EP 3: Poster session

Time: Tuesday 16:30–18:30 Location: Zelt

EP 3.1 Tue 16:30 Zelt

Development of a 360 degree FoV camera system as scientific payload for TRIPLE- IceCraft. — •Lutz Deriks[1], Dirk Heinen[1], Christopher Wiebusch[1], Simon Zierke[1], Clemens Espe[2], Marco Feldmann[2], Gero Francke[2], and Lars Schickendanz[2] — [1]RWTH Aachen University, III. Physikalisches Institut, Templergraben 55, 52056 Aachen, Germany — [2]GSI - Gesellschaft für Systementwicklung und Instrumentierung mbH, Liebigstraße 26, 52070 Aachen, Germany

Within TRIPLE, a project-line for Technologies of Rapid Ice Penetration and subglacial Lake Exploration initiated by the DLR Space Administration, a melting probe (TRIPLE-IceCraft) is currently in development. This melting probe will be suitable to carry a scientific payload through several hundred meters of ice into an ocean or subglacial lake and return the payload to the surface. A camera system is being developed as a payload. This system will generate 360 degree field of view pictures of the penetrated ice and a subglacial lake.

EP 3.2 Tue 16:30 Zelt

Magnetic helicity inverse transfer in supersonic isothermal MHD turbulence — •Jean-Mathieu Teissier[1,3] and Wolf-Christian Müller[1,2,3] — [1]Technische Univesität Berlin, ER3-2, Hardenbergstr. 36a, D-10623 Berlin, German — [2]Max-Planck/Princeton Center for Plasma Physics — [3]Berlin International Graduate School in Model and Simulation Based Research

Magnetic helicity is an ideal invariant of the magnetohydrodynamic (MHD) equations which exhibits an inverse transfer in spectral space. Up to the present day, its transport has been studied in direct numerical simulations only in incompressible or in subsonic or transonic flows. Inspired by typical values of the turbulent root mean square (RMS) Mach number in the interstellar medium, this work presents some aspects of the magnetic helicity inverse transfer in high Mach number isothermal compressible turbulence, with RMS Mach numbers up to the order of ten:

1) a clear Mach-number dependence of the spectral magnetic helicity scaling but an invariant scaling exponent of the co-spectrum of the Alfvén velocity and its curl,

2) the approximate validity of a dynamical balance relation found by incompressible turbulence closure theory,

3) a characteristic structuring of helically-decomposed nonlinear shell-to-shell fluxes that can be disentangled into different spectrally local and non-local transfer processes.

EP 3.3 Tue 16:30 Zelt

ComPol - A CubeSat Compton Telescope — •Matthias Meier — Max-Planck-Institut für Physik, München

Astrophysical objects with a large mass-to-size ratio are referred to as compact objects, e.g. black holes, white dwarfs, neutron stars. Many questions concerning these astrophysical objects are still not answered. Besides optical measurements X-ray and gamma ray survey are essential to improve the understanding of these objects. The objective of the CubeSat mission ComPol is to investigate the black hole binary Cygnus X-1 for one year. The goal is to improve its physical model by measuring spectrum and polarization in the hard X-ray range (20 keV to 2 MeV). The information about the polarization can be extracted from the kinematics of Compton scattering.

The destined detector system is a Compton telescope made up of two detector layers. The first detector layer, a Silicon Drift Detector (SDD), acts as a scatterer for the incoming photons which are subsequently absorbed in the second layer, a crystalline CeBr3 calorimeter. The SDD has been primarily developed for the TRISTAN project, a planned detector upgrade of the KATRIN experiment, to search for sterile neutrinos.

The poster presents the status of the currently ongoing design study for the detector set-up and the estimated sensitivity to detect polarization in an energy range from 20 keV to 300 keV. An outlook to the technical realization and the CubeSat launch will be given.

EP 3.4 Tue 16:30 Zelt

First Steps toward the Verification of Models for the Assessment of the Radiation Exposure at Aviation Altitudes during Quiet Space Weather Conditions — Matthias Meier[1], Kyle Copeland[2], Daniel Matthiä[1], Christopher Mertens[3], and •Kai Schennetten[1] — [1]German Aerospace Center, Institute of Aerospace Medicine, Radiation Biology Department, 51147 Köln, Germany — [2]Numerical Sciences Research Team, Protection and Survival Laboratory, FAA Civil Aerospace Medical Institute, Oklahoma City, OK, USA — [3]NASA Langley Research Center, Hampton, Virginia, USA

Space weather is an important driver of the exposure of aircrew and passengers to cosmic rays at flight altitudes. The assessment of the corresponding radiation doses can be realized by measurements or model calculations that cover the whole range of the radiation field in terms of geomagnetic shielding, atmospheric shielding, and the effects of space weather. Since the radiation field at aviation altitudes is very complex in terms of particle composition and energy distribution, the accurate experimental determination of doses at aviation altitudes is still a challenging task. Accordingly, the amount of data with comparatively small uncertainties is scarce. The Community Coordinated Modeling Center (CCMC) invited FAA, DLR, and NASA to make their radiation models for aviation CARI-7A, PANDOCA, and NAIRAS available for interested users via the CCMC web site. A concomitant comparison of model calculations with measuring data provided information on the predicting capabilities and the uncertainties of the current versions of these models under quiet space weather conditions.

EP 3.5 Tue 16:30 Zelt

FaNS: A Fast Neutron Spectrometer for the Bexus 30/31 campaign — •Hauke Jacobsen, Goerkem Bilgin, Stephan Boettcher, Bernd Heber, Malte Hoerloeck, Friedericke Schattke, and Carsten Wallmann — Christian-Albrechts-Universität Kiel

The interaction of primary cosmic rays with the molecules of the Earth's atmosphere leads to a complex radiation field which consists among others of neutrons. The Fast Neutron Spectrometer (FaNS) has been developed to determine the flux of fast neutrons within the Earth's atmosphere. The instrument consists out of a boron-doped plastic scintillator which is optimized for the energy range from about 0.5 MeV to above 10 MeV. Here we present a description of the measurement concept for a compact instrument that can be flown on weather balloons and aircraft and corresponding results of a GEANT 4 simulation.

EP 3.6 Tue 16:30 Zelt

Thermal Atmospheric Neutron Observation System — •Friederike Schattke, Marc Hansen, Lisa Romaneehsen, Jonas Zumkeller, Patrick Pohland, Bernd Heber, Henning Lohf, Stephan Böttcher, and Patrick Kühl — Christian-Albrechts-Universität zu Kiel, Institut für Experimentelle und Angewandte Physik, Abteilung Extraterrestrische Physik, Deutschland

The Earth is continuously exposed to high energy charged particles from galactic cosmic rays. Due to galactic cosmic rays interacting with atmospheric particles, secondary neutrons are generated. Those are moderated to thermal energies below 0.025 eV through elastic scattering with water particles. This means thermal neutrons indicate the presence of water in the nearby area. As our earth contains a lot if it, we expect to be able to measure thermal neutrons in our atmosphere, thus it is the perfect place to test different detector layouts. The main objective of the Thermal Atmospheric Neutron Observation System (TANOS) is to measure the flux of thermal neutrons in the stratosphere. In order to measure these low energy neutrons we make use of the internal conversion electrons resulting from thermal neutron capture in Gadolinium. Gadolinium is particularly suitable for the experiment due to its high cross section of 49.000 barn. In the atmosphere we expect a radiation field consisting of charged and neutral particles. The flux of secondary particles is the largest at a height of about 20 km, the so called Pfotzer maximum. To characterize this height dependency of the radiation field, TANOS also measures the flux of charged particles.

EP 3.7 Tue 16:30 Zelt

Wave-particle interaction in the Io flux tube — •Sascha Janser and Joachim Saur — Institut für Geophysik und Meteorologie, Cologne, Germany

Observations by the JUNO spacecraft revealed energetic, bidirectional particle populations with broadband energy distributions in the high-latitude region of Jupiter. These measurements indicate that an acceleration mechanism of stochastic nature plays a dominant role for the generation of the intense main auroral oval. In our current work, we investigate the heating of an energetic upward proton population recently observed by JUNO in the Io flux tube wake near Jupiter. We try to infer on the relevant physical acceleration process by considering a resonant as well as a non-resonant wave-particle interaction mechanism, both based on Alfven waves. We focus on necessary temporal scales to drive these mechanisms efficiently and also on the released wave energy by means of the transported Poynting flux along the flux tube.

EP 3.8 Tue 16:30 Zelt

Following the TraCS of exoplanets with Pan-Planets: Wendelstein-1b and Wendelstein-2b — Christian Obermeier[1,2], •Jana Steuer[1,2], Hanna Kellermann[1,2], Roberto Saglia[1,2], Thomas Henning[3], Arno Riffeser[1], Ulrich Hopp[1,2], Gudmundur Stefansson[4,5,6], Caleb Canas[4,5,7], Joe Ninan[4], John Livingston[8], Johannes Koppenhöfer[1,2], Ralf Bender[1,2], and Suvrath Mahadevan[4,5] — [1]Max Planck Institute for Extraterrestrial Physics, Munich — [2]University Observatory Munich (USM) — [3]Max Planck Insitute for Astronomy, Heidelberg — [4]Department of Astronomy & Astrophysics, The Pennsylvania State University — [5]Center for Exoplanets & Habitable Worlds, Pennsylvania — [6]Department of Astrophysical Sciences, Princeton University — [7]Penn State Astrobiology Research Center, Pennsylvania — [8]Department of Astronomy, The University of Tokyo

Hot Jupiters, although abundant among Sun-like stars, seem to get rarer with decreasing stellar mass. The goal of the Pan-Planets transit survey was the detection of such planets and a statistical characterization of their frequency. Here, we announce the discovery and validation of two planets found in that survey, Wendelstein-1b and Wendelstein-2b, two short-period hot Jupiters that orbit late K host stars. We validated them both by the traditional method of radial velocity measurements with the HIRES and HPF instruments and then by their Transit Colour Signature (TraCS). With this, we demonstrate that multi-band photometry is an effective way of confirming transiting exoplanets.

EP 3.9 Tue 16:30 Zelt

Hunting TESS Single Transits — •Jana Steuer[1,2], Frank Grupp[1,2], Arno Riffeser[1,2], Hanna Kellermann[1,2], Ralf Bender[1,2], and Roberto Saglia[1,2] — [1]University Observatory Munich (USM) — [2]Max Planck Institute for Extraterrestrial Physics, Munich

NASA's TESS satellite is monitoring stellar flux of mostly G, K and M dwarfs in search for transiting exoplanet signals in 26 sectors, each observed for roughly 27 days and overall covering about 85% of the entire sky. The number of confirmed exoplanets is expected to be increased dramatically by TESS, a successor to the highly successful Kepler and K2 missions. Ideally, a detected signal is recorded multiple times, thus indicating a period for the stellar companion. However, since many planets detectable by TESS will have periods exceeding 27 days, their signals only have a chance to be detected once, given that they are not positioned within an overlapping sector region. Ignoring these candidates would mean the loss of a huge number of most likely very interesting planets, orbiting at distances large enough to potentially be positioned within the habitable zone.

Our effort aims to find these single detections within the TESS data, infer a period by performing MCMC fitting and following up these signals with ground based radial velocity measurements and, if sensible, photometry observations with the Wendelstein 2.1 m telescope and possibly others to confirm or discard them as planets.

EP 3.10 Tue 16:30 Zelt

Velocity Dispersion Analysis of Corrected SEPT Electron Measurements — Alexander Kollhoff[1], Nina Dresing[1], Raul Gomez-Herrero[2], •Bernd Heber[1], Konstantin Herbst[1], and Andreas Klassen[1] — [1]Christian-Albrechts-Universität Kiel — [2]Universidad de Alcalá, Alcalá de Henares, Spain

SEP events with an impulsive intensity time profile are often accompanied by electrons with energies up to a few hundred keV. The velocity dispersion of these electrons, observed at 1 AU, can provide information about how they are injected and transported through the inner heliosphere. Measurements of the SEPT aboard the STEREO are often used to investigate electrons in SEP events. Due to the instrumental setup, energetic electrons can scatter out of the solid state detector, depositing less than their total energy. Therefore, each SEPT electron channel has a response to electrons with energies above its nominal energy range. This effect of contamination becomes especially significant during the rise time of SEP events, when the energy spectrum is flatter due to velocity dispersion and leading to seemingly earlier onsets in some energy channels. Computation using a GEANT4 simulation of the SEPT instrument resulted in new response functions for electrons. These response functions are used to correct the contamination of highly energetic electrons to lower electron channels. The corrected intensities are used to analyse the velocity dispersion of several SEP events. The corrected data lead to significant different onset times and with it to more realistic path length and injection times compared to uncorrected measurements.

EP 3.11 Tue 16:30 Zelt

Identifying and Quantifying the Role of Magnetic Reconection in Space Plasma Turbulence — •Jeffersson Agudelo[1], Daniel Verscharen[1], Robert Wicks[1], Christopher Owen[1], Andrew Walsh[2], Yannis Zouganelis[2], and Santiago Vargas[3] — [1]University College London, Department of Space and Climate Physics Mullard Space Science Laboratory — [2]European Space Agency, European Space Astronomy Centre — [3]Universidad Nacional de Colombia, Observatorio Astronómico Nacional

One of the outstanding open questions in space plasma physics is the heating problem in the solar corona and the solar wind. In-situ measurements, as well as MHD and kinetic simulations, suggest a relation between the turbulent nature of plasma and the onset of magnetic reconnection as a channel of energy dissipation, particle acceleration and a heating mechanism. Non-linear interactions between counter propagating Alfven waves drives plasma towards a turbulent state. On the other hand, the interactions between particles and waves becomes stronger at scales near the ion gyroradious, and so turbulence can enhance conditions for reconnection and increase the number of reconnection sites. We use fully kinetic particle in cell simulations, to study the onset of reconnection in a 3D simulation box with parameters similar to the solar wind, under alfvenic turbulence. We characteristic features of reconnection sites as steep gradients of the magnetic field strength, formation of strong current sheets and inflow-outflow patters of plasma particles near the difusion regions. These results will be used to quantify the role of reconnection in plasma turbulence.

EP 3.12 Tue 16:30 Zelt

Density Problem in the Early Universe: Solution by Quantum Gravity — •Philipp Schöneberg[1] and Hans-Otto Carmesin[1,2,3] — [1]Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — [2]Bahnhofstraße — [3]Universität Bremen, Fachbereich 1, Postfach 330440, 28334 Bremen

No density can be larger than the Planck density $\rho_P = 5,155 \cdot 10^{96}\,\frac{\mathrm{kg}}{\mathrm{m}^3}$. The time evolution of the actual light horizon should be traced back until the Planck length $L_P = 1.616 \cdot 10^{-35}$m is reached. However there arises a problem, as the framework of general relativity theory, GRT, that length L_P is only reached at the density $\rho = 6 \cdot 10^{214}\,\frac{\mathrm{kg}}{\mathrm{m}^3}$.

We present a solution of that model. We illustrate that solution with several model experiments. Additionally we derive the correct solution by using EXCEL in a graphic manner (Carmesin, H.-O. (2019): Die Grundschwingungen des Universums - The Cosmic Unification - With 8 Fundamental Solutions based on G, c and h - With Answers to 42 Frequently Asked Questions. Berlin: Verlag Dr. Köster.).

EP 3.13 Tue 16:30 Zelt

The Actual Controversy of the Hubble - Constant: Evaluation of Observations and Comparison with Theory — •Ole Rademacker[1] and Hans-Otto Carmesin[1,2,3] — [1]Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — [2]Bahnhofstraße — [3]Universität Bremen, Fachbereich 1, Postfach 330440, 28334 Bremen

First, we evaluate observations in order to show that the Hubble-constant is a function of the redshift. Secondly, we discuss the significance of that finding for the standard model of cosmology. Thirdly, we compare our results with a fundamental theory of quantum gravity. Fourthly, we discuss possible questions for future observations (Carmesin, H.-O. (2019): Die Grundschwingungen des Universums - The Cosmic Unification - With 8 Fundamental Solutions based on G, c and h - With Answers to 42 Frequently Asked Questions. Berlin: Verlag Dr. Köster.).

EP 3.14 Tue 16:30 Zelt

The Density Parameter Ω_c of the Dark Matter is a Function of G, c and h — •Hans-Otto Carmesin — Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — Studienseminar Stade, Bahnhofstr. 5, 21682 Stade — Universität Bremen, Fachbereich 1, Postfach 330440, 28334 Bremen

The nature of the dark matter is modeled: First, a very general and fundamental density problem of the early universe is pointed out and resolved by dimensional phase transitions. With it, the concept of the dimensional horizon is introduced. As a consequence, there occurs robust elementary particle of dark matter. Therefrom, $\Omega_c(G, c, h)$ is derived as a function of the universal constants G, c and h. The result is obtained from a completely fundamental theory without any fit parameters (Carmesin, H.-O. (2019): Die Grundschwingungen des Universums - The Cosmic Unification - With 8 Fundamental Solutions based on G, c and h - With Answers to 42 Frequently Asked Questions. Berlin: Verlag Dr. Köster.).

EP 3.15 Tue 16:30 Zelt

The effect of a strongly stratified layer in the upper part of Mercury's core on its magnetic field — •Patrick Kolhey[1], Daniel Heyner[1], Johannes Wicht[2], and Karl-Heinz Glassmeier[1] — [1]Technische Braunschweig, Institut für Geophysik und extraterrestrische Physik, Braunschweig, Germany — [2]Max Planck Institut for Solar System Research, Göttingen, Germany

Since its discovery Mercury's magnetic field has puzzled the community and modelling the dynamo process inside the planet's interior is still a challenging task. Therefore new non-Earth-like models were developed over the past decades trying to match Mercury's peculiar magnetic field. One promising model suggests a stably stratified layer on the upper part of Mercury's core. Such a layer divides the fluid core in a convecting part and a non-convecting part, where the magnetic field generation is mainly inhibited. As a consequence the magnetic field inside the outer core is damped very efficiently passing through the stably stratified layer by a so-called skin effect. Additionally, the non-axisymmetric parts of the magnetic field are vanishing, too, such that a dipole dominated magnetic is left at the planet's surface.In this study we present new direct numerical simulations of the magnetohydrodynamical dynamo problem which include a stably stratified layer on top of the outer core. We explore a wide parameter range, varying mainly the Rayleigh and Ekman number in the model under the aspect of a strong stratification of the stable layer. We show which conditions are necessary to produce a Mercury-like magnetic field and give a inside about the planets interior structure.