Plenarvortrag PV I Mo 11:30 HG X und HG Aula
From Disks to Planets: The Formation of Planetary Systems — •Thomas Henning — Max Planck Institute for Astronomy, Königstuhl 17, D-69117 Heidelberg, Germany

More than 400 extrasolar planets have been detected until today. These "new worlds" are characterized by a large range in orbital and strucural parameters, demonstrating the diversity of planetary system architectures. At the same time, observations at infrared and millimetre wavelengths have revealed the presence of protoplanetary disks around young stars and allowed the determination of their physical and chemical composition. The lecture will summarize our knowledge of planetary system formation in these disk, bridging the gap between their circumstellar micron-sized dust particles and planetary bodies of many 1000 kilometers in size.

Plenarvortrag PV II Di 11:00 HG X und HG Aula
The renormalization group - from peV to TeV, and from physics to mathematics — •Manfred Salmhofer — Institut für theoretische Physik, Universität Heidelberg

Since its inception in the context of quantum field theory and critical phenomena, the renormalization group has gradually developed into a universal tool that applies to theories at all energy scales, from ultracold atomic gases to high energy physics. Besides being successful in practice, it also has the virtue of allowing for mathematical proofs and indeed, its applications now range far into mathematics as well. In this talk I will give a survey of the method, its applications, and some recent developments.

Plenarvortrag PV III Di 11:45 HG X und HG Aula
Why go beyond the Standard Model? — •Hitoshi Murayama — IPMU, Tokyo — Berkeley

We are all excited that the LHC will be able to "complete" the standard model by discovering the Higgs boson. However, I'd like to argue that the discovery of Higgs would not actually "complete" it because it leaves so many questions unanswered. Based on the analogy to the superconductivity in the laboratory, new physics beyond the standard model must exist not too far above the scale of the Higgs boson condensate. In addition, recent non-accelerator data clearly point to physics beyond the standard model: dark matter, dark energy, neutrino mass, baryon asymmetry, and density fluctuation. I will discuss some of the possibilities that may be tested in the near future.

Abendvortrag PV IV Di 20:00 HG X und HG Aula
Max-von-Laue-Lecture: Working Toward a World Without Nuclear Weapons — •Sidney Drell — Professor and Deputy Director, Emeritus, at SLAC National Accelerator Laboratory, and Senior Fellow at the Hoover Institution at Stanford University, Stanford, CA 94305, USA

During the Cold War, the United States and the former Soviet Union relied on nuclear deterrence to navigate successfully through those perilous years. In today's world, with the accelerating spread of nuclear material, know-how, and weapons, we are facing an increasing danger that nuclear weapons, the deadliest weapons ever invented, may be acquired by ruthless national leaders or suicidal terrorists. Under these circumstances, relying on thousands of nuclear weapons for deterrence is becoming increasingly hazardous and decreasingly effective. What will it take to rekindle the vision of a world free of nuclear weapons that President Reagan and General Secretary Gorbachev brought to their remarkable summit at Reykjavik in 1986? Can a world-wide consensus be forged on a series of practical steps to escape the nuclear deterrence trap?

A world without nuclear weapons is a goal worth pursuing in itself. Beyond that, and most importantly, endeavoring to achieve that goal will also invigorate efforts to prevent the proliferation of nuclear weapons. But the road will not be an easy one. Real and serious obstacles lie ahead. Nations that have privileged positions in the international system by virtue of being nuclear weapons states will be reluctant to give up that status, or even to accept parity in nuclear weapons as stockpiles are reduced to low levels. Nations that fear the conventionally-armed military might of other nations will be reluctant to give up the option of a nuclear "equalizer." Factors such as these, rather than technical problems, are the main reasons why reaching zero will be so difficult. And these are problems that can be overcome. No law of nature stands in the way.

Preisträgervortrag PV V Mi 12:10 Oper
Dark Matters — •Simon White — Max Planck Institute for Astrophysics, Garching, Germany — Träger des Max-Born-Preises

Dark matter appears to dominate the matter content of our Universe and to have driven the formation of all structure within it. Although the nature of dark matter remains unknown, it is plausibly a new type of neutral elementary particle, perhaps a neutralino. Astronomical data constrain the spatial distribution of the dark matter, both at the recombination epoch (t=380,000 yr) and today (t=13.7 Gyr). In the present Universe, gravitationally bound dark matter halos are the basic units of nonlinear structure, and galaxies have condensed at their centres. I will show how these halos have grown out of the near-uniform matter distribution present at early times, and I will explore how the growth process is reflected in their current structure. In particular, I will discuss how the fine-scale structure of dark halos affects attempts to detect the dark matter directly in terrestrial laboratories or indirectly through its annihilation radiation.

Abendvortrag PV VI Mi 20:00 HG X und HG Aula
Mikro- trifft Makrokosmos – mit dem Large Hadron Collider auf der Suche nach Antworten auf fundamentale Fragen — •Norbert Wermes — Universität Bonn

Plenarvortrag PV VII Do 11:00 HG X und HG Aula
Präzisionsexperimente in Teilchen- und Astrophysik mit kalten und ultrakalten Neutronen — •Stephan Paul — Physik Department - TU München, Garching, Germany

In einem neuen Schwerpunktsprogramm stehen Präzisionsexperimente zur Teilchen- und Astrophysik mit Neutronen im Mittelpunkt. Neue hochintensive Quellen für ultrakalte Neutronen sowie für Neutronenzerfallsprodukte werden in den kommenden Jahren in Betrieb genommen, wobei die erwarteten Quellstärken die der heutigen Installationen um ein bis mehrere Größenordnungen übertreffen. Eine Reihe wissenschaftlicher Programme wird diese neuen Technologien nutzen und einige der ungelösten Fragen moderner Wissenschaft angehen: die Natur der Fundamentalkräfte und der zu Grunde liegenden Symmetrien ebenso wie z.B. die Eigenschaften der Gravitation bei sehr kleinen Abständen. Neue Einrichtungen und technische Entwicklungen öffnen das Fenster für signifikante Verbesserungen in der Präzision um 1-2 Größenordnungen. Dies wiederum erlaubt, die wissenschaftlichen Fragen in einer zu LHC Experimenten komplementären oder sogar einmaligen Weise zu studieren. Vier Hauptstoßlinien der Forschung werden vorgestellt: a) CP Verletzung und Teilchenphysik im frühen Universum b) die Struktur der schwachen Wechselwirkung und mögliche Erweiterungen des Standardmodells c) Gravitation bei kleinen Abständen sowie d) die Ladungsquantisierung und die Frage nach der elektrischen Neutralität des Neutrons.

Plenarvortrag PV VIII Do 11:45 HG X und HG Aula
Hochenergiekosmos: Experimente, Ergebnisse, Perspektiven — •Karl-Heinz Kampert — Universität Wuppertal, Fachbereich C - Physik

Observatorien der Astroteilchenphysik haben uns in jüngster Zeit neue und interessante Einblicke in das hochenergetische, nicht-thermische Universum ermöglicht. Ein zentrales Ziel der bodengebundenen, ballon- und satellitengestützten Messungen der Teilchen- und Gamma-Strahlung ist die Suche nach den Quellen der hochenergetischen kosmischen Strahlung, deren Energie bis über 10^8 TeV reicht. Die Anzahl der nachgewiesenen Gamma-Quellen im TeV-Bereich bewegt sich mittlerweile bei stattlichen Hundert. Daneben gibt es auch erste Hinweise auf den extragalaktischen Ursprung der höchstenergetischen geladenen Teilchen. Mit Neutrinoteleskopen werden Teilcheneigenschaften des Neutrinos, Obergrenzen oder vielleicht sogar Hinweise zur Natur der dunklen Materie bestimmt. Die Hochenergiedetektoren erlauben auch den Test fundamentaler Prinzipien der Physik; so wurde etwa der Gültigkeitsbereich der Lorentz-Invarianz mit bislang unerreichter Präzision geprüft. Der Vortrag gibt einen Überblick über den Stand dieses noch jungen Forschungsgebietes und diskutiert die Pläne und Perspektiven der kommenden Jahre.

Plenarvortrag PV IX Fr 11:00 HG X und HG Aula
Going to extremes: Fundamental physics and radio astronomy — •Michael Kramer — Max-Planck Institut fuer Radioastronomie, Bonn, Germany

In order to test our understanding of the physical world and the fundamental laws that govern it, we need to go to the extremes of the observable Universe. Exploring the fundamental forces under extreme

conditions is possible - often with extreme precision - using radio astronomical observations. While the received photons are of low energy, they are often the result of the most energetic particles in the cosmos. They carry information of the most extreme objects in the Universe, e.g. neutron stars, and their properties, namely polarisation and arrival times, reveal unique information about the only two fundamental long-range forces, electromagnetism and gravity. I will present examples of how aspects of gravitation in particular can be investigated along with addressing other fundamental questions in physics and astrophysics.

Plenarvortrag PV X Fr 11:45 HG X und HG Aula

What is wrong with the Sun? The Present and Future of Solar Physics — •Sami K. Solanki — Max-Planck-Institut für Sonnensystemforschung

The Sun, usually displaying a range of dynamic and energetic phenomena driven by its complex magnetic field, has gone into an unexpected decline, producing a much longer and quieter minimum of activity than at any time in the last century. This unusual minimum was not predicted and has starkly reminded us just how little we know about the nearest star. The Sun is a giant laboratory at our astronomical doorstep, providing insight into myriad processes acting throughout the universe. In recent years telescopes in space and on the ground have unveiled many of the Sun's secrets. For example, we have learnt that it is highly dynamic, producing spectacular displays that can affect technical systems on Earth and in space. Yet a number of fundamental aspects remain in the dark, including the causes of the current unusual minimum, awaiting new observational probes. The latest probe of the Sun has been the german-led SUNRISE observatory that flew in June 2009, hanging from a stratospheric balloon at 37km above sea level. It has revealed the Sun's surface with higher fidelity than ever before, leading to new insights into the fine structure and dynamics of the Sun's atmosphere and in particular of its magnetic field. On the horizon are other exciting missions, complementary in their aims and instrumentation. They include the Solar Dynamics Observatory (NASA), Solar Orbiter (ESA), Solar Probe (NASA) and Solar C (JAXA). They promise to open a new golden age of solar physics.