Münchner Physik-Kolloquium

Sommer 2018

Vortragsprogramm mit Abstracts

Beginn der Veranstaltungen ist um 17:15 Uhr, sofern keine besondere Anfangszeit vermerkt ist. Sämtliche Vorträge sind öffentlich bei freiem Eintritt. Die Art der Nachsitzung wird in der Veranstaltung bekannt gegeben.

LMU bezeichnet Vorträge im *Hörsaal H 030 der Fakultät für Physik / LMU* in der Schellingstraße 4, München.

TUM bezeichnet Vorträge im *Hörsaal 2 des Physik-Departments / TUM* am Forschungsgelände, James-Franck-Straße 1 in Garching. Das Forschungsgelände kann mit der U6 (bis Garching-Forschungszentrum) erreicht werden.

Nuclear physics as precision science

Prof. Dr. Ulf-G. Meißner TUM **2018-04-09**

Universität Bonn and Forschungszentrum Jülich

Theoretical nuclear physics has entered a new era. Using the powerful machinery of chiral effective Lagrangians, the forces between two, three and four nucleons can now be calculated with unprecedented precision and with reliable uncertainties. Furthermore, Monte Carlo methods can be adopted to serve as a new and powerful approach to exactly solve nuclear structure and reactions. I discuss the foundations of these new methods and provide a variety of intriguing examples. Variations of the fundamental constants of Nature can also be investigated and the consequences for the element generation in the Big Bang and in stars are considered. This sheds new light on our anthropic view of the Universe.

Probing the unfolding/refolding dynamics of individual proteins with AFM by lever

Dr. Devin Edwards LMU **2018-04-16**

JILA, National Institute of Standards and Technology and University of Colorado, Boulder, USA

Single-molecule force spectroscopy (SMFS) is an important tool for characterizing the unfolding/refolding dynamics of individual molecules. Here, we apply custom-modified atomic force microscopy (AFM) cantilevers to repeatedly unfold and refold the protein α3D at equilibrium. Observing a single protein unfold and refold hundreds of times enables the discovery of rarely populated intermediates and the reconstruction of the 1-D energy landscape. However, such equilibrium experiments have traditionally been inaccessible with AFM-based SMFS due to limited long-term stability. To overcome these limitations, we developed focused-ion-beam modified AFM cantilevers that achieve an unparalleled combination of force stability, force precision, and temporal resolution. This enhanced data quality allowed identification of an unfolding intermediate and transition path times that were previous.

The response of the global stratospheric circulation to climate change

Prof. Dr. Hella Garny TUM **2018-04-23**

Meteorologisches Institut, Ludwig-Maximilians-Universität München

The role of the stratosphere in the climate system is increasingly being appreciated, and it is known that the circulation of the stratosphere can significantly influence surface climate and weather. The fate of the large-scale circulation of the stratosphere in a changing climate is a much discussed topic in the last years. Progress has been made on the understanding of the mechanisms of the general acceleration of the circulation in response to climate change as simulated

Shedding light on the dark cosmos through gravitational lensing

Prof. Dr. Sherry Suyu LMU **2018-04-30**
Technische Universität München and MPI für Astrophysik, Garching

Strong gravitational lenses with measured time delays between the multiple images can be used to determine the Hubble constant that sets the expansion rate of the Universe. Measuring the Hubble constant is crucial for inferring properties of dark energy, spatial curvature of the Universe and neutrino physics. I will describe techniques for measuring the Hubble constant from lensing with a realistic account of systematic uncertainties. A program initiated to measure the Hubble constant to $< 3.5\,\%$ in precision from strong lenses is in progress. Search is underway to find new lenses in imaging surveys. An exciting discovery of the first strongly lensed supernova offered a rare opportunity to perform a true blind test of our modeling techniques. I will show the bright prospects of gravitational lens time delays as an independent and competitive cosmological probe.

Topological photonics

Prof. Dr. Alexander Szameit TUM **2018-05-07**
Universität Rostock

The recent experiments on photonic topological insulators signified a new direction. We present the progress in this area, including also the first observation of topological Anderson insulators, with an emphasis on universal ideas common to optics, cold atoms and quantum systems.

Artificial photosynthesis with functional semiconductors and nanosystems

Prof. Dr. Ian D. Sharp LMU **2018-05-14**
Walter-Schottky-Institut and Physik-Department, Technische Universität München

The capture of sunlight and its direct conversion to chemical fuels in artificial photosystems provides a promising route for sustainably meeting future energy demands. While functional systems comprising semiconductors coupled to catalysts have been demonstrated, progress has been hindered by a lack of materials that are both stable and efficient. Here, opportunities for creating new functionality via nanoscale engineering of semiconductor/catalyst interfaces, the development of new transition metal-based semiconductors, and discovery of basic mechanisms of energy conversion and efficiency loss will be discussed.

Emil J. Gumbel: Weimar pacifist and founder of the statistical theory of extremes

Prof. Dr. Matthias Scherer TUM **2018-05-28**
Fakultät für Mathematik, Technische Universität München

GUMBEL (⋆1891 Munich; †1966 New York). Eponym in mathematical statistics for the first type extreme value distribution and the copula that is both of extreme value and Archimedean kind. Hydrologists appreciate Emil J. Gumbel as a pioneer in promoting non-normal distributions in their field. Historians rank him among the most influential German intellectuals of the Weimar Republic. He disclosed secret societies that destabilized the Weimar Republic and used statistical methods to document political murders and to reveal a biased legal system. Born in Munich, he later became the first professor who lost his position for his political ideals and his stand against the national socialistic party, his books were banned and burned. Stripped of his nationality in 1933 he immigrated to France. In 1940 he escaped to the USA and settled in New York, where he was appointed Adjunct Professor at Columbia University in 1953. With this talk we commemorate the political life and the scientific contribution of the Munich-born mathematician Emil J. Gumbel and we recall the early years of the statistical theory of extremes.

High-contrast observations of extrasolar planets and protoplanetary disks

Dr. Sascha Quanz LMU **2018-06-04**
ETH Zürich, Switzerland

All major ground-based astronomical observatories are equipped with sophisticated, adaptive optics assisted high-contrast imaging instruments working at optical and/or near-infrared wavelengths. One of the key science drivers for these developments is the direct detection of extrasolar planets and circumstellar disks, the birthplaces of planetary systems. In this talk I will motivate the scientific interest for this research field, explain the main challenges for high-contrast imaging observations and how they can be overcome, and give a broad overview about the key scientific results obtained over the last years. I will conclude with an outlook what we can expect in the future with high-contrast imaging instruments for the next generation of 30-40 m telescopes such as Europe's Extremely Large Telescope.

When physics meets medicine: Targeted radionuclide therapy of cancer for precisi

Prof. Dr. Richard Baum TUM **2018-06-11**

Zentralklinik Bad Berka

Precision medicine is defined as treatments targeted to the needs of individual patients on the basis of genetic, biomarker, phenotypic, or psychosocial characteristics that distinguish a given patient from other patients with similar clinical presentations. Inherent in this definition is the goal of improving clinical outcomes for individual patients and minimizing unnecessary side effects for those less likely to have a response to a particular treatment.

Over the past decade, the use of Gallium-68 labeled somatostatin receptor (SSTR) PET/CT imaging followed by Lutetium-177 labeled SSTR-agonist (DOTATATE or DOTATOC) for peptide receptor radionuclide therapy (PRRT) has demonstrated remarkable success in the management of neuroendocrine neoplasms. Highly promising advances are being made in the management of advanced stage, progressive treatment refractory prostate cancer by applying the principle of theranostics (integration of diagnostics and therapeutics in the individualized management of disease).

Rapid progress is being made in the development of several radiometals potentially useful for theranostics. Matched pairs of radionuclides are being developed from the same element with comparable half-lives, to allow preparation of chemically identical radiopharmaceuticals for diagnostic and therapeutic purposes.

From dust storms on Mars to streaming in protoplanetary disks

Prof. Dr. Gerhard Wurm LMU **2018-06-18**

Universität Duisburg-Essen

On Mars dust storms can rage the whole planet and dust devils frequently cross its barren land. The physics is richer though as gas no longer follows the rules we know so well at Mars' low ambient pressure. Gas can creep along surfaces from cold to warm sides, somewhat counterintuitively.

Different story, some not so ordinary interaction between gas and solids might also be important in protoplanetary disks. Here, so called streaming instabilities can concentrate solids to become larger bodies, eventually.

These effects can be studied in laboratory experiments, on ground as well as under microgravity.

High-temperature superconductivity: new insights and perspectives

Prof. Dr. Bernhard Keimer TUM **2018-06-25**

Max-Planck-Institut für Festkörperforschung, Stuttgart

Three decades after the discovery of high-temperature superconductivity, experimental advances yield surprising new insights [1]. Beginning with an elementary introduction to superconductivity, this colloquium will outline our current understanding of this phenomenon. We will then discuss the latest developments, with a focus on electronic collective modes detected by high-resolution neutron and x-ray spectroscopies, and on the discovery of charge order and its interplay with superconductivity. We will also discuss perspectives for controlled manipulation of high-temperature superconductors and other correlated-electron materials at interfaces and in electronic devices.

[1] For recent reviews, see B. Keimer et al., Nature 518, 179 (2015); B. Keimer and J.E. Moore, Nature Physics 13, 1045 (2017).

Deep X: Deep learning with deep knowledge

Prof. Dr. Volker Tresp LMU **2018-07-02**

Ludwig-Maximilians-Universität München and Siemens

We argue that a labeled graph is an appropriate description of world state and world events on a cognitive abstraction level, representing facts as subject-predicate-object triples. A prominent and very successful example is the Google Knowledge Graph, representing on the order of 100B facts. Labeled graphs can be represented as adjacency tensors which can serve as inputs.

PicoPhotonics: Extreme nano-optics with single molecules and monolayers

Prof. Dr. Jeremy F. Baumberg

TUM **2018-07-09**

Cavendish Laboratory, University of Cambridge, UK

Coupling between coinage metal 'plasmonic' nano-components generates strongly red-shifted optical resonances combined with intense local light amplification on the nanoscale. I will show how we now create ultralow volume plasmonic cavities trapping light to $< 1\,\mathrm{nm}^3$, and are routinely able to watch individual molecules and bonds vibrating. Using DNA origami we couple 1–4 dye molecules together optomechanically, and produce strong-light matter coupling that changes their quantum emission properties. We also watch redox chemistry in real time, watching single electrons shuttle in and out of single molecules, as well as 2D materials confined in the same gap. Prospective applications range from (bio)molecular sensing to fundamental science.

Allgemeine Informationen

Das Münchner Physik-Kolloquium ist das Podium der physikalischen Forschung im Münchner Raum. Es wird gemeinsam von den beiden Universitäten und den entsprechenden Max-Planck-Instituten veranstaltet. Die Vorträge berichten über aktuelle Themen der Physik und angrenzender Gebiete und spiegeln den interdisziplinären Charakter der modernen Physik wider.

Die Darstellung wird möglichst allgemeinverständlich gehalten, um auch physikalisch interessierte Zuhörer aus dem industriellen oder schulischen Bereich anzusprechen. Die Vortragenden sind ausgewiesene Fachleute auf dem jeweiligen Gebiet, zum Teil auch neu nach München berufene Wissenschaftler, die sich in diesem Rahmen einer breiteren Öffentlichkeit vorstellen wollen. Das Kolloquium stellt insbesondere für die Studierenden der Physik eine einfache Möglichkeit dar, im Laufe eines Jahres alle wichtigen Arbeitsgebiete der gegenwärtigen physikalischen Forschung kennen zu lernen.

Es ist erklärtes Anliegen des Münchner Physik-Kolloquiums, die räumliche Trennung der Physik in die verschiedenen Forschungsstandorte in München und Garching durch eine gemeinsame Veranstaltung zu überbrücken. Dazu soll auch der alternierende Wechsel des Veranstaltungsorts beitragen.

Student event: Meet the speaker

We invite you to a **student-only** discussion-round with the speakers before each Munich Physics Colloquium talk. *Be curious and feel free to ask any question.*

Venue: Mondays, 16:00 h

TUM Seminar room PH 3076 (upper floor), Physik-Department der TUM, James-Franck-Straße 1, Garching

LMU Room H 522 (5th floor), Fakultät für Physik der LMU, Schellingstraße 4, München

Veranstaltende Einrichtungen

Max-Planck-Institute physikalischer Arbeitsrichtung
München / Garching

Technische Universität München
Physik-Department, James-Franck-Straße 1,
85748 Garching
TUM-Koordinatoren:
Prof. J. Finley, Prof. K. Krischer

Ludwig-Maximilians-Universität München
Fakultät für Physik, Schellingstraße 4,
80799 München
LMU-Koordinatoren:
Prof. J. Lipfert, Prof. T. Birnstiel

Aktuelles Programm: http://www.ph.tum.de/kolloquium