

Exoplanet Detection Methods

1. Exoplanet Characterization:

- GJ 899, M dwarf star w/ $m = 0.2 M_{\odot}$, $r = 0.2 R_{\odot}$

a) What is the inclination of GJ 899B?

As transit is being measured, the inclination is most likely very close to 90° .

b) What is the period of this exoplanet?

The period is approximately 5 days.

c) What is the radius of the planet?

$$Z = \left(\frac{R_p}{R_{\star}}\right)^2 \quad Z \approx 0.0023 \quad R_{\star} = 0.2 R_{\odot}$$
$$0.0023 = \left(\frac{R_p}{0.2 R_{\odot}}\right)^2$$

$$R_p \approx 0.0096 R_{\odot} \approx 6,700 \text{ km} \approx 1.05 R_{\oplus}$$

d) What is the semi-amplitude K of this planetary signal?

$$K \approx 2 \text{ m/s}$$

e) What is the mass of this planet?

$$K = M_p \sin i \left(\frac{2\pi G}{P M_{\star}^2}\right)^{\frac{1}{3}} \quad G = 6.6743 \cdot 10^{-11}$$

$$2 = M_p \left(\frac{2\pi \cdot 6.6743 \cdot 10^{-11}}{432,000 (0.2 M_{\odot})^2}\right)^{\frac{1}{3}} \quad P = 5 \text{ days} = 432,000 \text{ s}$$

$$M_p = \left(\frac{2\pi \cdot 6.6743 \cdot 10^{-11}}{432,000 (0.2 M_{\odot})^2}\right)^{\frac{1}{3}}$$

$$\approx 1.09 \cdot 10^{25} \text{ kg} \approx 1.83 M_{\oplus}$$

f) The composition of GJ 899B seems to closely mirror that of Earth
at 67% rock and 33% iron.