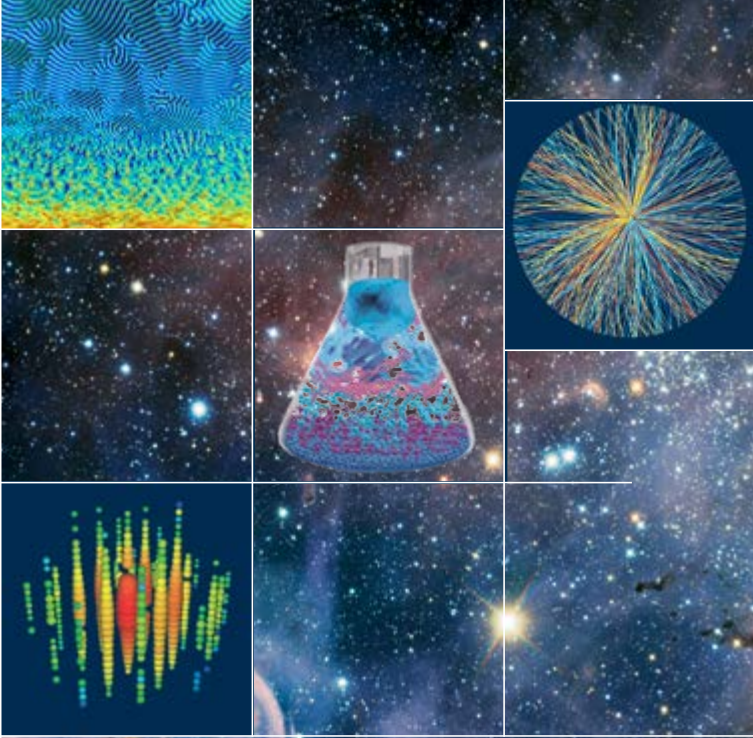


Science Afternoons

Astro-, Bio- & Particle Physics

THE VIRTUAL SCIENCE MEETING OF THE EXCELLENCE CLUSTER ORIGINS

November 23 – 25
December 1, 4, 9, 10 **2020**

https://tum-conf.zoom.us/s/96244041673
Meeting ID: 962 4404 1673
Passcode: 285451

TUM LMU ORIGINS Excellence Cluster

MONDAY, NOV 23

OPENING

13:00 **Andreas Burkert** (LMU) / **Stephan Paul** (TUM)

CN-2 PLANETS AND OTHER HABITATS

13:10 **Barbara Ercolano (LMU)**
Understanding planet formation in the context of emergence and survival of the first building blocks of life

13:35 **Oliver Trapp (LMU)**
Triggering chemical evolution

14:00 **Jana Steuer/Hanna Kellermann (LMU)**
FOCES spectrograph on Wendelstein - detection of exoplanets, combination with TESS data.

14:25 **Til Birnstiel (LMU)** **PRIZE WINNER TALK**
2020 Astrophysical Software Award of the German Astronomical Society for the software he developed for modelling the temporal and spatial evolution of dust in protoplanetary disks.

14:50 Tea and Coffee Break

ORIGINS PhD AWARD 2020 (THEORY)

15:10 **Roland Diehl (MPE)**
Laudatio to Christian Vogl

15:20 **Christian Vogl (TUM, MPA)**
Cosmological distances of type II supernovae from radiative transfer modelling

CN-4 DARK ENERGY

16:00 **Ariel Sanchez (MPE)**
Overview

16:25 **Paolo Campeti (MPA)**
Towards precision measurements of the primordial power spectrum of gravitational waves

16:50 **Alex Barreira (ORIGINS Fellow)**
The importance of galaxy bias on primordial non-gaussianity constraints

CN-2 PLANETS AND OTHER HABITATS

Mo Nov 23, 13:10 – 13:35h
CN-2 Overview:
Understanding Planet Formation in the Context of Emergence and Survival of the First Building Blocks of Life
Author: Barbara Ercolano (LMU)

Life's first building blocks must survive the harsh conditions of star and planet formation in the cosmos. Work in Connector 2 aims at looking at what those conditions might be and whether we can expect the emergence and persistence of complex molecules in planet forming environments and in young solar systems. In this overview talk I will show some of the current activities of this Connector.

CN-2 Planets and other habitats

Mo Nov 23, 13:35 – 14:00h
Triggering Chemical Evolution
Author: Oliver Trapp (CUP/LMU)

A fascinating question of abiogenesis is how simple organic molecules have developed into complex biological systems that are capable of being altered by evolutionary mechanisms. The fundamental question is what complexity is required to trigger evolution at the molecular level, i.e. molecules undergo their synthesis, selection and mutation leading to selectivity and replication. This question is closely linked to processes that lead to spontaneous symmetry breaking (chirogenesis) and ultimately to homochirality. This lecture focuses on mechanisms that lead to evolutionary systems at the level of organic molecules and open the possibility of chirogenesis. On the one hand, this is shown by the emergence of prebiotic organocatalysts and, on the other hand, a mechanism is discussed that leads naturally to the preferential formation of (deoxy)ribonucleosides and nucleotides. This creates the basis for self-sustaining and information-storing structures that can undergo dynamic alterations

CN-2 Planets and other habitats

Mo Nov 23, 14:00 – 14:25h

FOCES spectrograph on Wendelstein - detection of exoplanets, combination with TESS data

Authors: Jana Steuer/Hanna Kellermann (USM/LMU)

A new planet hunter is ready for action at the Wendelstein Observatory in the Bavarian Alps. FOCES, a high-resolution Echelle spectrograph has been refurbished, installed inside a pressure and temperature stabilized tank and connected via optical fibers to the 2.1m Fraunhofer Telescope (FTW). In order to further improve stability we use an optical frequency comb for wavelength calibration. The instrument is now finishing its commissioning phase with a series of test observations. Among this is the well-known 51 Pegasi b, the first planet ever discovered using the radial velocity (RV) method in 1995. We compare the performance of FOCES to previous measurements by different instruments around the globe. Those first results look very promising, with deviations of only a few m/s from the well-established RV-curve. In addition we will utilize FOCES and our photometric 3-channel imager 3KK in a campaign of follow-up observations of exoplanet - candidates found by NASA's TESS mission, which searches for planets using the transit method. Aside from delivering mass estimations for known TESS candidates with an established period, efforts are made to confirm or discard candidates appearing as single transits within the TESS data. Utilizing an in - house developed transit finder and MCMC - based fitting routine, the TESS light curves are analyzed in order to obtain an estimated period. Combining these photometric and spectroscopic assets of the FTW now allows us to conduct exoplanetary research at a high level with precise results. With its current capabilities, the Wendelstein observatory is able to independently conduct observations on short-term notice, no longer bound to the scheduling cycles and availability of other large facilities.

CN-2 Planets and other habitats

Mo Nov 23, 14:25 – 14:50h
2020 Astrophysical Software Award Prize Winner Talk
Author: Til Birnstiel (LMU)

09/22/2020. Press Release (see www.origins-cluster.de)

ORIGINS scientist Til Birnstiel is receiving the 2020 Astrophysical Software Award of the German Astronomical Society for the software he developed for modelling the temporal and spatial evolution of dust in protoplanetary disks. Young stars and the disks around them are built up from interstellar matter which initially contains only very small, at most micrometer-sized, dust particles. Til Birnstiel has written codes describing the mechanisms which lead to the growth of grains over several orders of magnitude in mass and to study how they are distributed and transported in the disk. His simulations of the dynamics and evolution of solid particles in disks have a vast impact on the understanding of planet formation. He and his team succeeded in developing the most widely used software codes in the field, which reflect not only the complex underlying physics but are also flexible enough to be applicable for the interpretation of observational data.

ORIGINS PhD AWARD 2020 (THEORY)

Mo Nov 23, 15:10 – 15:20h
Laudatio
Author: Roland Diehl (MPE)

ORIGINS PhD Award 2020 (Theory)

Mo Nov 23, 15:20 – 16:00h
Cosmological distances of type II supernovae from radiative transfer modelling
Author: Christian Vogl (TUM, MPA)

There is a great need for independent accurate measurements of the Hubble constant (H0). We establish a new one-step method to determine H0 based on radiative transfer modeling of type II supernovae and demonstrate its utility in a proof-of-principle measurement. In this first-ever application of the tailored-expanding-photosphere method in the Hubble flow, we find H0=72.3+2.9−2.8kms−1Mpc−1 in good agreement with state-of-the-art results. More and better data from our dedicated observing program will allow a significantly improved measurement in the near future.

CN-4 DARK ENERGY

Mo Nov 23, 16:00-16:25h
CN-4 Overview
Author: Ariel Sanchez (MPE)

The accelerated expansion of the Universe presents us with one of the most outstanding open problems in physics. Possible explanations involve a cosmological constant, a slowly rolling scalar field, more general degrees of freedom or deviations from the predictions of General Relativity on large scales. The Dark Energy connector aims to systematically investigate these scenarios. In this talk, I will present an update on the recent progress of the connector projects, including the analysis of modified gravity models, the effective field theory of the accelerated Universe, and high-precision measurements of the Hubble parameter.

CN-4 Dark Energy

Mo Nov 23, 16:25-16:50h
Towards precision measurements of the primordial power spectrum of gravitational waves
Author: Paolo Campeti (MPA)
MIAPP Building LIVE-STREAM

The primordial stochastic gravitational wave background is a window on quantum-gravitational effects at extreme energies, probing the boundaries of our current knowledge of quantum mechanics and Gravity. This sought-after signal contains, indeed, a unique wealth of information on the very early Universe physics and could allow us to probe energy scales unreachable by terrestrial particle colliders. Because of the major impact that this discovery would have on cosmology, we want to assess what is the ultimate information we can get on this signal. To do so, we studied the possibility of obtaining precision measurements on the shape of the spectrum of the primordial gravitational waves, taking two main steps while pursuing this major goal: first, we develop a model-independent treatment for characterizing the shape of the primordial tensor power spectrum, including an unprecedented level of realism in our analyses which reflects the current knowledge concerning present and future Cosmic Microwave Background (CMB) B-mode experiments; second, we provide forecasted constraints across $\sim$ 23 decades in frequency on the shape of the primordial tensor spectrum considering all the probes and all configurations, especially the ultimate and most ambitious CMB B-mode probes, space-borne and ground-based interferometers and Pulsar Timing Array surveys.

CN-4 Dark Energy

Mo Nov 23, 16:50 – 17:15h
The importance of galaxy bias on Primordial Non-Gaussianity constraints
Author: Alex Barreira (ORIGINS Fellow)
MIAPP Building LIVE-STREAM

The exquisite theoretical accuracy required for cosmological inference using galaxy data contrasts with our current poor knowledge of galaxy formation and evolution. In galaxy clustering studies, these uncertainties are absorbed in so-called "galaxy bias" parameters, which describe the dependence of galaxy formation on the environment and can be marginalized over in data analyses. Naturally then, the greater our prior knowledge on galaxy bias, the tighter the constraints on cosmology. In this talk, I will focus on Primordial non-Gaussianity (PNG) constraints using galaxies, which is one of the current main windows to shed light on the physics of the early Universe and Inflation. I will demonstrate that our current knowledge of galaxy bias is insufficient to obtain meaningful constraints on Inflation, but will show how this can be improved upon using cosmological simulations of galaxy formation. I will show the first ever predictions for the relevant bias parameters from hydrodynamical simulations, but will highlight that this is just an important first of still many needed steps to take.

TUESDAY, NOV 24

CN-8 EMERGENCE OF STRUCTURE

13:00 **Erwin Frey (LMU)**
Overview

13:25 **Petra Schwille (MPIB)**
Is there a "hydrogen atom" of biology?

13:50 **Ulrich Gerland (TUM)**
Prebiotic "kinetic error filtering" mechanism

14:15 **Job Boekhoven (TUM)** ERC Starting Grant
Active droplets as a platform to study the origin of molecular compartments

14:40 Tea and Coffee Break

ORIGINS PhD AWARD 2020 (EXPERIMENT)

15:10 **Erich Sackmann (TUM)**
Laudatio to Beatrice Ramm

15:20 **Beatrice Ramm (MPIB, LMU, Princeton)**
Self-organization and molecular transport by a biochemical reaction-diffusion system

CN-8 EMERGENCE OF STRUCTURE

Tue Nov 24, 13:00 – 13:25h
CN-8 Overview
Author: Erwin Frey (LMU)

CN-8 Emergence of structure

Tue Nov 24, 13:25 – 13:50h
Is there a "hydrogen atom" of biology?
Author: Petra Schwille (MPIB)

The hydrogen atom is the smallest representation of a chemical element and considered to be the most complex form of matter that can be analytically calculated, i.e. understood from first principles, by quantum mechanics. Thus, it has become a paradigm for understanding the material world in the perspective of physicists and chemists. Such a minimal system that aids the development of fundamental theories and hypotheses, however, has not yet been identified in biology. To the contrary, life sciences have from their very beginnings dealt with incomprehensively complex systems, such as animals and plants, and only the past decades have allowed us to elucidate their molecular makeup and formulate quantifiable laws that can be, albeit often with disappointingly low statistical confidence, addressed by physical methods and technologies. Our very simple question, which is however extremely challenging to answer, is whether something like a minimal system, reminiscent of the hydrogen atom for physics and chemistry, could also be identified for biology – the smallest possible representation of a living cell (being by definition the smallest unit of life). By methods of molecular biology and biochemistry we try to identify fundamental functional units in proteins or nucleic acids, the combination of which allows a system to develop emergent behavior to the point of establishing essential features of life, such as metabolism, replication, and functional evolution. Using cutting edge biophysical methods, we analyze these functions on the single molecule level and thereby aim to formulate a canonical set of functions that would be required for matter to become alive, independent of the carbon-based representation of life on earth.

CN-8 Emergence of structure

Tue Nov 24, 13:50 – 14:15h

A kinetic error filtering mechanism for enzyme-free copying of nucleic acid sequences

Author: Ulrich Gerland (TUM)

Accurate copying of sequence information is essential for self-replicating and evolving systems. Modern cells achieve error rates as low as 1 per billion with sophisticated enzymatic machineries that use free energy to repeatedly discriminate between correct and incorrect nucleotides. In contrast, experiments probing template-directed, nonenzymatic extension of RNA and DNA as potential prebiotic copying processes find error rates as high as 10% per base pair, making reliable information transmission impossible. These experiments also observed that initial errors often trigger a cascade of consecutive errors and significantly reduce the speed of downstream extension. Here, we explore the potential of the error-induced cascading and stalling effects as an error filtering mechanism under non-equilibrium environmental conditions. We show that error cascades can be exploited to discriminate between faithful and faulty polymerization products by means of their global kinetics. Limiting the time window for the polymerization process prevents erroneous strands to complete resulting in a pool where full-length products show an enhanced accuracy. Such a mechanism does not require any additional energy input to the extension reaction itself and can be controlled externally. However, filtering out strands comes at the expense of a reduced yield, and hence a characterization of the fidelity-yield trade-off is needed. We show that the yield issue can be circumvented via repeated copying, with the same strand serving as template multiple times. Such a process may be induced by temperature cycles occurring naturally in the vicinity of hydrothermal vents on the early Earth.

CN-8 Emergence of structure

Tue Nov 24, 14:15 – 14:40h
Active droplets as a platform to study the origin of molecular compartments
Author: Job Boekhoven (TUM), ERC Starting Grant

Active droplets are tiny drops of insoluble molecules that exist in water. Due to their active nature, these droplets show life-like behavior. For example, the droplets only form when external energy is supplied, and they dissolve again when the energy is no longer sufficient. They can even multiply by division when abundant energy is present. They play an important role in the function of certain organelles in the cells of our body. In this work, I'll describe our approach towards the synthesis of active droplets. These droplets emerge when fuel is present, but decay without. Moreover, we find these droplets can transiently up-concentrate functional RNA, and that this up-take is accelerated by the chemical reaction cycle. Finally, we show that in their pathway towards decay, these droplets self-divide asymmetrically. Self-division combined with emergence, decay, rapid exchange of building blocks, and functionality are all hallmarks of life, and we believe that our work could be a stepping stone towards its synthesis.

ORIGINS PhD Award 2020 (Experiment)

Tue Nov 24, 15:10 – 15:20h
Laudatio to Beatrice Ramm
Author: Erich Sackmann (TUM)
Laudatio concerning the PHD Thesis by Beatrice Ramm „**Self-organization and molecular transport by a biochemical reaction-diffusion system**“

To explore the structure of the tissues or to search for food cells form intinsically polarized bodies. To divide, the cytoplasm and the intracellular protein scaffold determining the cell shape have to be transiently decomposed and randomized to generate isotropic cytoplasmic solution. In bacteria (such as *Escherichia coli* and even *Cyanobacteria)* this task is fulfilled by a supramolecular protein complex consisting of two proteins: MinD and MinE which regulate the formation of an intracellular macromolecular scaffold at the new division furrow by a third component: MinC. A crucial step on the way to division is the search for a position of the septum forming the site of the novel division furrow. This task is fulfilled by pole-to-pole oscillations of the Min-system resulting in the formation of 2D protein pattern at the membrane surface.

The thesis of Beatrice Ramm provides new and highly important insights into the molecular basis and the dynamics of the self-organisation of protein pattern on cell membranes. These new insights were based on the development of a high-speed Atomic Force Microscope (AFM) allowing the dynamic observation of membrane pattern formation under biomimetic conditions.

A conceptional highlight of the thesis is the demonstration that the MinDE waves can serve the recruitment and clustering of other binding partners at the cell centre, including DNA and components that serve the sculpturing of the division furrow (such as MinC).

Most interestingly, Beatrice Ramm showed that charged lipids are not necessarily required although -under physiological conditions -electrostatic forces are expected to accelerate membrane pattern formation.

The membrane pattern formation observed in the PHD work can be understood in terms of entropy-driven wetting of surfaces by macromolecules. In systems between two and three dimensions (such as composite cell envelopes) the dynamics of the pattern formation by the coupled chemical reactions is controlled by the diffusive processes, whereby 2D random walk determine the kinetics of pattern formation

Finally, it is interesting to note that the position of cell division of mammalian cells is also confined to the midbody by oscillation of the central cell body that guides the chromosome duplication. This parallel behaviour is an impressive example of the regulation of cell signaling processes by universal physicochemical processes.

ORIGINS PhD Award 2020 (Experiment)

Tue Nov 24, 15:20 – 16:00h

Molecular transport by a biological reaction-diffusion system via ATP driven diffusiophoresis

B. Ramm[1], A. Goychuk[2], A. Khmelinskaia[3], P. Blumhardt[1], H. Eto[1], K. A. Ganzinger[4], E. Frey[2], P. Schwille[1]

[1]Max-Planck-Institute für Biochemie, Martinsried, Germany, [2]Ludwig-Maximilians-Universität München, Munich, Germany, [3]University of Washington, Seattle, WA, [4]AMOLF, Amsterdam, Netherlands

Speaker: Beatrice Ramm (MPIB, LMU, Princeton)

Spatiotemporal organization, a hallmark of living cells, is generally achieved via cargo transport by energy-dissipating NTPases based on specific protein-protein interactions. In contrast, cargo transport based on non-specific coupling remains poorly explored. Here, we found that a biological reaction-diffusion system, the *Escherichia coli* MinDE system, induces patterns and gradients of completely unrelated membrane-bound macromolecules by a purely physical mechanism: ATP-driven diffusiophoresis. Using a well-established *in vitro* reconstitution assay on supported lipid bilayers we show that MinDE patterns are able to spatiotemporally regulate various, functionally unrelated membrane-bound proteins. These findings implied that MinDE are able to position a much larger set of proteins in the cell than previously known. Intriguingly, the ATP-driven MinDE self-organization induced directed and active net transport of lipid-anchored proteins, establishing large-scale gradients on the membrane. To interrogate this phenomenon in more detail we employed a synthetic cargo: membrane-bound DNA origami-streptavidin nanostructures. Remarkably, by varying the number of streptavidin, we found that the extent of MinDE-driven cargo transport depends on the effective size of the cargo and leads to spatial sorting of different cargo molecules. Theoretical analysis of these data demonstrated that the diffusive fluxes of MinDE and the cargo couple via density-dependent friction. This non-specific process constitutes a diffusiophoretic mechanism, so far undescribed in a cell biology setting. It potentially represents a generic active transport mechanism in cells which could be particularly important for prokaryotes that lack specialized motor proteins and might have been prevalent in early forms of life.

WEDNESDAY, NOV 25

CN-1 BLACK HOLES

13:00 **Dieter Lüst (MPP, LMU)**
Overview

13:25 **Ioannis Lavdas (LMU)**
Hawking radiation and the Page curve

13:50 **Andrea Merloni (MPE)**
SRG/eROSITA detection of large-scale X-ray bubbles in the Milky Way halo

14:15 **Julien Wolf (MPE)**
Finding high-redshift quasars with eROSITA

14:40 **Jakob Knollmüller (ODSL)**
Imaging in space, time & frequency: M87* as movie

15:05 Tea and Coffee Break

CN-1 BLACK HOLES

Wed Nov 25, 13:00-13:25h
CN-1 Overview
Author: Dieter Lüst (MPP, LMU)

CN-1 Black holes

Wed Nov 25, 13:25-13:50h
Hawking radiation and the Page curve
Author: Ioannis Lavdas (LMU)

In this talk, we present the recent developments on the calculation of the Hawking radiation of evaporating black holes in the framework of holography and their significance regarding the black hole information paradox.

CN-1 Black holes

Wed Nov 25, 13:50 – 14:15h
SRG/eRosita detection of large-scale X-ray bubbles in the Milky Way halo
Author: Andrea Merloni (MPE)

CN-1 Black holes

Wed Nov 25, 14:15 – 14:40h

Finding high-redshift quasars with eRosita

Authors: *Julien Wolf, Kirpal Nandra, Mara Salvato, Teng Liu, Johannes Buchner, Marcella Brusa, Duy Hoang, Riccardo Arcodia, Marcus Brüggem, Gianfranco Brunetti, Francesco de Gasperin, Antonis Georgakakis, Aidan Hotan, Georg Lamer, Andreas Merloni, Vanessa Moss, Arne Rau, Huub Röttgering, Timothy Shimwell, Tanya Urrutia, Matthew Whiting, Wendy Williams*

Speaker*:* Julien Wolf (MPE)

High redshift quasars (z>5.5) signpost accretion onto super-massive black holes in the first Gyr of the Universe. The penetrating nature of X-rays enables a less absorption-biased census of the population of these luminous and persistent sources compared to optical/NIR colour selection. The ongoing SRG/eROSITA X-ray All-Sky Survey offers the unique opportunity to completely uncover the bright end of the high-z quasar population and probe regions of photometric parameter space left uncharted by dedicated optical surveys.

We present the soft X-ray detection of eFEDSU J083644.0+005459/SDSSJ08, an eROSITA source securely matched to the well-known quasar SDSS J083643.85+005453.3 (z=5.81). In addition, we report the detection of this quasar with LOFAR at 145 MHz and ASKAP at 888 MHz. The steep radio spectrum and parsec-scaled radio morphology of SDSS J083643.85+005453.3 indicate that it is in an early stage of its evolution into a large scale radio source. We find no indications for a strong jet contribution to the X-ray emission of the quasar, which is therefore likely to be linked to accretion processes.

The X-ray detection of SDSS J083643.85+005453.3 in a contiguous, near-uniform survey with well-understood selection function allows us to infer first constraints on the X-ray luminosity function at z>5.5 based on a secure spectroscopic redshift.

CN-1 Black holes

Wed Nov 25, 14:40 – 15:05h

Imaging in space, time and frequency: M87* as movie

Authors: *Philipp Arras, Philipp Frank, Philipp Haim, Jakob Knollmüller, Reimar Leike, Martin Reinecke, Torsten Enßlin*

Speaker: Jakob Knollmüller (ODSL)

MIAPP Building LIVE-STREAM

The recent observations of the black hole shadow of M87* with Very Long Baseline Interferometry (VLBI) by the Event Horizon Telescope (EHT) open the possibility to investigate the dynamical processes right at the edge of black holes. In this regime, traditional radio-astronomical imaging algorithms are brought to their limits. Compared to regular radio interferometers, VLBI networks have fewer antennas. The resulting sparser sampling of the Fourier sky can only be partly compensated by co-adding observations from different days, as the source changes. Here, we present an imaging algorithm that copes with the data scarcity and the source's temporal evolution, while simultaneously providing uncertainty quantification on all results. Our algorithm views the imaging task as a Bayesian inference problem of a time-varying flux density, exploits the correlation structure between time frames, and reconstructs a whole, 2+1+1 dimensional time-variable and spectral-resolved image at once. (https://arxiv.org/abs/2002.05218)

CN-6 COSMIC ACCELERATORS

15:30 **Frank Jenko (IPP)**
Overview

15:55 **Christian Haack (TUM)**
Detection of an astrophysical antineutrino via the Glashow resonance with IceCube

16:20 **Martin Weidl (IPP)**
Simulations of misaligned electron injection into a proton-driven plasma wakefield accelerator

16:45 **Francesca Capel (ODSL)**
Multi-messenger astrophysics through hierarchial modeling

CN-6 COSMIC ACCELERATORS

Wed Nov 25, 15:30 – 15:55h
CN-6 Overview
Author: Frank Jenko (MPE)

The Universe confronts us with the existence of astrophysical objects which are able to accelerate charged particles to more that 100 EeV! What are these cosmic accelerators, and how do they work? To address these questions, astrophysicists and plasma physicists need to work together very closely. This is what CN-6 is all about. We will summarize initial results and discuss our research plans. This includes the activities in the Munich Center for Plasma Astrophysics.

CN-6 Cosmic accelerators

Wed Nov 25, 15:55 – 16:20h
Detection of an astrophysical antineutrino via the Glashow resonance with IceCube
Author: Christian Haack (TUM)

The Glashow resonance describes the resonant production of a W− boson during the interaction of an electron antineutrino with an electron, peaking at an antineutrino energy of 6.3 petaelectronvolts (PeV) in the rest frame of the electron. While this energy scale is out of reach for current operating and future planned particle accelerators, natural astrophysical phenomena are expected to produce antineutrinos that reach beyond PeV energies. In this talk, I will report on the observation by the IceCube Neutrino Observatory of a particle shower with a deposited energy of $\sim$ 6 PeV. The deposited energy, as well as features consistent with the production of secondary muons in the particle shower indicate the hadronic decay of a resonant W− boson. The evidence for the Glashow resonance demonstrates the presence of electron antineutrinos in the astrophysical flux. By disentangling neutrinos from antineutrinos, it becomes possible to distinguish astronomical accelerators that produce neutrinos via hadronuclear or photohadronic interactions with or without strong magnetic fields. As such, knowledge of both the flavour and charge will add a new element to neutrino astronomy

CN-6 Cosmic accelerators

Wed Nov 25, 16:20 – 16:45h

Simulations of misaligned electron injection into a proton-driven plasma wakefield accelerator

Authors: *Martin Weidl, John P. Farmer, Alexander Pukhov, Frank Jenko. (IPP)*
Speaker: Martin Weidl

A proof of concept for novel particle-accelerator schemes, the AWAKE experiment at CERN investigates how several-GeV lepton beams can be produced in a proton-driven plasma wakefield accelerator (PDWFA). Ultrarelativistic protons from the Super Proton Synchrotron are injected into a plasma cell, where they excite wakefield gradients that can be hundreds of times steeper than in a conventional accelerator. Relativistic electrons in the wake of these proton drivers can 'surf' the plasma waves and gain several GeVs over only tens of metres. Controlling this acceleration is one of the main goals of the upcoming Run II of the AWAKE project.

The injection of these 'witness' electrons behind the driver requires extreme accuracy. We have performed quasistatic 3D PIC simulations to quantify the degradation of a witness beam which is not optimally aligned with the driver axis. For witness offsets above a critical length, the electron beam expands transversely and becomes too dilute to displace all of the background electrons. As an undesirable result, the emittance of the witness beam can rapidly grow. Our computations determine the critical offset and show which level of accuracy is required for optimal performance of a PDWFA.

Wed Nov 25, 16:45 – 17:05h

Multi-messenger astrophysics through hierarchical modeling

Author: Francesca Capel (ODSL)

MIAPP Building LIVE-STREAM

The goal of multi-messenger astronomy is to bring together diverse observations into a consistent physical picture, allowing us to test predictions and deepen our understanding. This is a huge challenge, with data from very different instruments, possible explanations from a range of complex models, unknown source populations and selection effects at play. I will discuss how we can leverage Bayesian hierarchical modelling as a statistical technique to address these challenges and make full use of the hard-earned experimental data. By including more information into the statistical analysis and carefully modelling uncertainties, it is possible to unearth weak signals and gain more insightful results. To demonstrate this approach, I will draw on examples from my research into the potential source populations of ultra-high-energy cosmic rays and astrophysical neutrinos.

TUESDAY, DEC 1

CN-3 DARK MATTER

13:00 Mathias Garny **(TUM)**
Overview

13:25 **Kai Urban (TUM)**
Sommerfeld-corrected relic abundances of wino dark matter with NLO electroweak potentials

13:50 **Volker Springel (MPA)** **PRIZE WINNER TALK**
2020 Gruber Cosmology Prize for his defining contributions to cosmological simulations

14:30 **Andreas Burkert (USM/LMU)**
Fuzzy dark matter and the challenge of dark matter halo cores

14:55 **Klaus Dolag (C2PAP/LMU)** ERC Advanced Grant
THE COMPLEX nature of the intra cluster medium

15:20 Tea and Coffee Break

15:45 **Richard Ellis (SAC, University College London)** **EXTERNAL HIGHLIGHT TALK**
Probing cosmic dawn: Age-dating galaxies in the reionisation era

CN-3 DARK MATTER

Tue Dec 1, 13:00 – 13:25h
CN-3 Overview
Author: Mathias Garny (TUM)

In this talk the status of the dark matter connector will be reviewed. Given the increasing evidence for dark matter, the question about its identity and origin is one of the most outstanding open questions in fundamental physics. The various research units address this question from different viewpoints, including structure formation on small and large scales, extensions of the Standard Model of particle physics, the production of dark matter in the Early Universe, as well as searches for interactions between dark matter particles and the known particle species in direct detection, indirect detection and collider experiments. The dark matter connector provides the possibility to link the broad expertise within ORIGINS regarding all of these approaches, and explore whether or not dark matter is cold, (self-)interacting, or fuzzy.

CN-3 Dark matter

Tue Dec 1, 13:25 – 13:50h
Sommerfeld-corrected relic abundances of wino dark matter with NLO electroweak potentials
Authors: *Kai Urban, Martin Beneke, Robert Szafron (TUM)*
Speaker: Kai Urban (TUM)

For heavy electroweak dark matter, the resummation of large quantum corrections due to long-range potentials (the "Sommerfeld effect") is crucial in determining the precise annihilation cross-sections. In this talk, I will review the Sommerfeld effect and consider the one-loop correction to the potential, which provides the leading non-relativistic correction to the Sommerfeld effect in the case of wino or wino-like dark matter particles $\chi 0$. I will discuss the impact of this correction on the indirect detection and relic abundance prediction.

PRIZE WINNER TALK

Tue Dec 1, 13:50 – 14:30h
Simulations of the dark and luminous sides of cosmic structure formation
(*2020 Gruber Cosmology Prize for his defining contributions to cosmological simulations)*
Author: Volker Springel (MPA)
MIAPP Building LIVE-STREAM

Simulations of cosmic structure formation have come a long way. Nowadays, they are not only accurately predicting the dark matter backbone of the cosmic web and the internal structure of halos and their satellites far into the non-linear regime, but are also capable of following the baryonic sector with rapidly improving physical fidelity. In my talk, I will review the methodology and selected successes of recent hydrodynamical galaxy formation simulations, and critically discuss some of the primary uncertainties in modelling strong, scale-dependent feedback processes. I will also highlight predictions for the structure of magnetic fields in galaxies and the importance of cosmic rays in galaxy evolution. Finally, I discuss some of the challenges lying ahead in this field in the coming years.

CN-3 Dark matter

Tue Dec 1, 14:30 – 14:55h
Fuzzy dark matter and the challenge of dark matter halo cores
Author: Andreas Burkert (USM/LMU/ORIGINS Spokesperson)

Dark matter halo cores challenge our standard paradigm of cold dark matter. I will discuss the evidence for cores and the observed core scaling relations. It is shown that these scaling relations are in disagreement with the currently frequently discussed fuzzy dark matter scenario. Core scaling relations therefore provide a powerful tool in constraining dark matter particle properties.

CN-3 Dark matter

Tue Dec 1, 14:55 – 15:20h
The COMPLEX nature of the intra cluster medium
Author: Klaus Dolag (C2PAP/LMU/MPA), ERC Advanced Grant

The majority of the visible, ordinary matter within the universe (baryons in form of hot plasma within galaxies and galaxy clusters) is shaped by complex physical processes (microscopic plasma instabilities; large scale progression of astrophysical systems). Still the treatment of magnetic fields and relativistic particles (so called cosmic rays) is still mostly ignored due to their complexity, although they are fundamental plasma components, shaping the underlying fluid properties (like viscosity and transport coefficients).

COMPLEX (COsmological Magnetic fields and PLasma physics in EXtended structures) aims to develop the numerical framework to perform simulations which take into account such effects.

EXTERNAL HIGHLIGHT TALK

Tue Dec 1, 15:45 – 16:25h

Probing cosmic dawn: Age-dating galaxies in the reionisation era

Author: Richard Ellis (SAC, University College London)

The first billion years after the Big Bang represents the final observational frontier in assembling a coherent picture of cosmic history. During this period early stars and galaxies formed, and the Universe was first bathed in ultraviolet light. As a result, itis thought that hydrogen in the intergalactic medium then transitioned from a neutral gas to one that is now fully ionised. How and when did this 'cosmic reionisation' occur and were star-forming galaxies the primary agents? And can we estimate ages for the most distant examples to pinpoint when `cosmic dawn' occurred? Long exposures with Hubble have provided targets deep in the reionisation era and challenging spectroscopy with ALMA, Keck and VLT enables us to determine their ionising properties and stellar ages. Recent work has provided the first possible indication of when cosmic dawn occurred and sets the stage for further progress with the James Webb Space Telescope and the European Extremely Large Telescope.

FRIDAY, DEC 4

CN-5 TURBULENCE

13:00 **Thorsten Naab (MPA)**
Overview

13:25 **Naveen Yadav (MPA)**
3D supernovae progenitor models

13:50 **Ulrich Steinwandel (USM/LMU)**
Supernovae feedback in the turbulent interstellar medium

14:15 **Linda Tacconi (MPE)** **PRIZE WINNER TALK**
Foreign member of the Royal Swedish Academy recognizing her exceptional research in millimetre astronomy and her efforts to promote European astronomy.

14:55 Tea and Coffee Break

CN-7 MATTER UNDER EXTREME CONDITIONS

15:30 **Laura Fabbietti (TUM)**
Overview

15:55 **Bernhard Hohlweger (TUM)**
Studying the strong interaction of stable and unstable hadrons at the LHC

16:20 **Robert Bollig (MPA)**
3D Supernovae explosions of perturbed progenitors and the effects of muonization

CN-5 TURBULENCE

Fr Dec 4 13:00 – 13:25h
CN-5 Overview
Author: Thorsten Naab (MPA)

This overview of the current research focus of Connector 5 addresses turbulent processes, which are ubiquitous most astrophysical systems.
Covering more than twelve orders of magnitude in spatial scales we highlight recent result on stellar interiors, the multi-phase interstellar medium, and galaxy clusters. In all these environments turbulence is an important player.

CN-5 Turbulence

Fr Dec 4 13:25 – 13:50h
3D Supernovae progenitor models
Author: Naveen Yadav (MPA)

In recent years, 3D modelling of core-collapse supernovae has become possible. The simulations are limited in two ways: most of them use 1D progenitors, and they are short (extending ~ 1.0 s). In this talk, I will outline the progress we have made in advancing 3D progenitor models and some interesting aspects of the long self-consistent core-collapse simulations performed using these progenitors.

CN-5 Turbulence

Fr Dec 4 13:50 – 14:15h
Supernovae feedback in the turbulent interstellar medium
Author: Ulrich Steinwandel (USM/LMU)

PRIZE-WINNER TALK

Fr Dec 4 14:15 – 14:55h
The Evolution of the Star-forming ISM across Cosmic Time
(*Foreign member of the Royal Swedish Academy of Sciences)*
Author: Linda Tacconi (MPE)

Over the past decade comprehensive and systematic studies of star formation and the gas contents of galaxies during the epochs that are associated with the peak (z~1-3), and subsequent winding down (z<1) of star formation have enabled us to illustrate the important role that cold gas plays in the assembly of galaxies across cosmic time. These studies show that star forming galaxies contained significantly more molecular gas at earlier cosmic epochs than at the present time. Global rates of galaxy gas accretion, which vary with cosmological expansion, primarily drive this increase in cold gas and star formation rates in the dominant main sequence galaxy population. Studies also show that the molecular gas depletion time depends mainly on redshift or Hubble time, and at a given z, on the vertical location of a galaxy relative to the "star formation main sequence". In this talk, I will discuss various strategies and methods used to determine the evolution of cold gas contents, and discuss the latest gas scaling relations with redshift, star formation and stellar mass. I will also discuss how simple gas regulator models successfully predict the combined evolution of molecular gas fractions, star formation rates, galactic winds, and gas phase metallicities.

CN-7 MATTER UNDER EXTREME CONDITIONS

Fr Dec 4 15:30 – 15:55h
CN-7 Overview
Author: Laura Fabbietti (TUM)

CN-7 Matter under extreme conditions

Fr Dec 4 15:55 – 16:20h
Precise measurements of Ξ- and Ω-nucleon interactions and constraints on lattice QCD potentials
Author: Bernhard Hohlweger (TUM)
ALICE Collaboration

A precise understanding of the Equation of State of dense objects like neutron stars is limited by the knowledge about hyperon interactions and the precision of the models describing the latter. Recently, the ALICE Collaboration has demonstrated that two-particle femtoscopic measurements, which are sensitive to the source of particle emission and to the interaction of the particle pair, can provide precise data on hyperon-nucleon and hyperon-hyperon interaction potentials. The size of the emission source of any baryon pair is determined based on a measurement of the correlation function of proton pairs, where modifications due to the decay of short-lived resonances are modeled explicitly. In turn, femtoscopy in small systems makes it possible to map the core of the potential at small distances and is currently the only viable way to provide a sensitive experimental measurement against which theoretically predicted potentials can be tested. In this talk we show the first precise study of the pΞ and pΩ interactions, measured in pp collisions at 13 TeV with the ALICE detector. For the first time, clear signatures of the strong attractive interaction can be observed for these particles. Traditionally, meson exchange models are used to describe the hyperon sector and are constrained by the scarce scattering and hypernuclei data, almost exclusively available for Λ hyperons. Recently the HAL-QCD collaboration conducted calculations without relying on constraints by data and with quarks and gluons as degrees of freedom. Their results converge for the interactions between heavier Ξ and Ω hyperons and nucleons, and in the pΩ system they predict a bound state. The potentials provided by HAL-QCD calculations and meson-exchange are applied to describe the experimentally measured correlation function. For the pΞ interaction the HAL-QCD prediction is strongly favoured by the data compared to the meson-exchange model. For the pΩ channel, strongly bound systems are largely excluded and the comparison between data and calculations only leaves room for binding energies below 1MeV.

CN-7 Matter under extreme conditions

Fr Dec 4 16:20 – 16:45h

3D Supernovae explosions of perturbed progenitors and the effects of muonization

Author: Robert Bollig (MPA)

3D simulations of the neutrino-driven supernova explosion mechanism, spanning more than 7 minutes from the pre-collapse progenitor phase up to several seconds post-explosion, have recently become possible. In these simulations we explored not only the influence of progenitor perturbations but also the effects of a muonic component in the equation of state of a hot plasma. Muons are known to be present in cold neutron stars, yet their connection to the earliest phases of a supernova had not been self-consistently explored in 3D. In this talk I will give an overview of the first successful simulations that demonstrate the viability of the neutrino-driven explosion mechanism to reach the canonical explosion energy of 1 Bethe as well as the unexpected neutrino heating boost of the novel muonic physics.

WEDNESDAY, DEC 9

14:00 **Thomas Kuhr (LMU)**
RU-A Overview: Fundamental particles and forces

14:25 **Thibaud Humair (MPP)**
RU-A Highlight: Status of Belle II, first results and prospects

14:50 **Andreas Weiler (TUM)**
RU-B Overview: Particles and the cosmos

15:15 **Christoph Wiesinger (TUM)**
RU-B Highlight: No neutrinos not found

15:40 Tea and Coffee Break

16:00 **Joseph Mohr, Jochen Weller (LMU)**
RU-C Overview: Origins and evolution of Large Scale Structure

16:25 **Volker Springel (MPA)**
RU-D Overview: From the Large Scale Structure to galaxies, stars and planets

16:50 **Dieter Braun (LMU)**
RU-E Overview: Prebiotic molecules and origins of life

RU -A Fundamental particles and forces

Wed Dec 9 14:00 – 14:25h
RU-A Overview
Author: Thomas Kuhr (LMU)
MIAPP Building LIVE-STREAM

RU-A studies fundamental particles and forces at a large range of energy scales. The structure of space-time is investigated at the Planck scale, the standard model of particle physics is challenged at the high-energy and high-precision frontiers, and the formation of compound objects by strong interaction is researched. New approaches and recent results will be presented.

RU-A Highlight

Wed Dec 9 14:25 – 14:50h
Status of Belle II, first results and prospects
Author: Thibaud Humair (MPP)

The Belle II experiment, located in Tsukuba, Japan, started taking data in 2018. It supersedes the Belle experiment, which was in operation until 2010. It is designed to detect the decays of heavy flavour particles, in particular B mesons, produced in a clean environment by the electron-positron collider SuperKEKB. SuperKEKB is foreseen to achieve a B meson production rate approximately forty times higher. In this talk, I will illustrate how these decays are used as precision tests of the Standard Model of Particle Physics, in particular how they can shed light on the mechanisms explaining the asymmetry between matter and anti-matter. I will give a status update on the data taking and show some of the first measurements based on the Belle II data collected so far, including searches for dark matter particles. I will also discuss the main goals of the Belle II collaboration for the coming decade, and how the planned research will complement that of its direct competitor, the LHCb collaboration at CERN.

RU-B: Particles and the cosmos

Wed Dec 9 14:50 – 15:15 h
RU-B Overview
Author: Andreas Weiler (TUM)

Some of the most spectacular astrophysical phenomena are intricately connected to particle physics properties. Elementary particles are unique probes for exploring otherwise invisible astrophysical phenomena. Conversely, the cosmos is a unique laboratory to study elementary particle properties under conditions that cannot be realised within terrestrial experiments.

Through large-scale neutrino experiments, Origins scientists search for lepton number violation in neutrinoless double beta decay (GERDA/LEGEND), probe the neutrino mass (KATRIN), perform neutrino astronomy, carry out precision oscillation measurements and undertake sterile neutrino searches (IceCube, Borexino, JUNO, KATRIN).

They are also deeply involved in direct and indirect Dark Matter search experiments, in both neutrino and gamma-ray astronomy (CRESST, DEAP, IceCube, MAGIC/CTA, FERMI), and with particle collider experiments (ATLAS). Origins scientists collaboratively address key topics at the crossroads of particle physics, astrophysics and cosmology.

RU-B Highlight

Wed Dec 9 15:15 – 15:40h
No Neutrinos not found
Author: Christoph Wiesinger (TUM)

Hidden by their tiny mass, neutrinos may carry a profound secret with far-reaching consequences for both particle physics and cosmology. Given zero electric charge and no color, they may be Majorana particles - fermions that are their own anti-particles.Double beta decay offers a unique probe for this hypothesis.Finding no neutrinos in its final state would prove lepton number non-conservation, and identify neutrinos as Majorana particles.The experimental signature is the emission of two electrons, sharing the full available decay energy, hence, a mono-energetic peak at the end of a standard-model allowed continuum. Current experiments are aiming for neutrinoless double beta decay half-lives beyond 1e26 yr.Sensitivity-wise, this race has been won by the GERDA experiment.Given a record-low background expectation, excellent energy resolution and a total exposure of more than 100 kg yr, no signal was found. The corresponding half-life limit is >1.8e26 yr at 90% C.L., and coincides with the median sensitivity for the null hypothesis.Under standard assumptions and given recent nuclear structure calculations for Ge-76, the effective Majorana mass is constrained to <[79,180] meV. I will discuss major building blocks of this result, and provide insight into the upcoming LEGEND experiment, which is front line to pick up the baton of Ge-76 experiments.

RU-C: Origins and evolution of large-scale structure

Wed Dec 9 16:00 – 16:25 h
RU-C Overview
Author: Joseph Mohr, Jochen Weller (LMU)
Speaker: Jochen Weller (LMU)

RU-D: From the large-scale structure to galaxies, stars and planets

Wed Dec 9 16:25 –16:50 h
RU-D Overview
Author: Volker Springel (MPA)
MIAPP Building LIVE-STREAM

Galaxies are the fundamental cosmic building blocks that link large-scale structure formation to the origin of chemical elements, stars, planets and eventually life. I will give an overview of the goals and selected recent activities in this research area, which focuses on questions such as: How did galaxy structure evolve and how is the visible Universe connected to the dark? Is our Milky Way special? How do stars form and how were galaxies enriched with heavy elements? Which conditions lead to the formation of our Solar System or habitable systems in general?

RU-E: Prebiotic molecules and origins of life

Wed Dec 9 16:50 –17:15 h
RU-E Overview
Author: Dieter Braun (LMU)

The research unit E with the focus on prebiotic molecules and origins of life has progressed along various lines. A focus was the organization and complex assembly of molecules, including a highly efficient algorithm to study its dynamics (Frey group) and the study of coacervate structures promoting and understanding the non-equilibrium of temporary phase separations (Boekhoven group). The Mutschler group studied catalytic RNA molecules of increasing length with much progress towards ligation and Oliver Trapp is working towards creating and polymerizing DNA and RNA to feed these structures. Ulrich Gerland has developed a unique code to study the complex binding and replication dynamics of RNA which was already put to use in a collaboration with the Braun group. The Schwille group studies RNA replication in confined spaced, including vesicles in icy phases. Non-equilibrium cycles is studied with proteins and with prebiotic reactions in the Braun group with a focus to study the evolutionary dynamics using deep sequencing. All of this research is enabled with molecule purification and detection of the IDSL. A number of PIs successfully made the next step in their career, including Chase Broedersz (Amsterdam), Hannes Mutschler (Darmstadt) and Ville Kaila (Stockholm). The collaboration network continues to be designed to support young investigators.

IDSL Summary

Author: Dieter Braun (LMU)

We continue to build the ice, dust sequencing lab despite the laboratory space not freeing up until April 2021. The sequencing will be a cornerstone of future experimentation, and funding through the ORIGINS cluster was crucial to secure the facility at the Gene Center. This collaboration runs smoothly with one sequence run about every 3 weeks. The Großgeräteantrag for the Orbritrap mass spectrometer is operational now and a ESI-TOF with plasma ionization is on the way. As already practiced before, the financing of the IDSL is a combined effort of the ORIGINS cluster and the CRC Emergence of Life. This year, we covered the UV illumination by ordering a high power, still low pulse length UV laser from 190-300nm through CRC Emergence of Life funds, together with a kinetic phosphate NMR machine. With TA Martina Hysi we work to establish the IDSL as a collaborative center to promote Molecular evolution in the Munich area.

ODSL Summary

Author: Allen Caldwell (MPP)

The Origins Data Science Lab (ODSL) is now reaching critical strength, with three postdoctoral researchers in the core team (Francesca Capel, Philipp Eller and Jakob Knollmueller) and two Fellows (Johannes Buchner and Oliver Schulz) on board. The team will be augmented by a postdoctoral researcher focusing on Dark Matter (funded through the Dark Matter connector) and the hiring of a tenure-track faculty at the TUM that will take over the coordination of the ODSL. In the future, it is planned to work closely with C2PAP members as well as members of the AR/VR team at the USM/LMU. The activities started or carried out this year by the ODSL include the launching of a weekly Journal Club meeting, the organization of a week-long workshop on 'State-of-the-Art in Sampling and Clustering' (together with the INSIGHTs ITN), and running two one-week Block Courses on 'Introduction to Probabilistic Reasoning' and 'Introduction to Machine Learning and Numerical Methods'. The ODSL launched a call for proposals for projects that would benefit from ODSL consultation. Nine proposals were received and the selection of proposals to be carried out with help from ODSL is currently ongoing. We expect the ODSL to be operating at full capability by the middle of next year, when the tenure-track faculty position is filled.

Selected Seed Posters of 2020:

Diamond detectors for low-mass dark matter searches

Authors: *Lucia Canonica, Federica Petricca, Stefan Schönert*

In this project, we have proposed to study the potential of diamond cryogenic detectors for the detection of light dark matter (DM) candidates. Thanks to its cryogenic properties (high Debye temperature and long-lived phonon modes), diamond operated as low temperature calorimeters could reach an energy threshold in the eV range and would allow for the exploration of new parameters of the DM-nucleus cross section. The goal of the project is to characterize the cryogenic properties of diamonds and to realize a proof-of-principle low-threshold DM cryogenic detector. In this contribution, the preliminary cryogenic performance of CVD diamond samples obtained with homoepitaxial growth will be reported. The potential of such a detector in the current landscape of dark matter searches will be also illustrated. future plans will be also illustrated.

Large Area Photon Detection With High Efficiency and High Position Resolution

Authors: *Ralf Hertenberger, Otmar Biebel, Bernhard Flierl, Maximilian Herrmann, Felix Klitzner, Christoph Jagfeld, Maximilian Rinnagel*

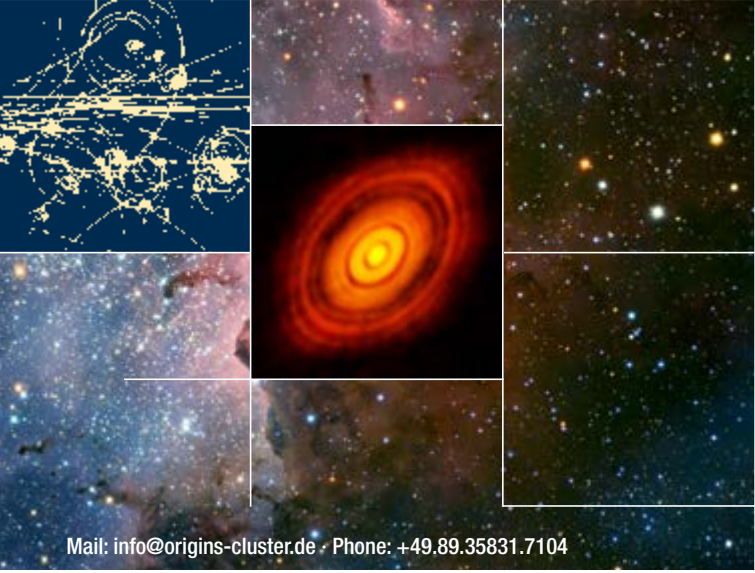
Detectors utilizing the Cherenkov effect have been well established for particle identification of charged particles in detector systems such as LHCb or HADES. In reverse it is possible to determine the momentum of a known particle by measuring the opening angle of the Cherenkov cone in thick Cherenkov media.
Our goal with this 100 cm2 prototype is a proof of principle using cosmic muons. A traversing muon creates around 700 Cherenkov photons in a 1-2 cm thick ulta-violet (UV) transparent LiF, BaF2 or MgF2 window with an optical refractive index around 1.5 in the UV range. The conversion to electrons happens in transmission in a photosensitive CsI layer at the bottom of the radiator. High voltage around -300 V, applied to a tiny layer of Chromium in between the crystal and the CsI, forces the electrons into the drift region of a Micromegas micro gaseous pattern detector, where the electrons are detected with excellent spatial resolution after gas-amplification in the anode-stage of the detector. Overall efficiencies of 7% seem possible at transparencies of 60% through the Chromium layer and conversion efficiencies around 12% in the CsI layer. Thus, good momentum resolution and spatial resolution of the muon track will be achieved. We will present the detector design as well as studies concerning the transmission of the radiator material and the predicted photon yield.

Tests of Silicon Detectors for Precision Beta Spectroscopy in Neutron Decay

Authors: *Manuel Lebert, Bastian Märkisch, Susanne Mertens*

The neutron decay spectrometer PERC (Proton Electron Radiation Channel) is currently under construction at the MEPHISTO beamline at the FRM II in Garching. It will serve as an intense and clean source of electrons and protons from the free neutron decay for precision measurements. The goal is to improve the sensitivity of the properties of the weak interaction by one order of magnitude. Also it is possible to look for physics beyond the Standard Model via new effective couplings. The central component of the experiment is a 12 m long superconducting magnet system. In an 8 m long decay volume a uniform magnetic field guides the decay products either towards two upstream detectors or to an high-field region. This region works as a filter for the electrons and protons phase space that reach the main detector downstream.

Initially all three detectors will be scintillators with silicon photomultiplier readout. In a later upgrade the main detector will be replaced by a pixelated silicon detector. This resolves the high non-linearities and big energy resolution of scintillators. For the development of this novel detector a new test stand has been established at TUM.



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THURSDAY, DEC 10

ANNUAL GENERAL ASSEMBLY OF ALL CLUSTER MEMBERS

15:00 **Andreas Burkert (LMU), Stephan Paul (TUM)**
ORIGINS Summary

15:20 **Katharina Langosch (ORIGINS), Alice Smith-Gicklhorn (ORIGINS), Ina Haneburger (MIAPP)**
Administration, Scientific Coordination, Public Outreach & Website

15:50 **Andreas Weiler (TUM), Rolf Kudritzki (LMU)**
MIAPP Summary

16:05 **Dieter Braun (LMU)**
IDSL Plans

16:20 **Martin Losekamm/Sebastian Rückerl (TUM)**
LRSM Summary

16:35 **Klaus Dolag** (USM/LMU)
C2PAP Summary

16:50 **Allen Caldwell** (MPP)
ODSL Summary