

Physics of Planetary Systems — Exercises — Set 9

Problem 9.1 (2 points)

Use available data to show that radii of close-in gas giants are affected by heating from stellar radiation. Discuss your results. *Hints: You can obtain data from <https://exoplanet.eu/>, filter for the right mass range, use semi-major axes and stellar properties to calculate the insolation from the star onto the planet.*

Problem 9.2 (2 points)

Assume you have detected companion candidates with the following radii: (a) $3 R_{\text{Jup}}$, (b) $1 R_{\text{Jup}}$, (c) $0.3 R_{\text{Jup}}$, and (d) $0.1 R_{\text{Jup}}$. Estimate the types and (ranges of) masses for these four objects.

Bonus problem 9.3 (2 extra points)

Assume the surface density of the planetesimal swarm in the early Solar System to be $\Sigma = 10 \text{ g cm}^{-2}$ at 1 au and $\Sigma \propto r^{-3/2}$. How many finished, isolated oligarchs do you expect to find between 1 and 30 au?

Problem 9.4 (2 points)

Estimate the distances of the “ice lines” for H_2O (sublimation temperature around 170 K) and CO ice (around 20 K) from the Sun.

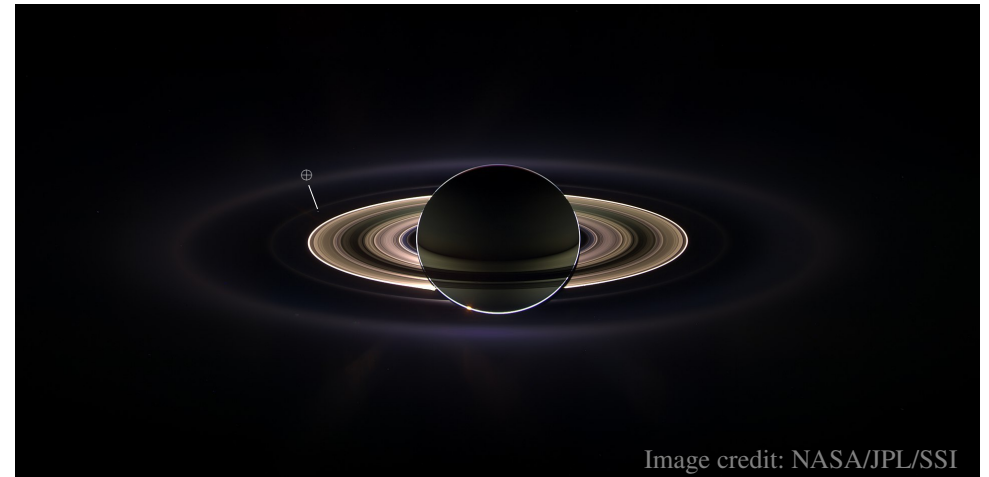


Figure 1: Saturn and its rings eclipse the Sun. Earth is visible in the background.