Physics of Planetary Systems — Exercises

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Set 3

Problem 3.1

Describe 3 sources of “False Positives” (i.e. a transit-like event seen in photometry that turns out not to be a planet) and what observations you can make to prove that these are not really transiting planets. *(2 points)*

Problem 3.2

Assume that you have the photometric precision to detect a transit depth of 1%. What is the earliest spectral type for which you can detect a hot Jupiter exoplanet with a radius of 1 R_{Jupiter} orbiting around a main sequence star? (Use the relation between spectral type and stellar radius.) *(2 points)*

Problem 3.3

Calculate the transit probability, photometric amplitude, and transit duration for (a) Neptune in a circular orbit at 0.1 AU from a solar-type star and (b) a G2V star in a circular orbit at 2 AU from a K0III giant (like Pollux). *(2 extra points)*

Problem 3.4

One of the assumptions in the classical theory of viscous accretion disks is that the sound speed is much smaller than the Keplerian velocity. Check this assumption with a direct estimate. *(2 points)*

Problem 3.5

Find *all* possible power-law stationary solutions for surface density Σ, temperature T, and viscosity ν of accretion disks. Which of them are physical and which are not? Plot a couple of solutions. *(3 points)*

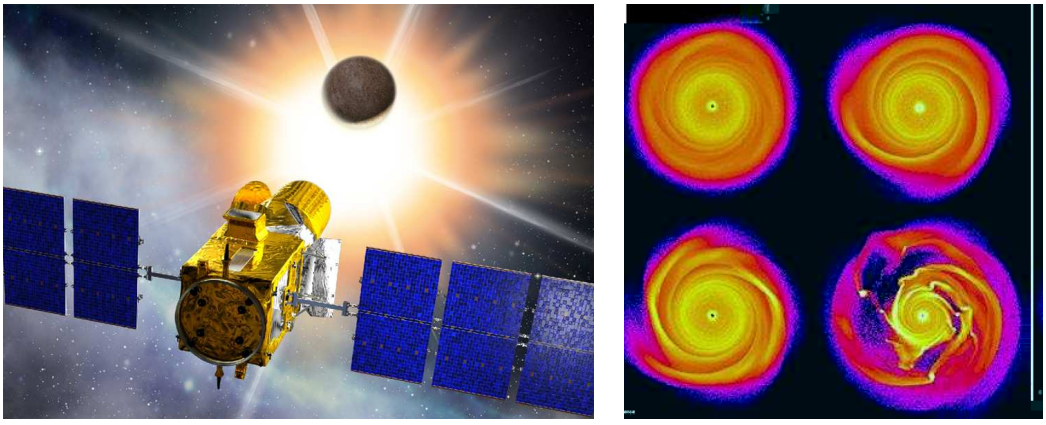

Figure 1: *(Left)* Artist’s impression of the CoRoT space telescope (http://corot.de). *(Right)* Snapshot of a simulation showing a gravitationally unstable disk (Mayer et al., 2003).

Web: `http://www.astro.uni-jena.de/Users/tloehne/planetensysteme/uebungen.html`
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