EP 9: Poster

Zeit: Donnerstag 16:30–19:00 Raum: Foyer Nordbau

EP 9.1 Do 16:30 Foyer Nordbau

The Elementary Particle of Dark Matter Forming the Gosset Lattice — •Ole Rademacker[1] and Hans-Otto Carmesin[1,2,3] — [1]Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — [2]Universität Bremen, Fachb. 1, Pf. 330440, 28334 Bremen — [3]Studienseminar Stade, Bahnhofstraße 5, 21682 Stade

An equivalence principle is elaborated and founded. With it a third development of H.-O. Carmesins theory of quantum gravity is presented. The theory combines quantum physics with general relativity and is based on three numerical inputs only: the constants G, c and h (Carmesin, H.-O. (2018): A Model for the Dynamics of Space - Expedition to the Early Universe. PhyDid B, p. 1-9. Carmesin, H.-O. (May 2018): Entstehung dunkler Materie durch Gravitation, Model for the Dynamics of Space and the Emergence of Dark Matter. Berlin: Verlag Dr. Köster. Carmesin, H.-O. (July 2018): Entstehung dunkler Energie durch Quantengravitation, Universal Model for the Dynamics of Space, Dark Matter and Dark Energy. Carmesin, H.-O. (November 2018): Entstehung der Raumzeit durch Quantengravitation, Theory for the Emergence of Space, Dark Matter, Dark Energy and Space-Time. Berlin: Verlag Dr. Köster.). The most stable local solution of that theory is elaborated and identified with the elementary particle of dark matter. It forms the Gosset lattice or E8 lattice at the ground state. Corresponding phonons can in principle be observed with gravitational waves. The total amount of mass formed by the novel elementary particle is in accurate accordance with the observed total mass of dark matter in the universe, whereby the difference is 0.23 % only.

EP 9.2 Do 16:30 Foyer Nordbau

A Numerical Study of the Solution of the Horizon Problem and of the Flatness Problem — •Lennert Sprenger[1] and Hans-Otto Carmesin[1,2,3] — [1]Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — [2]Universität Bremen, Fachb. 1, Pf. 330440, 28334 Bremen — [3]Studienseminar Stade, Bahnhofstraße 5, 21682 Stade

An equivalence principle has been developed and used in a research club. From that principle Hans-Otto Carmesins theory of quantum gravity has been derived. With it fundamental problems of physics have been solved and an accurate accordance with observations has been achieved. Thereby all results have been obtained by using only three numerical inputs: the natural constants G, c and h. In addition a novel minimization principle has been developed. It establishes a tool for the analysis of emerging structures at the ground state. In particular the era of cosmic inflation has been explained and excellent quantitative accordance with observations of the CMB is achieved, whereby the deviation is below 3 %. Thereby the flatness problem, the horizon problem and the problem of energy conservation have been solved (see for instance Carmesin, H.-O. (2018): A Model for the Dynamics of Space - Expedition to the Early Universe. PhyDid B, p. 1-9. Sprenger, L. and Carmesin, H.-O. (2018): A Computer Simulation of Cosmic Inflation. PhyDid B, p. 1-4. Carmesin, H.-O. (May 2018): Entstehung dunkler Materie durch Gravitation, Model for the Dynamics of Space and the Emergence of Dark Matter. Berlin: Verlag Dr. Köster.). Here we present a numerical study that shows the solutions of the horizon problem and of the flatness problem in more detail.

EP 9.3 Do 16:30 Foyer Nordbau

Numerical Investigation of the Emergence of Dark Energy and the Time Evolution of the Hubble Constant — •Paul Brüning[1] and Hans-Otto Carmesin[1,2,3] — [1]Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — [2]Universität Bremen, Fachb. 1, Pf. 330440, 28334 Bremen — [3]Studienseminar Stade, Bahnhofstraße 5, 21682 Stade

An equivalence principle has been developed and used in a research club. From that principle H.-O. Carmesins theory of quantum gravity has been derived. With it fundamental problems of physics have been solved and an accurate accordance with observations has been achieved based on the fundamental natural constants G, c and h only. In particular the emergence of dark energy has been explained by zero - point oscillations of the gravitational field and excellent quantitative accordance with observations of the CMB has been achieved, whereby the deviation is below 0.073 %. The zero - point oscillations are polychromatic. Therefrom the different measured Hubble constants have been explained with an accuracy of 1 % (see for instance Carmesin, H.-O. (2018): A Model for the Dynamics of Space - Expedition to the Early Universe. PhyDid B, p. 1-9. Carmesin, H.-O. (July 2018): Entstehung dunkler Energie durch Quantengravitation, Universal Model for the Dynamics of Space, Dark Matter and Dark Energy. Berlin: Verlag Dr. Köster.). Here we present a study of the zero - point oscillations that achieves a high numerical detail. In particular we calculate the time evolution of the measurable Hubble constant.

EP 9.4 Do 16:30 Foyer Nordbau

Die Gedanken sind frei. Philosophie des Universums — •Helmut Hille — Fritz-Haber-Straße 34, 74081 Heilbronn

Von Anaximander aus Milet (ca. 611 - 545) wurde als einer der ältesten Sätze der antiken Philosophie überliefert: "Der Ursprung der seienden Dinge ist das Unbegrenzte. Denn aus diesem entstehe alles und zu diesem vergehe alles. Weshalb auch unbeschränkt viele Welten produziert werden.* Ohne heutige Kenntnisse in Physik und Kosmologie konnte Anaximander rein durch Vernunftüberlegungen diese Aussage treffen, die m.E. immer Bestand haben wird, solange wir der Vernunft und nicht dem Wunschdenken oder dem Zeitgeist folgen. Dazu gilt es, als Erstes zwischen Universum und Kosmos zu unterscheiden. Ein Kosmos ist ein geordnetes Ganzes, das aus einem gemeinsamen Ereignis hervorgegangen ist, das wir Big Bang oder auf Deutsch *Urknall* nennen. Das Universum ist das räumlich und zeitlich Unbegrenzte, in dem es unzählige Kosmen oder andere Konfigurationen gibt, wodurch bereits die Frage nach der Herkunft des von uns bewohnten Kosmos beantwortet ist. Ein Kosmos geht aus einer zusammenströmenden Materie oder Antimaterie hervor, die bei großer Menge und Dichte einen Big Bang verursacht, der alle Formatierungen löscht. Aus der verbleibenden strahlenden Energie ging anschließend und später durch Supernovae die Materie hervor, die wir kennen. Folgen wir weiterhin dem Satz von der Erhaltung der Energie, ergeben sich die Gegenstände der Kosmologie fast von selbst.

EP 9.5 Do 16:30 Foyer Nordbau

Unveiling cosmic voids in large-scale structure surveys: the impact of tracer bias — •Giorgia Pollina — University-Observatory Munich, Germany

The large-scale structure of the Universe can only be observed directly via luminous tracers of the underlying matter density field. However, luminous tracers, such as galaxies, do not precisely mirror the clustering statistic of the bulk of the dark matter distribution: their correlation function (or power spectrum) is biased and depends on various properties of the tracers themselves. Although on small scales this bias is an unestablished function of space and time, on very large scales it results in a constant offset in the clustering amplitude, known as linear bias. In this talk we focus on the bias of luminous objects within and around cosmic voids, enormous under-dense regions of the Universe that occupy the vast majority of its volume. As a remarkable result, we find that – within voids – the relation between matter and galaxy density is always linear and determined by a multiplicative constant. Furthermore, the value of this constant decreases with the increase of the size of voids and asymptotes to the linear bias. This result opens to the possibility of using such simple relation in other voids studies, allowing to extend our theoretical understanding of these immensely large under-densities (typically defined as depressions in the matter density field) to voids that are identified using galaxies as tracers of the matter density. Ultimately we test these findings with observations, using the Dark Energy Survey data currently available.

EP 9.6 Do 16:30 Foyer Nordbau

Monte-Carlo modeling of uncertainties in the detection of plumes on Europa with the Hubble Space Telescope — •Stephan Schlegel[1], Joachim Saur[1], and Lorenz Roth[2] — [1]Institute of Geophysics and Meteorology, University of Cologne, Germany — [2]Department of Space and Plasma Physics, KTH Royal Institute of Technology, Sweden

The search for liquid water within different planetary bodies in our solar system is an ongoing subject of many scientific works. In our work we revisit the detection of Europa's plume within Hubble Space Telescope observations by Roth et al. 2014 and provide a new assessment of the errors associated with the detection. For this purpose we consider the different error sources that occur while processing or are

inherent to the instrument or the physics of the system. To achieve better insight on the statistical behavior of such observations, Monte Carlo tests for different emission models of Europa as seen from the Hubble Space Telescope were carried out. For this purpose models with plumes were compared to models without plume. Additionally by varying different parameters, contributions of different error sources could be separated and the significance of the properties of the plumes could be analyzed in detail. Therefore, atmospheric emissions, contribution of the surface reflectance as well as inaccuracies in target acquisition were investigated. It could be shown that the significant Lyman alpha anomaly which was present in the observations has a rather high signal to noise ratio of 5.4 and can most likely be attributed to plume activity.

EP 9.7 Do 16:30 Foyer Nordbau

MHD simulation of rotating insulator planets' magnetospheres — •Justus Sagemüller and Joachim Saur — Institut für Geophysik und Meteorologie, Universität zu Köln

Magnetohydrodynamics is a useful approach to model the plasma dynamics around planetary bodies. This description needs to take into account that matter below the surface of rocky or gaseous planets is an insulator. This results in nontrivial boundary conditions because the simulations usually do not solve for the currents directly, but for the magnetic fields.

A solution to this problem has been given in Duling et al. 2014 with a poloidal-toroidal decomposition based on spherical-harmonic expansion. A direct implementation can work well in particular for e.g. Jovian moons, but has limited flexibility due to the need for a spherical-polar grid and large, pre-computed transformation matrices.

We generalise this scheme, aiming to make it applicable to rotating planets with strong, not axis-aligned intrinsic (dynamo) magnetic field – the most extreme example being Neptune – and implement it on a cartesian grid in the Athena++ code.

The essential rotation of the dynamo field is successfully tested for simple dipole examples, with the goal to ultimately apply the description for future models of Neptune's magnetosphere.

EP 9.8 Do 16:30 Foyer Nordbau

Paleomagnetospheric Modelling of the Hermean Magnetosphere — •Daniel Heyner — TU Braunschweig, Braunschweig, Deutschland

Mercury possesses a very weak magnetic field. The surface field strength at the equator is 190 nT which is ca. 160 times weaker than the terrestrial value. Magnetic field measurements from the MESSENGER probe indicate the possibility of a much stronger dipole moment in ancient times, allowing even a field of comparable surface field strength as the terrestrial value. Mercury is also subject to an intense inflow of solar wind plasma due to its proximity to the Sun. This flow is not steady having intrinsic natural variations as well as the variation due to the changing heliocentric distance along the Hermean orbit. It is known that the solar wind dynamic pressure is also exponentially decaying over time. The solar wind plasma flow exerts an inward pressure on the magnetopause, the outermost boundary of the magnetosphere. The internal magnetic field pressure by the planetary dipole acts against the inward solar wind push. Thus, pressure equilibrium defines the spatial scale of the magnetopause. The electric currents in the magnetopause induce a magnetic field acting on the planet, driving e.g. induction currents in the interior and maybe even quench the internal dynamo process. It is demonstrated, how the magnetopsheric spatial scale changes with a time-dependent internal dipole moment and solar wind pressure using a semi-empirical magnetospheric modeling approach. The resultant magnetopause fields acting on the planet are computed and discussed.

EP 9.9 Do 16:30 Foyer Nordbau

Flux rope formation by a confined solar flare preceding a coronal mass ejection — •Bernhard Kliem[1], Jeongwoo Lee[2], Rui Liu[3], Stephen M. White[4], Chang Liu[5], and Satoshi Masuda[6] — [1]Institute of Physics and Astronomy, University of Potsdam, Germany — [2]Kyung Hee Univ., Yongin, Republic of Korea — [3]USTC, Hefei, China — [4]AFRL, Albuquerque, NM, USA — [5]NJIT, Newark, NJ, USA — [6]Nagoya University, Japan

Two categories of onset mechanism for solar eruptions (coronal mass ejections [CMEs], filament or prominence eruptions, and flares) are currently being debated. Ideal MHD mechanisms suggest the instability of a magnetic flux rope, thus, must assume that a flux rope exists at eruption onset. Reconnection mechanisms assume that a (not yet verified) mechanism of self-amplifying magnetic reconnection commences in a sheared magnetic arcade, triggering and driving the eruption and forming a flux rope as a result. Here we analyze an eruption event which strongly indicates that a magnetic flux rope was formed prior to a major CME by a preceding confined flare (i.e. a flare not associated with a CME). We also present evidence that such flux-rope-forming precursor flares often occur prior to CMEs, which lends support to the ideal MHD mechanism for solar eruptions.

EP 9.10 Do 16:30 Foyer Nordbau

Parametric study of torus instability threshold — •Jun Chen[1,2], Bernhard Kliem[2], and Rui Liu[1] — [1]University of of Science and Technology of China, Hefei, China — [2]University of Potsdam, Potsdam, Germany

Utilizing the analytical model of Titov & Demomulin (1999) to set a toroidal current channel in force-free equilibrium, partially submerged under the solar photosphere to model a solar prominence, we studied the threshold of torus instability for a range of different geometries and external toroidal field strengths. Four parameters of the equilibrium have been varied: minor radius and footpoint distance of the current channel, strength of the external toroidal field, and sunspot distance. The sunspot distance determines the height profile of the external poloidal field's decay index, thus, determines the torus-unstable height range. We found that the critical decay index at the torus instability threshold increases (corresponding to a more stable situation) when the strength of the external toroidal field or the radius of the current channel increase. For given apex height, the threshold does not depend significantly on the footpoint distance of the current channel.

EP 9.11 Do 16:30 Foyer Nordbau

FitCoPI: Fitting density and temperature of coronal active region plasma in 3D from single vantage point observations — •Stephan Barra — MPI für Sonnensystemforschung, Göttingen — Ruhr-Universität Bochum, Theoretische Physik IV, Bochum

Since the solar coronal plasma is optically thin, diagnostics of coronal plasma basically have no resolution along the line of sight. So far, this problem can be overcome only either by stereoscopic observations, or by observing the sun repetitively with enough time lag. The former approach has the problem that STEREO data is not generally available. The latter one suffers from poor time resolution, since the sun needs to rotate until the perspective changes significantly.

We present our newly developed FitCoPI code. It implements a novel method of fitting the solar active region corona to single vantage point observations. The method requires a set of simultaneous EUV or X-ray images. The outcome is an 3D approximation of the density and temperature in the corona. The method is tested against a model corona. Using SDO/AIA data, it is further applied to AR 11087, observed on July 15th 2010, for which the results can be tested against independent data from STEREO A/EUVI. In both cases, the results are very satisfying, though some problems remain near the solar surface.

EP 9.12 Do 16:30 Foyer Nordbau

Untersuchung über die Sensitivität von SOHO/EPHIN auf solare Röntgenflares — •Stefan Jensen, Patrick Kühl, Andreas Klassen und Bernd Heber — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, Leibnizstraße 11, 24118 Kiel, Germany

Das Electron Proton Helium INstrument (EPHIN) an Bord der Raumsonde SOHO wurde zum Nachweis von Elektronen im Energiebereich von 0.3 - 10 MeV und Protonen und Helium im Energiebereich von 4 - 51 MeV entwickelt. Es hat sich gezeigt, dass die im Instrument genutzten Halbleiterdetektoren sensitiv auf solare Röntgenereignisse sind. Um dieses Ansprechen zu verstehen, haben wir eine mathematische Modellierung mit Hilfe der GEANT 4 Bibliothek des EPHIN Sensors entwickelt und das Ansprechvermögen für harte Röntgenstrahlung berechnet. Die Berechnungen ergeben, dass aufgrund der elektronischen Schwellen und der mit der Energie abfallenden Wechselwirkungsquerschnitte das Instrument im wesentlichen Photonen im Energiebereich von 30 keV bis 60 KeV registriert.

EP 9.13 Do 16:30 Foyer Nordbau

Thermal Atmospheric Neutron Observation System — •Friederike Schattke, Marc Hansen, Patrick Pohland, Lisa Romaneehsen, Jonas Zumkeller, Robert Wimmer-Schweingruber, and Bernd Heber — 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. 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 conversion electrons resulting through thermal neutron capture in Gadolinium. Gadolinium is particularly suitable for the experiment due to its high cross section of 49000 barn. In the atmosphere we expect a radiation field consisting of charged and uncharged 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. In this talk we are going to present the detector layout and its response function that is simulated with GEANT4.

EP 9.14 Do 16:30 Foyer Nordbau

Atmospheric Simulation with AtRIS for the Thermal Atmospheric Neutron Observation System — •Marc Hansen, Friederike Schattke, Patrick Pohland, Jonas Zumkeller, Lisa Romaneehsen, Bernd Heber, and Robert Wimmer-Schweingruber — 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. In the atmosphere we expect a radiation field consisting of charged and uncharged particles. The flux of secondary particles is largest at a height of about 20 km, the so called Pfotzer maximum. In the course of the development of the Thermal Atmospheric Neutron Observation System (TANOS), we simulated the expected fluxes with the Atmospheric Radiation Interaction Simulator (AtRIS) which is based on GEANT4. AtRIS has been designed to simulate the interaction of radiation with arbitrary (exo)planetary atmospheres. In this talk we are going to present the results of this simulation.

EP 9.15 Do 16:30 Foyer Nordbau

Thermal Atmospheric Neutron Observation System Junior Calibration — •Patrick Pohland, Friederike Schattke, Marc Hansen, Jonas Zumkeller, Lisa Romaneehsen, Robert Wimmer-Schweingruber, and Bernd Heber — Christian-Albrechts- Universität zu Kiel, Institut für Experimentelle und Angewandte Physik, Abteilung Extraterrestrische Physik, Deutschland

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 conversion electrons resulting through thermal neutron capture in gadolinium. Gadolinium is particularly suitable for the experiment due to its high cross section of 49000 barn. An essential part of the project is the calibration of the instrument for which a ^{207}Bi probe was used. In this talk I am going to present the calibration and its results.

EP 9.16 Do 16:30 Foyer Nordbau

Observations of charge sign dependent modulation of galactic cosmic rays during four successive solar cycles — •Bernd Heber, Marlon Koeberle, Patrick Kuehl, and Johannes Marquardt — Christian-Albrechts-Universität, 24118 Kiel, Germany

The intensity of galactic cosmic rays (GCRs) is modulated as they traverse the turbulent magnetic field embedded in the solar wind. These particles are scattered by irregularities in the interplanetary magnetic field and undergo convection and adiabatic deceleration in the expanding solar wind. The large-scale heliospheric magnetic field leads to gradient and curvature drifts leading to charge sign dependent variations. In this contribution we investigate the time period from 1980 to 2017, including two and one solar minima during the $A < 0$ and $A > 0$ solar magnetic epoch as well as four solar magnetic field polarity reversals. Observations are taken from instruments aboard IMP-8, ISEE-3, Ulysses as well as from PAMELA and AMS-02. While the latter two separate between particle and its corresponding anti-particle the instruments utilized in this study before cannot. In order to compare these measurements with each other we utilize here the electron plus positron flux. Since the proton to antiproton ratio is smaller than 10^{-3} the contribution of antiprotons is neglected. The measurements by the Kiel Electron Telescope aboard Ulysses are altered by the variation along the orbit of the spacecraft that needs to be taken into account.

EP 9.17 Do 16:30 Foyer Nordbau

SUPRATHERMAL PROTONS IN THE INNER HELIOSHEATH: A POSSIBLE MECHANISM FOR THE INTERSTELLAR BOUNDARY EXPLORERIBBON — •Adama Sylla and PD Dr. Horst Fichtner — Theoretische Physik IV

The basis for the modelling of so-called energetic neutral atoms (ENAs) observed with the Interstellar Boundary Explorer (IBEX) is the phase-space transport of suprathermal protons in the inner heliosheath. The modelling of all-sky maps of ENA fluxes at different energies will provide insight into the large-scale structure of the outer heliosphere. Numerical solutions of the transport equation of suprathermal pick-up ions (PUIa) will be presented. These solutions allow to compute the production rates along a given line of sight and, in turn, the differential ENA flux from a given direction. This way synthetic all-sky ENA flux maps will be computed for different ENA energies.

EP 9.18 Do 16:30 Foyer Nordbau

The effects of stellar activity on orbiting planets — •ADriana Valio — Center for Radio Astronomy and Astrophysics Mackenzie, Mackenzie Presbyterian University, Sao Paulo, Brazil

Stellar activity manifests itself in the form of surface spots and faculae and also by flares and mass ejections from its atmosphere. When an orbiting planet transits in front of the star and occults one of these features, small signatures are imprinted in the transit light curve. These can be modeled to yield the physical characteristics of spots and faculae, such as size, temperature, location, magnetic field, and lifetime. Monitoring of these signatures on multiple transits yield the stellar rotation and differential rotation, and even magnetic cycles for long enough time series. Flares have also been detected from active stars, the impact of the flaring UV flux on possible living organisms in close orbit planets is also discussed. Mass ejections also affect the planetary atmosphere being responsible for atmospheric erosion.

EP 9.19 Do 16:30 Foyer Nordbau

A Laboratory for Rapid Space Missions — •Martin J. Losekamm, Laura Fabbietti, and Stephan Paul — Technical University of Munich, Garching, Germany

Small satellites have become a versatile and widely used platform for scientific and commercial technology-demonstration missions. In such short-term missions, costs can be substantially reduced through the use of commercial-off-the-shelve components and ride-share launches. For the same reasons, development times are significantly shorter than for larger satellites. Despite strict limitations in size, mass, and available power, the CubeSat standard—the foundation of the most abundant class of small satellites—has enabled numerous scientists around the world to test or operate their instruments in space.

Within the recently approved DFG Cluster of Excellence "ORIGINS", we will establish a laboratory dedicated to the development of small but versatile satellites and other space-based platforms. These could either be used in preparatory missions to demonstrate technologies for larger endeavors or be self-contained experiments in their own right. In this contribution, we present the rationale for establishing the laboratory and the technologies we intend to develop. We also introduce initial and future science missions.

EP 9.20 Do 16:30 Foyer Nordbau

The ORCA detector — •Christian Steigies[1], Juan José Blanco[2], Óscar García-Población[2], José Medina[2], Ignacio García-Tejedor[2], Manuel Prieto[2], Sindulfo Ayuso[2], Raúl Gómez-Herrero[2], Juan Antonio Garzón[3], Almudena Gomis[4], Victor Villasante-Marcos[4], Marcos Seco[3], Anna Morozova[5], Georgy Kornakov[6], Teresa Kurtukian[7], Alberto Blanco[8], Bernd Heber[1], Helena Krüger[9], and Du Toit Strauss[9] — [1]CAU Kiel — [2]University of Alcalá — [3]University of Santiago de Compostela — [4]Instituto Geográfico Nacional — [5]CITEUC-Univ. de Coimbra — [6]TU-Darmstadt — [7]CEN-Bordeaux — [8]LIP-Coimbra — [9]North-West University Potchefstroom

The ORCA (Observatorio de Rayos Cósmicos Antártico) detector consists of three different instruments with a common field of view: NEMO, MITO and TRISTAN. The goal of these instruments is to measure different components of the secondary cosmic rays that are created in the Earth's atmosphere: neutrons, muons, electrons and

gamma rays. ORCA is performing a latitude scan of cosmic rays on its way from Spain to Livingston Island in Antarctica, where the instrument will be installed permanently at the Juan Carlos I research station when it arrives there in the summer season of 2018/19. The data measured by ORCA will be made available for research in scientific databases like NMDB.

EP 9.21 Do 16:30 Foyer Nordbau

Statistical properties of material line elements in incompressible MHD turbulence — •Philipp Hess, Oliver Henze, and Wolf-Christian Müller — Technische Universität Berlin, Berlin, Germany

The statistics of infinitesimal material line elements are studied numerically in stationary incompressible magnetohydrodynamic (MHD) turbulence using velocity gradient time series. The velocity gradient data is obtained by tracking Lagrangian particles in a stochastically forced direct numerical simulation (DNS). The deformation of material lines in turbulence is of fundamental interest and practical importance. Vortex lines and magnetic field lines in an inviscid fluid of high conductivity are examples of vector fields that are proportional to material line elements. It is known analytically and shown in hydrodynamic simulations (Girimaji & Pope 1990) that the length of material line elements increases exponentially in time. The stretching rate of line and surface elements are found to be significantly lower in MHD turbulence than in the hydrodynamic case. Moreover the results show that the material lines are primarily aligned along the direction of the magnetic field. Further the role of the magnetic field in material element deformation is investigated by injecting cross and magnetic helicity into the system.

EP 9.22 Do 16:30 Foyer Nordbau

Investigation of topology-driven magnetic reconnection with CWENO finite volume numerics — •Raquel Mäusle[1], Jean-Mathieu Teissier[2], and Wolf-Christian Müller[2] — [1]Freie Universität Berlin, Berlin, Germany — [2]Technische Universität Berlin, Berlin, Germany

Magnetic reconnection is a process that changes the magnetic field topology due to finite electrical resistivity in the field's plasma environment. A possible trigger for the onset of reconnection is a high entanglement of the field lines which can exponentially amplify the influence of small resistive effects [Boozer 2012].

This type of topology-driven reconnection is investigated by finite-volume numerics in order to verify the proposed theory. The plasma is described by the ideal magnetohydrodynamic (MHD) equations, in which resistivity is neglected.

A simple numerical setup is used to study this mechanism with 3D simulations, in which the initially constant magnetic field is driven to high entanglement. A fast transition from a stationary state to a chaotic state is observed, which is characterized by locally enhanced current densities, large separations of neighboring field lines and a change in the mapping of foot points. The consequences of these observations and their relation to reconnection dynamics are discussed.

EP 9.23 Do 16:30 Foyer Nordbau

A linear slit coronagraph combined with a high resolution partailly multiplexed imaging spectrometer — •Adalbert M. Ding[1] and Shadia R. Habbal[2] — [1]Institut für Technische Physik, Berlin, and IOAP, Technische Universität Berlin — [2]Institute for Astronomy, University of Hawaii, USA

A high resolution imaging grating spectrometer has been designed to continuously investigate the solar corona using a small satellite on a sun synchronous orbit. To discriminate against the diffracted and scattered light from the solar disk a coronagraph set-up with 2 rectangular slits placed in sequence, using linear Lyot-type occulter and apertures, is positioned in front of the spectrometer using an off-axis parabolic and a spherical mirror. The second rectangular aperture acts also as the entrance slit for the spectrometer. The spectrometer uses echelle gratings operating in 40th to 50th order. The sensitivity and the resolution of the instrument makes it possible to measure velocities in the range of 20km/s to 2000km/s through Doppler spectroscopy. Using coatings with particularly low reflection coefficients a reduction of the solar stray light of 8 orders of magnitude is possible. Possible geometries and instrument parameters of the satellite's load will be discussed and compared with earlier results from previous solar eclipses.

EP 9.24 Do 16:30 Foyer Nordbau

NO production in the mesosphere and lower thermosphere during a geomagnetic storm in April 2010 — •Miriam Sinnhuber[1] and Stefan Bender[2] — [1]Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]University of Trondheim, Trondheim, Norway

Electrons accelerated in the magnetosphere during geomagnetic storms precipitate into the polar atmosphere above ≈60 km altitude. Energetic electron precipitation is a major source of NO in the high latitude mesosphere and lower thermosphere due to collision reactions leading to excitation, dissociation and ionization of N_2, O_2 and O, and subsequent ion chemistry reactions.

We investigate NO production during one geomagnetic storm in April 2010 combining observations from SCIAMACHY/ENVISAT with results from a global chemistry-climate model extending up into the thermosphere at about 250 km. During and after the storm, both observations and model results show a clear NO enhancement at geomagnetic latitudes roughly related to the radiation belts. However, comparing the model results to observations reveal differences both in the amount and spatial coverage of the NO production. These differences indicate significant problems probably with the representation of electron precipitation in the model.

EP 9.25 Do 16:30 Foyer Nordbau

Exploring Star-Planet Interactions with MHD Simulations — •Fabian Menezes and Adriana Valio — UPM/CRAAM, Sao Paulo, Brazil

Stars can strongly interact with their close-in planets through their magnetic field. The stellar magnetic field is the driver of activity in the star and can trigger energetic flares, coronal mass ejections and ionized wind. These phenomena may have an important impact on the magnetosphere and atmosphere of the orbiting planets. In this project for Foreign Student Program, we will focus on how stellar magnetic fields, their winds and flares impact close-in planets. Also, we will study how the magnetic reconnection between the planet and the star can trigger stellar activity. To accomplish that, we characterize spots (radius, intensity, and position) on the surface of some stars by fitting the small variations in the light curve of a star caused by the occultation of a spot during a planetary transit. Next, we develop stellar magnetic maps using the spots distribution on the stellar surface. From the spot temperatures we can determine its magnetic field intensity using the same relation of sunspots. This magnetic configuration is used as input for the three-dimensional magnetohydrodynamics numerical simulation of the stellar magnetic field. Moreover, the stellar interaction with a magnetized planet is investigated.