Plenarvortrag PV I Mo 9:15 Plenarsaal

Status of the FAIR Project — •Paolo Giubellino — FAIR & GSI, Darmstadt

The construction of the Facility for Antiproton and Ion Research FAIR is progressing well. FAIR is one of the European flagship facilities for basic science in the coming decades and will become operational around 2025. The unique accelerator and experimental facilities will allow for a large variety of unprecedented fore-front research in physics and applied science. The science program of FAIR is structured along four research pillars: NUSTAR, CBM, PANDA and APPA. In the field of nuclear structure, nuclear astrophysics and nuclear reactions, the FAIR accelerator with the versatile NUSTAR instrumentation will give access to the yet unknown region of r-process path nuclei at and beyond N=126 and thereby provide stringent constraints for our understanding of the nucleosynthesis of the heaviest nuclei. In the field of nuclear and hadronic matter physics, CBM will offer unique conditions for a comprehensive study of QCD matter at the highest net-baryon densities achievable in the laboratory. In the field of hadron physics, PANDA opens up excellent research opportunities for high- precision systematic measurements in hadron spectroscopy and hadron structure. In addition FAIR will also allow for novel precision experiments in atomic physics as well as for tests of fundamental symmetries and interactions in nature. Last but not least, FAIR, with its large variety of ion beam species, energies and intensities will offer broad opportunities for a rich applied research program, APPA. The progress of the FAIR realization and the status as well as first results from the intermediate research program FAIR phase 0 at GSI will be presented.

Plenarvortrag PV II Mo 10:00 Plenarsaal

The dual role of the plasma edge in tokamaks — •Elisabeth Wolfrum — Max Planck Institute for Plasma Physics, Garching, Germany

One of the paths to achieving nuclear fusion on earth is the confinement of hot plasma in a magnetic device, called tokamak. In the largest one, ITER, currently being built in the south of France, a burning deuterium-tritium plasma will require core ion temperatures above 10 keV (100 Mio °C) at densities around $10^{20} m^{-3}$. In the core of a tokamak plasma turbulence is the dominant transport mechanism limiting the temperature gradient. Therefore, the first role of the plasma edge is to act as boundary condition to the core, as its temperature value is a crucial quantity which determines the performance of a tokamak plasma. In steady state conditions, all heat, that is deposited or produced in the centre, is transported across the plasma edge towards the wall. Thus, the second role of the plasma edge is to provide conditions for safe operation without damaging the plasma facing components.

The plasma edge region is characterised by different physical properties, such as strong pressure gradients which drive flow shear. This combination can lead to both suppression of background turbulence as well as drive of magneto-hydrodynamic and turbulent modes determining the transport from the core to the wall. In this talk the most important ingredients of the physical properties of the plasma edge will be explained, the status of knowledge will be shown together with possible options for the operation of the plasma edge in ITER, and open research questions will be illustrated.

Mittagsvortrag PV III Mo 13:00 HS 12

Umgang mit Geld als Physikerin und Mutter — •Friederike Lichtenegger — Giesecke+Devrient Currency Technology GmbH, München

Geld, Geld, Geld ... Vieles im Leben dreht sich um Geld. Bei Giesecke+Devrient kann man es nicht nur verdienen, sondern auch produzieren und prüfen. Der Wert von Geld basiert auf Vertrauen. Gerade heute, in einer sich rasch verändernden und vernetzten Welt, steigt die Bedeutung von Vertrauen in die jeweilige Währung.

Deshalb bietet G+D Currency Technology als vertrauensvoller Partner von Zentralbanken und Währungsindustrie ganzheitliche Expertise und innovative Technologien, um die Effizienz im Bargeldkreislauf zu steigern und zu sichern. Vertrauen schaffen in den gedruckten Wert einer Banknote ist seit jeher bis heute die Herausforderung, der sich G+D Currency Technology tagtäglich stellt. Das Ergebnis: die kontinuierliche Weiterentwicklung von Lösungen und Services entlang des kompletten Bargeldkreislaufs – von der Herstellung des Banknotensubstrats über das Design der Banknote bis hin zur Prüfung der Umlauffähigkeit und Vernichtung abgenutzter Scheine. Dabei ermöglicht unsere starke globale Präsenz eine große Nähe zu unseren Kunden.

In meinem Vortrag werde ich das Unternehmen Giesecke+Devrient vorstellen, auf Einstiegsmöglichkeiten eingehen und meine persönliche Laufbahn in dem Unternehmen von der Entwicklung ins Projektmanagement neben einer Familie mit zwei Kindern vorstellen.

Plenarvortrag PV IV Di 9:00 Plenarsaal

Testing General Relativity with Cosmological Observations — •Ruth Durrer — Universite de Geneve, Switzerland

General Relativity (GR) is immensely successful. With the late discovery of gravitational waves from black hole and neutron star mergers, it has passed all its tests with flying colours.

But so far, all observations have tested the vacuum equations of GR. The most important non-vacuum case, cosmology, is in agreement with GR only after the introduction of two otherwise unknown components, 'Dark Matter' and 'Dark Energy' which amount to about 96% of the total energy budget of the present Universe. This let people in the field question the validity of GR for cosmology. Might it be that GR is flawed on large, cosmological scales? Or in the presence of matter in general?

But how can we test Einstein's equation in the presence of matter. Can't we simply move any modification of the Einstein tensor to the right hand side and call it a 'dark matter/energy' component?

In my talk I shall discuss possible ways (partially) out of this dilemma. How to test both, the left and the right hand side of Einstein's equations with cosmological observations.

Plenarvortrag PV V Di 9:45 Plenarsaal

On the tension between mathematics and physics — •Miklos Redei — London School of Economics and Munich Center for Mathematical Philosophy, London and Munich, United Kingdom and Germany

Because of the complex interdependence of physics and mathematics their relation is not free of tensions. The talk looks at how the tension has been perceived and articulated by some physicists, mathematicians and mathematical physicists. Some sources of the tension are identified and it is claimed that the tension is both natural and fruitful for both physics and mathematics. An attempt is made to explain why mathematical precision is typically not welcome in physics.

Mittagsvortrag PV VI Di 13:00 HS 12

Highway to Intellectual Property – ein persönlicher Werdegang — •Carmen Tesch-Biedermann — Patentanwältin und Inhaberin von Athene Patent, München

Die promovierte Physikerin und Buchautorin arbeitet mit Begeisterung seit mehr als15 Jahren an der spannenden Schnittstelle zwischen Wirtschaft, Technik und Recht. Wie Ideenschutz funktioniert, was ihre Arbeit als Patentanwältin auszeichnet und wie ein persönlicher Werdegang auf diesem Gebiet aussehen kann, beschreibt die Referentin in diesem Lunch-Talk.

Plenarvortrag PV VII Mi 8:30 Plenarsaal

Reconciling the past and the present: The shared history of physicists and museums — •Marta C Lourenco — Museums of the University of Lisbon/CIUHCT, Portugal

Each generation is responsible for selecting the limited number of objects that get to be preserved for the future, in museums, libraries and archives. These objects shape our understanding of the universe and ourselves and, in the long-term, determine our common heritage, history and identity.

Throughout the 20th century, physicists have played prominent roles in the creation of museums and science centres in Utrecht, Osaka, Montreal, Cambridge, Rio, Lisbon, and other locations across the world. These museums covered not only physics but also astronomy, biology, mathematics and chemistry, and other fields. Moreover, physicists have been actively involved in creating *museums of influence* that changed the history of museums themselves, e.g. the Palais de la Découverte in Paris (1937), the Exploratorium in San Francisco (1969) and the CosmoCaixa in Barcelona (2004).

What motivates physicists to create museums? Is it a special interest in the past? Is it a desire to communicate science to broad audiences? Is it a desire to be remembered? In this talk, I will use examples to explore the relations between physicists and museums. I will also discuss old and new ways in which contemporary physicists continue to contribute to the preservation, study and public interpretation of our scientific heritage.

Plenarvortrag PV VIII Mi 9:15 Plenarsaal

Particle-hole symmetries in condensed matter — •Martin Zirnbauer — University of Cologne, Koeln, Germany

Non-relativistic condensed matter breaks the charge conjugation symmetry C of relativistic quantum fields. However, for half-filled bands a close analog, namely particle-hole symmetry C', may emerge. The two symmetry operations C and C' are similar in that they both transform any excitation of energy E and charge Q to another excitation of the same energy E but the opposite charge -Q. They differ in that charge conjugation is a unitary operation, whereas particle-hole conjugation is anti-unitary.

After reviewing some background material from many-body theory, this talk illustrates the phenomenon of emergent particle-hole symmetries in condensed matter by a series of examples, culminating with the spectacular case of the half-filled lowest Landau level. Along the way, we argue that the Nobel Prize winning Haldane phase of antiferromagnetic quantum spin chains is a topological phase protected by a particle-hole symmetry.

Preisträgervortrag PV IX Mi 10:00 Plenarsaal

Decoding the QCD phase structure with relativistic nuclear collisions — •Peter Braun-Munzinger — GSI, Planckstr. 1, 64291 Darmstadt, Germany — Tr\"{a}ger der Stern-Gerlach-Medaille

In this talk we demonstrate that the phase structure of strongly interacting matter can be decoded via analysis of particle production in high energy nuclear collisions. This is achieved by making use of the observed thermalization pattern of particle abundances within the framework of the statistical hadronization approach at various collision energies. The thermalization holds not only for hadronic constituents composed of light quarks but also for light, loosely bound nuclei. The observed energy dependence of the production yields and fluctuations of different particle species contains characteristic features which are used to determine the temperature and baryo-chemical potential of the matter produced. The above observations imply quark-hadron duality at the QCD phase boundary and establish the first experimental delineation of the location of the phase change in strongly interacting matter. New experimental opportunities for relativistic nuclear collisions are pointed out for the near and longer term future.

Preisträgervortrag PV X Mi 10:30 Plenarsaal

Charmonia as Probe of Deconfinement - Recent Results and Perspectives — •Johanna Stachel — Physikalisches Institut, Universität Heidelberg — Trägerin der Stern-Gerlach-Medaille

Charmonia are hadrons composed of a charm quark and its antiparticle. Their production mechanism in relativistic nuclear collisions and its connection to a quark-gluon plasma (QGP) formed there has been a key topic for more than 30 years. In this talk we will demonstrate how* recent results from the Large Hadron Collider have shed new light on the topic: the presence of a QGP does not reduce but actually enhance their production at collisers since charm quarks in the fireball are deconfined. This implies that the production rate of charmonia scales quadratically with the number of charm quarks, thereby providing a fingerprint for deconfinement and the position of the QCD phase boundary. The underlying physics is well described in the Statistical Hadronization Model for Charm (SHMC) which was proposed nearly 20 years ago* We will present the current experimental situation and the comparison to the most recent SHMC predictions. The fundamental question whether there exist colorless bound states inside the QGP is related to the experimentally challenging measurements of excited-state populations of charmonia which will be studied with precision with the* upgraded ALICE apparatus at the LHC in the coming years.

Mittagsvortrag PV XI Mi 13:00 HS 12

Wieso? Weshalb? Warum? Ein theoretischer Physiker in der Supply Chain — •Markus Pfannmüller — Director Supply Chain Engineering Order Management, Infineon Technologies AG, München

Nach Studium und Promotion in theoretischer Physik arbeitete der Referent in einer Unternehmensberatung, und beim Halbleiterunternehmens Infineon im IT Projektmanagement-Office und in verschiedenen Positionen des Supply Chain Managements.

Heute führt er dort als Abteilungsleiter ein globales Team von zwölf Personen.

Fragen, die neben anderen behandelt werden sollen, sind:

- Was waren Überlegungen und Kriterien an den Entscheidungspunkten?
- Worauf ist man als Physiker bei einer Karriere außerhalb der Forschung vorbereitet, worauf nicht?
- Welche Fähigkeiten eines Physikers werden noch gebraucht, was kam alles dazu?
- Und nicht zuletzt auch: Was macht daran eigentlich Spaß?

Der Vortrag möchte zur Diskussion und eigenen Überlegungen anregen.

Abendvortrag PV XII Mi 19:30 Plenarsaal

Urknall, Sternenstaub und Frage nach der Entstehung des Lebens — •Andreas Burkert — Computational Astrophysics Group, Universitätssternwarte, Ludwig Maximilians Universität, München

Wie konnten aus den Anfangsbedingungen des Urknalls nicht nur unser komplex strukturiertes Universum, sondern auch das Leben auf der Erde entstehen? Sind wir allein im Universum? Oder ist die Entstehung von Leben unabdingbar und ein immer wieder stattfindender, natuerlicher Prozess im All? Die Suche nach Antworten auf diese Fragen gehoert zu den groessten intellektuellen Herausforderungen der Menschheit.

Die physikalischen Prozesse im Universums scheinen fein abgestimmt zu sein, um ideale Voraussetzungen fuer Leben zu schaffen. Eine fundamentale und faszinierende Erkenntnis der modernen Astrophysik ist die Tatsache, dass die chemischen Elemente, aus denen die Erde und das Leben aufgebaut sind, in den Zentren massereicher Sterne produziert wurden. Am Ende ihrer Entwicklung explodieren diese Sterne als sogenannte Supernovae und schleudern dabei die Bausteine der Planeten und des Lebens in das umgebende interstellare Gas, wo sich neue Sterne und nun auch Planeten bilden können. Es gibt inzwischen keinen Zweifel mehr: Alles basiert auf Sternenstaub und die Entstehung der Urbausteine des Lebens ist ein all gegenwärtiger Prozess. Dies, verbunden mit der Entdeckung von tausenden von Planetensystemen um andere Sterne, viele davon in sogenannten habitablen Zonen, macht es wahrscheinlich, dass es Leben auch anderswo im Universum gibt.

Aber wie koennen wir Leben im All nachweisen? Und welche kulturellen, ethischen und gesellschaftlichen Konsequenzen haette die Entdeckung von exosolaren Leben fuer unser Weltbild und unsere Vorstellung über die Stellung des Menschen im All? Und wie verändert dies die Beziehung des Menschen zur Erde?

Der Vortrag fasst unsere bisherigen Erkenntnisse zusammen und diskutiert aktuelle Forschungsprojekte auf der Suche nach Antworten auf die vielen offenen und spannenden Fragen.

Plenarvortrag PV XIII Do 9:00 Plenarsaal

Climate change and gravity waves in the middle atmosphere — •Franz-Josef Lübken — Leibniz-Institute of Atmospheric Physics, Schloss-Str. 6, Kühlungsborn, Germany

The middle atmosphere (MA, here roughly 20-120 km) exhibits some unexpected features. For example, the summer mesopause region (at roughly 80-90 km) at middle and polar latitudes is much colder in summer compared to winter. It cools down to approximately 130 Kelvin which is the coldest place in the Earth's atmosphere and promotes the formation of ice particles known as noctilucent clouds (NLC). The peculiar thermal structure is mainly caused by gravity waves and tides which propagate from lower altitudes to the middle atmosphere where they break and lead to a circulation with upward/downward winds in the summer/winter hemisphere accompanied by cooling/heating, respectively. In this presentation some new results regarding observations of gravity waves by ground based lidar will be discussed.

The increase of greenhouse gases leads to a cooling of the MA by up to -2 K/decade which is significantly stronger in magnitude compared to the warming in the troposphere. NLC are proposed to be sensitive indicators for trends in the middle atmosphere. We have recently shown that an increase of carbon dioxide alone surprisingly does not(!) lead to an increase of NLC brightness and occurrence frequency. Instead, an enhancement of methane (which is chemically converted to water vapor in the middle atmosphere) causes significant changes of NLC parameters on centennial timescales. The physical background of these results are explained in the presentation.

Plenarvortrag PV XIV Do 9:45 Plenarsaal

Tailoring ultrafast light pulses in waveguides — •Carsten Fallnich — Institute of Applied Physics, University of Muenster, 48149 Muenster, Germany — MESA+ Institute of Nanotechnology, University of Twente, Enschede 7500 AE, The Netherlands

Waveguide-based optical systems are of interest for many applications related to a compact size and robustness, and third-order nonlinearities can be exploited at modest power levels, amongst others for parametric frequency conversion via four-wave mixing or intermodal cross-phase

modulation. But to flexibly tailor the waveguide-internal electrical field of ultrafast light pulses, access to the amplitudes and phases of the spectral components is needed, such that waveguide-based systems seem to be at a disadvantage compared to the common use of free-space arrangements with spatial light modulators. In order to introduce richer light tailoring functionalities into waveguide-based systems, e.g., for improved exploitation of nonlinear effects, the design of the waveguides has to be reconsidered in respect of the waveguide dispersion, the number of guided spatial modes, as well as the injected light composition in frequency, time, and space. Taking such aspects into account, the talk will show recent experimental as well as theoretical advances on waveguide optics ranging from broadband supercontinuum generation, over rapidly tunable ultrafast parametric oscillators, up to ultrafast optical switching and spatio-temporal mode control.

Mittagsvortrag PV XV Do 13:00 HS 12

Vom Doktorhut zum Vorstandshemd: Physiker können auch Unternehmer — •Wilhelm Kaenders — Gründer und Vorstand TOPTICA Photonics AG, Lochhamer Schlag 19, 82166 Graefelfing

Der promovierte Physiker leitet mit einem Partner seit zwanzig Jahren ein mittleres Unternehmen und vertreibt Lasergeräte für die Forschung und industrielle Anwendung. Dass gerade die Physik der kalten Atome en vogue war oder dass er sein Unternehmen in Boomzeiten der New Economy startete, begünstigten den anfänglichen Geschäftserfolg. Die TOPTICA Photonics AG (230 Mitarbeiter) nutzt die dt. Forschungslandschaft für Laserpräzisionstechnologie in globalen Märkten. Angetrieben durch die Physik-Nobelpreise hat sich ein weltweiter Markt entwickelt: Ionen- und Atomfallen, interferierende Atomwolken und Quantencomputer werden weltweit mit TOPTICA-Produkten erzeugt und gebaut. Wo zuerst Frequenzen "geteilt" wurden, werden sie heute zunehmend mit TOPTICA-Lasern "gekämmt". Unsere Laser sind beteiligt an der Spektroskopie von Antimaterie, aber auch der Suche nach der Supersymmetrie. Die Firma erzielt Wachstumsraten von etwa 15%/Jahr und beschäftigt alleine in Deutschland 65 Physiker.

Mittagsvortrag PV XVI Do 13:00 HS 4

Forschungsförderung durch die DFG – ein Überblick — •Wolfgang Müssel — Deutsche Forschungsgemeinschaft (DFG)

Die zentrale Aufgabe der Deutschen Forschungsgemeinschaft (DFG) ist die Auswahl und Finanzierung der besten Forschungsvorhaben an deutschen Hochschulen und Forschungsinstituten, wobei die Förderung sowohl im Rahmen von Einzelprojekten als auch für gemeinsame und koordinierte Forschungsprogramme erfolgen kann. In diesem Vortrag soll ein Überblick über die Fördermöglichkeiten der DFG in der Physik gegeben werden. Neben einer Übersicht der verschiedenen Förderinstrumente werden auch die Antrags- und Entscheidungsverfahren der DFG vorgestellt.

Mittagsvortrag PV XVII Do 13:30 HS 4

ErUM-Pro: Projektförderung im BMBF-Rahmenprogramm „Erforschung von Universum und Materie“ — •Hanna Mahlke — Projektträger DESY

Sie haben laufende Projekte im Rahmen der Projektförderung des BMBF an Großforschungsanlagen oder wollen in Zukunft ein Projekt beantragen? Der Projektträger DESY informiert über die Fördermöglichkeiten im BMBF-Rahmenprogramm ErUM (Erforschung von Universum und Materie) und gibt Tipps zur Antragstellung sowie für laufende und abgeschlossene Projekte.

Plenarvortrag PV XVIII Fr 9:00 Plenarsaal

Neutron Star Mass and Radius Measurements and Implications for the Dense Matter Equation of State — •James Lattimer — Stony Brook University, Stony Brook, NY, USA

The recent detection of gravitational waves and electromagnetic emissions from the binary neutron star merger GW170817 resulted in stringent limits concerning the masses and radii of the coalescing stars. These estimates complement onging measurements from pulsar timing and X-ray observations as well as theoretical limits stemming from neutron matter theory and condensed matter and nuclear experiments. There are important ramifications for the dense matter equation of state originating not only from these mass and radius measuremnts, but also from new lower and upper bounds to the maximum mass of neutron stars that can be inferred from observations. Additional gravitational wave events together with results from the NICER X-ray mission that are expected in the near future will continue the excitement in this topic.

Plenarvortrag PV XIX Fr 9:45 Plenarsaal

Kinetic turbulence simulations for space and laboratory plasmas — •Daniel Told, Daniel Grošelj, Alejandro Bañón Navarro, and Frank Jenko — Max Planck Institute for Plasma Physics, Boltzmannstr. 2, D-85748 Garching, Germany

Many natural plasmas such as the interstellar medium, the solar wind, or hot accretion disks are known to exist in a strongly turbulent state. Key physical processes occurring in these systems such as particle acceleration, reconnection and turbulent heating can only be understood by means of kinetic modeling and careful validation against observations.

Computational modeling via fully kinetic simulations is very expensive, and despite routinely relying on the use of a reduced ion/electron mass ratio, 3-dimensional turbulence simulations have only become feasible very recently.

To alleviate this problem, various reduced models such as hybrid fluid/kinetic models as well as gyrokinetics and further reductions have been developed. We will discuss the key physics observed in fully and reduced-kinetic simulations, as well as the benefits and limitations of model reductions, along with directions for future work.

Beyond the purely computational work, it is crucial to demonstrate the reliability of any kind of model by validating its results against observations and/or laboratory measurements. Examples of successful validation exercises will be shown.