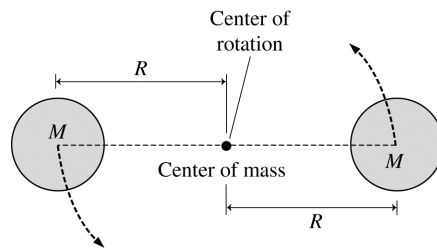


12.61. Model: Assume the two stars are spherical masses.

Visualize: The gravitational force between the two stars provides the centripetal acceleration required for circular motion about the center of mass.



Solve: Newton's second law is

$$F_{\text{gravitation}} = \frac{GMM}{(2R)^2} = MR\omega^2 = MR\left(\frac{2\pi}{T}\right)^2 \Rightarrow R = \left(\frac{GT^2M}{16\pi^2}\right)^{\frac{1}{3}}$$

Using $T = 90 \text{ days} = 90 \times 24 \times 3600 \text{ s}$ and $M = 2M_{\text{sun}} = 3.98 \times 10^{30} \text{ kg}$, we get $R = 4.667 \times 10^{10} \text{ m}$. Thus the star separation is $2R = 9.33 \times 10^{10} \text{ m}$.