Physics of Planetary Systems — Exercises — Set 12

Problem 12.1 *(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 12.2 *(1 point)*

A nearby open cluster has a metallicity [Fe/H] = 0.5. You will start a radial velocity survey of 100 solar-like stars in this cluster. Based on results from radial velocity surveys of field stars, how many planet-hosting stars do you expect to find?

Problem 12.3 *(2 points)*

In the scenario of THOMMES, DUNCAN, and LEVISON (2002), Uranus and Neptune originally formed between Jupiter and Saturn, i. e. at a distance of around 7 au from the Sun. Jupiter and Saturn subsequently scattered them outward to their current orbits. Assume that Jupiter was the main reason for that scattering event. By how much did Jupiter's orbital semi-major axis change during this process?
Hints: assume circular orbits; consider conservation laws.

Bonus problem 12.4 *(0.5 extra points for each item)*

List open questions, difficulties, unsolved problems in the state-of-the-art planet formation theories.

Figure 1: NGC 6357, a star-forming region in Scorpius, with open cluster Pismis 24 in its center. (Credit: Davide de Martin (ESA/Hubble), the ESA/ESO/NASA Photoshop FITS Liberator & Digitized Sky Survey 2.)

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