
Exoplanet Data Analysis

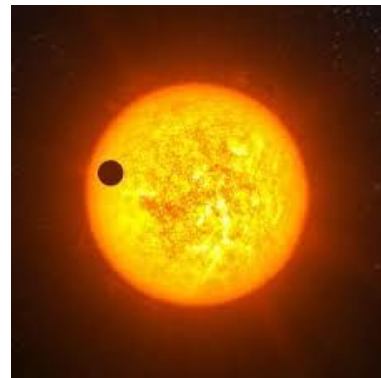
— Measuring the properties of exoplanets from
recorded data in the NASA Exoplanet Archives —

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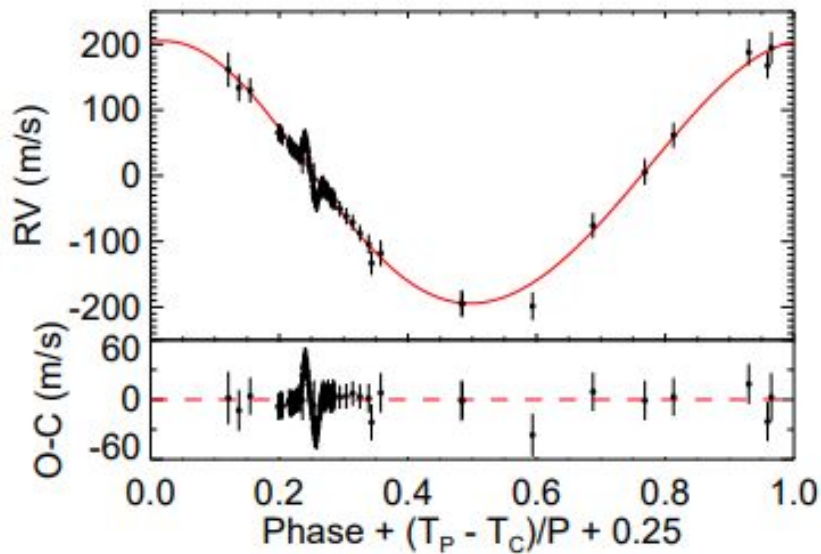
Goals and Motivation

- Understand and navigate the NASA Exoplanet Archive (NEA)
- Fit models to observed data to derive detected signals
- Derive physical properties of exoplanets based on observed data
- Propagate errors from observed data through data analysis

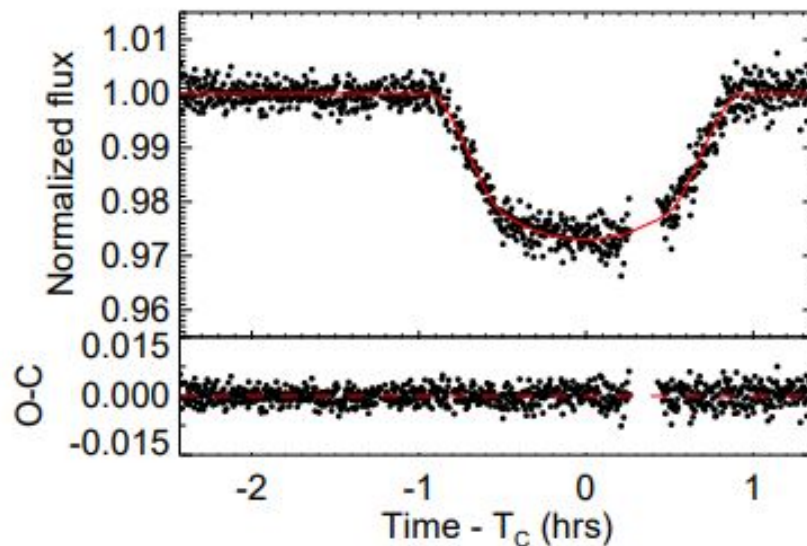
Target: HD 189733 b



Method: EXOFAST



Radial Velocity: 200.80 m/s



Transit Depth: 2.474 %

Method: Deriving Physical Properties

Transit \longrightarrow Radius

$$f = \left(\frac{R_p}{R_*} \right)^2$$

Radial Velocity \longrightarrow Mass

$$K = v_* \sin i = \left(\frac{M_p}{M_*} \right) \sqrt{\frac{GM_*}{a}} \sin i$$

Mass/Radius \longrightarrow Density

$$\rho = \frac{M}{\frac{4}{3} \pi R^3}$$

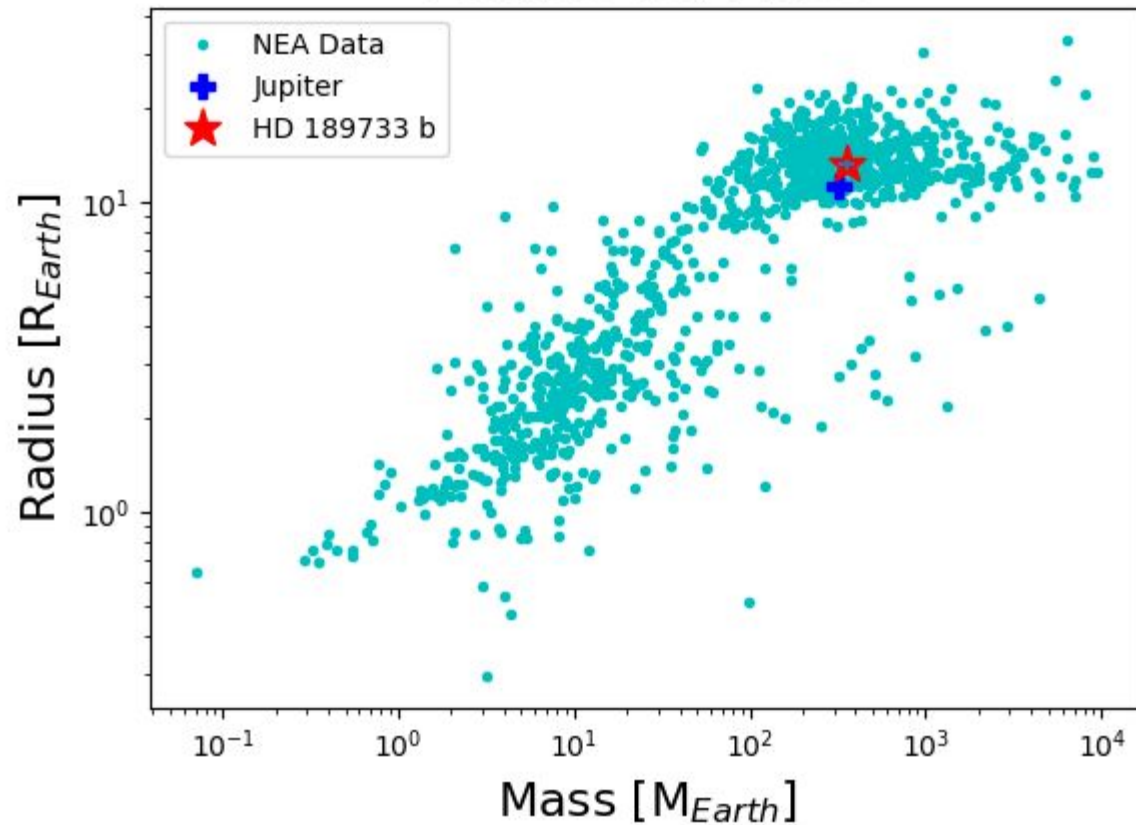
Physical Properties of HD 189733 b

Mass: $360 \pm 36 M_{\oplus}$
 $1.13 \pm 0.11 M_{\text{Jup}}$

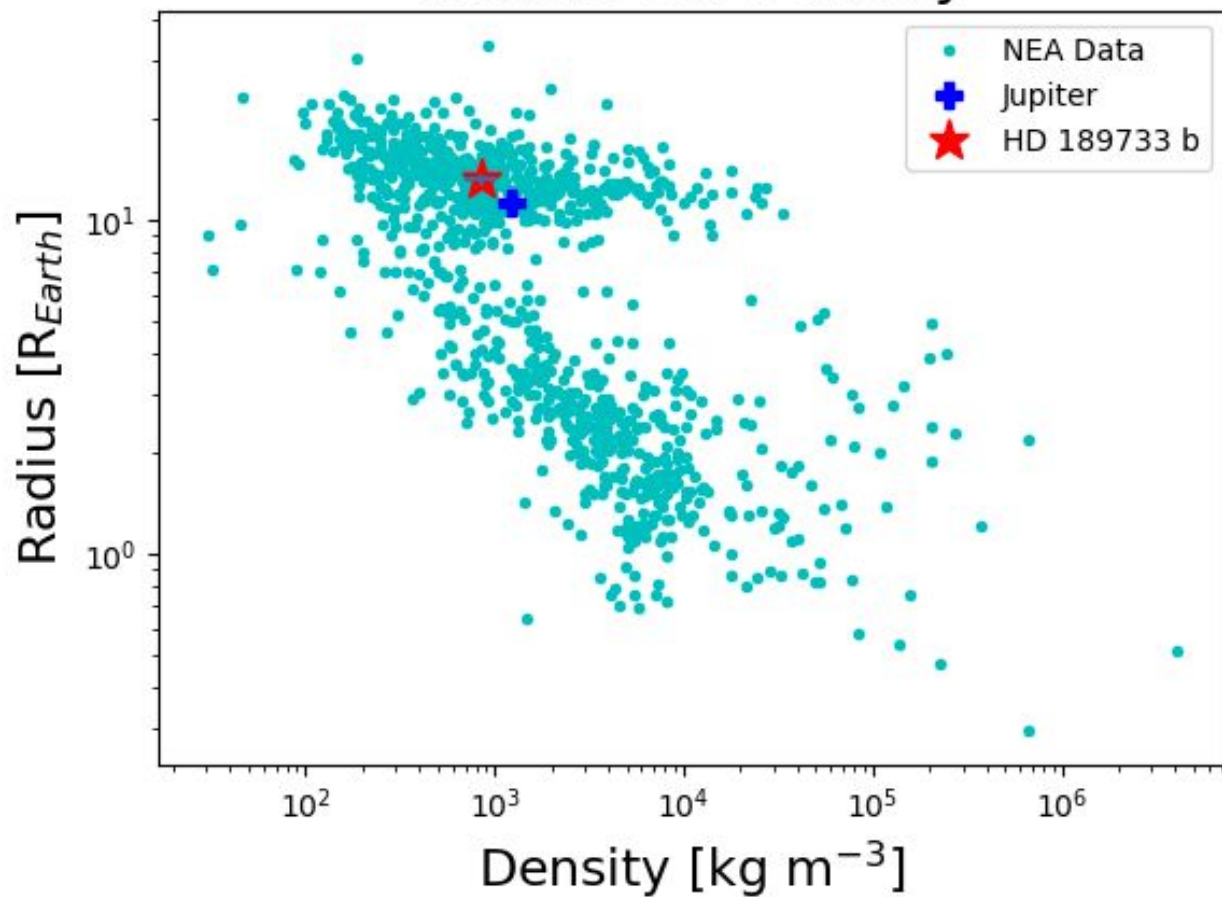
Radius: $13.2 \pm 0.4 R_{\oplus}$
 $1.18 \pm 0.04 R_{\text{Jup}}$

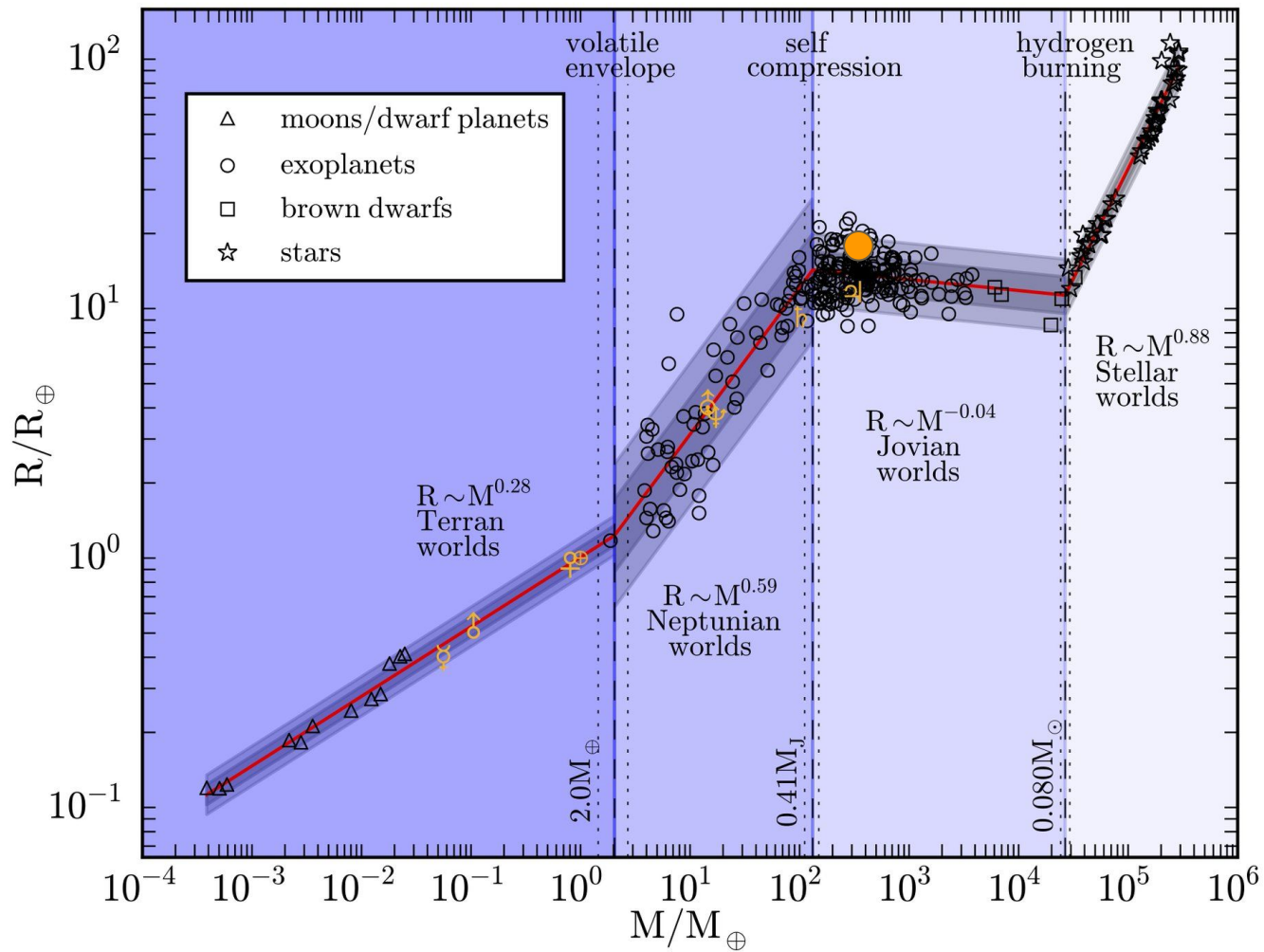
Density: $1173 \pm 164 \text{ kg(m}^{-3}\text{)}$
88.5% density of Jupiter

Radius vs. Mass



Radius vs. Density





Conclusion

HD 189733 b is a gas giant

- Mass and Radius similar to Jupiter
- Physical properties similar to other gas giants in NEA
- Falls within the “Jovian Worlds” section of Chen and Kipping (2016)’s plot of the mass-radius relation

Questions?

Contributions

Frank: Lead Author

Brendan: Exofast, mass, radius and density comparison plots

Johnny: Calculation of physical properties and uncertainty propagation

Alyssa: Presentation creator, Chen and Kipping (2016) comparison