EP 3: Astrophysik/Astrobiologie

Zeit: Dienstag 14:00–16:00 Raum: HS 9

EP 3.1 Di 14:00 HS 9

Atoms in the strong magnetic fields of magnetic white dwarfs and neutron stars — •Christoph Schimeczek and Günter Wunner — 1. Institut für Theoretische Physik, Universität Stuttgart, 70550 Stuttgart

The analysis of high resolution magnetic white dwarf spectra (Sloan Digital Sky Survey) and neutron star spectra (Chandra & XMM-Newton) sets the demand for precise atomic data of atoms and ions from hydrogen to iron at magnetic field strengths ranging from 10^2 T to 10^{10} T. We present values for transition energies and oscillator strengths obtained with our fast and precise tools for arbitrary magnetic field strengths and atomic states, reaching a relative precision of 10^{-6} for hydrogen and 10^{-2} for heavier elements up to iron. This provides an important contribution to the understanding of these fascinating objects.

EP 3.2 Di 14:15 HS 9

Dust in the Outer Solar System — Christian Vitense[1], •Alexander Krivov[1], Hiroshi Kobayashi[1,2], and Torsten Löhne[1] — [1]Astrophysikalisches Institut, Friedrich-Schiller-Universität Jena, Germany — [2]Nagoya University, Japan

Dust close to stars is either primordial and represent building material for planets or is secondary being produced in mutual collisions of planetesimals. In the latter case these so-called debris dust is detected via infrared excess or in resolved images. The link between the dust and the dust-producing planetesimal belt can then be established by modelers. Here we show, using the example of the Kuiper belt, that this link is not always unique. It may not be possible to infer properties of planetesimals from dust or vice versa, because it is unseen mid-sized objects that set the properties of the dust distribution. In the model presented here we found in the Kuiper belt that only objects smaller than a hundred meters are responsible for the dust production, while larger objects are not yet part of the collisional cascade. Staying consistent with dust impact and thermal emission measurements, we show that it is still possible to have different size distributions for the dust, using the same population of transneptunian objects as parent bodies. Furthermore, we present a new piece of evidence that the parent bodies (planetesimals) must have born big, which is based on the analysis of the amount of dust in the EKB region. We find that the EKBOs smaller than a few tens of kilometers in size must be strongly underabundant. In other words, there has to be a pronounced break in the size distribution for objects at those sizes.

Hauptvortrag EP 3.3 Di 14:30 HS 9

Exoplanetary Systems — •Artie Hatzes — Thüringer Landessternwarte Tautenburg

We are in the "Golden Era" of Exoplanet studies. To date almost 900 exoplanets have been discovered around other stars and over 120 of these are in multiple systems. Astronomers have also started to characterize these worlds in terms of their mass, radius, density, and surface temperature. Atmospheric features in exoplanets have also been detected. At the forefront of these characterization studies are CoRoT and Kepler, the first space telescopes devoted to the finding exoplanets via the transit method. Together these two space missions have discovered over 100 transiting exoplanets as well as thousands of more candidates that await confirmation. I will review the current status of our knowledge on exoplanetary systems focusing on the exciting results from the CoRoT and Kepler space missions. I will also discuss the prospects of finding the "Holy Grail" of exoplanets: terrestrial planets in the habitable zone of other stars.

EP 3.4 Di 15:00 HS 9

Anwendung der wavelet-basierten Filtermethode VARLET zur Detektion von Exoplaneten in variablen Lichtkurven der Weltraummissionen CoRoT und Kepler. — •Sascha Grziwa, Judith Korth und Martin Pätzold — Rheinisches Institut für Umweltforschung, Abteilung Planetenforschung an der Universität zu Köln, Deutschland

Der Einsatz dedizierter Weltraumteleskope wie CoRoT und Kepler haben die Anzahl der bestätigten Exoplaneten stark gesteigert. Tausende weitere Kandidaten warten auf eine Bestätigung durch bodengestützte Nachbeobachtung. Eine statistisch signifikante Anzahl von Exoplaneten aus verschiedenen Teilen unserer Milchstraße verhilft uns zu neuen Erkenntnissen über die Verteilung und Entstehung von Planetensystemen. Unsere Detektionspipeline EXOTRANS wird seit 2006 erfolgreich für die Weltraummission CoRoT und seit 2011 zur Verarbeitung der öffentlich zugänglichen Daten des Weltraumteleskops Kepler eingesetzt. Variationen des beobachteten Sterns erschweren die Detektion von Exoplaneten in hochaufgelösten Lichtkurven erheblich.

Das RIU-PF entwickelte die wavelets-basierte modellunabhängige Filtermethode VARLET, welche die Variationen des Zielsterns vollständig separiert. Durch Einsatz dieser Filtermethode lassen sich auch flache Transits in variablen Lichtkurven detektieren. Wir präsentieren die Ergebnisse der Anwendung von VARLET als Teil unserer Detektionspipeline EXOTRANS auf die Lichtkurven der Weltraumteleskope CoRoT und Kepler. Insbesondere fanden wir mehr als 200 bisher unbekannte Kandidaten in den Daten des Weltraumteleskops Kepler.

EP 3.5 Di 15:15 HS 9

The PLATO Mission - revealing extra-solar Earths — •Heike Rauer — Institut für Planetenforschung, DLR, Berlin-Adlershof

This decade is witnessing a rapid increase in our understanding of the nature of extra-solar planet systems and their host stars. Missions such as Corot and Kepler have confirmed that not only are extra-solar planets a common occurrence, but that multiple planetary systems are also the norm. Whilst there has been significant progress in discovery and to some extent understanding of extra solar planets and their host star(s), major questions remain as we seek to reveal the presence of extra-solar planets harbouring life.

PLATO is a proposed ESA M3 mission which will revolutionise our understanding of extra-solar planets, through its discovery of planets around hundreds of thousands of stars, orders of magnitudes more than previously known. Its exquisite sensitivity will ensure that it detects planets to Earth masses up to the 'habitable' zone. PLATO will probe the interiors of both the host star(s) and their orbiting planetary systems.

This presentation will describe the PLATO science yield: detecting rocky planets up to the habitable zone with known radii and masses, including planets orbiting solar-like stars; obtaining statistically significant numbers of characterized small planets at different orbits, around various star types; thus providing a set of well characterised small terrestrial planets around bright stars as targets for future atmosphere spectroscopy.

EP 3.6 Di 15:30 HS 9

How accurate are estimates of planetary bulk composition as inferred from determinations of planet mass and radius? — •Frank Sohl[1], Frank W. Wagner[1], and Heike Rauer[1,2] — [1]DLR Institut für Planetenforschung, Berlin — [2]Zentrum für Astronomie und Astrophysik, Technische Universität Berlin, Germany

Masses and radii of transit planets are provided by radial velocity and photometric observations. The inferred mean density is the main indicator of the bulk composition of solid planets. Structural models of low-mass exoplanet interiors that are consistent with the thermodynamics of the high-pressure limit are compositionally distinct, but they do partly suffer from inherent degeneracy or non-uniqueness problems. These are related to the imperfect knowledge of the internal differentiation state and/or the possible presence of an optically thick atmosphere. We will discuss the role of mass and radius measurement errors for determinations of a planet's mean density and bulk chemical composition using calculated relations between radius and mass of solid exoplanets ranging from super-Earths to mini-Neptunes. It is shown that mass-radius relationships based on numerical models of solid exoplanet interiors are sufficiently robust to infer a planet's bulk composition from accurate determinations of its mean density. Reference: Sohl, F.; F.W. Wagner, H. Rauer (2012), arxiv.org/pdf/1211.3331 .

EP 3.7 Di 15:45 HS 9

Mass determination of young directly imaged planet candidates and brown dwarfs — •Tobias Schmidt[1], Ralph Neuhäuser[1], Andreas Seifahrt[2], and Markus Mugrauer[1] — [1]Astrophysikalisches Institut und Universitäts-Sternwarte, 07745 Jena, Germany — [2]Department of Astronomy and Astrophysics, University of Chicago, USA

About 25 sub-stellar companions with large separations ($>\tilde{}$ 50 AU) are confirmed. The origin and early evolution of these objects is still under debate. While often these sub-stellar companions are regarded as brown dwarfs, they could possibly also be massive planets, mass estimates are very uncertain so far. They are companions to primary stars or brown dwarfs in young associations and star forming regions like Lupus and Chamaeleon, hence their ages and distances are well known, in contrast to free-floating brown dwarfs.

Here we present how mass estimates of such young directly imaged companions can be derived. An empirical classification by medium-resolution spectroscopy is currently not possible, because a spectral sequence that is taking the lower gravity into account, is not existing. This problem leads to an apparent mismatch between spectra of old field type objects and young low-mass companions. We show that from spectra of the objects, using light concentration by an AO, temperature, extinction, metallicity and surface gravity can be derived and that this procedure allows a mass determination in combination with luminosities by the direct observations, as done by us for e.g. GQ Lup, CT Cha or UScoCTIO 108 and PZ Tel.