# EP 11: Exoplanets

Zeit: Mittwoch 15:15–16:45 Raum: AKM

EP 11.1 Mi 15:15 AKM

**Warum der Mangel an kurzperiodischen massiven Exoplaneten?** — •Ludmila Carone und Martin Pätzold — Rheinisches Institut für Umweltforschung, Abteilung Planetenforschung, an der Universität zu Köln

Insgesamt 407 extrasolare Planeten wurden seit 1995, der Bekanntgabe des ersten extrasolaren Planeten um einen sonnenähnlichen Stern, gefunden. Bei den meisten handelt es sich um Gasriesen, die in engen Umlaufbahnen um ihre Sterne kreisen. Obwohl schwere Planeten mit extrem kurzperiodischen Bahnen bevorzugt entdeckt werden sollten, scheinen Planeten mit großen Halbachsen unter 0,03 AE relativ selten zu sein. Die beiden kurzperiodischsten und gleichzeitig massiven Planeten WASP-18b und WASP-19b wurden erst 2009 entdeckt.

Wir erklären den Mangel an massiven extrasolaren Planeten auf extrem kurzen Umlaufbahnen durch den Austausch von Gezeitenkräften. Dieser führt je nach angenommenem Gezeitendissipationskoeffizienten über der Lovezahl zweiter Ordnung (Q*/k2*) zu einer Abnahme der großen Halbachse des Planeten, bis dieser das Rochelimit erreicht und zerstört wird. WASP-18b und WASP-19b sind daher seltene Vertreter von Planeten, die gerade aufgrund der Gezeitenwechselwirkung Richtung Stern wandern.

EP 11.2 Mi 15:30 AKM

**Scientific Analysis of CoRoT Light Curves** — •Juan Cabrera — Institut für Planetenforschung - DLR - Rutherfordstr. 2 12489 Berlin

The CoRoT satellite was launched on December 2006 with two goals: the search for extrasolar planets and the study of the internal structure of stars. So far, six planets and a brown dwarf (with 20 Jupiter masses) have been reported and several results on stellar seismology have been published.

This presentation will show the treatment of the data provided by the satellite CoRoT and the different tools used to analyze the signal. A careful study of the scientific output, the light curves, provides information about the presence of planets, results about the thermal structure of the transiting planet through the analysis of the secondary eclipse, the search for multiple planetary systems through the perturbations in the ephemeris of transits, the search for reflected light of non transiting planets, the study of the stellar activity of the star, the interactions between the star and the planet and the search for moons and rings around transiting planets. Interesting results in these areas will be presented.

EP 11.3 Mi 15:45 AKM

**Structure and Composition of the CoRoT-7b Exoplanet** — •Frank W. Wagner, Frank Sohl, Hauke Hussmann, Heike Rauer, and Matthias Grott — Institute of Planetary Research, German Aerospace Center, Berlin, Germany

The field of planetary sciences is rapidly expanding due to the growing number and unexpected diversity of discovered planets beyond the solar system. CoRoT-7b is the first exoplanet among more than a dozen low-mass ($< 15\ M_\oplus$) extrasolar planets for which the radius *and* mass have been accurately determined. In units of Earth equivalents, these are $1.68 \pm 0.09\ R_\oplus$ (Léger et al. 2009) and $4.8 \pm 0.8\ M_\oplus$ (Queloz et al. 2009), respectively. The average compressed density of CoRoT-7b of $5.6 \pm 1.3$ Mg m$^{-3}$ is comparable to the Earth's (5.515 Mg m$^{-3}$) and suggests a terrestrial-type bulk composition. We model the internal structure of CoRoT-7b as a type example for a terrestrial extrasolar planet using mass and energy balance constraints. Our results suggest that CoRoT-7b may represent a dry, rock-rich planet predominantly composed of silicates, similar to the Earth's Moon (Wagner et al. 2009). An iron-rich core at depth would be small and less massive or even non-existent, suggesting that CoRoT-7b may have originated in the iron-depleted region beyond the snowline and lost its volatile mass fraction when subsequently moving toward its primary.

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EP 11.4 Mi 16:00 AKM

**Gravitational Perturbations in Exoplanetary Systems** — •Szilard Csizmadia[1] and CEST Team[2] — [1]DLR, Intitut für Planetenforschung — [2]-

Studying exoplanets is a very new research field of astrophysics. The sequence of discoveries started only in 1995 and more than 400 planets were discovered around other stars than the Sun in the last 15 years. Most of these exoplanets is known to be lonely planet around its host star, but few real planetary systems are also known. It is believed that there are more planets and small bodies in every system just we did not detected those planets.

To find additional objects in the systems, one promising technique is the so-called transit timing variation method which measures the tiny orbital period changes of a transiting exoplanets and it tries to reconstruct the origin of these period chhanges. Note that Neptune was discovered by a similar way.

Here I summarize the types of gravitational perturbations in a planetary system, the role of Kozai-resonance in the formation and evolution of the systems. I also present our results about the transiting exoplanet CoRoT-1b.

EP 11.5 Mi 16:15 AKM

**Plasma interaction between exoplanets and their host stars** — •Timo Grambusch and Joachim Saur — Institut für Geophysik und Meteorologie, Universität zu Köln, Zülpicher Str. 49a, D-50674 Köln

We present a method to calculate the energy flux, which is transported by plasmawaves from exoplanets to their host stars.

In the last fourteen years more than 400 exoplanets have been discovered and most of them are so-called Hot Jupiters. Those planets have a short semi-major axis ($< 0.1$ AU) and a mass in the order of Jupiter's mass. For some of these planets the stellar wind is sub-Alfvénic, which means that no fast-shock is present and an Alfvén wing forms. In this case the interaction is similar to the Io-Jupiter interaction where the Alfvén wing produces a footprint in the ionosphere of Jupiter.

For our calculations we assume that the main contribution of the energy flux is carried by the integrated Poynting flux. We discuss how the energy flux depends on the extend of the magnetosphere, the stellar wind velocity, the stellar magnetic field and other parameters. Finally, we will provide the total energy fluxes for several exoplanets, where observational hints for a planet-star connection exist.

EP 11.6 Mi 16:30 AKM

**On the Detectability of Biomarkers in Extrasolar Super-Earth Atmospheres** — •Heike Rauer[1,2], Adrian Belu[3], Stefanie Gebauer[1], Mareike Godolt[1], John Lee Grenfell[1], Daniel Kitzmann[1], Beate Patzer[1], Franck Selsis[3], Barbara Stracke[2], and Philip von Paris[2] — [1]Zentrum für Astronomie und Astrophysik, Technische Universität Berlin (TUB), Hardenbergstr. 36, 10623 Berlin, Germany — [2]Institut für Planetenforschung, Deutsches Zentrum für Luft- und Raumfahrt (DLR), Rutherfordstraße 2, 12489 Berlin, Germany — [3]Laboratoire d'Astrophysique de Bordeaux, CNRS, Universite Bordeaux 1, BP89, 33270, Floirac, France

The presence of biomarker molecules in the atmospheres of terrestrial planets is usually interpreted within the context of biological activity. However, the instrumental design requirements for the detection of such species are demanding because of the weak signals. In this contribution we present detailed studies of spectral resolutions and signal-to-noise ratios achievable with currently proposed space telescopes for emission and transmission spectra of Super-Earth planets.