Welcome

Stimulated by the discovery of more than 700 extrasolar planets and recent solar system observations, planet formation and the subsequent evolution of planetary systems has received the highest attention of the scientific community. Following the tradition of previous workshops in this series, this 8th Workshop on Planet Formation and Evolution will bring together scientists from various theoretical, observational and experimental fields and is aimed to stimulate interdisciplinary discussion between astronomy, astrobiology, planetary science, mineralogy, laboratory work, and other adjacent fields.

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12:30 - 14:00		– LUNCH BREAK –

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Talks

Solar System Studies (Chair: A. Pack)

Name: Mario Trieloff
Affiliation: Institut für Geowissenschaften, Universität Heidelberg
Title: **Review Talk: Solar System Studies**
Abstract: TBD

Name: Åke Nordlund
Affiliation: Centre for Star and Planet Formation
Title: **Planetesimal Formation and the Origin of ^{26}Al in the Early Solar System**
Abstract: The presence and initial abundances of short-lived radionuclides (SLRs; e.g., ^{26}Al, ^{53}Mn, ^{60}Fe, ^{182}Hf) in the Solar System can be used to obtain evidence about the timescales of processes in the early Solar System. Many SLRs are believed to have a stellar origin, and may have been inherited from the molecular cloud that the Sun was borne in. Recent high-precision measurements ^{26}Mg in meteorites and their components show that, despite its short half-life of 0.73 Ma, ^{26}Al was present at levels of ^{26}Al/^{27}Al $\sim$2.8e-5 at the birth of the Solar System.

We study the origin of live ^{26}Al in the early Solar System, using three-dimensional MHD models of star formation that keep track of yields from supernovae and stellar winds via passive scalar transport equations. We use both the RAMSES adaptive mesh refinement code and the uni-grid Stagger Code, enhanced with detailed ISM cooling and heating functions, and with tables of nuclear yields, stellar life times, stellar wind speeds and mass loads, as a function of stellar mass. Stars, represented by sink particles, are created according to a standard IMF in the cold and dense local molecular clouds that form in the larger environment, and the motions of massive stars are followed until they explode as supernovae, giving back kinetic energy and chemical yields to the ISM.

Using numerical simulations representative of giant molecular clouds with masses 1e5 to 1e6 solar masses, on scales ranging from 40 to 160 pc, we show that, contrary to widely held beliefs, the occurrence of ^{26}Al at the levels deduced for the early solar system is a natural consequence of star formation under typical GMC conditions – no special event such as a late chance injection of SLRs into the proto-solar nebula or proto-stellar disk is needed. Evidence of limited mixing indicates that formation of planetesimals was very rapid. The current upper limit for the formation time of CAIs in one parent body is only 2 kyr.

Name: John Wasson
Affiliation: UCLA
Title: **Heterogeneous accretion of the solar nebula**
Abstract: Each group of chondritic meteorites consists of assemblages of materials from one nebular location at one time. They record large differences in chemical composition, moderate differences in O-isotopic composition, and small but well-resolved differences in the isotopic compositions of many other elements. There is thus indisputable evidence that the solar nebula was heterogeneous and there is no plausible way to account for this heterogeneity other than that the composition changed with time because the parcels of materials falling in from the molecular cloud consisted of variable contributions from different parts of the heterogeneous molecular cloud.

Name: Hiroko Nagahara
Affiliation: Dept. Earth Planet. Sci., The Univ. Tokyo
Title: **Chemical evolution of the protosolar disk**
Abstract: Behavior of dusts and evolution of the protosolar disk are responsible for composition of planetesimals, which further affects the composition of planets. Although physical behavior of dusts have been extensively studied, the relationship between physics and chemistry has been scarcely stidied yet. In order to relate physics and chemistry, we have developed a model to describe phase change as a function of pressure and temperature, where evaporation and condensation of solid are thermodynamically and kinetically taken into the model. The model stands on experimental data for evaporation and condensation of major planet forming minerals, metal, Mg-silicate, and Al2O3. The results show that the solid phases condense are dependent on total pressure, cooling time scale of the gas, and specifically the degree of dust/gas separation. The degree of dust/gas separation is dependent on the degree of turbulence of the disk. The chemical fractionation is divided into three modes: (1) no fractionation if dust/gas separation is not effective at rapid cooling conditions (cooling time smaller than about one thousand years) and the critical size for dust separation is fairly large (larger than about mm), (2) significant fractionation at moderate cooling rate and moderate dust separation size, and (3) weak fractionation due to complete aggregation of large dusts at low cooling rate of the gas. The results predicts chemical variation of planetesimals in extrasolar disks.

Name: Nagisa Machii
Affiliation: IGEP, TU Braunschweig
Title: **The relation between the physical properties and the collisional outcome of meteoritic matrix**
Abstract: Chondrites are one of the major groups of meteorites. They consist of spherical objects, called chondrules, which are typically millimeter-sized, and fine-grained matrix between the chondrules. Analyses of chondrites showed that the chondrules experienced high temperatures whereas the matrix experienced only low temperature. Based on these previous results, we assume that chondrules and matrix were formed at different places in the protoplanetary disk and subsequently collided with each other. In this work, we investigated the relation between the physical properties of large dust agglomerates and their collisional outcomes.

Samples used in the work were glass beads of 1, 3 and 4.7 mm as chondrule analogs and polydisperse spherical silica particles of 0.8 ± 0.3 μm as matrix analogs. To determine the physical properties of large dust agglomerates, we performed compression tests and obtained compression curves, which indicate the relation between porosity and pressure. From these curves, we could determine the pressure of the elastic limit for dust aggregates with individual porosities. Within the error bars, this elastic limit is identical to the compressive strength of the aggregate. We thus consider that the any point on the compression curve represents the compressive strength of the agglomerate of that porosity.

Collision experimentsbetween the mm-sized solid projectiles and fluffy dust aggregates were performed at three velocity ranges, i.e. 0.2-2, 2-5, and 30-300 m/s, using a drop tower (at TU Braunschweig), a spring gun, and a light-gas gun (at Kobe Univ.). As collisional outcomes, intrusion, (nearly) sticking and bouncing were observed. Comparing the impact pressure, P, with the compressive strength of dust, Yc, we found that intrusion occurs when P $>$Yc and bouncing occurs when P $<$Yc.

Name: Gerhard Wurm
Affiliation: Faculty of Physics, University Duisburg-Essen
Title: **Photophoretic separation of metals and silicates: the formation of Mercury like planets and metal depletion in chondrites**
Abstract: There is a general trend in the Solar System that planetary bodies close to the sun contain more metal than objects further out. This is evident in the uncompressed densities of Mercury and the metal depletion in most chondrites. As the two smallest Extrasolar planets for which mass and size could be determined so far (Corot-7b and Kepler-10b) are Mercury like and orbit close to their star, sorting of metals and silicates with distance might be a general feature of planet formation. Adding the recent results of the MESSENGER mission, the loss of a silicate mantle in high temperature events like a giant impact or evaporation seems to be ruled out. An explanation for all these findings is still lacking but it requires a 'physical' process which separates metals from other materials. We suggest that photophoresis at the inner edge or inside the inner edge of a protoplanetary disk provides such a mechanism. It also fits to other observations like irradiation of planetary precursors or timing of asteroid formation. The basic idea is that high thermal conductivity particles like metals are insensitive to photophoresis while lower thermal conductivity particles like silicates are pushed outwards. This way a natural gradient evolves in a planetary system where inner bodies are metal rich and outer bodies are metal poor.

Name: Richard Parker
Affiliation: Institute for Astronomy, ETH Zurich
Title: **Dynamical histories of supernova-enriched Suns**
Abstract: Analysis of meteorites in the Solar System suggests that the Sun and its protoplanetary disc was most likely enriched by the supernova explosion of a 25 $M_{\odot}$star at a distance of 0.1 - 0.3 pc. The mass of the most massive star in a star cluster is related (possibly fundamentally) to the mass of the cluster; the presence of a 25 $M_{\odot}$star suggests that the Sun likely formed in the company of at least ∼2000 other stars. In this contribution I present the results of N-body simulations of star clusters where the most massive star is 25 $M_{\odot}$, and discuss the dynamical histories of solar-mass stars that are "in the right place at the right time" - i.e. enriched by the supernova. Whilst some enriched solar-mass stars do suffer interactions that would likely hinder planet formation, others remain virtually unscathed during the first 10Myr of the cluster's evolution.

Name: Susanne Pfalzner
Affiliation: MPIfR
Title: **The cluster origin of the Sun - Consequences for the formation of the solar and other planetary system**
Abstract: The solar system was most likely born in a star cluster containing at least 1000 stars. It is highly probable that this cluster environment influenced various properties of the solar system like its chemical composition, size and the orbital parameters of some of its constituting bodies. In the Milky Way, clusters more massive than 10^3 $M_{\odot}$only form in two types - starburst clusters and leaky clusters - each following a unique dynamical development in the mass-radius plane. Given that this is the same mass range as the solar birth cluster, our Sun must have formed either in a starburst or a leaky cluster. It is demonstrated that it is highly probable that the solar system formed in a leaky cluster. This means that the solar birth cluster quickly expanded after gas expulsion and its average stellar mass density evolved as $\rho_l >\approx 150 t_c^{-2.6\pm0.2} [M_{\odot} \mathrm{pc}^{-3}]$. Due to the large cluster mass-loss in this process, the solar birth cluster dispersed to a large extent after just 20 Myr, with only about 10%-20% of the stars remaining bound. It is demonstrated that an encounter determining the characteristic properties existing in our solar systems most likely happened very early on (< 2Myr) in its formation history. After 5Myr the likelihood of a solar-type star experiencing such an encounter in a leaky cluster is negligible. This explains why the solar system could develop and maintain its high circularity later in its development

Name: Horst Uwe Keller
Affiliation: IGEP TU Braunschweig
Title: **Comets - Key Witnesses of the Beginning**
Abstract: Once it was realized that comets contain large proportions of highly volatile compounds (H_2O dominates) it became obvious that they must have formed in the cold outer fringes of the planetary nebula. Their key role for the understanding of the primordial material and physical processes in the early solar nebula was readily recognized and it was only consequential that ESA's first interplanetary mission was the flyby of comet Halley. Comet encounters during the last decade consolidated our perception of kilometre sized fragile nuclei with very low surface albedo and localized activity. Recent results on the $CO/CO_2/H_2O$ composition of comets show that there is a wide dispersion in abundance ratios and little if any systematic difference between Jupiter-family comets (JFCs) and Long-period and Halley-type comets (LPCs and HTCs). This suggests formation of all types of comets in largely, but not entirely, overlapping regions, probably between the CO and CO_2 snow lines. The traditional view that JFCs formed beyond Neptune and the longer period comets within todays giant planets is not supported. This is no surprise considering the dynamic turmoil created by the postulated radial motion of Jupiter and Saturn. Stardust samples of cometary coma material revealed highly refractory grains produced near the sun requiring radial mixing before and probably during the formation of cometary nuclei. On the other hand strong correlations of cometary hydrocarbon compounds with interstellar material are found. An outlook of what we can expect from the Rosetta comet rendezvous mission and of the merits of a comet nucleus sample return will be given.

Laboratory Work on Planet Formation (Chair: G. Wurm)

Name: Jürgen Blum
Affiliation: IGEP, TU Braunschweig
Title: **Review Talk: Laboratory Work on Planet Formation**
Abstract: The past years have provided us with a tremendeous amount of new laboratory work on the processes which potentially can lead to the formation of planetesimals in protoplanetary disks (PPDs). Although many details need to be clarified before a reliable picture of the dust evolution in PPDs can be drawn, it seems obvious that direct collisional growth can only form mm- to cm-sized dust aggregates. Herafter, other processes, such as gravitational instabilities or fragmentation-induced growth processes must be responsible for the formation of km-sized planetesimals. I will review the state of the art in this field of laboratory astrophysics.

Name: Johannes Deckers
Affiliation: Fakultät für Physik, Universität Duisburg-Essen
Title: **Coagulation of Dust - Collisions in the Decimetre Range**
Abstract: Planets are formed by accretion of planetesimals, which are km-size protoplanetary bodies. Dust agglomerates play a major role in the formation process of these planetesimals. They either evolve from dust agglomerates through coagulation, or they form by gravitational instabilities in highly dense parts of the protoplanetary disc. Decimetre size dust agglomerates play an important role in both scenarios, as they are direct precursors for the critical meter-size bodies and can easily be trapped in vortices, in which critical particle densities can be reached to enable gravitational collapse. Therefore it is important to investigate the collision dynamics of the decimetre size agglomerates. Especially the threshold conditions for fragmentation are important for coagulation models. In our experiment we investigated the collisions of decimetre size dust agglomerates of equal size and porosity. The experiments were carried out in the drop tower in Bremen under microgravity conditions at pressures of <0.1 mbar. Collisions were observed at velocities between 6 cm/s and 30 cm/s. The collisions were observed with two high-speed cameras, which were aligned perpendicular to each other to obtain full 3-dimensional information of the impact process. We will present first results of the microgravity experiments and a first analysis of the fragmentation conditions for dust agglomerates in the critical decimetre range.

Name: Rainer Schräpler
Affiliation: IGEP, TU Braunschweig
Title: **The low-velocity behavior of large Dust Agglomeraties**
Abstract: We performed micro-gravity collision experiments in our laboratory drop-tower using 5-cm-sized dust agglomerates with volume filling factors of 0.3 and 0.4, respectively. The dust aggregates consisted of micrometer-sized silica particles and were macroscopically homogeneous. We measured the coefficient of restitution for collision velocities ranging from $1 \sim \mathrm{cm} \sim \mathrm{s}^{-1}$ to $0.5 \sim \mathrm{m} \sim \mathrm{s}^{-1}$, and determined the fragmentation velocity. For low velocities, the coefficient of restitution decreases with increasing impact velocity. At higher velocities, the value of the coefficient of restitution becomes constant, before the aggregates break at the onset of fragmentation. We interpret the qualitative change in the coefficient of restitution as the transition from a solid-body-dominated to a granular-medium-dominated behavior. We complement our experiments by molecular dynamics simulations of porous aggregates and obtain a reasonable match to the data. We discuss the importance of the outcome of our experiments for protoplanetary disks, debris disks, and planetary rings.

Name: Sebastiaan Krijt
Affiliation: Leiden Observatory
Title: **A dynamic contact model for adhesive micron-sized spheres**
Abstract: The first steps towards planet formation involve the formation of centimeter to meter sized aggregates from micron-sized ice and dust particles (monomers). During this growth phase, the critical sticking velocity and the rolling force are crucial parameters, since they determine the strength of a bond between monomers, and the ease with which an aggregate can restructure. Currently used descriptions for both the sticking parameter and the rolling force are based on a static contact model, and predict values that are systematically smaller than experimentally determined ones.
We investigate a dynamic contact model for adhesive spheres, in which the "effective" surface energy varies with the rate at which the contact is created or destroyed, an effect which is caused by non-linear behavior near the contact edge. We show how this model can be used to describe a collision, and how it explains in a natural way the high sticking velocities observed in experiments. In addition, this contact model results in a new formulation of the rolling force, which has a profound influence on the restructuring dynamics of aggregates.

Name: Hidekazu Tanaka
Affiliation: ILTS, Hokkaido University
Title: **Growth of Dust Aggregates in Protoplanetary Disks and Reexamination of Particle Interaction Models**
Abstract: Dust growth is the first step of planet formation in protoplanetary disks. Dust growth also influences the temperature of protoplanetary disks. However, we still have a large uncertainty in the dust growth process. This uncertainty mainly comes from unknown factors in dust internal structure and collisional outcomes. The dust structure and the collisional outcome would be closely related with each other. In recent years, many theoretical studies on aggregate collisions and growth have been done. In the present talk, we introduce remarkable results in these theoretical studies, mainly focusing on numerical simulations of dust collisions by our group. In the numerical simulations of dust collisions, we adopt the interaction model between constituent particles of dust aggregates. We have started the reexamination of the particle interaction model, by performing molecular dynamics simulation of particle collisions. We also report the preliminary results of our molecular dynamics simulations.

Name: Eike Beitz
Affiliation: IGEP
Title: **Experiments on the formation of chondrule dust rims**
Abstract: Beitz, E., Blum, J., IGEP, TU Braunschweig, e.beitz@tu-bs.de
Dusty rims around chondrules are hypothesized to have either formed by accretion of dust particles while floating freely in the solar nebula [1] or by compaction processes on their parent bodies [2]. We will present our experimental method to accrete dust onto chondrule analogs according to the first formation scenario and show how such dust rims influence the collision behavior of dust-coated chondrules. We also tested the feasibility of the second formation scenario in a compaction experiment. Here, a sample consisting of dust and chondrule analogs was statically or dynamically compressed to study whether or not dust rims can be formed due to the proposed differential compaction process. We will present our results on the resulting sample structures and the degree of compaction that was reached in our experiments. [1] Morfill, G. et al. (1998) Icarus 134, 180-184. [2] Trigo-Rodriguez, J. et al. (2006) GCA 70, 1271-1290.

Name: Thorsten Meisner
Affiliation: Universität Duisburg-Essen
Title: **High speed dust collisions and their consequences on planetesimal formation**
Abstract: Planets form in protoplanetary disks around developing and evolving stars. Inside of protoplanetary disks solid material is initially existent in form of micrometer-sized dust grains. Following the coagulation model those dust grains grow up to decimeter-sized bodies through collisions. At this, the model of Weidenschilling and Cuzzi (1993) predicts relative velocities around 50 m/s between micrometer-sized and decimeter-sized objects. To understand the processes which happened at such large velocities, we perform laboratory experiments with a recently developed high speed centrifuge. Inside of this centrifuge micrometer-sized dust particles are accelerated from an inner rotating drum towards a surrounding exterior wall onto a target. The accelerated dust particles reach velocities of up to 50 m/s. First results will be presented.

Name: Carsten Güttler
Affiliation: Kobe University
Title: **A new experiment-based collision model to overcome the bouncing barrier**
Abstract: Implementing the latest laboratory experiments on dust aggregation into coagulation models, we recently found that we could not describe the growth of dust into planetesimals. In the experimental-theoretical approach of Güttler et al. (2010) and Zsom et al. (2010) we considered all laboratory data that was available at that time and found that the dust growth is halted at aggregate sizes around millimeters. In a new approach (Windmark et al., 2012), we added the most recent laboratory results and also reduced the number of considered experiments to those which were identified to be important earlier. In this talk, I will present the new experiments and the developments of the collision model used by Windmark et al. (2012). In the talk of F. Windmark, we will then see how this new model can explain to break through the millimeter-size 'bouncing barrier'.

Name: Fredrik Windmark
Affiliation: ITA, University of Heidelberg
Title: **Planetesimal formation by sweep-up: How the bouncing barrier can aid growth**
Abstract: The formation of planetesimals is often accredited to collisional sticking of dust grains. The exact process is however unknown, as collisions between larger aggregates tend to lead to fragmentation or bouncing rather than sticking. To study this, we have created a new dust collision model based on the latest laboratory experiments, and have used it together with a dust-size evolution code capable of resolving all grain interactions in the protoplanetary disk. We find that for the general dust population, bouncing collisions prevent the growth above millimeter-sizes. However, if a small number of cm-sized particles are introduced, they can act as a catalyst and start to sweep up the smaller particles. At a distance of 3 AU, 100-meter-sized bodies are formed on a timescale of 1 Myr. The bouncing barrier is here even beneficial, as it prevents the growth of too many large particles that would otherwise only fragment among each other, and creates a reservoir of small particles that can be swept up by larger bodies. However, for this process to work, a few seeds of cm-size or larger have to be introduced.

Name: René Weidling
Affiliation: IGEP, TU Braunschweig
Title: **Dust-Aggregate Collisions at Low Velocities**
Abstract: R. Weidling, C. Güttler, and J. Blum It is commonly accepted that planetesimals form in disks of gas and dust, the so-called protoplanetary disks. However, the exact mechanism of their formation remains unknown. The most complete summary of experimental results of the early growth phase was presented by Güttler et al. (2010), which was then used by Zsom et al. (2010) to model the whole growth process starting with single micrometer-sized grains. They found that growth stalls at sizes of about a millimeter due to bouncing of the aggregates. Investigating the exact transition between bouncing and sticking collisions is the purpose of the MEDEA experiment (Weidling et al., 2012). We investigate the evolution of an ensemble of dust aggregates under microgravity conditions that cools down due to mutual collisions. In our experiments, we examined collisions with velocities of centimeters to millimeters per second. We will present the results of experiments both from the drop tower and a suborbital flight and refine the model by Güttel et al. Based on the collisions where the aggregates stick to each other, we infer physical properties of the aggregate-aggregate contact.
Güttler et al., 2010, Astronomy and Astrophysics, Volume 513, A56. Weidling et al., 2012, Icarus, Volume 218, Issue 1, p. 688-700. Zsom et al., 2010, Astronomy and Astrophysics, Volume 513, A57.

Name: Christoph Loesche
Affiliation: Faculty of Physics, University Duisburg-Essen
Title: **Moving and Sorting Chondrules by Photophoresis**
Abstract: At the (outward moving) inner edge of protoplanetary disks chondrules are subject to photophoresis and can be sorted due to photophoretic properties. We evaluate the photophoretic strength on chondrules for different settings. Based on tomographies the influence of detailed shape and internal structure and composition is calculated. This is compared to measurements in microgravity experiments. In addition dust mantled homogeneous spheres, inhomogeneous spheres as well as the resulting effective thermal conductivities concerning the photophoretic force have been calculated. We find that the photophoretic strength depends on size for various settings and might explain why chondrules are found size sorted in chondrites.

Physics and Evolution of Protoplanetary Disks (Chair: P. Armitage)

Name: Kees Dullemond
Affiliation: ITA, University of Heidelberg
Title: **Review Talk: Physics and Evolution of Protoplanetary Disks**
Abstract: In this review talk I will discuss several aspects of the physics of protoplanetary disks that have relevance to the formation of planets, and to observations of protoplanetary disks. Theory topics include grain growth & drift, accretion physics, planets opening gaps etc.. Observations include recent scattered light images of disks, recent results on transition disks and perspectives for ALMA in the very near future.

Name: Jacob Simon
Affiliation: JILA, University of Colorado
Title: **Turbulent Linewidths in Protoplanetary Disks: Predictions from Numerical Simulations**
Abstract: I will present recent numerical simulations of turbulence in protoplanetary disks, both in the self-gravitating regime and in the case of turbulence driven by the magnetorotational instability (MRI). From these simulations, we extract the distribution of turbulent velocities (i.e., fluctuations about the mean orbital motions) and compare with recent sub-mm observations that measure typical values for these velocities using molecular linewidths in disk atmospheres. Our simulations show general agreement between the peak of the velocity distributions and the observationally extracted values. Our calculations also make predictions as to how the typical turbulent velocities vary with disk radius, height, and inclination angle for both self-gravity and the MRI. We will test these predictions with future ALMA observations, thus constraining theoretical models for turbulence and angular momentum transport in these disks.

Name: Neal Turner
Affiliation: JPL/Caltech and MPIA Heidelberg
Title: **In the shadow of the mountain: what young stars' infrared variability reveals about protostellar disks**
Abstract: Young stars' near-infrared emission shows several puzzling features, including variability uncorrelated with visible-light changes, foreground extinction that recurs erratically on timescales of weeks, and excesses over the stellar photosphere too large to explain by reprocessing in a hydrostatic circumstellar disk. I demonstrate that each of these features can be explained by a time-varying, magnetically-supported disk atmosphere like those suggested by MHD calculations of magneto-rotational turbulence. Through Monte Carlo radiative transfer calculations I show that such support yields near-infrared variations spanning the observed range of amplitudes. Since the starlight-absorbing surface lies higher than in hydrostatic models, a greater fraction of the stellar luminosity is reprocessed into the near-infrared, providing a natural explanation for the larger excesses. The atmosphere rises high enough to obscure the star in systems viewed near edge-on , if the dust in the outer parts of the disk has undergone some growth or settling.

Name: Tilman Birnstiel
Affiliation: LMU Munich
Title: **Can grain growth explain transition disks?**
Abstract: In the past years, many transitional disks have been detected via SED modeling and sub-mm imaging. The inner hole size range from a few to more than 70 AU. The origin of those structures, however, remains mysterious. In this talk I will present how the size and spatial distribution of dust can be understood analytically and what the prospects of grain growth effects in explaining the observational signatures of transition disks are.

Name: Luca Ricci
Affiliation: Caltech
Title: **Testing the models of solids evolution in disks through sub-mm interferometry**
Abstract: Observations of protoplanetary disks at sub-mm wavelengths trace mm-sized pebbles in the disk outer regions. Models of dust evolution including grain growth and radial migration in the disk can therefore be tested by these data. I will outline the state-of-the-art of this field by presenting old and new data obtained with CARMA, PdBI, ATCA and EVLA interferometers for a sample of about 100 young disks. I will also show how very-low mass disks are particularly suitable to test the model predictions and investigate the physics of solids evolution in disks. This is currently being investigated through undergoing observations with ALMA of four disks around brown dwarfs and very low mass young stars, and I will present the preliminary results from this project.

Name: Ingo Thies
Affiliation: Argelander-Institut für Astronomie
Title: **The dynamical birth environment of planets and brown dwarfs**
Abstract: The recent development of protostellar and protoplanetary models and the ongoing discoveries of extrasolar systems have led to a paradigm change in understanding the origin of our Solar System and its siblings. Rather than forming quietly and in isolation, planetary systems are now understood to form in highly dynamical environments of episodically accreting discs, tidal and viscous perturbations and disc fragmentation, and thus their structure being highly dependent on the properties of the host star-forming cluster. Here we present the most recent results of our SPH computation on the evolution of perturbed discs, and the formation of brown dwarfs and massive planets. For the first time, the perturbations of gaseous circumstellar disks through passing binary stars and the consequences on the outcome of binary-induced fragmentation will be demonstrated. In addition, we discuss a possible connection between lithium-depletion in stellar atmospheres and misaligned planetary systems as a consequence of repeated accretion.

Name: Michiel Hogerheijde
Affiliation: Leiden Observatory
Title: **Herschel observations of cold water vapor and ammonia in protoplanetary disks**
Abstract: I present the results of a Herschel/HIFI study into the presence of cold water vapor in a sample of protoplanetary disks, carried out as part of the Guaranteed Time Key Program 'Water in Star Forming Regions with Herschel' (WISH). While toward most disks only upper limits are obtained, rotational ground-state emission lines of ortho-H_2O and para-H_2O are clearly detected toward the disk of TW Hya. The detection of cold water vapor, extending to at least 115 AU, in this disk indicates the presence of a vast reservoir of water ice totalling $\sim 10^{28}$ g or thousands of Earth Oceans. Photodesorption by stellar ultraviolet radiation likely liberates a small amount of water vapor from icy grains. Significant settling of such icy grains toward the disk midplane is required to match the detected amount of water vapor. The water ortho-to-para ratio of 0.77 is significantly different from that observed in Solar System comets where a range of 1.5–3 is found. If this reflects the temperature regime of the water ice (formation), this finding suggests that long-range mixing of volatiles has occured in the Solar Nebula. The same Herschel/HIFI data also detect the emission of NH_3 in TW Hya's disk, and the implications of this finding are discussed.

Name: Richard Alexander
Affiliation: University of Leicester
Title: **Observational diagnostics of protoplanetary disc dispersal**
Abstract: Understanding how protoplanetary discs evolve and are eventually dispersed is a critical ingredient of any theory of planet formation. We now have a relatively mature model, in which gas disc evolution is dominated by a combination of viscous accretion and photoevaporation, but this theoretical picture is largely unconstrained by observations. I discuss a number of different diagnostics which we can use to relate these models to current and future observations. I will show how line emission from the photoevaporative wind, statistical studies of T Tauri accretion rates, and the properties of exoplanets can all be used to inform our understanding of how protoplanetary discs evolve.

Name: Martin Ilgner
Affiliation: LMU Munich
Title: **Grain charging in protoplanetary discs**
Abstract: Recent work identified a growth barrier for dust coagulation that originates in the electric repulsion between colliding particles. Depending on its charge state, dust material may have the potential to control key processes towards planet formation such as magnetohydrodynamic (MHD) turbulence and grain growth, which are coupled in a two-way process. I will present results of work aimed at quantifying the grain charging at different stages of disc evolution. In particular, two very extreme cases of grain morphology are considered: compact spherical grains and aggregates with fractal dimension Df 2. Applying a simple chemical network that accounts for collisional charging of grains, a semi-analytical solution will be presented which can be used to calculate the equilibrium population of grain charges and the ionisation fraction efficiently. The grain charging was evaluated for different dynamical environments ranging from static to non-stationary disc configurations. The results show that the adsorption/desorption of neutral gas-phase heavy metals, such as magnesium, effects the charging state of grains. The greater the difference between the thermal velocities of the metal and the dominant molecular ion, the greater the change in the mean grain charge. Agglomerates have more negative excess charge on average than compac t spherical particles of the same mass. The results indicate that grain charging in a non-stationary disc environment is expected to lead to similar results.

Name: Sean Andrews
Affiliation: Harvard-Smithsonian Center for Astrophysics
Title: **Millimeter-wave Observations of Protoplanetary Transition Disks**
Abstract: Circumstellar disks are thought to experience a rapid "transition" phase in their evolution that can have a considerable impact on the formation and early development of planetary systems. I will present high angular resolution (0.3" = 20-60 AU) millimeter-wave observations from a survey of such transition disks in nearby star-forming regions. With those data, we directly resolve dust-depleted disk cavities on scales comparable to the extent of our Solar System. Surprisingly, these large cavities are common, comprising at least 1 in 5 (20%) of the disks at the high end of the disk mass distribution. Utilizing these results, I will briefly assess the physical mechanisms proposed to account for transition disk structures. I will argue that neither photoevaporation or particle growth *alone* can reproduce the observations. Instead, the data are more commensurate with the substantial disk structure perturbations expected from dynamical interactions with low-mass (planetary?) companions. Finally, I comment on observations of the cold gas content in these disks and highlight some updates to our approach for modeling such data.

Name: Andrea Banzatti
Affiliation: ETH Zurich, Institute for Astronomy
Title: **On the role of T Tauri variability in processing the warm molecular gas in young circumstellar disks**
Abstract: What is the effect of changes in the spectral energy distribution of young stars in the T Tauri phase on the molecular gas present in circumstellar disks? Recent analyses of mid-IR Spitzer spectra have shown that warm molecular gas (e.g. water, OH, and simple organics) is commonly detected toward T Tauri systems and might be an important tracer for the chemical and physical evolution of the planet formation region in young disks. Many studies suggest that the composition of gas and dust in circumstellar disks (inherited from the ISM and evolved through the protostellar phase) can be further altered by several processes relevant for planet formation. The outcome of this evolution may have important implications concerning the composition of forming planets and their atmospheres, and perhaps on their habitability. Disk heating and exposure to UV radiation, which can strongly affect the chemistry, have been proposed to be particularly important. In the extreme c ase of the strongly variable EX Lupi, ongoing processing of dust and gas have been observed and related to the change in temperature and total luminosity (especially the UV flux) during a recent accretion outburst. In this presentation we: 1) show the results from the analysis of the change in molecular gas emission in EX Lupi, from comparison of quiescent and outburst Spitzer spectra; 2) describe new results concerning the connection between variability in the central source and water emission from the circumstellar disk of DR Tau, based on multiple epochs of simultaneous observations with XSHOOTER and VISIR at the VLT; and 3) give some outlook on future studies of this kind utilizing the newly upgraded VISIR-2.0 on the VLT.

Name: James Owen
Affiliation: Canadian Institute for Theoretical Astrophysics
Title: **The final stages of discs clearing**
Abstract: Mechanisms to clear the gas and dust from protoplanetary discs after a few Myrs of evolution has been a subject of debate for several years. The majority of proposed mechanisms (e.g. planet formation, grain growth, photoevaporation) suggest that clearing takes longer the further through the disc it proceeds. This is primarily driven by the longer time-scales, and larger amounts of gas and dust to clear as one moves to larger and larger radii in the disc. However, such a prediction does not appear to be backed up by observations with very few transition discs observed with inner holes sizes > 50 AU in size. I will present a new clearing mechanism that takes over when disc clearing has proceed to larger radii > 50 AU, driven by the deeply penetrating high energy radiation (FUV/X-rays) that can clear the outer disc on much faster ∼dynamical time-scales.

Name: Matthias Schreiber
Affiliation: Universidad de Valparaiso
Title: **The nature of transition circumstellar disks**
Abstract: We present millimeter wavelength photometry, high-resolution optical spectroscopy, and adaptive optics near-infrared imaging for a sample of 74 transition disk objects (defined as disks with reduced levels of near-IR and/or mid-IR excess emission). We use these ground-based data to estimate disk masses, multiplicity, and accretion rates. Combining these estimates with additional information such as SED morphology and fractional disk luminosity allows to investigate the mechanisms potentially responsible for the inner opacity holes of transition disks. We classify the disks in our sample as strong candidates for the following categories: grain-growth dominated disks, giant planet forming disks, photoevaporating disks, debris disks, and circumbinary disks. We discuss this high-quality sample in the context of the current paradigm of the evolution and dissipation of protoplanetary disks and use its properties to constrain different aspects of the key processes driving their evolution. Follow-up observations of particularly interesting individual systems using the sparse aperture masking technique and the sub-millimeter array are highlighted.

Name: John Carpenter
Affiliation: Caltech
Title: **Observational Constraints on Spatial Variations of Grain Growth in Circumstellar Disks**
Abstract: John Carpenter, Laura Perez, Andrea Isella, Sean Andrews, Claire Chandler, and the Disks@EVLA Collaboration
The first step toward planet formation in protoplanetary disks is the growth of particles from sub-micron size grains to centimeter-sized pebbles. Observationally, grain growth can be inferred by measuring the spectral energy distribution at millimeter wavelengths, where the spectral slope will depend on the grain size distribution as well as the dust properties. While grain growth in disks has been inferred for some time from multi-wavelength submillimeter photometry, resolved images of the dust emission now permit constraints on the spatial variation of grain growth within disks. We will present sub-arcsecond interferometric observations from the Combined Array for Research in Millimeter-wave Astronomy (CARMA), the Expanded Very Large Array (EVLA), and the Submillimeter Array (SMA), that span more than an order of magnitude in wavelength from sub-millimeter to centimeter wavelengths. These observations constrain the radial distribution of circumstellar material and characterize the spatial variations on the dust opacity spectral slope that may originate from particle growth. The most recent results of this observational program will be presented and compared with theoretical predictions of grain size evolution in circumstellar disks.

Name: Leonardo Testi
Affiliation: ESO/Arcetri
Title: **Observational constraints on disk evolution and the initial steps towards planet formation**
Abstract: Planet formation is expected to occur in circumstellar disks during the first few Myrs of the stellar pre main sequence evolution. In the core accretion paradigm of planet formation, the solid component of the disks (the dust) grows and coagulate to form planetesimals and rocky cores of planets. We have been studying extensively the grain growth process in nearby star forming regions protoplanetary disks. As a tool we use submillimetre and centimeter wave emission from the dust in the disk midplane, that depends on the opacity per gram of dust, which in turn is related to the composition and size of dust grains. We find evidence for an early growth of dust and a relatively long survival time for large grains in disks. We also discuss the evidence for grain populations segregation in disks as constrained with high angular resolution millimeter observations. We discuss the remarkably low dispersion of properties in our samples in the context of evolutionary models of dust populations in disks. Our results are at odds with simple model expectations that predict rapid migration and depletion of the large grains population in disks: observations show that large grains are retained in the outer disks for relatively long timescales (few to several Myrs). We discuss possible mechanisms to solve the discrepancies between models and observations, as well as the results of observational tests with ALMA and other millimetre arrays in that provide critical constraints on the model assumptions and on the initial conditions for planet formation.

Name: Carsten Dominik
Affiliation: Sterrenkundig Instituut "Anton Pannekoek"
Title: **Vertical transport of water ice on dust grains**
Abstract: Recent observations of water vapor emission lines with HERSCHEL have opened the door to study the ice content in protoplanetary disks. One of the observational results are that apparently, less water ice than expected is on the dust grains. We will discuss the vertical transport of grains with water ice layers in order to investigate if indeed ice is concentrated onto midplane grains, where it could aid planet formation.

Name: Paola Pinilla
Affiliation: ITA, University of Heidelberg
Title: **Particle Traps in Transitional Disks**
Abstract: Fragmentation and rapid inward drift are obstacles for dust to grow from micron size particles to planetesimals. Different efforts have been aimed to explain how these two phenomena can be prevented. The idea of long-lived pressure bumps has been studied as a solution to trap dust particles and transitional disks are potentially interesting laboratories for testing this idea. We numerically model the dust drift and growth in a disk which structure is modified by a massive gas giant planet. As a result of the significant depletion of the surface density when a massive planet clears a gap, a single pressure bump is created in the outer edge of the gap where particles may stop to drift inwards. Consequently, the outer edge of the gap has became a possible planetesimal factory.

Name: Alexander Krivov
Affiliation: AIU, U. Jena
Title: **Herschel's "Cold Debris Disks": Failed Planetesimal Formation?**
Abstract: A.V. Krivov and the DUNES consortium

An important result of the Herschel Open Times Key Program DUNES is a discovery of a new class of "cold debris disks". These are tenuous disks that show little or no infrared excess at 100μm, but a significant one at 160μm and possibly longer wavelengths. A comparison of the dust temperatures inferred from the SEDs to the disk radii estimated from resolved images suggests that the dust is colder than a black body at the dust location. This requires the grains to be large (compared to far-infrared wavelengths) and to have low absorption in the visible. The latter can be achieved, for instance if the dust is rich in ices. However, the absence of small grains is puzzling, since collisional models of debris disks predict the grains of all sizes down to several times the radiation pressure blowout limit to be present. One possibility to explain the cold disks is to assume them to be composed of unstirred primordial millimeter-sized grains. Our collisional simulations show that, at least for some collision outcome prescriptions, such disks can indeed survive for gigayears, largely preserving the primordial size distribution. The modeled thermal emission appears to be roughly consistent with the observed one.

Name: Farzana Meru
Affiliation: ETH Zürich
Title: **Exploring the properties and signatures of planets in transition discs**
Abstract:

Transition discs typically have lower mass accretion rates onto the central star compared to their full disc counterparts (e.g. Najita et al 2007). The presence of planets is one way in which such discs can be sculpted, a theory that is further motivated by recent observations suggesting that transition discs may harbour planets (e.g. Huelamo et al 2011, Kraus & Ireland 2012). The signatures that these planets leave behind may be imprinted on the low mass accretion rates which may be affected by both the planet mass and its location in the disc. We use hydrodynamical simulations to carry out a systematic study to understand how the characteristics of transition discs are affected by these properties. Preliminary results indicate that both the location and mass of the planet may have a significant effect on the rate at which the inner disc is cleared. This affects the mass accretion rate onto the central star which is a key observational signature of such discs. In conjunction with observational data, this provides insights into the properties of planets that could potentially be sculpting the observed transition discs.

Name: Olja Panic
Affiliation: Institute of Astronomy, Cambridge
Title: **HD 100546 disc asymmetries resolved in the mid-infrared**
Abstract: A region of roughly half of the Solar system scale around the star HD 100546 is largely cleared of gas and dust, in contrast to the outer disc extending to about 400 AU. However, some material is observed in the immediate vicinity of the star. Studying the structure of the inner and the outer disc is a first step to establish the origin of the gap between them and possibly link it to presence of planets.

Our observations of HD100546 are carried out with VLTI interferometer instrument MIDI, in N-band where disc emission dominates over the star. With projected baseline lengths of 40m our long baseline observations are most sensitive to the inner few AU from the star, and we combine these with observations at shorter, 15m baselines, to probe disc larger scale emission beyond the gap.

We find that the inner disc extends less than 0.7AU from the star, and the wide gap to 11AU. The derived orientation, i=53+-8deg and PA=145+-5deg, is consistent with prior observations of the disc rim and 100AU scale geometries, suggesting co-planarity. Most interestingly, the observed chromatic phases show that the N-band brightness is strongly asymmetric. This may be caused by gravitational perturbation of the disc by an unseen planet/companion, long suspected in HD100546.

Name: Steve Ertel
Affiliation: IPAG Grenoble
Title: **An unbiased survey for exozodiacal dust**
Abstract: Exozodiacal dust clouds (exozodis) are thought to be extrasolar analogs to our zodiacal dust disk. The investigation of their incidence, brightness and evolution are critical for the feasibility and success of future terrestrial planet search missions using direct imaging. Modeling of the few bright exozodis detected so far reveals the extreme and unexpected nature of these systems, the origin of which remains enigmatic. The detection of the dust with present instruments is difficult due to the low excess emission and the high angular resolution necessary to spatially disentangle the stellar and dust emission. Detailed multi-wavelength observational studies including spatially resolved imaging are impossible with present instrumentation.

We are carrying out the first large ($\sim$200 nearby main-sequence stars), unbiased survey for exozodiacal dust using near-infrared interferometry. The resulting data set will allow us to carry out a statistical analysis correlating the incidence and abundance of warm and hot dust with properties of the host systems (e.g., age, spectral type of the host star, the existence of known planets or of a Kuiper Belt like planetesimal population). Our survey is carried out with VLTI/PIONIER in the southern and CHARA/FLUOR in the northern hemisphere with unprecedented sensitivity.

In this talk, I review the challenges of exozodi detection and present our observing strategy designed to deal with these challenges with special emphasis on the VLTI visitors instrument PIONIER. I will present first results from our survey including a statistical analysis of our northern sample.

Name: Avi Mandell
Affiliation: NASA GSFC
Title: **The Temperature and Distribution of Organic Molecules in the Inner Regions of T Tauri Disks**
Abstract: High-resolution NIR spectroscopic observations of warm molecular gas emission from young circumstellar disks allow us to constrain the temperature and composition of material in the inner planet-forming region. By combining advanced data reduction algorithms with accurate modeling of the terrestrial atmospheric spectrum and a novel double-differencing data analysis technique, we have achieved very high-contrast measurements (S/N ∼500-1000) of molecular emission at 3 microns. In disks around low-mass stars, we have achieved the first detections of emission from HCN and C2H2 at near-infrared wavelengths from several bright T Tauri stars using the CRIRES spectrograph on the Very Large Telescope and NIRSPEC spectrograph on the Keck Telescope. We spectrally resolve the line shape, showing that the emission has both a Keplerian and non-Keplerian component as observed previously for CO emission. We used a simplified single-temperature local thermal equilibrium (LTE) slab model with a Gaussian line profile to make line identifications and determine a best-fit temperature and initial abundance ratios, and we then compared these values with constraints derived from a detailed disk radiative transfer model assuming LTE excitation but utilizing a realistic temperature and density structure. Abundance ratios from both sets of models are consistent with each other and consistent with expected values from theoretical chemical models, and analysis of the line shapes suggests that the molecular emission originates from within a narrow region in the inner disk (R <1 AU).

Name: Jean-François Gonzalez
Affiliation: Centre de Recherche Astrophysique de Lyon
Title: **Planet Gaps in the Dust Layer of 3D Protoplanetary Disks: Observability with ALMA**
Abstract: The Atacama Large Millimeter/submillimeter Array (ALMA) will have the necessary resolution to observe a planetary gap created by a Jupiter-mass planet in a protoplanetary disk. We ran full 3D, two-fluid Smoothed Particle Hydrodynamics (SPH) simulations of a planet embedded in a gas+dust T Tauri disk for different planet masses and grain sizes. The gas+dust dynamics, where aerodynamic drag least to the vertical settling and radial migration of grains, is consistently treated. The resulting dust distributions are passed to the Monte Carlo radiative transfer code MCFOST to construct synthetic images in the ALMA wavebands. We then use the ALMA simulator to produce images that include thermal and phase noise for a range of angular resolutions, wavelengths, and integration times, as well as for different inclinations, declinations and distances. We also produce images which assume that gas and dust are well mixed with a gas-to-dust ratio of 100 to compare with previous ALMA predictions, all made under this hypothesis.

Our findings clearly demonstrate the importance of correctly incorporating the dust dynamics. We show that the gap carved by a 1 M_J planet orbiting at 40 AU is visible with a much higher contrast than the well-mixed assumption would predict. In the case of a 5 M_J planet, we clearly see a deficit in dust emission in the inner disk, and point out the risk of interpreting the resulting image as that of a transition disk with an inner hole if observed in unfavorable conditions. Planet signatures are fainter in more distant disks but declination or inclination to the line-of-sight have little effect on ALMA's ability to resolve the gaps. Signposts of planets in disks should therefore be routinely seen by ALMA in nearby star-forming regions. We present optimized observing parameters to detect them.

Name: Elisabetta Rigliaco
Affiliation: University of Arizona
Title: **The origin of the [OI] low-velocity component from protoplanetary disks**
Abstract: Models of protoplanetary disk evolution suggest that viscous evolution, photoevaporation driven by the central star, and planet formation are the main disk dispersal mechanisms. Viscous evolution is expected to dominate early on, as stars accrete at high rates and drive outflows. As the accretion rate falls, photoevaporative flows gain strength, as high-energy photons from the star can more readily penetrate through the accretion columns and heat the disk gas to thermal escape velocities.

The low-velocity component of the [OI] lines (blueshifted by few km/s) has been proposed as diagnostic for the photoevaporative disk wind (Hartigan et al. 1995, Ercolano & Owen 2010). Here we investigate its origin in two ways. First we compare the ratio of the equivalent widths of the [OI]6300/[OI]5577Åfor a sample of ∼40 T Tauri stars (observed with Mayall Telescope, UVES, FEROS and HIRES at a very-high resolution (∼5 km/s)) with the FUV luminosity of the star. Second, for a smaller subset of objects with high-spectral resolution spectra obtained with CRIRES/VLT and VISIR/VLT, we compare the line profiles of the [OI] lines with those of lines proposed to trace the wind (CO ro-vibrational band at 4.7um and the low velocity component of [Ne II] 12.81um).

Our preliminary results suggest that there is a trend between the equivalent widths ratio of the [OI] lines and the accretion luminosity (or FUV luminosity) of the star, leading us to believe that there is a substantial mass flow rate driven by the FUV, with some implications on the disk lifetimes.

Name: Germano Sacco
Affiliation: INAF-Osservatorio Astrofisico di Arcetri
Title: **High-Resolution Spectroscopy of Ne II Emission From Young Stellar Objects**
Abstract: Constraining the spatial and thermal structure of the gaseous component of circumstellar disks is crucial for understanding star and planet formation. Models predict that the [Ne II] line at 12.81 μm detected in young stellar objects (YSOs) with Spitzer traces disk gas and its response to high-energy radiation, but such [Ne II] emission may also originate in shocks within powerful outflows. To distinguish between these potential origins for mid-infrared [Ne II] emission and to constrain disk models, we observed 32 YSOs using the high-resolution (R ∼30,000) mid-infrared spectrograph VISIR at the Very Large Telescope. We detected the 12.81 μm [Ne II] line in 12 objects, tripling the number of detections of this line in YSOs with high spatial and spectral resolution spectrographs. We obtain the following main results. (1) In Class I objects the [Ne II] emission observed from Spitzer is mainly due to gas at a distance of more than 20-40 AU from the star, where neon is, most likely, ionized by shocks due to protostellar outflows. (2) In transition and pre-transition disks, most of the emission is confined to the inner disk, within 20-40 AU from the central star. (3) Detailed analysis of line profiles indicates that, in transition and pre-transition disks, the line is slightly blueshifted (2-12 km s^{-1}) with respect to the stellar velocity, and the line width is directly correlated with the disk inclination, as expected if the emission is due to a photoevaporative disk wind. (4) Models of EUV/X-ray-irradiated disks reproduce well the observed relation between the line width and the disk inclination, but underestimate the blueshift of the line

Planet Formation (Chair: M. Davies)

Name: Wilhelm Kley
Affiliation: Institute of Astronomy & Astrophysics
Title: **Review Talk: Planet Formation**
Abstract: In 1993 the first extrasolar planet (51 Peg) orbiting another solar type star has been discovered. Since then the number has increased to over 770 as of today with many additional Kepler candidates. The surprising orbital properties of the newly discovered worlds required a revision of the standard theory of planet formation. In the talk I will discuss the main formation scenarios (sequential accretion vs. gravitational instability) in the context of the whole ensemble of extrasolar planets. The necessity of dynamical evolution of young planets in the disc will be emphasized and new results will be discussed.

Name: Satoshi Okuzumi
Affiliation: Nagoya University
Title: **Rapid Coagulation of Porous Dust Aggregates Outside the Snow Line: A Pathway to Successful Icy Planetesimal Formation**
Abstract: Rapid orbital drift of macroscopic dust particles is one of the major obstacles against planetesimal formation in protoplanetary disks. We reexamine this problem by considering porosity evolution of dust aggregates. We apply a porosity model based on recent N-body simulations of aggregate collisions, which allows us to study the porosity change upon collision for a wide range of impact energies. As a first step, we neglect collisional fragmentation and instead focus on dust evolution outside the snow line, where the fragmentation has been suggested to be less significant than inside the snow line because of the high sticking efficiency of icy particles. We show that dust particles can evolve into highly porous aggregates (with internal densities of much less than 0.1 g/cc even if collisional compression is taken into account. We also show that the high porosity triggers significant acceleration in collisional growth. This acceleration is a natural consequence of particles' aerodynamical property at low Knudsen numbers, i.e., at particle radii larger than the mean free path of the gas molecules. Thanks to this rapid growth, the highly porous aggregates are found to overcome the radial drift barrier at orbital radii less than 10 AU (assuming the minimum-mass solar nebula model). This suggests that, if collisional fragmentation is truly insignificant, formation of icy planetesimals is possible via direct collisional growth of submicron-sized icy particles.

Name: Alexander Seizinger
Affiliation: Astronomie und Astrophysik
Title: **Numerical Simulations of the Bouncing Behavior of Porous Dust Aggregates**
Abstract: During the first growth phase from microscopic dust grains to meter sized objects the bouncing of colliding aggregates may influence the collisional evolution significantly. However, it is still debated how frequently bouncing instead of fragmentation or sticking occurs. We present results from molecular dynamic simulations addressing the bouncing behavior of porous dust aggregates on microscopic scales. With the enormous computing power provided by modern GPUs we are able to simulate collisions of aggregates with a diameter of 100μ for the first time

Name: Andrea Fortier
Affiliation: University of Bern
Title: **Planet formation models: the interplay with the planetesimal disc**
Abstract: According to the core instability model, giant planet formation is based first on the formation of a solid core which, when massive enough, can gravitationally bind gas from the nebula to form the envelope. The most critical part of the model is the formation time of the core: it has to grow up to several Earth masses before the gas component of the protoplanetary disc dissipates in order to trigger the accretion of gas. The growth of giant planets' cores occur mainly in the so-called oligarchic regime. Embryos growing in the disc stir their neighbour planetesimals, exciting their relative velocities, which makes accretion more difficult. In previous versions of our model, interactions between protoplanets and planetesimals were oversimplified, leading to a fast planetary formation. Here we introduce a more realistic treatment for the evolution of planetesimals' relative velocities, which directly impact on the formation timescale. In the case o f simultaneous formation, we developed a simple model which includes collisions and ejections between protoplanets, and competition for the accretion of solids when the protoplanets' feeding zones overlap. We find that the formation of giant planets is favoured by the accretion of small planetesimals. However, during their formation, planets migrate. Due to the slow growth of a protoplanet in the oligarchic regime, rapid inward type I migration has important implications on intermediate mass planets that have not started yet their runaway accretion phase of gas. Most of these planets end in the central star. Surviving planets have either masses below 10 Earth masses or above several Jupiter masses. A similar situation is found in the case of planetary systems, where low mass planets are even more abundant. To form giant planets before the dissipation of the disc, small planetesimals ($\sim$0.1 km) have to be the major contributors of the solid accretion process. However , the combination of oligarchic growth and fast inward migration leads to the absence of intermediate mass planets.

Name: Yann Alibert
Affiliation: University of Berne
Title: **Planet formation: from internal structure level to system level**
Abstract: We will present results of planetary system formation model, showing in particular the effect of interactions between planets forming in the same system. We will show that gravitational interactions and competition for accretion between planets modify the orbital parameters and bulk composition of resulting planets. In a second part, we will present the limitations of the models and future improvements.

Name: Christoph Mordasini
Affiliation: MPIA
Title: **Combined models of planet formation and evolution: The planetary mass-radius relationship**
Abstract: The research of extrasolar planets has entered an era in which we characterize extrasolar planets. This has become possible with measurements of the radii of transiting planets, and the luminosity of planets observed by direct imaging. Meanwhile, the precision of radial velocity surveys allows to discover not only giant planets, but also very low-mass planets. Uniting all these different observational constraints into one coherent picture is an important, but also difficult undertaking. One approach is to develop a theoretical model which can produce testable predictions for all these observational techniques. In my talk, I will described how we have extended our planet formation model into a self-consistently coupled formation and evolution model which allows us to calculate all major quantities which characterize a planet (mass, semimajor axis, composition, radius, luminosity) during its entire life starting at a tiny seed embryo in the disk to a Gigayear old planet. I will then show results obtained by using the new model in population synthesis calculations. I will discuss how the planetary mass-radius relationship forms and evolves in time. The basic shape of the mass-radius relationship can be understood from the core accretion model. For a given mass, there is a considerable diversity in associated radii, reflecting different formation histories. We compare the synthetic M-R plane with the observed one, finding good agreement for a>0.1 AU. The synthetic planetary radius distribution is characterized by a strong increase towards small R, and a second, lower local maximum at about one Jovian radius. The increase towards small radii comes from the increase of the mass function towards low M. The second local maximum is due to the fact that radii are nearly independent of mass for giant planets. A comparison of the synthetic radius distribution with data from the Kepler satellite shows good agreement for R>$2R_\oplus$, but divergenc e for smaller radii. This indicates that for R>$2R_\oplus$, the radius distribution can be described with planets with primordial H_2/He atmospheres as in the model, while at smaller radii, planets of a different nature dominate. We predict that in the next few years, Kepler should find the second, local maximum at about 1 Jovian radius. Finally, I will conclude that the comparison of the radii of the synthetic planets with observations allows to better constrain the formation process, and to distinguish between fundamental types of planets.

Name: Aurélien Crida
Affiliation: University of Nice / Observatoire Côte d'Azur
Title: **Satellites Formation : from the Earth to Neptune.**
Abstract: This talk is devoted to satellite formation from the spreading of a "tidal disk" : a dynamically cold debris disk inside the Roche radius of the planet. Beyond the Roche radius, solids aggregate, forming new moons that migrate outward because of the disk's gravitational torque. Recently, Charnoz et al. (2010, 2011) showed with numerical simulations that the physical properties of Saturn's regular satellites inside Titan's orbit can be explained if they were born from the spreading of the rings. I will present an analytical model of this process, and show that it applies as well to Uranus, Neptune, the Earth, and Pluto.

We demonstrate that if the disk's life-time is long (which would be the case for a massive ring around a giant planet), migration is faster than accretion, and many satellites form and migrate away. During this phase, mergers take place in a hierarchical way, so that the final mass-distance distribution of the satellites should follow a particular law. This law is found to be in very good agreement with the present distributions of the inner satellites of Saturn, Uranus, and Neptune. Conversely, if the spreading is fast (the disk's life-time is short), then accretion is faster than migration, and the entire disk's material gathers into one large satellite, possibly with a smaller companion. This is the case of a debris disk created by a giant impact on a terrestrial planet, and is consistent with the latest Moon formation models.

Therefore, we suggest that most regular satellites in the Solar System formed from the spreading of a tidal disk, and that terrestrial and giant planets satellites systems can be unified in this new paradigm for satellite formation.

Name: Hubert Klahr
Affiliation: MPIA
Title: **The Role of Turbulence in Planetesimal Formation**
Abstract: This presentation gives an overview on our latest simulations of gravitationally assisted planetesimal formation. We analyze conditions and properties of both magento-rotational turbulence as well as turbulence triggered from the baroclinic structure of protoplanetary disks. In both cases it is long lived flow features in geostrophic balance, either zonal flows or anticyclonic vortices that being high pressure regions constitute traps for solid material. In comparison to our first numerical simulations of gravoturbulent planetesimal formation which made the presence of 30cm boulders necessary we now can use much smaller material because of a more realistic treatment of simulating the turbulence.

Name: Eric Gaidos
Affiliation: University of Hawaii
Title: **Running out of Gas, Fast: Shorter Disk Lifetimes and Faster Giant Planet Formation**
Abstract: Giant planets such as Saturn and Jupiter capture most of their mass directly as gas from a progenitor disk, and one test of any planet formation theory is whether it can produce giant planets before the gaseous disk dissipates. Disk lifetimes are estimated from studies of young star-forming regions/stellar clusters and plots of disk fraction vs. cluster age, and a lifetime of 6 million years (Myr) is widely cited. However, both observations and theory indicate that star formation in a cluster is not simultaneous and may occur over a comparable timescale. As a consequence, disks may be observed in older clusters because some stars form later, rather than disks persisting longer. Accounting for this effect leads to typical disk lifetimes of 2 Myr or less. Such short lifetimes impose a severe challenge to the canonical core-accretion theory of giant planet formation if cores typically form at 5 AU, e.g. at a supposed "ice line". Instead, I propose that the core of gas giants, including Jupiter, form at 1-2 AU, where the dynamical time is 10 times shorter, and that these proto-giants subsequently migrate outward or inward, depending on the radial structure of the disk, the presence of a second giant planet, e.g. Saturn, and how quickly the planet opens a gap in the disk. A peak in the orbital distribution of giant planets in Doppler surveys at 1-1.5 AU may be a signature of this planetary nursery. A model predicts that the ice condensation front at the disk midplane moves interior to 2 AU by 1.5 Myr and this discontinuity in the disk structure may trap migrating planetesimals and accelerate the formation of giant planet cores.

Name: Giovanni Rosotti
Affiliation: Excellent Cluster
Title: **The interplay between X-ray photoevaporation and planet formation**
Abstract: Observations reveal that most (if not all) discs go through the "transitional disc" phase, which is currently interpreted as the last stage before the disc dispersal. Photoevaporation and planet formation have been studied as possible physical mechanisms responsible for the formation of these discs, however both of them cannot account for discs that exhibit large holes and high mass accretion rates. While it is likely that more than one mechanism is at play, the interplay between them has until now not been studied in detail. I will show results from 2d simulations of protoplanetary discs undergoing X-ray photoevaporation with an embedded giant planet, to assess the potential of planet formation instigating the early formation of a photoevaporation driven gap up to radii larger than typical for photoevaporation alone.

Name: Ben Ayliffe
Affiliation: Monash University
Title: **The hydrodynamic collapse of a protoplanetary envelope**
Abstract: In the core accretion model of planet formation, giant planets form by accumulating massive gas envelopes onto solid cores. I present numerical models which demonstrate that such a massive envelope may hydrodynamically collapse onto its core, rather than condensing by the currently favoured process of purely quasi-static contraction. Our results were obtained using long term three-dimensional radiation hydrodynamics calculations that include self-gravity. This rapid collapse of a massive envelope, occurring in less than a year, leads to an order of magnitude increase in its central density, a 50% increase in its maximum temperature, and the formation of a circumplanetary disc. Following this condensation, accretion from the circumstellar disc onto the protoplanet resumes at its pre-collapse rate, enabling further growth.

Name: Chris Ormel
Affiliation: UC Berkeley
Title: **Investigating the gas flow around low-mass planets.**
Abstract: When protoplanets reach Mars-size, their gravity becomes large enough to affect the gas flow in its immediate surroundings. Close to the planet an atmosphere forms, where the density is larger than that of the protoplanetary disk. At slightly larger radii corresponding to the Hill sphere, the flow pattern (gas velocity) is quite different than that of the simple 'shearing-sheet' of the (unperturbed) background nebula. Since small particles couple very well to the gas, their accretion behavior is, therefore, quite sensitive to the flow pattern. To this end, we have studied the gas flow around gravitating bodies embedded in gaseous disks. Combining numerical and analytical tools, we provide a description of the flow pattern, applicable for small, embedded planets (Earth to super-Earth). In this way, we quantify for a broad parameter range where the boundary between atmosphere and nebula lies, and how much gas the protoplanet can bind. We also discuss the implications for scenarios where these objects grow predominantly by sweeping up small-particles of pebble size or smaller.

Name: Sergei Nayakshin
Affiliation: University of Leicester
Title: **Formation of planets inside giant gas embryos: ideas, progress, and open problems**
Abstract: Boley et al (2010), Nayakshin (2010) and others have recently suggested that young massive gaseous protoplanets born in the outer (more than tens of AU) disc migrate inward faster than they contract, and are therefore tidally disrupted closer to their parent star. Dust growth and sedimentation within the embryo create a massive solid core which survives the disruption (Cha and Nayakshin 2011). In principle, the new scheme may account for planets of all types and separations but much more detailed work is needed to explore this further.

Here we present Nayakshin and Lodato 2012, who model numerically the viscous gas disc evolution together with the radial migration of the giant gaseous planet embedded in the disc. We show that tidal disruption of the planet may fuel an FU Ori accretion outburst not unlike the observed bursts. We also present ideas and simulations on how this new model could account for the debris rings and the Kuiper belt in particular (Nayakshin and Cha 2012). We finish by listing the outstanding issues of the theory.

Name: Richard Nelson
Affiliation: Queen Mary, University of London
Title: **Planetesimal and planetary dynamics in discs with dead zones**
Abstract: It is generally believed that protoplanetary discs sustain MHD turbulence in their near-surface layers, with the midplane region maintaining a near-lamimar dead zone that is subject to relatively small turbulent fluctuations and stresses. In my talk I will present the results of recent non-ideal MHD simulations that examine the role of the dead zone in regulating the collisional velocities of planetesimals, and I will discuss their implications for the coliisional growth/destruction of these bodies. I will also present results from simulations of low mass planets embedded in turbulent discs with dead zones designed to examine the efficacy of the turbulent stresses there in desaturating corotation torques. Implications of the results for the migration of low mass planets during planetary formation will be discussed.

Name: Roland Speith
Affiliation: Physikalisches Institut, Universität Tübingen
Title: **Numerical simulations of collisions between porous pre-planetesimals**
Abstract: One of the early stages during the planet formation process includes the transition from millimetre-sized highly porous dust aggregates to larger objects, potentially by collisional growth. However, growth of pre-planetesimals in this size regime may be hampered by bouncing or fragmentation during the collisions. To investigate the collisional outcome we perform numerical simulations utilizing an SPH code which has been developed to model solid body mechanics and in particular impacts of highly porous agglomerates. We present recent results of parameter studies where we investigate fragmentation and bouncing criteria in pre-planetesimal collisions depending on aggregate size, aggregate porosity, aggregate homogeneity, and impact velocity. As a general result we find that the collisional outcome crucially depends on the porosities of the colliding objects.

Name: Simon Casassus
Affiliation: Universidad de Chile
Title: **Dynamical clearing in HD142527.**
Abstract: I will present observations of the transition disk HD142527, including ALMA data and comparison AO imaging and spectroscopy. Our observations reveal a disturbed cavity, far from steady state. This cavity can be understood in the context of dynamical clearing by a planetary mass companion.

Name: Andras Zsom
Affiliation: MIT-EAPS
Title: **Sedimentation driven coagulation inside the snow-line**
Abstract: The evolution of dust particles in protoplanetary disks determines many observable and structural properties of disks such as the spectral energy distribution (SED), scattered light images of disks, temperature profile, chemistry just to name a few. Dust coagulation is also the first step towards planet formation.
We investigate the problem of sedimentation - driven coagulation using a detailed collision model based on laboratory experiments. We know from the presence of the 10 micron feature in disk SEDs that large amount of micron and sub-micron sized particles are present in the disk atmosphere throughout the lifetime of the disk. Theoretical models however suggest that these micron sized particles coagulate and sediment in a timescale much shorter than the disk's lifetime. We examine what physical process is required to explain the long-term presence of micron sized particles in the disk atmosphere and thus explain observations.

Name: Shoichi Oshino
Affiliation: National Astronomical Observatory of Japan
Title: **Planet formation around M-type stars**
Abstract: We have discovered more than 3000 extrasolar planets, including Kepler planetary candidates, since 1995. Many of them have been found around F, G, and K-type stars, while M-type stars have been poorly explored even using ground-based telescopes with large aperture because M-type stars are too faint for visible eyes to monitor. The total number of planets discovered around M-type stars is limited to about 50. However, M-type stars account for about 70% of stars in our galaxy. M-type stars are promising targets for doppler surveys to excavate unseen low-mass planets due to large stellar wobbles. Less luminous M-type stars also allow us to find habitable planets with one Earth-mass in inner regions. Thus, several planet surveys for M-type stars are now ongoing and then it is expected that many of extrasolar planets around M-type stars are harvested.
Toward upcoming discoveries of planets orbiting M-type stars, we study planet formation around M-type stars by using N-body simulations, which focus on runaway and oligarchic growth phases of a planetesimal swarm. It is still unclear whether planet formation in inner regions around M-type stars proceeds in a manner similar to that around G-type stars because the ratio of the Hill radius to the physical radius of a protoplanet is quite different. However, we confirm semi-analytical formulae for the oligarchic growth of protoplanets, which are given by Kokubo & Ida (2002). Following those results, we discuss characteristics of planetary systems around M-type stars.

Name: Karsten Dittrich
Affiliation: Max Planck Institute for Astronomy
Title: **Planetesimal formation in zonal flows**

Abstract: Recent simulations have shown long lived axisymmetric sub- and super-Keplerian flows in protoplanetary disks. These zonal flows are found in local as well as global simulations of disks unstable to the magneto-rotational instability. I investigated the strength and life-time of zonal flows and the resulting long-lived gas over- and under-densities as well as particle concentrations as functions of the azimuthal and radial size of the local shearing box. Changes in the azimuthal box size do not affect the zonal flow features. However, the strength and life-time of zonal flows increase with longer radial box sizes. Our simulations show indications, and support earlier results, that zonal flows have a natural length scale of approximately 5 gas pressure scale heights. For the first time, the reaction of dust particles in boxes with zonal flows are studied. Particles of some centimeters in size reach a hundred-fold higher density than initially, without any self- gravitating forces acting on the point masses. Collision velocities of these particles are measured and compared to analytical calculations.

Extrasolar Planetary Systems (Chair: C. Dominik)

Name:	Artie Hatzes
Affiliation:	Sternwarte Tautenburg/ Universität Jena
Title:	**Review Talk: Extrasolar Planetary Systems**
Abstract:	TBD

Name:	Roberto Saglia
Affiliation:	Max-Planck Institut fuer extraterrestrische Physik
Title:	**The RoPACS (Rocky Planets around cool stars) project**
Abstract:	The RoPACS project is a FP7 Marie Curie Initial Training Network of the EU Commission to detect and characterize (rocky) planets around cool stars, using the transit method to exploit WTS, a wide field, J band imaging survey running at the UKIRT telescope. I'll review the survey's discoveries (two Jupiter-like planets around an F and a K star) and the stringent constraints on the frequency of planets around M-dwarfs deriving from the observations.

Name:	Johannes Koppenhoefer
Affiliation:	USM
Title:	**Pan-PlanetS - A Search for Transiting Planets Around Cool Stars**
Abstract:	The Pan-STARRS Planet Survey (Pan-PlanetS) is a search for transiting extra-solar planets around cool stars in the Galactic disk. The large field of view of the Pan-STARRS1 camera enables us to monitor 100.000 M-dwarfs in seven fields with a photometric precision better than 1%. We give a description of the goals of Pan-PlanetS and present some early results from the first two observing campaigns in 2010/2011.

Name: Aviv Ofir
Affiliation: Göttingen University
Title: **An Independent Planet Search In The Kepler Dataset I. Kepler KOIs.**
Abstract: We start a project to re-analyze the entire public *Kepler* dataset, searching for planetary transits using the SARS pipeline. This pipeline was tried and tested extensively by processing the entire *CoRoT* mission data. In this first part of the project we use this pipeline to search for (additional) planetary transits only in a small subset of stars - the *Kepler* Objects of Interest (KOIs), which are already known to include at least one promising planet candidate.
Desite the fact that KOIs represent fewer than 1% of the Kepler dataset, we are able to significantly update the overall statistics of planetary multiplicity: we find ∼100 new transit signals on ∼70 systems on these light curves only, the majority of them were singly-transiting systems that are now multiply-transiting. We enlarge the number of detected signals in these systems by up to four additional transit signals in each system, on top of the previously known KOIs. We re-visit the statistics of period commensurability in light of the new data, many of which exhibit this special period relationship. We also discuss sub-optimal fitting of multi-transiting systems by the *Kepler* Mission that caused the error on the a/R_* parameter to be overestimated by a median factor of ∼4.
We conclude that despite the phenomenal success of the *Kepler* mission, parallel analysis of the data by multiple teams is required to make full use of the data.

Name: Martin Seeliger
Affiliation: AIU Jena
Title: **Ground-based observations of transit timing variation**
Abstract: Photometric follow-ups of known transiting exoplanets may lead to discoveries of additional, even very low mass bodies in extrasolar systems. This is possible by detecting and then analysing variations in transit parameters of the transiting exoplanet. If there is another (not necessarily transiting) planet in the system, it interacts gravitationally with the transiting planet which generates deviations from the strictly Keplerian case, i.e. can generate (quasi-)periodic variations in one or more orbital parameters, such as the orbital period. The transit timing variation (TTV) method, that was already successfully applied on space-based (i.e. Kepler) data, is sensitive to small perturbing masses in orbits near the low-order mean-motion resonances (MMR). A terrestrial-mass planet perturbing a hot-Jupiter gas giant is expected to cause a TTV amplitude of ∼1 minute which grows significantly if the third body approaches a MMR. However, deriving the orbital elements and mass of the perturber from TTV is a difficult inverse problem that requires many observations to at least partially remove degeneracies and point out the most probable configuration. So far, we have observed transits of selected known transiting planets with known or suspected non-zero eccentricities and/or scatter in the RV orbit solution (which may indicate additional planets in the system). We could show that the achievable precision using ground-based data allows us to find planets as described above. Since single-site ground-based observations are not sufficient, we use the YETI-network, a consortium of small- to medium-size telescopes around the world to be able to cover all longitudes, allowing us to observe transits at certain phases and to probe certain frequencies in the periodogram, even though they would not be observable from single-site monitoring. Hence we are now able to compensate the disadvantages of ground-based observations.

Name: Maren Mohler
Affiliation: MPI for Astronomy
Title: **Disentangling planetary RV signals and stellar activity**
Abstract: Planets form in circumstellar disks around newly born stars. The timescales of planet formation and migration remain poorly constrained and are a matter of ongoing debate. Detections of planets around very young stars (<100 Myr) can help putting observational constraints on these time scales. While most radial velocity (RV) surveys try to avoid young and active stars, our SERAM survey is explicitly dedicated to the era of planet formation and evolution. However, since young stars in this age regime are still very active, it is a challenging problem to differentiate between planetary RV signals and stellar activity. I will give an overview on the effects of starspot activity on the measured radial velocity curves and discuss strategies to disentangle activity-induced variability and planetary-induced RV signals. This will include the use of both the commonly used activity indicators like the bisector velocity span (BVS) and the Ca II K index as well as alternative and complementary analysis methods. I will also present the application of these methods to promising targets from our SERAM survey.

Name: Annelies Mortier
Affiliation: CAUP
Title: **The frequency of giant planets around metal-poor stars**
Abstract: The discovery of around 700 extrasolar planets, so far, has lead to the first statistics concerning extrasolar planets. The presence of giant planets seems to depend on stellar metallicity and mass. For example, they are more frequent around metal-rich stars, with an exponential increase in planet occurrence rates with metallicity. In this regard, two samples of very metal-poor stars have been analyzed to see if giant planets are indeed rare around these objects. In this unique sample, radial velocity datasets were obtained with two different spectrographs (HARPS and HIRES). Taking the detection limits for these data into account, trustworthy numbers for the planet frequency can be obtained. The results of this study point out that giant planet frequency is indeed a strong function of metallicity. However, the frequencies are most likely higher, in the low metallicity end, than previously thought. In this talk, I will present the datasets, the methods, and most importantly, the results we have found.

Name: Gabriel-Dominique Marleau
Affiliation: McGill (Canada) & MPIA
Title: **Constraining the initial entropy of directly-detected exoplanets**
Abstract: The initial entropy of a gas giant planet is a key witness to the processes which gave birth to it. However, formation models are not yet able to reliably predict it, and Jupiter-like objects might be much colder and fainter than in the popular, "hot-start" models used to interpret direct detections. Not only does using hot starts mean that the inferred masses are only *lower* bounds, but it also discards precious information about these objects' initial entropies.

With in mind especially the large number of lower-mass, closer-in objects expected in the near future from surveys such as SPHERE or GPI, we show how to derive formation-model-independent joint constraints on the mass and initial entropy S_i of a planet based on its age and luminosity. We apply this procedure to systems where additional mass information is available, from stability analyses or radial-velocity measurements, which lets tighter constraints on their initial entropy be placed. In particular, we find that the HR$\sim$8799 planets and $\beta\sim$Pic must all have formed with $S_i \geqslant 9$, independent of uncertainties on the age of the systems.

Name: Ronny Errmann
Affiliation: AIU Jena
Title: **YETI - search for young transiting planets**
Abstract: The transit method is the only method to determine the radius of a planet and inclination of the orbit directly. Radial velocity follow up results the true mass. So far only transiting exoplanets older than several hundred Myr are known. To close the gap at young ages, the YETI network (Young Exoplanet Transit Initiative) was established. The network consists of ground based telescopes with mirror sizes of 0.4 to 2m, located at different longitudes all over the world. With the telescopes it is possible to observe continuously for 24h a day without gaps in the light curves and therefor not missing a transit. The targets are young clusters, which provide a large number of young stars with similar properties. The cluster is observed with YETI in three runs per year with length of one to two weeks each and over three years. The first target was Trumpler 37 with an age of 4 Myr. The monitoring started 2009. We reach a precision better than 30 milli-mag for 5500 out of the 17,000 field stars. Data processing of 55,000 images from 12 telescopes is still in progress, but we found already 2 transiting candidates, for which follow up is partly done and proposed.

Name: Carlos del Burgo Díaz
Affiliation: INAOE
Title: **PHASES: Planet Hunting and AsteroSeismology Explorer Spectrophotometer**
Abstract: We present the project PHASES (Planet Hunting and AsteroSeismology Explorer Spectrophotometer), which is aimed at developing a space-borne telescope to obtain absolute flux calibrated spectra of bright stars. The science payload is intended to be housed in a micro-satellite launched into a low-earth Sun-synchronous orbit. PHASES will be able to measure micromagnitude photometric variations due to stellar oscillations/activity and planet/moon transits. It consists of a 20 cm aperture modified Baker telescope feeding two detectors: the tracking detector provides the fine telescope guidance system with a required pointing stability of 0.2", and the science detector performs spectrophotometry in the wavelength range 370-960 nm with a resolving power between 900 (at blue wavelengths) and 200 (at read wavelengths). The spectrograph is designed to provide 1% RMS flux calibrated spectra with signal-to-noise ratios >100 for stars with V<10 in short integration times. Our strategy to calibrate the system using A type stars is presented.
From comparison with model atmospheres it would be possible to determine the stellar angular diameters with an uncertainty of approximately 0.5%. In the case of a star hosting a transiting planet it would be possible to derive its light curve, and then the planet to stellar radius ratio. Bright stars have high precision Hipparcos parallaxes and the expected level of accuracy for their fluxes will be propagated to the stellar radii, and more significantly to the planetary radii. The scientific drivers for PHASES give rise to some design challenges, which are particularly related to the opto-mechanics for extreme environmental conditions. The optical design has been developed with the primary goal of avoiding stray light reaching the science detector.

Evolution of Planetary Systems (Chair: R. Nelson)

Name: Alessandro Morbidelli
Affiliation: OCA
Title: **Review Talk: Solar System evolution and the diversity of planetary systems**
Abstract: Extrasolar planetary systems provide evidence for extensive migration of giant planets. However, it is usually assumed that Jupiter and Saturn did not migrate significantly. Hydrodynamical simulations show that Jupiter should have migrated inwards in the solar nebula when Saturn was not yet formed. Then Saturn, once close to its final mass, could have migrated faster than Jupiter until being caught in their mutual 2:3 mean motion resonance. Once in resonance, the two planets could have migrated outwards. We find that the inward-then-outward migration of Jupiter, with a migration reversal at 1.5AU, explains the current structure of the Solar System at an unprecedented level. It would have truncated the disk of planetesimals at about 1AU, explaining the large Earth/Mars mass-ratio. It would have also depleted, then re-populated the asteroid belt region, with inner-belt bodies originating between 1 and 3AU and outer belt bodies originating between and beyond the giant planets, thus explaining the significant compositional differences across the belt. Finally, the orbits of the giant planets when the gas is removed would correspond to the initial conditions of the "Nice model", which explains the current configuration of the outer Solar System. Therefore, we conclude that there is substantial evidence for a wide-range migration of Jupiter and Saturn in the solar nebula. Assuming that giant planets form in sequence at increasing distances from the central star, most of the observed diversity of planetary systems could stem from the occurrence or avoidance of two events: (i) the capture in resonance of the first, inner planet by the second, initially smaller one, which triggers outward migration and (ii) the growth of the outer planet beyond the mass of the inner one, which causes inward migration of both planets to resume. The Solar System structure results from the occurrence of (i) and avoidance of (ii).

Name: Bertram Bitsch
Affiliation: OCA, Nice
Title: **Influence of the disc structure on planetary migration**
Abstract: Recent research has shown that the direction of migration for low mass planets in accretion discs (type-I-migration) can change from inwards to outwards, when taking non-isothermal effects into account. This change in the direction of migration can prevent newly formed planets from falling into the star at an early time of the disc evolution. The migration is strongly dependent on the disc structure, namely on the entropy gradient in the disc. In previous studies the disc structure was calculated self-consistently by the equilibrium state of viscous heating and radiative cooling. In a real disc around a young star, the disc structure is also determined by stellar irradiation. I will present a disc model including viscous heating, radiative cooling and stellar irradiation and explain its implications for the migration of planets in gas discs. I will focus especially on the location of the zero-torque radius, where planets and planetary embryos could accumulate and grow further in mass.

Name: Sean Raymond
Affiliation: Bordeaux Astrophysical Lab
Title: **Giant planet sculpting of outer planetesimal disks**
Abstract: We present simulations of the dynamical evolution of planetesimal disks located exterior to systems of ice- and gas giant planets. Although interactions with the disk cause planets to undergo planetesimal driven migration or cross resonances, high-mass giant planets are largely insensitive to the presence of the disk. However, the giant planets' dynamics scts to sculpt the orbital distribution of the disk; for stable planets the disk is slowly eroded from the inside outward. Instabilities among giant planets excite the eccentricities and inclinations of planetesimals to a degree that depends critically on the strength of the instability and the eccentricities of surviving giant planets. Weak instabilities can also trap planetesimals in low-order resoanances with the outermost giant planet. Strong instabilities often completely eject the entire disk. There exists a class of strong instabilities with a single surviving planet which transforms a plane tesimal disk into an isotropically-distributed cloud; we call these "mini-Oort clouds" because the planetesimal orbits are confined within 100 AU. Our results have implications for the interpretation of debris disk observations and predict that an eccentric giant planet - debris disk anti-correlation will be found by upcoming surveys.

Name: Alexandre Correia
Affiliation: University of Aveiro
Title: **Eccentricity pumping by tidal effect.**
Abstract: Planets close to their host stars are believed to undergo significant tidal interactions, leading to a progressive damping of the orbital eccentricity. However, when the orbit of the planet is excited by an outer companion, tidal effects combined with gravitational interactions may give rise to a secular increasing drift on the eccentricity. As long as this secular drift counterbalances the damping effect, the eccentricity can increase to high values. This mechanism may explain why some of the moderate close-in exoplanets are observed with substantial eccentricity values.

Name: Anne-Sophie Libert
Affiliation: University of Namur
Title: **Formation of 3-D multiplanet systems**
Abstract: in collaboration with B. Bitsch, A. Crida, K. Tsiganis
Recently, the possibility that extrasolar systems can be '3-D systems', namely they are composed of two or more planets whose orbital planes have substantial values of mutual inclinations, has been considered. Some analytical studies have highlighted that such systems can be long-term stable, and a first observational confirmation has estimated the mutual inclination of the orbital planes of planets c and d of the Upsilon Andromedae system to 30° (McArthur et al. 2010). We examine possible dynamical mechanisms for the formation of planetary systems with high mutual inclinations, starting from a coplanar system that undergoes Type II migration in a gas disc. For a two-planet system, we show that capture into higher-order MMRs (such as the 3/1, 4/1 and 5/1) can result in inclination excitation – as in the case of the 2/1 MMR studied by Thommes & Lissauer (2003) – provided that at least one of the planets reaches eccentricity values higher than 0.4. For a three-planet system, an additional inclination excitation mechanism exists: the three planets can be trapped in a multiple mean motion resonance – as in the case studied by Morbidelli et al. (2007), for the young solar system. If the resonance persists as the gas dissipates, a stable resonant 3-D three-planet system can form. Otherwise, the system is dynamically disrupted, typically leading to the ejection of one planet and the formation of a highly non-coplanar two-planet system. Moreover, 3-D hydrodynamical simulations of a giant planet in an isothermal gas disc have been performed to estimate the inclination damping that should be included in our model. The effects of such damping on the previous results are finally discussed.

Name: Marian Jakubik
Affiliation: Astronomical Institute Slovak Academy of Sciences
Title: **The accretion of Uranus and Neptune by collisions among planetary embryos in the vicinity of Jupiter and Saturn**
Abstract: Modeling the formation of the ice giants Uranus and Neptune is a long-lasting problem in planetary science. Due to gas-drag, collisional damping, and resonant shepherding, the planetary embryos repel the planetesimals away from their reach and thus they stop growing. This problem persists independently of whether the accretion took place at the current locations of the ice giants or closer to the Sun. Instead of trying to push the runaway/oligarchic growth of planetary embryos up to 10-15 Earth masses, we envision the possibility that the planetesimal disk could generate a system of planetary embryos of only 1-3 Earth masses. Then we investigate whether these embryos could have collided with each other and grown enough to reach the masses of current Uranus and Neptune. Our results point to two major problems. First, there is typically a large difference in mass between the first and the second most massive core formed and retained beyond Saturn. Second, in many simulations the final planetary system has more than two objects beyond Saturn. The growth of a major planet from a system of embryos requires strong damping of eccentricities and inclinations from the disk of gas. But strong damping also favors embryos and cores to find a stable resonant configuration, so that systems with more than two surviving objects are found. In addition to these problems, in order to have substantial mutual accretion among embryos, it is necessary to assume that the surface density of the gas was several times higher than that of the minimum-mass solar nebula. However this contrasts with the common idea that Uranus and Neptune formed in a gas-starving disk, which is suggested by the relatively small amount of hydrogen and helium contained in the atmospheres of these planets. Only one of our simulations "by chance" successfully reproduced the structure of the outer Solar System.

Name: Maria de Juan Ovelar
Affiliation: Leiden Observatory
Title: **Can habitable planets form in clustered environments?**
Abstract: The question of whether the star-forming environment affects the formation and evolution of planetary systems has been extensively studied from a theoretical point of view. However, no conclusive observational evidence of such effects has been found. We address the problem by analysing the distribution of observed protoplanetary discs (PPD) radii in star-forming regions with different ambient stellar surface densities. In this talk, we present empirical evidence, at $> 95\%$ confidence level, for a change in the PPD radius distribution at ambient densities $> 10^{3.5}pc^{-2}$. This coincides with a simple theoretical model for the truncation of PPDs by dynamical interactions. If this agreement is causal, the ongoing truncation of PPDs and planetary systems limits the possible existence of planets in the habitable zone (HZ). The maximum HZ lifetime then decreases with higher host stellar masses and ambient densities, indicating that habitable planets are not likely to be present in long-lived stellar clusters, and may have been ejected altogether to form a population of unbound, free-floating planets. Finally, we predict that dynamical interactions can cause a measurable depletion of the PPD mass function, which can be detected with ALMA observations of the densest nearby and young clusters.

Name: Clement Baruteau
Affiliation: DAMTP, University of Cambridge
Title: **Recent developments in planet migration theory**
Abstract: Planetary migration is the process by which a forming planet undergoes a drift of its semi-major axis caused by the tidal interaction with its parent protoplanetary disc. One of the key quantities to assess the migration of embedded planets is the tidal torque between the disc and planet, which has two components: the Lindblad torque and the corotation torque. In this communication, I will review the latest results on both torque components, with a special emphasis on the various processes that give rise to additional, large components of the corotation torque. These additional components of the corotation torque could help address the shortcomings that have recently been exposed by models of planet population syntheses.

Name: Amy Bonsor
Affiliation: IPAG, Grenoble
Title: **The interaction between planets and smaller bodies in planetary systems: can scattering explain observations of warm dust belts or exozodis around main sequence stars or dusty, polluted white dwarfs?**
Abstract: Observations of exo-planetary systems find that multi-planet systems and systems with both planets and planetesimal belts are common. The interactions between the planets and the planetesimal belts can be important in sculpting the planetary system. In this talk, I discuss the scattering of small bodies by planets, with particular reference to the structures that can be produced and the relation of these to observations of exo-planetary systems. One question of particular interest is whether scattering processes can help explain observations of warm dust belts or exozodi around main sequence stars. Another intriguing set of observations are those of white dwarfs polluted by planetary material. Could these also be explained by scattering processes?

Name: Francesco Marzari
Affiliation: Dept. of Physics, Padova, Italy
Title: **Planetesimal accumulation around Kepler-16 (AB)**
Abstract: Planetesimal accumulation in the exoplanetary system Kepler-16 (AB) appears to be a complex process due to the secular perturbations of the close binary and gas drag due to the gaseous component of the disk surrounding the two stars. We show that the formation of planetary embryos may be possible only beyond 3 AU while the observed planet has a semimajor axis of 0.7 AU. By modeling planet migration in a fully radiative disk we find that the planet, once formed, quickly migrates into the inner re- gions of disk explaining the present orbit of the detected exoplanet.

Name: Melvyn Davies
Affiliation: Lund Observatory
Title: **The dynamical evolution of exoplanet systems**
Abstract: Today we know of over 700 planets around other stars. Many of these are massive planets, found on tight, and yet eccentric, orbits around their host stars. I will discuss the dynamical evolution of these systems. All stars are formed in some sort of cluster or association. I will discuss how planetary systems are vulnerable to perturbations from passing stars and stellar companions within stellar clusters. These perturbations may lead to a chain of events that result in the ejection of some planets, leaving those remaining on tighter, and eccentric, orbits. In addition, we may also be able to explain a sub-population of hot jupiters, and planets seen recently via direct imaging to be on very wide orbits.

Name: Krzysztof Goździewski
Affiliation: Toruń Centre for Astronomy
Title: **A dynamical analysis of the HU Aqr planetary system**
Abstract: In the past few years, a new class of extrasolar planets have been discovered. Many compact binaries are found to host massive Jupiter-like companions in a few AU orbits. These discoveries rely on the eclipse timing technique and the Roemer effect. Our work is devoted to a self-consistent orbital model of such observations. In particular, we focus on the cataclysmic polar HU Aqr and its putative 2-planet system. We investigate, whether dynamically stable planetary configurations may persist in the long-term time scale. The results are important to establish possible formation scenarios of such circumbinary planetary systems.

Name: Alex Dunhill
Affiliation: University of Leicester
Title: **Eccentricity growth of embedded giant planets**
Abstract: Most extra-solar planets have eccentric orbits around their host stars. This is in stark contrast to Solar System planets, which are all in near-circular orbits, and it is unclear how exoplanets attain their eccentricities. One possible mechanism for exciting eccentricity is by resonant interactions between a young planet and its parent protoplanetary disc. We present high-resolution 3-D numerical simulations of this planet-disc interaction. We find that eccentricity is only excited in discs that have very high surface densities with shallow radial profiles; in more realistic discs the excitation is very weak, and is further damped by other resonant torques. We conclude that disc-planet interactions cannot explain a significant fraction of observed exoplanet eccentricities, and discuss the consequences of our results for future exoplanet studies.

Name: Helena Morais
Affiliation: University of Aveiro
Title: **Stability of prograde and retrograde planets in binary systems**
Abstract: We will present results on the stability of prograde versus retrograde planets in binary systems. We will show that retrograde planets are stable up to distances closer to the perturber than prograde planets. We will show that instability is due to single resonance forcing, or caused by nearby resonances' overlap. We will conclude that the observed enhanced stability of retrograde planets with respect to prograde planets is due to essential differences between the phase-space topology of retrograde versus prograde resonances (at p/q mean motion ratio, the prograde resonance is of order p - q while the retrograde resonance is of order p + q).

Planetary Atmospheres (Chair: B. Ercolano)

Name: Heike Rauer
Affiliation: DLR, Institut für Planetenforschung
Title: **Review Talk: The detection of habitable planets, their atmospheres and habitability**
Abstract: The detection of terrestrial planets in the habitable zone (HZ) and the subsequent detection of habitable conditions and signatures for life on these planets are among the most interesting, but challenging, goals of exoplanet research. This talk will review the status and future prospects for the detection of terrestrial planets in the HZ and review the conditions needed to be habitable. Results of model simulations of terrestrial exoplanet atmospheres will then be used to discuss the detectability of spectral signatures to infer habitability or even signatures of life under various conditions.

Name: Ravit Helled
Affiliation: Tel-Aviv University
Title: **Uranus and Neptune: Formation, Evolution, and Interior Structure in Solar and Extrasolar Planetary Systems**
Abstract: The number of extrasolar planets with masses similar to those of Uranus and Neptune is increasing rapidly. It is clear that a better understanding of the formation mechanism, evolutionary path, and interior structure of this planetary population is desirable. Despite their distance from the Sun, Uranus and Neptune are the best representatives of this planet-class in our own Solar System, and although we have much more information available on Uranus and Neptune compared to extrasolar planets with similar masses, our understanding of Uranus and Neptune is still rather limited. While Uranus and Neptune are similar in mass (about 14.5 and 17.1 Earth masses, respectively) they differ in other physical properties such as thermal emission, obliquity, and atmospheric enrichment. We present new interior models of Uranus and Neptune base on the available measurements and suggest that Uranus and Neptune may not be "twin planets", and that it is possible that each planet represents a different "class" of planets in this mass range in terms of composition, internal structure, and possibly, formation mechanism. Finally, we summarize the available constraints and measurements for Uranus and Neptune, present the questions that should be asked, and discuss the implications for studying extrasolar planets in this mass regime.

Name: Yasunori Hori
Affiliation: National Astronomical Observatory of Japan
Title: **On the Accretion of Atmospheres Onto Super-Earths**
Abstract: Low-mass planets with several Earth-masses and orbital periods of a few days have been discovered via radial-velocity measurements and transit surveys. Although some super-Earths have density comparable to that of water, many of them have density comparable to or larger than that of Mercury and the Earth. We show that if these super-Earths migrated to inner regions or were assembled in a protostellar disk close to their present location, some of them may have accreted and then lost an envelope several times more massive than their cores. In contrast, the envelope accreted by planetary embryos at several AU from their host stars is mostly retained. Based on these results, we suggest that 1) most of low-density super-Earths were probably formed out of refractory material beyond the ice line, 2) very few, if any short-period super-Earths have evolved into hot Jupiters through gas accretion near their present location. We also show that it is possible to form super-Neptune mass planets through accretion of metal-rich disk gas.

Name: Yamila Miguel
Affiliation: Max-Planck-Institut für Astronomie
Title: **Exploring super-Earth atmospheres**
Abstract: The search for extrasolar planets has resulted in the discovery of super-Earths, with masses between 1 and 10 Earth masses. Interior models suggest that some of these exoplanets might be potentially rocky in nature, with outgassed atmospheres. Since no such planets exist in our solar system, the atmospheric composition and structure of these potentially rocky super-Earths remains largely unknown. These planets are interesting targets for future observations, therefore, addressing their composition and atmospheric structure is a major issue and the aim of our work. We explore the composition and possible atmospheric structure of super-Earths with outgassed atmospheres and how this structure changes according to the planetary observable data: mass or radius, semimajor axis and stellar type, to get a better understanding and characterization of extrasolar rocky planets In order to explore such planetary atmospheres and find out what we expect to find in these worlds, we model potential outgassing and atmospheric profiles. In this work we show our results, exploring how different initial conditions lead to different atmospheres for the planets.

Name: Lisa Kaltenegger
Affiliation: MPIA / CfA
Title: **Concepts of the Habitable Zone**
Abstract: The HZ around a single star has been calculated by several authors. Two concepts are commonly used throughout the literature for cloud free (see Kasting et al.1993, Underwood et al.2003) and cloudy atmospheres (Selsis et al.2007) which have been derived from the same model originally proposed by Kasting et al.(1993). The main differences among studies of the HZ are the imposed climatic constraints such as a $CO_2/H_2O/N_2$ atmosphere with varying $CO_2/H_2O/N_2$ concentrations (e.g., Earth's), or model atmospheres with high H_2 concentrations (Gaidos /&Pierrehumbert 2010) or limited water supply (Abe et al.2011).
We discuss the implication of these constraints on the Habitable Zone and its resulting limits as well as detectable spectral features in a planet's rocky atmosphere that could be used to test our concept of the Habitable Zone.

Name: Paul Hartogh
Affiliation: Max-Planck-Institut für Sonnensystemforschung
Title: **Herschel observations of planets**
Abstract: This talk will present latest Herschel results on the atmospheres of Mars and the gas giants.

Name: Miriam Rengel
Affiliation: Max-Planck-Institut für Sonnensystemforschung
Title: **Observations of Key Atmospheric Gases in Venus and Titan's Atmospheres**
Abstract: Crossing the next frontier in characterization of "exo-Earths" and "exo-moons", it is instructive to start with an assessment of the atmospheric characterization of terrestrial planets and satellites in our own Solar System. In this report we will concentrate in the key atmospheric gases of Venus and Titan as seen by far-infrared and submillimeter spectroscopic ground and space-based observations. Athough these atmospheres have been studied with a variety of remote-sensing techniques, across a wide spectral range, they are still not fully understood. With the help of spectroscopic observatiosn and appropriate radiative transfer calculations, we constrain the chemical concentration profiles, temperature and winds in these fascinating atmospheres.
In particular, I will present: (1) observations of CO lines on Venus's mesosphere with the Heinrich Hertz Submillimeter Telescope/1.3 mm ALMA receiver in different periods to examine the dynamics and variability, (2) CO lines on Venus's mesosphere with APEX/ FLASH to determine vertical thermal structure and wind velocities, (3) high S/N spectrum of Titan recorded by Herschel/ PACS grating spectrometer during 2010 to constraint on both the temperature and the key abundances in Titan's atmosphere, (4) CO and HCN line observations on Titan as seen by APEX / SHFI.
This study attempts to contribute to constrain radiative transfer and retrieval algorithms for planetary atmospheres, and to give hints to the current and future ground and space-based data acquisition leading to a more thorough understanding of the chemical composition and dynamics of atmospheres of terrestrial planets and moons, and possible extra-solar ones as well.

Name: Daniel Kitzmann
Affiliation: TU Berlin
Title: **Climatic impact of CO2 ice clouds in atmospheres of terrestrial exoplanets**
Abstract: Clouds play a significant role for the energy budget in planetary atmospheres. They can scatter incident stellar radiation back to space, thereby effectively cooling the planetary surface. On the other hand, they may contribute to the atmospheric greenhouse effect by trapping outgoing thermal radiation. For planets near the outer boundary of the habitable zone, condensation of CO2 can occur due to the low atmospheric temperatures. The climatic effect of such CO2 ice clouds may play an important role for the surface temperature and, therefore, for the question of habitability of those planets. However, the optical properties of CO2 ice crystals differ significantly from those of water droplets or water ice particles occurring in the Earth atmosphere. Except for a small number of strong absorption bands CO2 ice particles are almost transparent with respect to absorption. Instead, they are highly effective scatterers at long and short wavelengths. Therefore, the climatic impact of a CO2 ice cloud will depend on how much of the incident stellar radiation is scattered to space in comparison to the amount of thermal radiation scattered back towards the planetary surface. In this contribution we study this potential scattering greenhouse effect of CO2 ice particles and present the resulting radiative forcing of these CO2 clouds as a function of particle sizes and densities. Additionally, we discuss their impact on the outer boundary of the habitable zone for terrestrial planets around main sequence host stars.

Name: Stefanie Gebauer
Affiliation: Zentrum für Astronomie und Astrophysik
Title: **On the evolution of Earth's atmosphere considering the biogeochemical modeling of oxygen**
Abstract: The understanding of the evolution of Earth-like planetary atmospheres is deeply intertwined with our knowledge of the development of Earth's atmosphere. Since the Archean era O2 has increased from its pre-biotic concentration of 10-12 PAL (Present Atmospheric Level) to modern levels of 21 % vmr. Thereby, the evolution of molecular oxygen concentrations in the atmosphere of Earth is strongly related to chemical, geological and biological processes. The goal of this work is to simulate the evolution of an Earth-like planetary atmosphere considering the effect of biogeochemical cycles for periods before, during and after the great rise in oxygen. A 1D radiative-convective photochemical model (after e.g. Kasting et al. 1984; Segura et al. 2003; Grenfell et al. 2007), adapted to calculate O2, N2, and CO2 interactively over the lower and middle atmosphere, is coupled to a biogeochemical model of oxygen considering biological and geological processes. We calculate the atmosphere before, during and after the great rise in oxygen and show the corresponding surface fluxes needed to maintain a given oxygen surface mixing ratios. To understand the resulting fluxes the Pathway Analysis Program (PAP) (Lehmann 2004) is used to gain insight into the complex chemical pathways producing and destroying oxygen in the atmosphere. To understand to which extent the habitability of a planet is controlled by the interplay between its atmosphere and biogeochemistry, the coupled biogeochemical model calculates the corresponding biosphere for the atmospheric scenarios considered regarding the biogeochemical cycle of oxygen.

Name: Lisa Nortmann
Affiliation: Institut für Astrophysik
Title: **Ground-based Transmission Spectroscopy of Exoplanet Atmospheres**
Abstract: More than 770 exoplanets have been detected in the last two decades and space missions such as CoRoT and Kepler are beginning to find rocky exoplanets with radii smaller than Earth's. In response to the quantity of exoplanet detections the characterization of these planets has shifted into the focus of exoplanet research. The atmosphere of a planet is of particular interest as it is of key importance in order to constrain the planet's interior composition and it will be our best hope for the task of identifying habitable worlds outside of our solar system in the foreseeable future.

Over 200 of the known exoplanets are periodically transiting in front of their host star in our line of sight. These transiting extra solar planets present us with the unique opportunity to measure the transmission spectra of their atmospheres. This is due to the fact that during such an event part of the light emitted by the host star will pass through the exoplanet atmosphere before it arrives at the telescope.

With the precision reachable by using the current generation of instruments and telescopes such transit transmission measurements are feasible for planets which exhibit highly extended atmospheres.

I will present results of ground-based spectrophotometric observations of the highly inflated hot Jupiter WASP-17b, which were obtained with the FORS2 instrument mounted on one of the Very Large Telescopes. The exoplanet atmosphere was probed in the visible wavelength region between 740 - 1000 nm where potassium, water and titanium oxide absorption is predicted by theoretical models. I will elaborate on the potential of the method in general and discuss the current limitations of ground-based observations of this kind.

Posters

1. Serena Emily Arena (CRAL Lyon):
   Characterisation of global flow and SPH noise in simulations of protoplanetary discs
2. Guillem Aumatell (Universität Duisburg-Essen / Universität Münster):
   Contact physics of Water Ice in Protoplanetary Disks, Breakup, Twisting, Rolling and Sliding.
3. Roman Baluev (Pulkovo Astronomical Observatory):
   PlanetPack: a radial-velocity analysis tool for planet detection, characterisation, and dynamics
4. Lisa Benamati (CAUP):
   Gaia and the search for other planets: combining astrometry and radial velocity
5. Julie Brisset (IGEP, TU Braunschweig):
   SPACE on REXUS: a protoplanetary dust collision experiment on a sounding rocket
6. Łukasz Bukowiecki (Nicolaus Copernicus University):
   Photometric follow-ups of transiting exoplanets WASP-3 b, WASP-10 b and WASP-12 b
7. Nahuel Cabral (Institute of Physics & IPAG):
   Magnetic cavity and planet population synthesis.
8. Ubach Catarina (Swinburne University):
   Signatures of grain growth in protoplanetary discs
9. Cristiano Cosmovici (IASP-INAF):
   Search for Water in Exoplanetary Atmospheres
10. Christophe Cossou (Laboratoire d'Astrophysique de Bordeaux):
    migration and growth of planetary embryos in radiative protoplanetary disks
11. Fulla Daniel (ESO):
    Commissioning ALMA: Early Science
12. Tatiana Demidova (Pulkovo Observatory of Russian Academy of Sciences):
    Asymmetric illumination of protoplanetary disks in the presence of low-mass companions.
13. Jessica Donaldson (University of Maryland, College Park):
    Modeling the HD 32297 Debris Disk with Far-IR Herschel Data
14. Joanna Drazkowska (ITA, University of Heidelberg):
    Joining the small scale dust growth and the large scale planet formation: toward a new computational model
15. Natalia Dzyurkevich (Max-Planck Institute for Astronomy):
    Charged dust in protoplanetary disk with the dead zone defined by the ambipolar diffusion.
16. Virginie Faramaz (IPAG):
    DUst around NEarby Stars : Dynamical Modeling of the 2-3 Gyr-old Debris Disk of ζ2 Reticuli - Searching for a Planetary Companion
17. Julien Faure (CEA):
    Dynamics of the inner edge of the dead zone in protoplanetary disks
18. Stephen Fendyke (Queen Mary, University of London):
    Eccentric planets in protoplanetary discs: Implications for the dynamics of the corotation region and the horseshoe drag
19. Mario Flock (SAP - CEA - Saclay):
    Gas and Dust dynamics in MRI turbulent Accretion Disks
20. Kateryna Frantseva (Taras Shevchenko National University of Kyiv):
    Polarimetric effects simulation for HD189733 Frantseva K., Kostogryz N.M., Yakobchuk T.M.
21. Hideaki Fujiwara (Subaru Telescope, NAOJ):
    AKARI and Spitzer Observations of Warm Debris Disks
22. Philipp Gast (DLR, Institut fuer Planetenforschung):
    Influence of Initial Abundances on Chemical Evolution of the Turbulent Disk
23. Campanella Giammarco (Queen Mary University of London):
    Evolution and dynamics of the eccentric planetary system HD 181433
24. Christian Ginski (AIU Jena):
    Orbital motion of sub-stellar companions
25. Miwa Goto (USM):
    Line imaging of disks around Herbig Ae stars of group I and II by CO vibrational transitions

26. Antonio Hales (ALMA/NRAO):
A CO Survey of Protoplanetary disks: Characterizing the Gas Content in the Epoch of Planet Formation.
27. Michal Hanasz (Centre for Astronomy, Nicolaus Copernicus University):
Different shades of streaming instability
28. Paul Harvey (University of Texas at Austin):
A Survey of Cold Dust in Brown Dwarf Disks With Herschel
29. Siddharth Hegde (Max Planck Institute for Astronomy):
Colors of extreme exoEarth environments
30. Mitsuhiko Honda (Kanagawa University):
Observations of water ice in the disk around HD 100546
31. Sheng Jin (Max-Planck-Institut für Astronomie):
Equilibrium planetary atmospheres with dual-band approximation
32. Attila Juhasz (Leiden Observatory):
Asymmetries in protoplanetary disks through the eyes of ALMA
33. Watanabe Keisuke (Tokyo institute of technology):
Thermal instability induced by the gas dust temperature difference
34. Thorben Kelling (Fakultät für Physik, Universität Duisburg-Essen):
Dust recycling at the inner edge of protoplanetary disks: experimental results from microgravity
35. Florian Kirchschlager (Christian-Albrechts-Universität zu Kiel):
Blowout size of porous dust grains
36. Manfred Kitze (AIU Jena):
Bayesian Transit Detection
37. Christine Koepferl (USM Munich):
Disc Clearing of Young Stellar Objects: evidence for fast inside-out dispersal
38. Stefan Kothe (IGEP, TU Braunschweig):
Experiments on the agglomeration of sub-millimeter sized dust aggregates
39. Quentin Kral (LESIA - OBSPM):
Coupled dynamical and collisional modelling of debris discs.
40. Masanobu Kunitomo (Tokyo Institute of Technology):
The Origin of the Lack of Close-in Planets around Intermediate-mass Red Giants
41. Hiroyuki Kurokawa (Tokyo Institute of Technology & MPIA):
Evolution of super-Earths with hydrogen atmosphere
42. Fred Lahuis (SRON):
Epic changes in the IRS 46 mid-infrared spectrum; an inner disk chemistry study
43. Lea Feodora Lenz (Goettingen University):
High resolution emission spectroscopy: Searching for auroral H3+ (emission) features in hot Jupiter atmospheres
44. Rik van Lieshout (API, University of Amsterdam):
The effect of dust sublimation in the innermost regions of debris disks
45. Torsten Loehne (Astrophysical Institute, Friedrich Schiller University):
Modelling the HIP 17439 debris disk as observed by Herschel/DUNES
46. Carlo Felice Manara (ESO - Garching):
The timescales of protoplanetary disk evolution. New scenario opening?
47. Heloise Meheut (University of Bern):
The Rossby vortices in the context of planetesimal formation
48. Jonathan Menu (Instituut voor Sterrenkunde, KU Leuven):
TW Hydrae: an infrared interferometric study of a transitional disk
49. Tobias Müller (Institut für Astronomie und Astrophysik):
Gravitational Instability of irradiated disks
50. S. Eva Nessenius (Universität Frankfurt Main):
Evolution and Geological Planet Formation
51. Grzegorz Nowak (Centre for Astronomy, Nicolaus Copernicus University):
Photometric follow-ups of transiting exoplanets WASP-3 b, WASP-10 b and WASP-12 b
52. Takaya Okamoto (Department of Planetary Science, Kobe University):
Capture of Exotic Dust Grains by Highly Porous Primitive Bodies: A Suggestion from High Velocity Impact Experiments
53. Mahmoudreza Oshagh (CAUP):
Characterizing the configuration of planetary systems: the case for active stars
54. Martin Pessah (Niels Bohr Institute):
On Angular Momentum Transport in Accretion Disk Boundary Layers Around Young Stars
55. Monika Petr-Gotzens (ESO-Garching):
Circumstellar disk evolution in binaries
56. Giovanni Picogna (Dept. of Physics, Padova, Italy):
3D simulations of circumstellar disks in binary star systems.

57. Arnaud Pierens (Laboratoire d'Astrophysique de Bordeaux):
Protoplanetary migration in non-isothermal disks with turbulence driven by stochastic forcing
58. Elke Pilat-Lohinger (Institute of Astrophysics, University of Vienna):
Planets in Binary Star Systems
59. Christophe Pinte (IPAG, Grenoble):
Radial dust migration in the TW Hydra protoplanetary disk
60. Stefanie Raetz (AIU Jena):
Transit Timing Variations of TrES2: a homogeneous analysis of ground- and space-based photometry
61. Thorsten Ratzka (Universitäts-Sternwarte München):
A Mid-Infrared Interferometric View of the Evolution of Circumstellar Discs
62. Basmah Riaz (Uni. of Hertfordshire):
The radial distribution of dust species in young brown dwarf disks
63. Katherine Rosenfeld (Harvard-Smithsonian Center for Astrophysics):
An Anomalous Kinematic Pattern in the TW Hya Gas Disk
64. Jan Philipp Ruge (ITAP, University of Kiel):
Tracing Planets in Protoplanetary-Discs
65. Sarah Rugheimer (Harvard University - Center for Astrophysics):
Spectral Fingerprints of Earth-Llike Planets Around FGK Stars
66. Vachail Salinas (Universidad de Chile):
SINFONI observation of transition disks
67. Jorge Sanz-Forcada (Centro de Astrobiologia (INTA-CSIC)):
Photoevaporation of protoplanetary disks by XUV stellar radiation
68. Jorge Sanz-Forcada (Centro de Astrobiologia (INTA-CSIC)):
CARMENES: the new exoplanet hunter at Calar Alto
69. Manuel Steinhausen (Max-Planck-Institut für Radioastronomie):
Influence of the cluster environment on the structure in protoplanetary discs
70. Takayuki Tanigawa (CPS / Hokkaido Univ.):
Formation of Circumplanetary Disks
71. Hiroshi Terada (Subaru Telescope):
Water Ice in Silhouette Disks in the M42 and M43 regions
72. Audrey Trova (Univ. de Bordeaux & LAB):
Two useful formulae for thin disc models with self-gravity
73. Kathrin Ulbrich (Institut für Astrophysik Göttingen):
Synthetic spectra of protoplanetary disks
74. Esa Vilenius (Max Planck Institute for Extraterrestrial Physics):
TNOs are Cool: Thermal modeling of large samples of Kuiper belt objects observed with Herschel Space Observatory
75. Christian Vitense (University of Jena):
Were EKBOs born big?
76. Christopher Wright (UNSW@ADFA):
7 mm imaging of the disk around HD100546 with the Australia Telescope Compact Array
77. Günther Wuchterl (Thüringer Landessternwarte):
Theoretical Planetary Statistics

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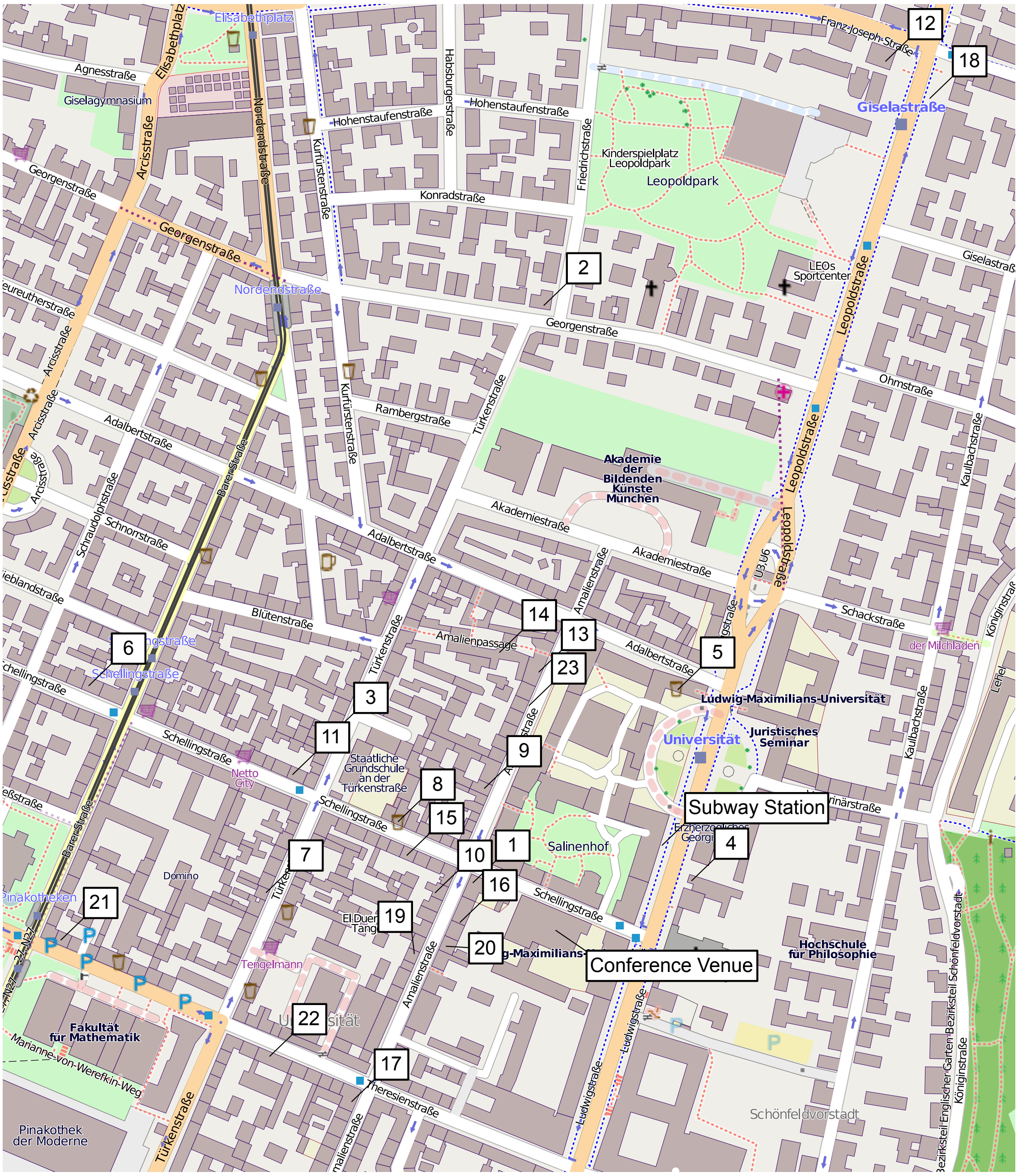
Lunchmap

Below you can find some ideas for lunchtime or dinner around the conference venue. Also the area between U-Bahn "Giselastraße" and "Münchner Freiheit" on Leopoldstraße and its side streets offer a variety of great outdoor cafés and restaurants.



Bavarian / Traditional

1. Atzinger
   One of the most popular student bars with old-fashioned charm – for young and old.
   Schellingstraße 9
   Tel.: 089 282880
   `www.atzingermuenchen.de`

2. Georgenhof
   Traditional Bavarian inn with lovely beergarden.
   Friedrichstraße 1
   Tel.: 089 34077691
   `www.georgenhof-muenchen.de`

3. Alter Simpl
   Restaurant with Bavarian food and old history – a “classic”.
   Türkenstraße 57
   Tel.: 089 34077691
   `www.alter-simpl.com`

Coffee Houses

4. Café an der Uni
   Cozy Café with italian atmosphere, nice beergarden and sight of the Ludwigskirche
   Ludwigstraße 24
   Tel.: 089 28986600
   `www.cadu.de`

5. Unilounge
   Just one step away from the main building. Coffee is perfect and Italian style.
   Geschwister-Scholl-Platz 1
   `www.unilounge-muenchen.com`

6. Café Altschwabing
   Viennese coffee house atmosphere with the turkish influence of the owner.
   Schellingstraße 56
   Tel.: 089 2731022
   `www.altschwabing.com`

7. Café Puck
   Legendary breakfast menue, salads and main dishes for every taste.
   Türkenstraße 33
   Tel.: 089 2802280
   `www.cafepuck.de`

8. Schall & Rauch
   Beloved place for students to hang out. In the evenings it turns to a bar.
   Schellingstraße 22
   Tel.: 089/ 30 - 44 33 97 23
   `www.schallundrauch.de`

9. Spoon
   cozy and designer atmosphere, like an Italian Espresso Bar. Changing lunch menu every day.
   Amalienstraße 69
   Tel.: 089/ 27370217
   `www.signorrossi.de`

Pasta & Pizza

10. Da Claudio
    Good prices, good service, good italian food.
    Amalienstraße 53
    Tel.: 089 28808247
    `www.mittagstipp.de`

11. Lo Studente
    Student-Pizzeria No 1. Low prices, wood-oven pizza.
    Schellingstraße 30
    Tel.: 089 2737-5447
    `www.lostudente-muenchen.de`

12. Ristorante Adria
    stylish and modern restaurant, places inside and outside
    Leopoldstraße 19
    Tel.: 089 33039864
    `www.adriamuenchen.de`

13. Pasta e basta
    good food, excellent prices in modern and relaxed atmosphere.
    Amalienstraße 87
    Tel.: 089/ 1393-9446
    `www.pastaebasta-web.com`

Green Food / Vegetarian

14. Naturkost Mutter Erde
    small location with vegetarian organic dishes, cakes, outdoor terrace.
    Amalienstraße 89
    Tel.: 089 283127
    `www.amalienpassage.de`

15. Dean & David
    Green fresh-to-eat restaurant; best salads in town, sandwiches, curries.
    Schellingstraße 13
    Tel.: 089 33098317
    `www.deananddavid.de`

16. Pommes Boutique
    Best fries in town; lots of toppings; veggie sticks; also meat like the famous “Currywurst”.
    Amalienstraße 46
    Tel.: 089 95473312

www.pommesboutique.de

Asian Tastes

17. Nam Nam
    Exotic healthy food, good design, places inside and outside.
    Amalienstraße 25
    Tel.: 089 28755875
    www.nam-nam.eu

18. Bento Box
    Modern ambiente, fresh Sushi and more.
    Leopoldstraße 42
    Tel.: 089 33036812
    www.bentobox.de

19. Asaka Running Sushi
    An assembly line is serving excellent and extraordinary Sushi variations.
    Amalienstraße 39
    Tel.: 089/ 28998161
    www.qype.com

Others

20. DELI STAR Bagel & Coffee
    Nice Coffee Shop. If you need a bagel, this is the place to go. Nice variety, best quality.
    Amalienstraße 40
    Tel.: (089) 16 88 956
    http://www.delistar.de/bagel_coffee_01.htm

21. Brasserie Tresznjewski
    French flair, long bar, good food, beer, wine and cocktails.
    Theresienstraße 72
    Tel.: 089 282349
    www.tresznjewski.com

22. Cohen's
    Jewish specialities from around the world, live Klezmer music on friday evenings.
    Theresienstr. 31
    Tel.: 089 2809545
    www.cohens.de

23. Der verrückte Eismacher
    ...translates to "The crazy ice-cream maker": a variety of typical ice-creams and a few special flavors such as beer, white sausage, salmon, and others.
    Amalienstraße 77
    on.fb.me/N59enr

Dinner

The conference dinner will take place on Thursday, 6th of September 2012 at 8 pm in the restaurants you signed up for on Monday.

1. Augustiner am Dom
   Bavarian brewery
   Frauenplatz 8
   MVV: U3 | U6 Marienplatz
   Tel: +49 (89) 23 23 84 80
   `augustineramdom.de`

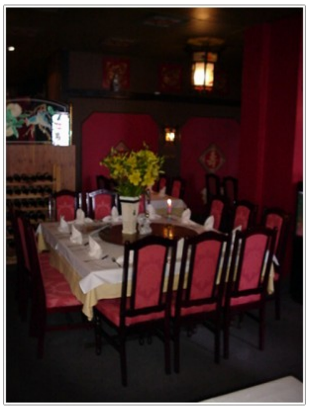
2. Hans im Glück
   Burger grill
   Türkenstraße 79
   MVV: U3 | U6 Universität
   MVV: Tram 27 Schellingstraße
   Tel: +49 (89) 66 66 46 88
   `hansimglueck-burgergrill.de`

3. Kalypso
   Greek cuisine
   Agnesstr. 8
   MVV: U2 Josephsplatz
   MVV: Tram 27 Elisabethplatz
   Tel: +49 (89) 27 10 900
   `kalypso.de`

4. Ksara
   Lebanese cuisine
   Haimhauserstraße 7
   MVV: U3 | U6 Münchner Freiheit
   Tel: +49 (89) 33 08 82 97
   `ksara.de`

5. Löwenbräukeller
   Bavarian brewery
   Nymphenburger Straße 2
   MVV: U1 Stieglmaierplatz
   Tel: +49 (89) 54 72 66 90
   `loewenbraeukeller.com`

6. Man Fat
   Chinese cuisine
   Barer Straße 53
   MVV: U3 | U3 Universität
   MVV: Tram 27 Schellingstraße
   Tel: +49 (89) 27 20 962
   `man-fat.de`



7. Paulaner im Tal
   Bavarian brewery
   Tal 12
   MVV: U3 | U6 Marienplatz
   Tel: +49 (89) 21 99 400
   `paulaner-im-tal.de`

8. Der Pschorr
   Bavarian brewery
   Viktualienmarkt 15
   MVV: U3 | U6 Marienplatz
   Tel: +49 (89) 44 23 83 940
   `der-pschorr.de`

9. Ratskeller
   Bavarian cuisine
   Marienplatz 8
   MVV: U3 | U6 Marienplatz
   Tel: +49 (89) 21 99 890
   `ratskeller.com`

10. Riva
    Italian cuisine
    Feilitzschstraße 4
    MVV: U3 | U6 Münchner Freiheit
    Tel: +49 (89) 30 90 51 808
    `riva-schwabing.de`

11. Weißes Bräuhaus
    Bavarian brewery
    Tal 7
    MVV: U3 | U6 Marienplatz
    Tel: +49 (89) 29 01 380
    `weisses-brauhaus.de`