# Physics of Planetary Systems — Exercises

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## Set 9

### Problem 9.1

A recent CoRoT transit candidate has a period of $P = 0.65$ days and a transit depth of $6.4 \times 10^{-4} = 0.64‰$. This may be another Super Earth like CoRoT-7b. Assuming the star has solar properties ($M_* = 1\ M_\odot$, $R_* = 1\ R_\odot$) and the planet has Earth's density ($\rho_{\rm pl} = 5.5$ g cm$^{-3}$), estimate the radius of the planet and the radial velocity amplitude of the star. *(2 points)*

### Problem 9.2

Outline the steps you would take to confirm that CoRoT-7b (see Problem 9.1) is a planet without measuring the full radial velocity curve. *(1 point)*

### Problem 9.3

Imagine a gas disk with a planet trying to eat a gap with a width of (twice) the planet's Hill radius. Assume that the gas is refilling the gap "behind" the planet at the radial gas drift speed of a viscous accretion disk, $v_{\rm r}$. Estimate the minimum planetary mass needed in order to create a gap that is still open when the planet reaches the same region of the gas disk again. (In other words: how massive has the planet got to be to successfully clear a gap?) *(3 points)*

### Problem 9.4

Now, assume that a planet (at 1 AU in the MMSN) can grow from all the gas that enters its Hill sphere while it sweeps through the gas disk. For the two cases of a low-mass planet and a high-mass (gap-opening) planet, estimate the accretion rate. (Assume a radial gas drift speed of 2 m/s.) *(2 points)*

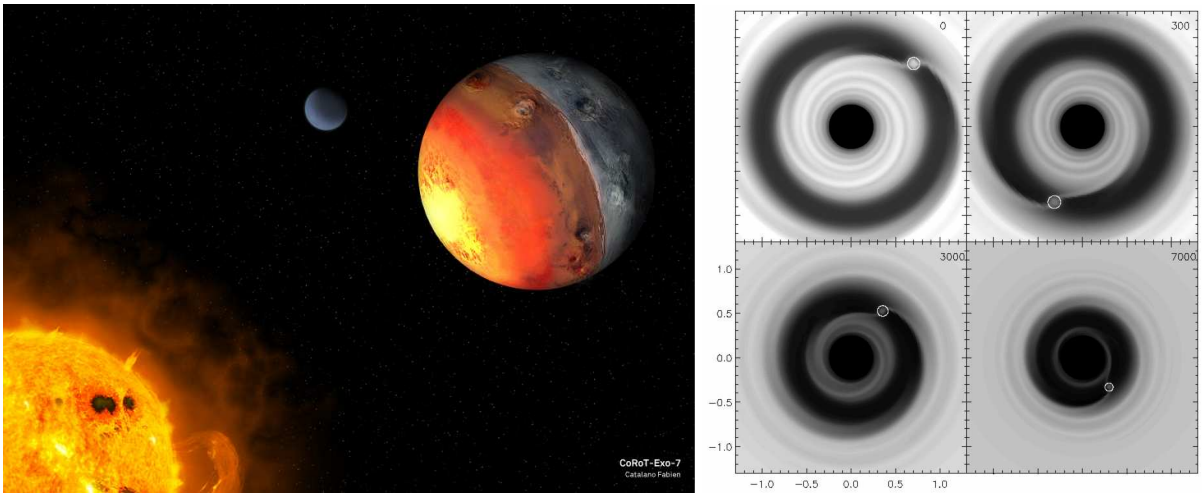


**Figure 1:** *(Left)* An artist's rendition of the system CoRoT-7. *(Right)* A planet forms a gap in the protoplanetary disk and migrates inward. (NELSON et al., 2000)

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