B) In kilometers, this is 0.043 AU x (150 million km/1 AU) = **6.4 million kilometers**.

Problem 3 – What is the temperature T (in kelvins) of the planet if its average temperature at a distance of D Astronomical Units. Answer: $T = 310 / (0.043)^{1/2}$ so T = **1,500 kelvins**.

The actual graph of the data published by the astronomers is shown below: