The detection of transiting extrasolar planets with CoRoT
-Light curves analysis-

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The CoRoT mission

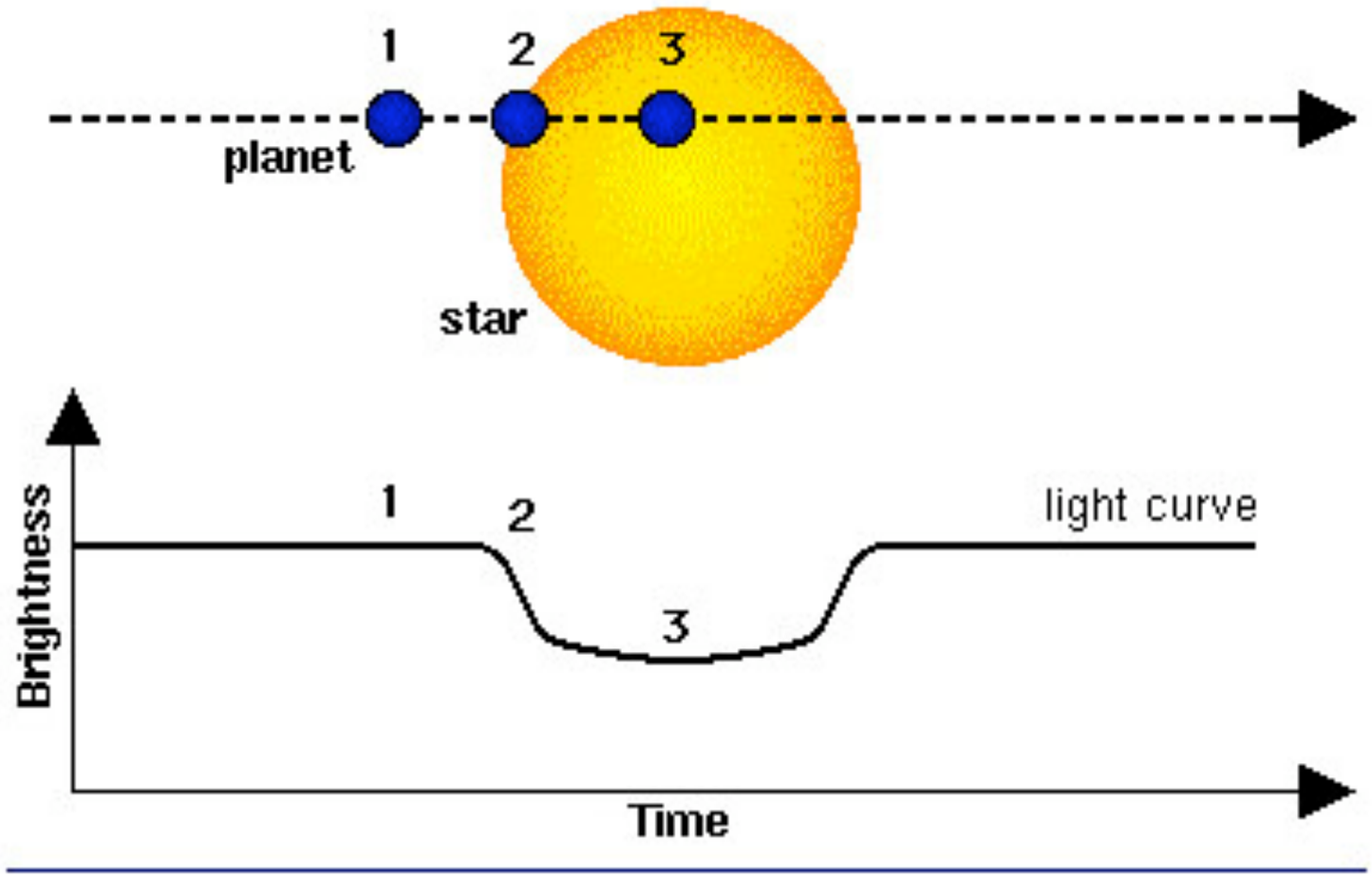
- Launched December 2006
- Find extrasolar planets using the Transit Method
- Continuously monitoring ~12.000 stars per observing field with magnitudes [11.5-16]
- Mission duration: 2.5 years

What's an extrasolar planet?

- An extrasolar planet (or exoplanet) is a planet orbiting a star different from the Sun
- Its mass must below the limiting mass for thermonuclear fusion of deuterium (~13 Mjup for solar metallicity)
- Its minimum mass/size required is the same as that used in our Solar System
- 307 exoplanets known so far (01/08/2009)

The Transit Method

- When star pass in front of its parent star, it causes a drop in brightness



- Transit depth:
  ~1% for Jupiter-size
  ~0.01% for Earth-size

$$\frac{\Delta F}{F} = \left[\frac{R_p}{R_*}\right]^2$$

Advantages/Disadvantages

- If more than one transit is visible, the orbital period is known
- Simultaneous monitoring of large number of sources
- Direct measurement of planet/star size ratio
- But transit probability very small and method sensitive to large planets

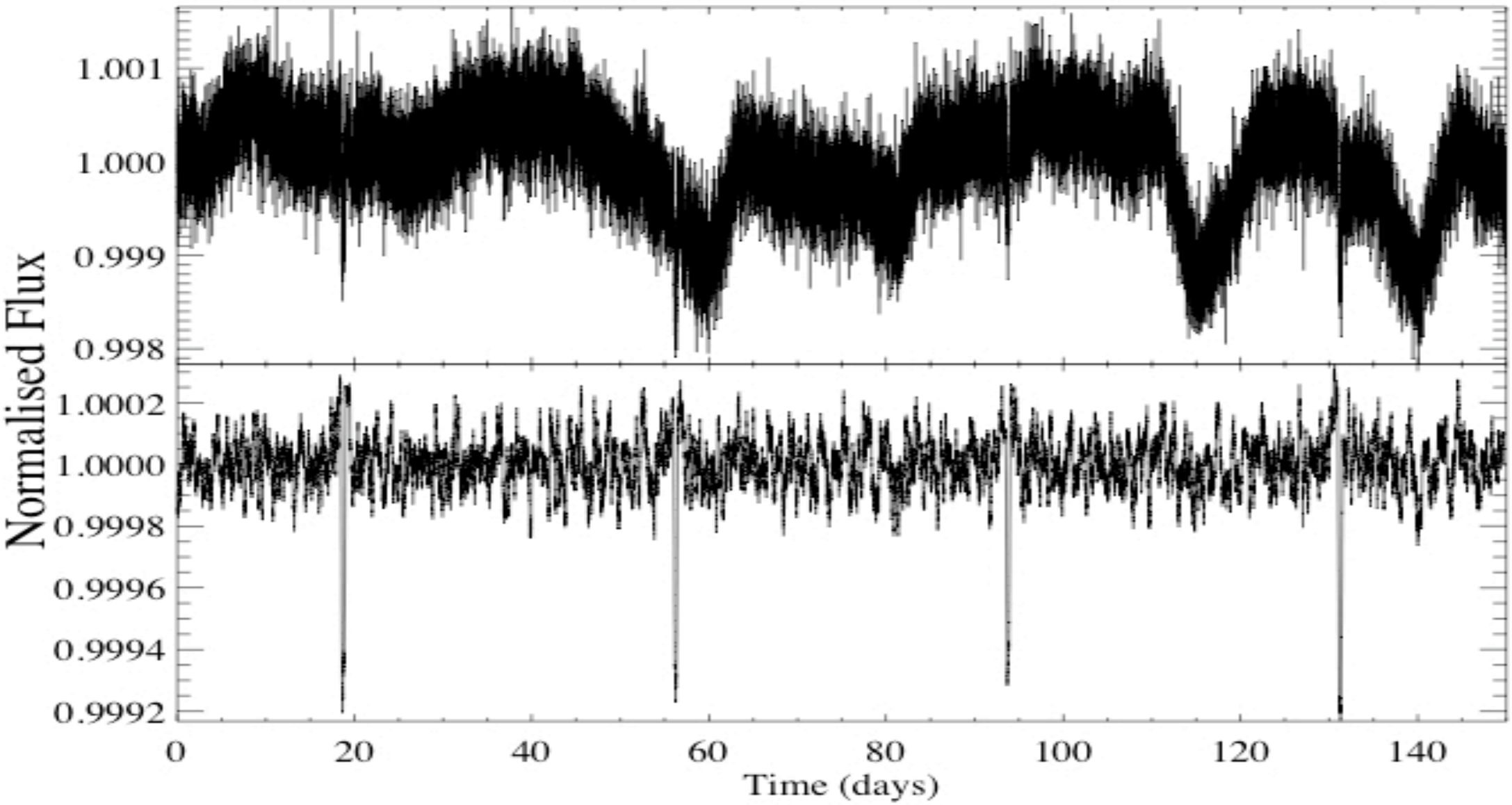
CoRoT fields

- Year divided into two 6-months of observation toward galactic center and galactic anti-center.
- Each of these 6 months is divided between a short run (20 days) and long run (150 days)
- Observation runs already performed:

	IRa01	LRc01	SRc01	LRa01
run type	Initial run	Long run	Short run	Long run.
direction	anti-center	center	center	anti-center
length (days)	60	150	20	150

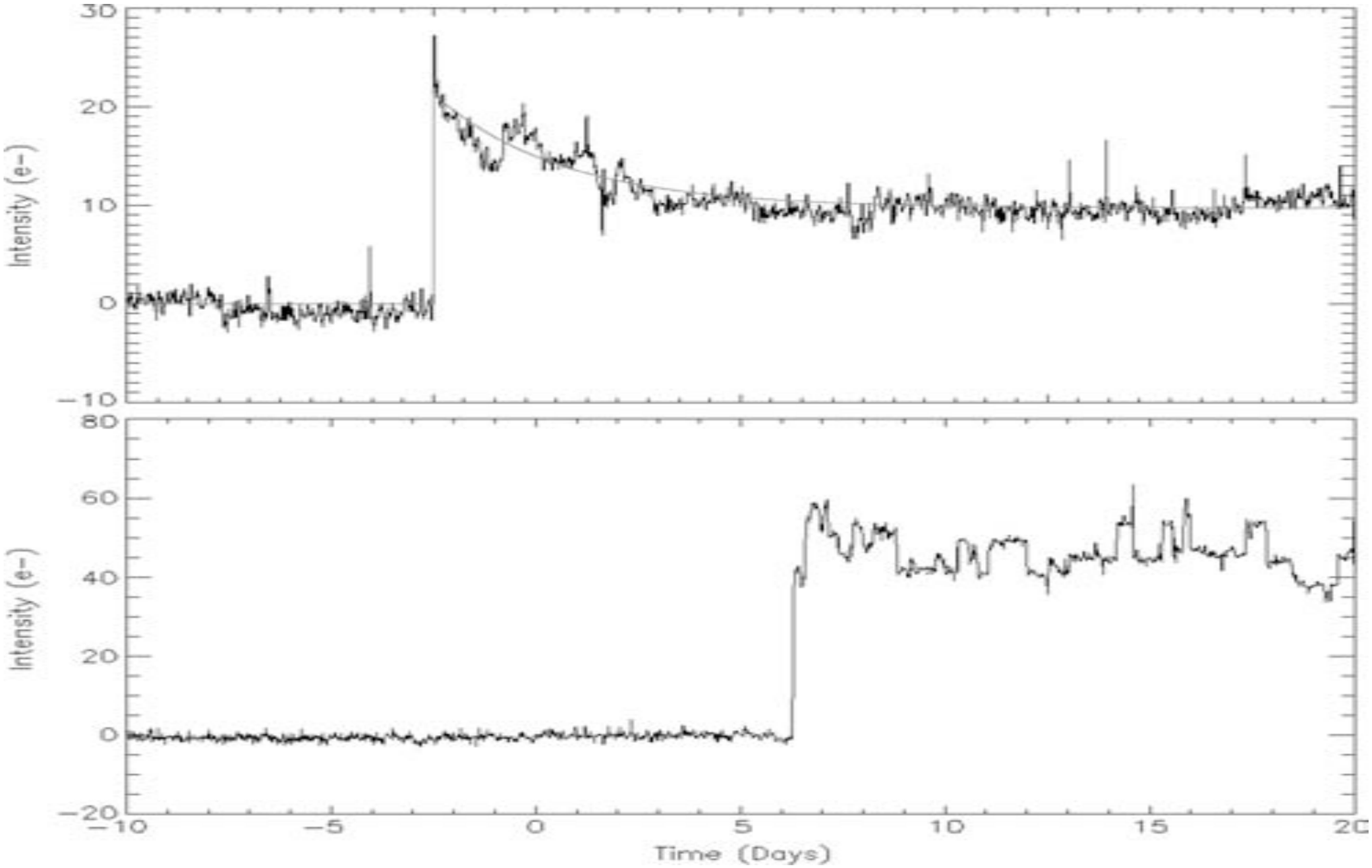
What do we expect to see?

(stellar noise and photon noise only)



Simulated light curve using SOHO data (Carpano & Fridlund 2008)

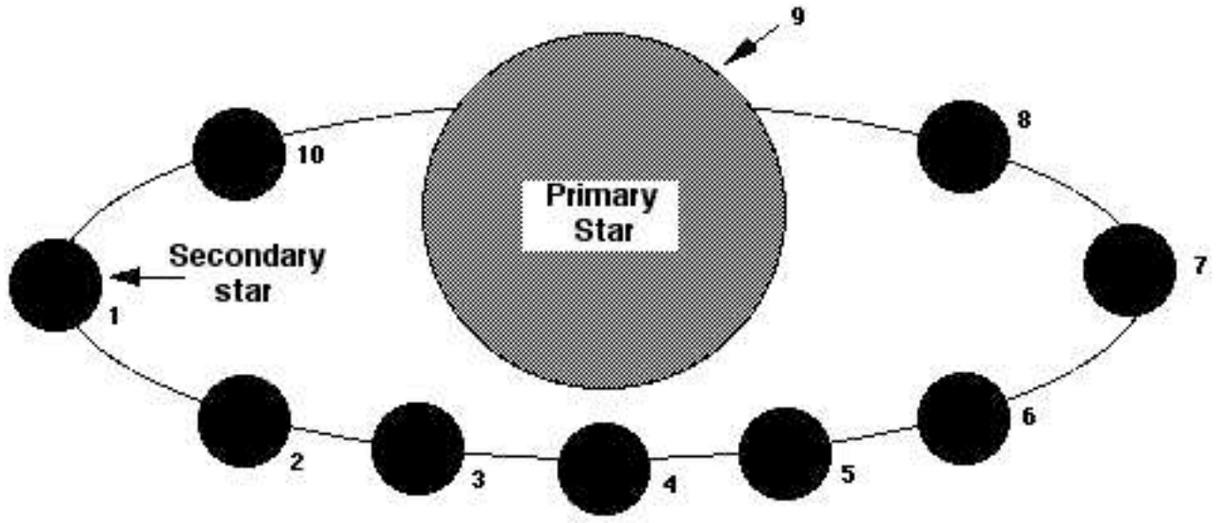
Extra-noise:"Hot-pixels"

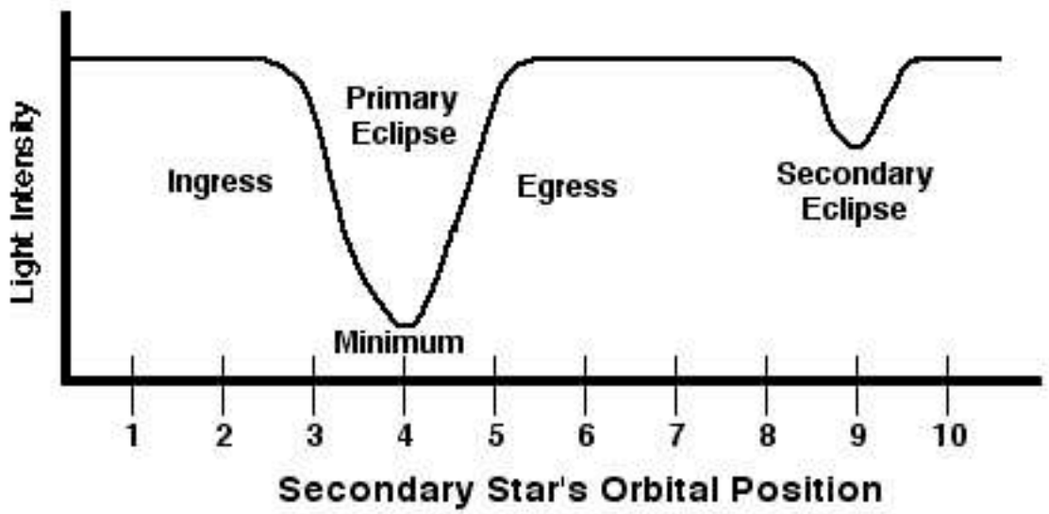


Generation of bright pixel after particle impact (Pinheiro da Silva et al. 2008)

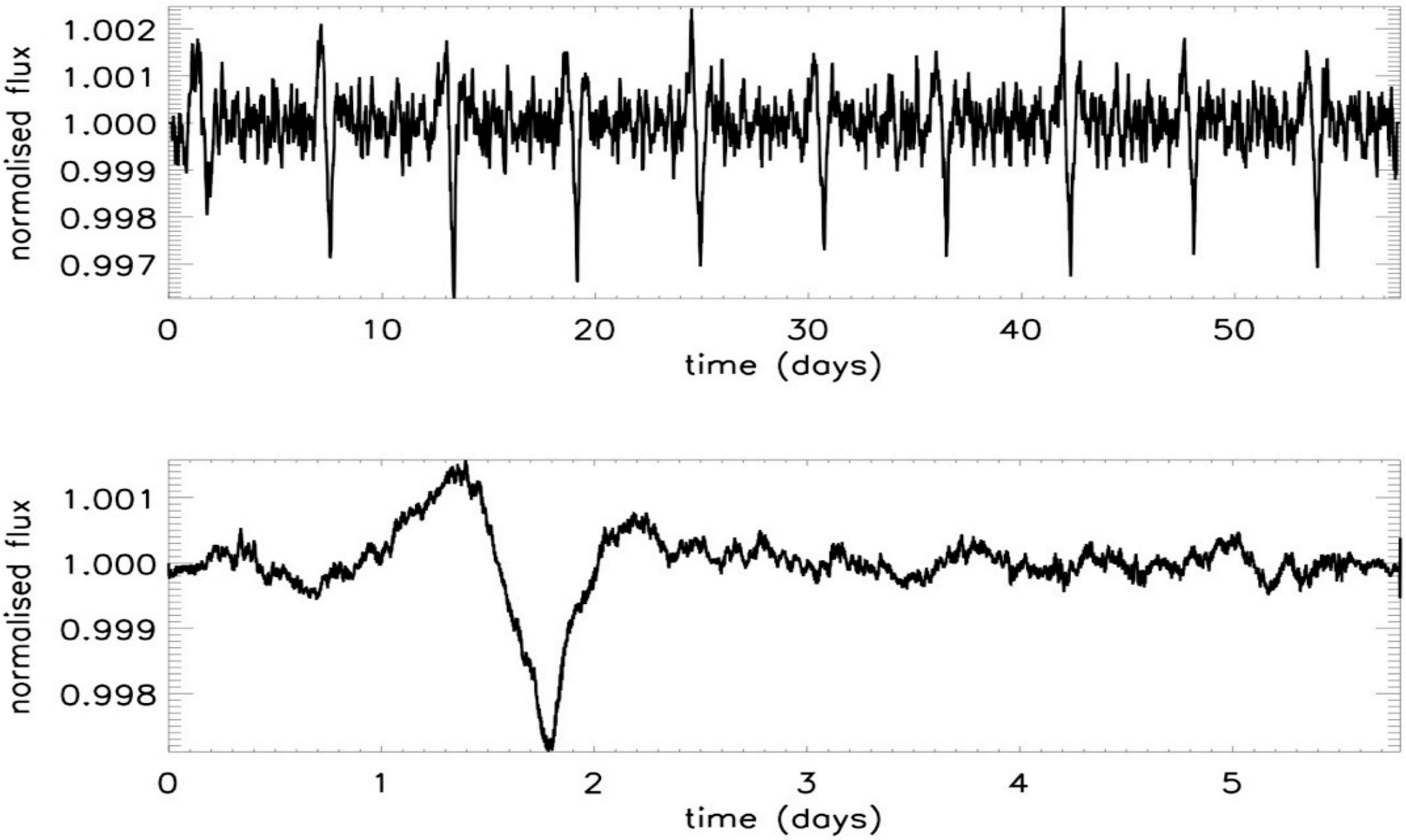
Looks like a planet... but it's not!

(eclipsing binaries at grazing angle)

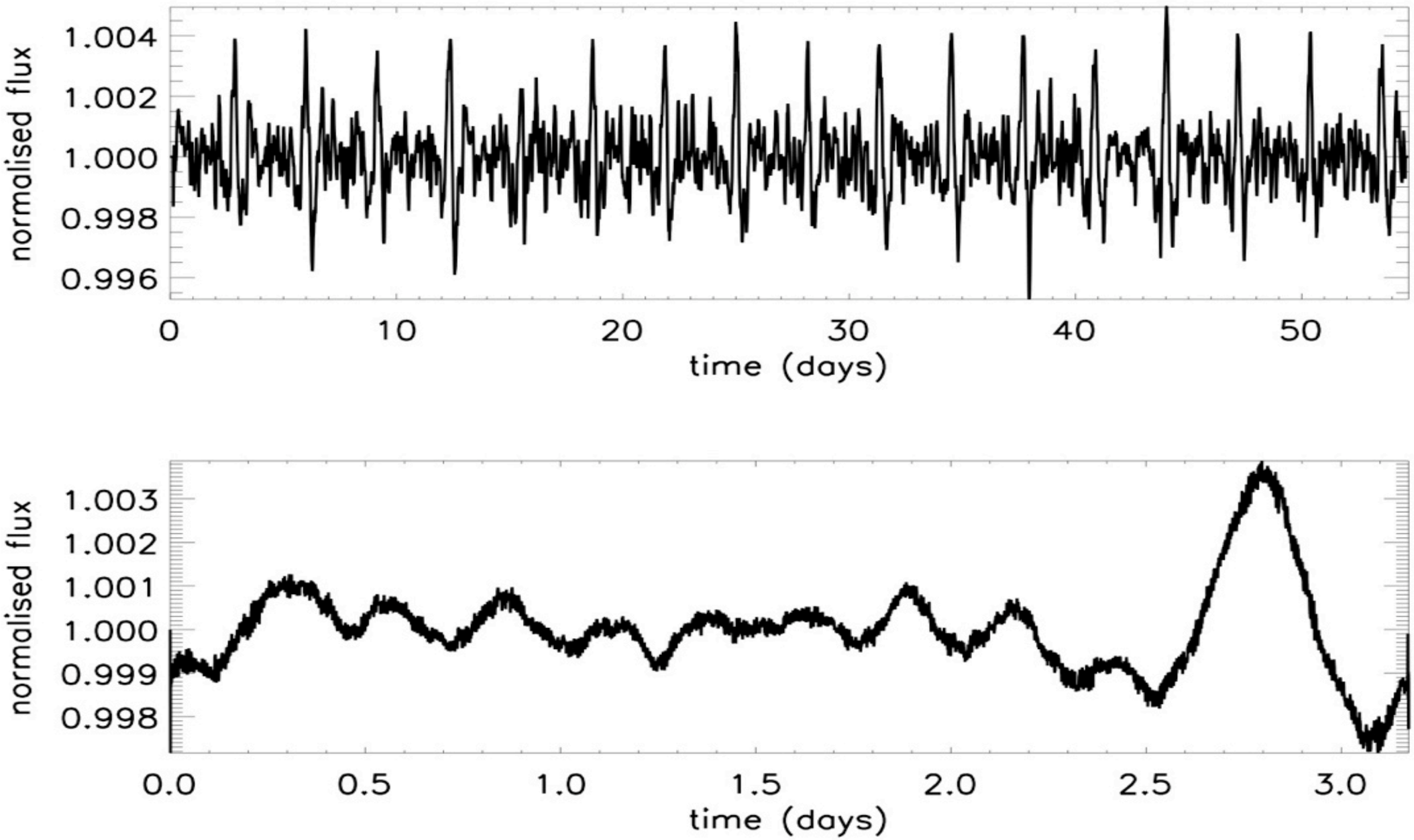




Not a planet... but interesting!



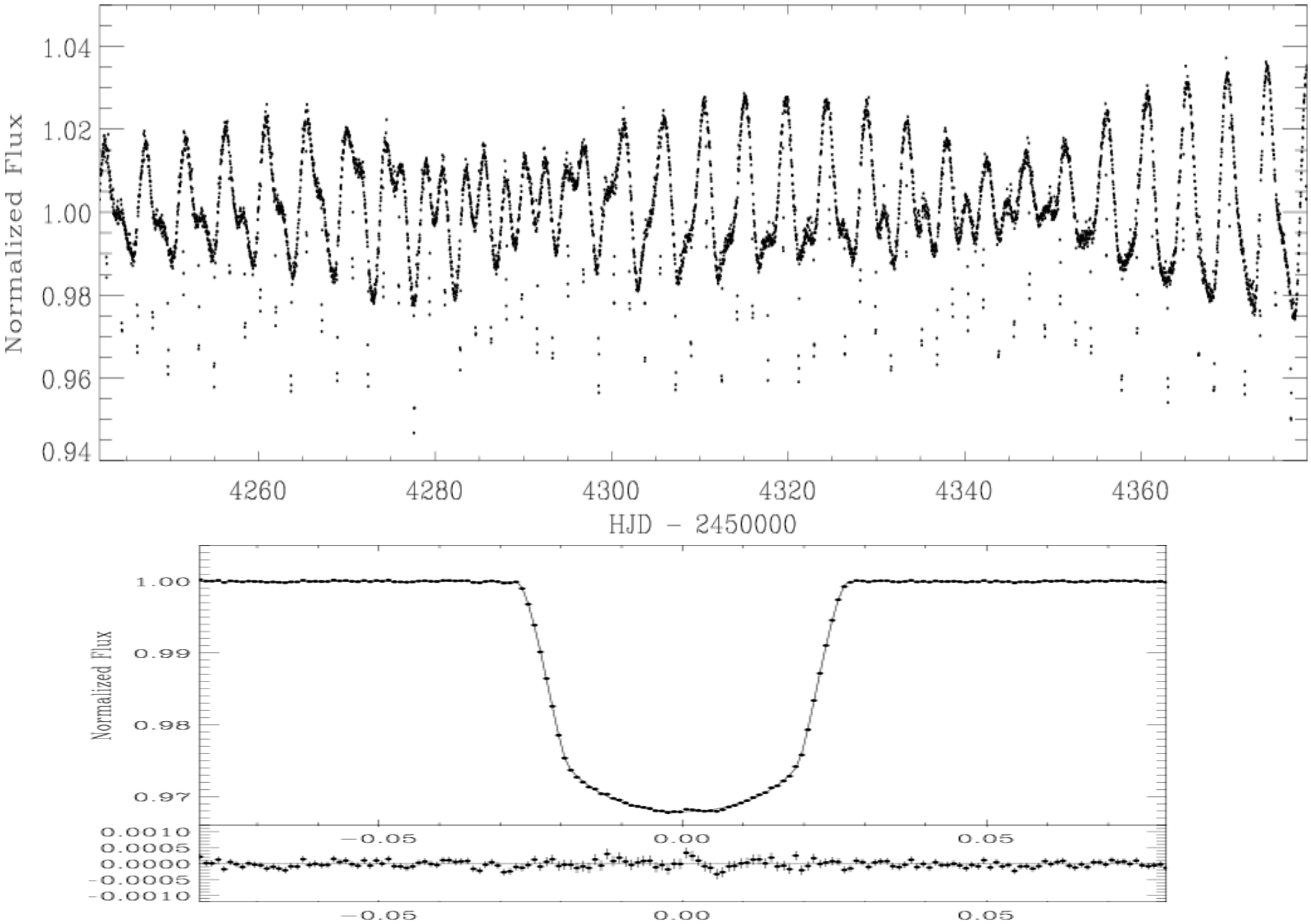
Oscillations?



Planets discovered with CoRoT

- CoRoT-Exo-1b (published): R=1.5Rjup, M=1Mjup, P=1.5days
- CoRoT-Exo-2b (published): R=1.5Rjup,M=3.3Mjup, P=1.7days
- CoRoT-Exo-3b (submitted) is a peculiar Brown dwarf: R=1Rjup, M=21Mjup(!), P=4.3days
- CoRoT-Exo-4b (accepted): R=1.2Rjup, M=0.75Mjup, P=9.2days
- +CoRoT-Exo-5b (in preparation)

Example: CoRoT-Exo-2b



Conclusions

- ~30.000 light curves analysed so far
- 1% are possible planet candidates (from CoRoT data only)
- 1/2 of the candidates are/will be soon followed up (ground-based FU)
- Results: 5-7 confirmed so far (+few other good candidates)
- About ~15 planets are expected from theory

Detection of planets with CoRoT (especially small ones) is very challenging!