

Plenary Talk PV I Mon 11:30 ZHG011
The solar magnetic field and variability — ●SAMI K. SOLANKI — Max Planck Institute for Solar System Research, Göttingen

The solar magnetic field influences many aspects of the Sun, including its activity and its brightness variability. Solar activity manifests itself in numerous ways, such as the presence of sunspots and faculae on the solar surface, of a hot corona, bright flares and mighty coronal mass ejections. The variations in solar brightness are important for the atmosphere of the Earth, which receives almost all of its energy from the Sun and which is consequently influenced by changes in this irradiation. In recent years there has been considerable progress in both the theoretical and observational study of solar magnetism and variability, not least thanks to work that has been done at the Max Planck Institute for Solar System Research. The talk will present some of the highlights of this research, including realistic radiation-MHD simulations of solar magnetic features in the solar atmosphere, observations of the solar magnetic field with novel instrumentation and from unusual vantage points, as well as studies of archives of historic and prehistoric solar variability.

Plenary Talk PV II Mon 12:15 ZHG011
The Role of Applications in the History of Quantum Mechanics — ●CHRISTIAN JOAS — Niels Bohr Archive, Copenhagen — Department of Science Education, University of Copenhagen

In my talk, I will challenge the conventional division between foundations and applications in physics and explore how physicists throughout the history of quantum mechanics have applied the theory and extended its scope beyond its original domains. Rather than merely solving specific problems, many applications of quantum mechanics to new domains (scattering, complex atoms, molecules, solids, nuclei) were drivers of conceptual innovation and played pivotal roles in shaping both the theory and its interpretation. I will illustrate this with a few examples from the early history of quantum mechanics. Without these applications, which are often dismissed as merely derivative extensions, the textbooks of quantum mechanics would look very different. There is untapped potential for physicists, historians, and philosophers to delve deeper into the applications of quantum mechanics. This perspective not only enriches historical studies and broadens the focus to include developments in fields that conventional wisdom considers less fundamental, but also provides tools for understanding contemporary developments in fields like quantum information and quantum computing, where practical applications carry considerable weight.

Plenary Talk PV III Tue 9:00 ZHG011
The Dawn of Multimessenger Astrophysics — ●ANNA FRANCKOWIAK — Ruhr-Universität Bochum, Germany

The recent discoveries of high-energy astrophysical neutrinos and gravitational waves have opened new windows of exploration to the Universe. Neutrinos can escape dense environments from where photons can not reach us and travel undeflected through the Universe. In combination with measurements of electromagnetic radiation, neutrinos can help to solve long-standing problems in astrophysics and probe physics in extreme environment that otherwise are hardly accessible to laboratory experiments. They are key to unraveling the origin of cosmic rays.

Recent multimessenger observations reveal TeV-PeV neutrino production in interactions of cosmic rays in our own galaxy and in distant galaxies when massive stars explode or the central supermassive black hole accretes large amounts of matter. This talk will summarize recent discoveries and give an outlook on new experiments and possible future breakthroughs.

Plenary Talk PV IV Tue 9:45 ZHG011
Equipping the Next Generation: Quantum Education and Workforce Development in the U.S. — ●HEATHER LEWANDOWSKI — JILA and Department of Physics, University of Colorado, Boulder, USA

Quantum sensing, networking and communication, and computing have garnered significant attention due to their transformative potential and advantages over traditional technologies. The second quantum revolution has not only advanced technological frontiers, but also created a growing need for STEM graduates equipped with quantum-specific expertise. Preparing students to be successful in this rapidly evolving field requires empowering them with a range of technical and professional skills and knowledge.

I will present findings from extensive studies of both the landscape of quantum education in the U.S. and insights from the quantum industry. These findings include an overview of existing programs (e.g., certificates, minors, degrees) and courses across the U.S., as well as an analysis of key industry activities, job profiles, and the skillsets valued across roles. Additionally, I will highlight our local initiatives to bridge the gap between education and industry needs. These efforts include experimental training embedded in lab courses and a novel, two-semester, project-based course. In this course, student teams collaborate on industry-sponsored projects to develop practical skills in areas such as nanofabrication and servo electronics, alongside essential professional competencies like project management, communication, and budget planning.

Plenary Talk PV V Wed 9:00 ZHG011
Quantum field theory, quantum reference frames and the type of local algebras — ●CHRISTOPHER FEWSTER — Department of Mathematics, University of York, York, UK

Algebraic quantum field theory (AQFT) assigns a von Neumann algebra to each bounded spacetime region, generated by the associated observables. Under reasonable assumptions, these algebras are all isomorphic to a specific von Neumann algebra of type III₁ [1], leading to significant physical differences between quantum field theory and quantum mechanics. Recently, Chandrasekaran, Longo, Penington and Witten (CLPW) [2] have argued that the inclusion of gravity can require the introduction of an “observer”, and that the physical observables constitute an algebra of type II. This talk will explain these developments and their significance, without assuming familiarity with von Neumann algebras or AQFT. I will focus on the CLPW model and an operationally motivated generalisation [3], which reinterprets the observer as a quantum reference frame (QRF), and sheds light on the roles of gravity and the QRF/observer.

[1] D. Buchholz, C. D’Antoni, and K. Fredenhagen, *The Universal Structure of Local Algebras*, *Comm. Math. Phys.* 111 (1987) 123-135.

[2] V. Chandrasekaran, R. Longo, G. Penington, and E. Witten, *An algebra of observables for de Sitter space*. *JHEP* 2023(2) 1-56.

[3] C.J. Fewster, D.W. Janssen, L.D. Loveridge, K. Rejzner and J. Waldron, *Quantum Reference Frames, Measurement Schemes and the Type of Local Algebras in Quantum Field Theory*, *Comm. Math. Phys.* 406 (2025) 19:1-87.

Plenary Talk PV VI Wed 9:45 ZHG011
Image-guided radiotherapy for cancer treatment: recent developments and future innovations — ●DANIELA THORWARTH — Section for Biomedical Physics, Department of Radiation Oncology, University of Tübingen, Germany

Cancer treatment with radiation therapy has experienced significant innovations in the last two decades, leading to highly precise and personalized treatments today, allowing to deposit high energy doses in the tumor while sparing critical healthy tissue as much as possible.

Modern high-precision radiation treatments are delivered using image-guided radiotherapy systems. During this presentation, an overview of recently developed hybrid systems for online image-guided radiotherapy will be given, including CT-adaptive radiotherapy, magnetic resonance-guided radiotherapy and also image-guided particle therapy approaches. In addition to an introduction to the technical and physical realization of the hardware systems, potential and challenges related to radiation dose deposition in tissue, dosimetry and assessment of biological tissue properties will be highlighted. Moreover, current and future innovations aiming at real-time adaptation of radiotherapy treatment beams for moving targets will be discussed.

Lunch Talk PV VII Wed 12:30 ZHG007
DFG funding opportunities for Early Career Researchers — ●MANUEL KRÄMER — Deutsche Forschungsgemeinschaft e.V., Kennedyallee 40, 53175 Bonn

The German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) is the central organization for third-party funding of basic research in Germany. It offers a broad spectrum of funding opportunities from individual grants to larger coordinated programmes.

This talk will give an overview of the funding programmes that are tailored to Early Career Researchers. These funding schemes facilitate, for example, research stays abroad or the establishment of a junior research group. I will focus the talk on the Walter Benjamin Programme, the Emmy Noether Programme as well as the Heisenberg Programme and I will explain the different scopes and aims of these programmes.

Plenary Talk PV VIII Thu 9:00 ZHG011
The ESA Euclid mission: a journey to understand the dark side of the universe — ●GUADALUPE CAÑAS-HERRERA — European Space Agency, Noordwijk, the Netherlands

Euclid is a medium-class space mission led by ESA, with contributions from NASA, selected in October 2011 and successfully launched in July 2023. Its primary objective is to shed light on the nature of Dark Matter, which constitutes about 25% of the Universe's energy content, and Dark Energy, which makes up approximately 70% and is believed to drive the current accelerated expansion of the Universe. To achieve these goals, Euclid is creating the most comprehensive and precise 3D map of the Universe by surveying one-third of the sky. Understanding Dark Matter and Dark Energy requires performing a demanding statistical analysis to compare Euclid's data to cosmological models using two complementary probes: weak gravitational lensing and galaxy clustering. In this talk, I will provide an update on the Euclid mission since its launch, discuss its key science objectives, and explain how we construct theoretical predictions for its primary observables to achieve Euclid's ultimate goal: understand the dark Universe. I will also present the latest forecasts on cosmological parameters and extended models preparing ahead of the internal Euclid first cosmological data release.

Plenary Talk PV IX Thu 9:45 ZHG011
Negative hydrogen ion sources - utilizing low temperature plasmas in ITER's neutral beam systems — ●URSEL FANTZ and IPP NNBI TEAM — Max-Planck-Institut für Plasmaphysik

Large and powerful negative hydrogen ion sources (H⁻, D⁻) will be used at the international fusion experiment ITER to deliver after acceleration and neutralization energetic beams of neutral particles (H, D) to the tokamak. These beams will be used for heating and current drive, but also for plasma diagnostics. The inductively coupled plasma source (ICP) operates at low gas pressure (0.3 Pa) using a frequency of 1 MHz and a total power of 800 kW to illuminate an area of 1 x 2m. The ion source relies on surface conversion of hydrogen atoms and positive hydrogen ions into negative ions at a low work function converter surface, for which caesium is injected into the low temperature plasma. The latter introduces temporal and, together with the magnetic filter field, a spatial component into the otherwise stable plasma, which adds to the challenge of generating up to 60 A of homogeneously extracted negative ions for up to an hour. The diagnostics and modelling of the plasma and the extraction provide access to exciting aspects of plasma physics. The development of such negative ion sources follows the European step-ladder approach to meet the ITER target parameters. The development phases, the status and the challenges, as well as the

way forward, are discussed.

Lunch Talk PV X Thu 12:30 ZHG007

Book Launch – Physik: Erkenntnisse und Perspektiven (in German) — JOACHIM ULLRICH¹, ULRICH BLEYER¹, ●SARAH KÖSTER², ●CLAUS LÄMMERZAHL³, DIETER MESCHEDÉ⁴ und LUTZ SCHRÖTER¹ — ¹Deutsche Physikalische Gesellschaft e. V., Bad Honnef — ²Universität Göttingen, Institut für Röntgenphysik, Göttingen — ³Universität Bremen, Weltraumwissenschaft ZARM, Bremen — ⁴Universität Bonn, Institut für Angewandte Physik, Bonn

Join us for the book launch of the new DPG publication. You will have the opportunity to pick up a free copy – while stocks last!

The title “Physik: Erkenntnisse und Perspektiven” (Physics: Insights and Perspectives) refers to a publication, which was produced on a voluntary basis by almost 200 authors. It provides a detailed exploration of the fundamentals of physics, current research and future developments. The book offers readers an engaging and inspiring insight into the world of physics! The publication is also available at www.physik-erkenntnisse-perspektiven.de – along with exclusive video interviews. Printed copies can also be ordered by covering the shipping costs.

Evening Talk PV XI Thu 19:30 Paulinerkirche
Von Quanten und Kollisionen – Göttingen trifft Genf — ●STEFFEN KORN — II. Physikalisches Institut - Georg-August-Universität Göttingen

Der Vortrag nimmt die Zuhörer mit auf eine faszinierende Reise durch die Geschichte und Gegenwart der Quantenphysik. Beginnend mit den revolutionären Entdeckungen des frühen 20. Jahrhunderts, als Physiker in Göttingen die Grundsteine der Quantenmechanik legten, beleuchtet der Vortrag Schlüsselkonzepte wie den Welle-Teilchen-Dualismus und die Quantenverschränkung. Göttingen, einst Epizentrum dieser wissenschaftlichen Revolution, wurde in den 1920er Jahren zum Ausgangspunkt für eine Entwicklung, die bis in die moderne Teilchenphysik reicht. Der Bogen spannt sich von den Arbeiten von Born und Planck, getrieben von dem Bedürfnis zu verstehen, "Was die Welt im Innersten zusammenhält", bis hin zu den monumentalen Experimenten am CERN in Genf. Dort, am ATLAS-Experiment des Large Hadron Collider (LHC), prallen Teilchen mit ungeheurer Energie aufeinander, um Antworten auf die grundlegendsten Fragen des Universums zu finden. Wie die Erkenntnisse der Quantenmechanik bis heute die Suche nach neuen Teilchen und Kräften im Universum prägen, wird anschaulich erklärt und in den Kontext aktueller Forschung gestellt. Freuen Sie sich auf eine spannende Mischung aus historischer Wissenschaftsgeschichte, physikalischen Einsichten und modernen Entdeckungen - von Göttingens Quantenpionieren bis zu den Teilchenkollisionen der Gegenwart.