Großes Physikalisches Kolloquium an der Universität zu Köln

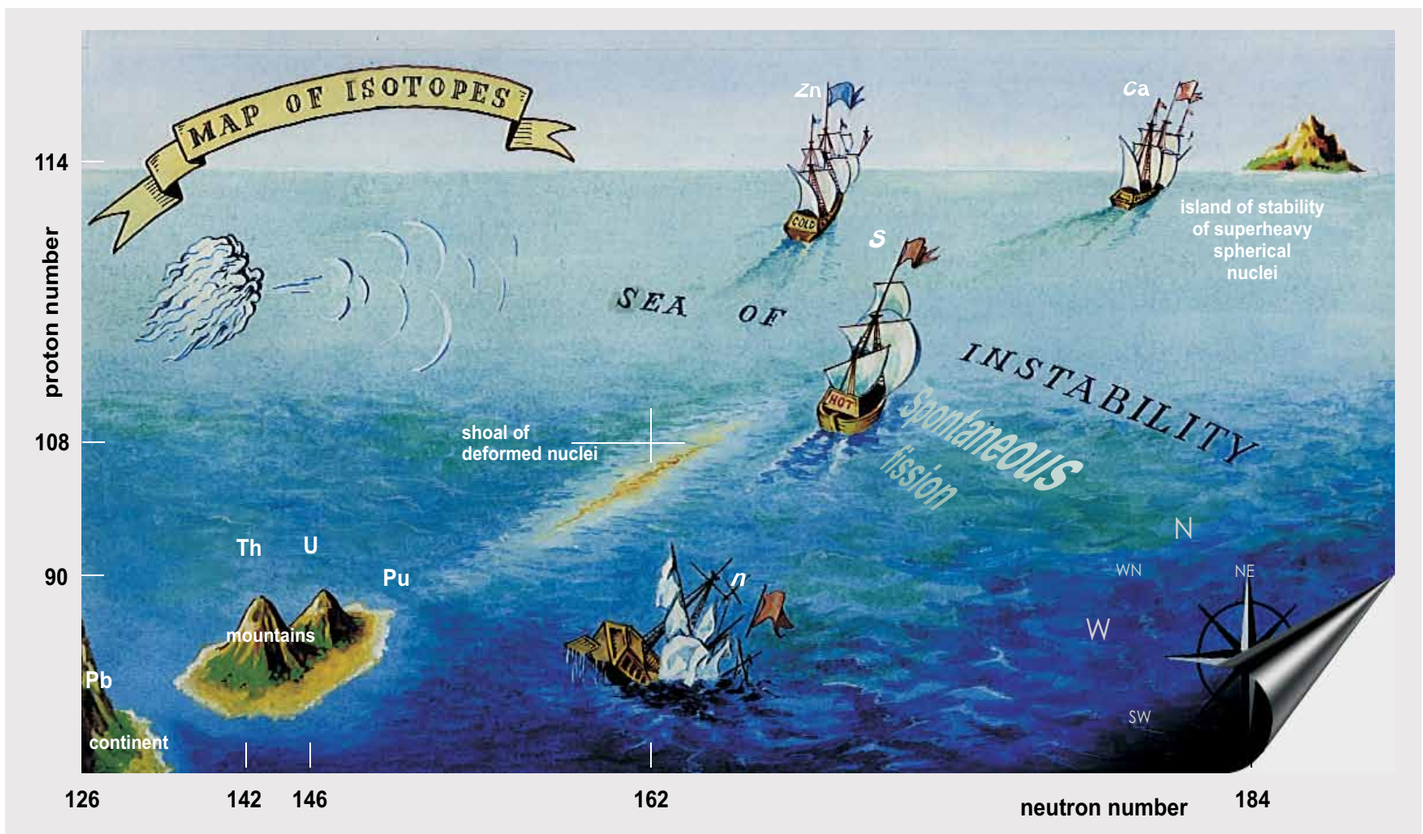
Prof. Dr. Rolf-Dietmar Herzberg
University of Liverpool

12.05.2015
16^{45} Uhr / HS III

Alchemy in the 21st century: the quest to understand super heavy elements

A chemical element is characterised by the total number of positively charged protons in the atomic nucleus. The interplay between the attractive short range strong force and the repulsive long range Coulomb force leads to a limit in the number of protons and neutrons that can be bound in a nucleus. Today single atoms of elements up to Z=118 have been created in the laboratory.

Super heavy nuclei are so finely balanced on the edge of stability that they provide extremely sensitive testing grounds for nuclear models. With the advent of modern detection systems structural investigations are possible in systems ever further from stability, including the determination of shape and single particle structure, chemical properties, and the unique identification of the precise atomic number of the produced nuclei via X-ray fingerprinting.



Großes Physikalisches Kolloquium an der Universität zu Köln

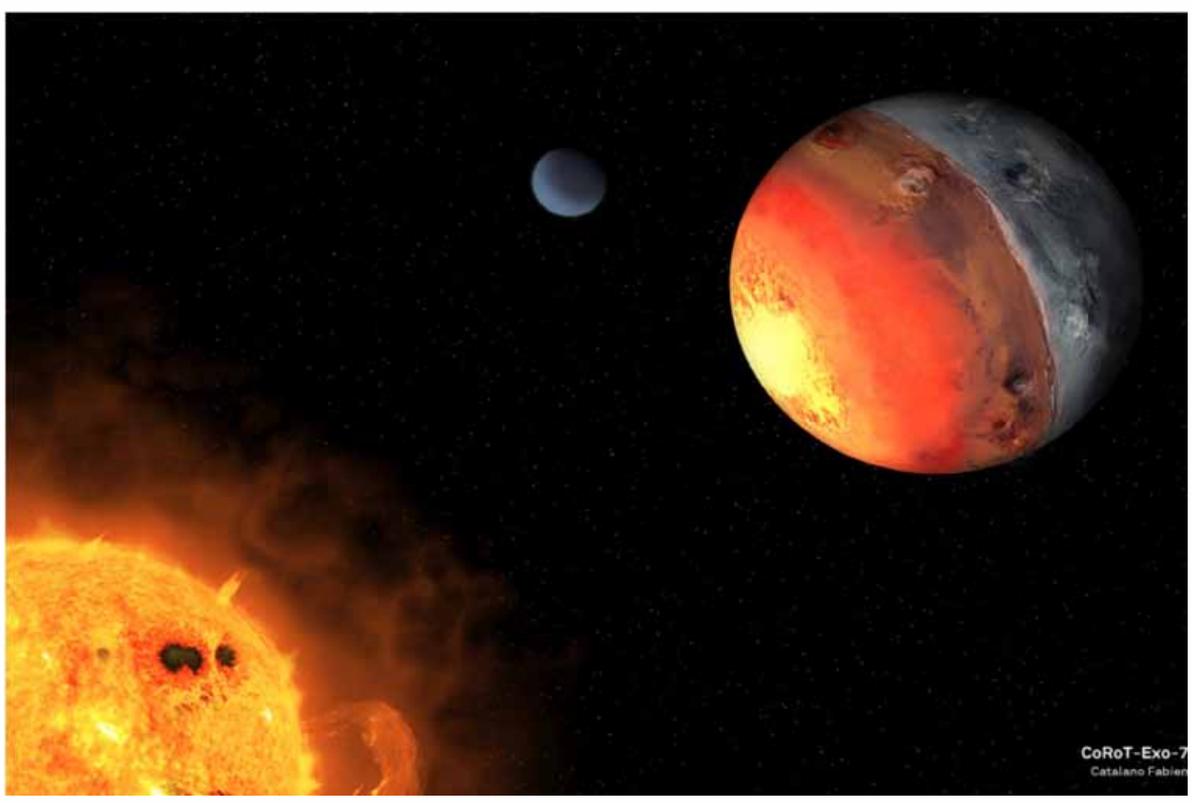
Prof. Dr. Artie Hatzes
Thüringer Landessternwarte Tautenburg

09.06.2015
16[45] Uhr / HS III

From 51 Peg to the Kepler Space Mission – Twenty Years of Exoplanet Research

Twenty years ago the first Jupiter-mass planet was found orbiting a sun-like star. With a 4-day orbital period 51 Peg b was the first indication that planetary systems could be far more diverse than what we expected from the properties of our own solar system. Early exoplanet discoveries consisted mostly of giant planets in single systems.

We now know of thousands of multi-planet systems and have detected planets with the mass of earth, albeit with short orbital periods. The field has also moved into an era where exoplanets are being characterized in terms of their true mass, radius, density, surface temperature, and atmospheric features. I will discuss the early history of exoplanet research but will focus largely on two space missions CoRoT and Kepler, that have been at the forefront of these characterization studies. Almost 20 years after the discovery of 51 Peg, a giant planet in a 4-day orbit, the field of extrasolar planets continues to produce unexpected discoveries



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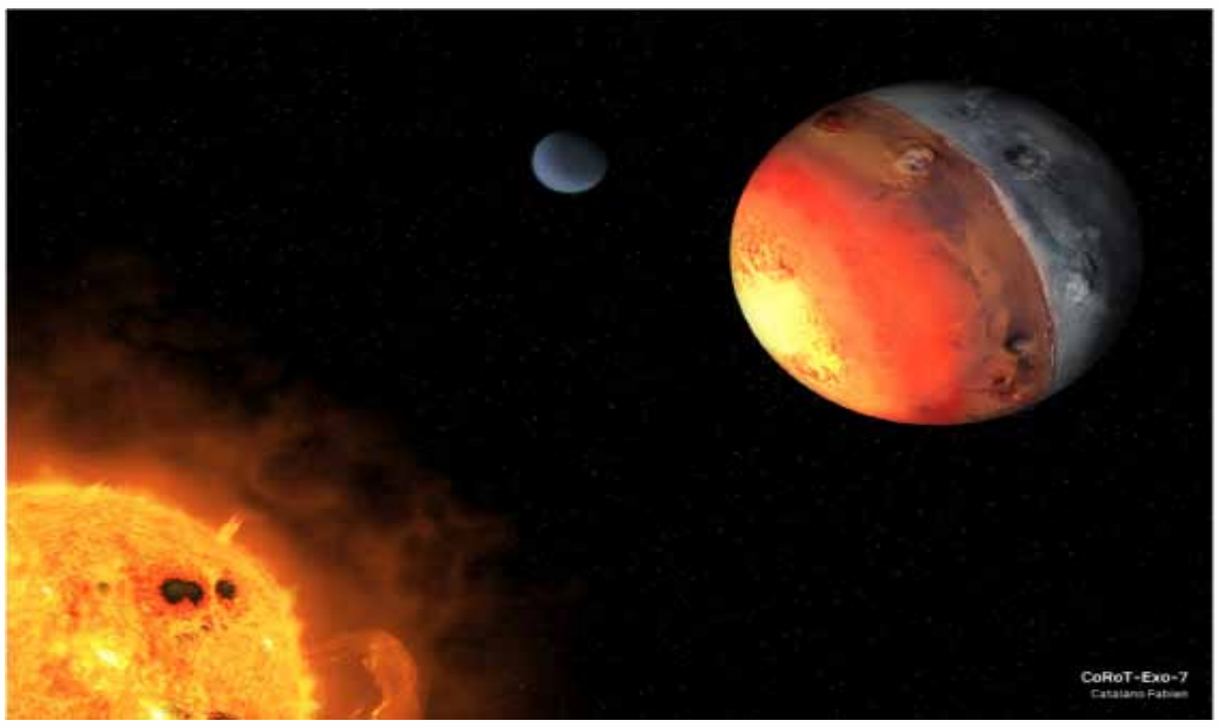


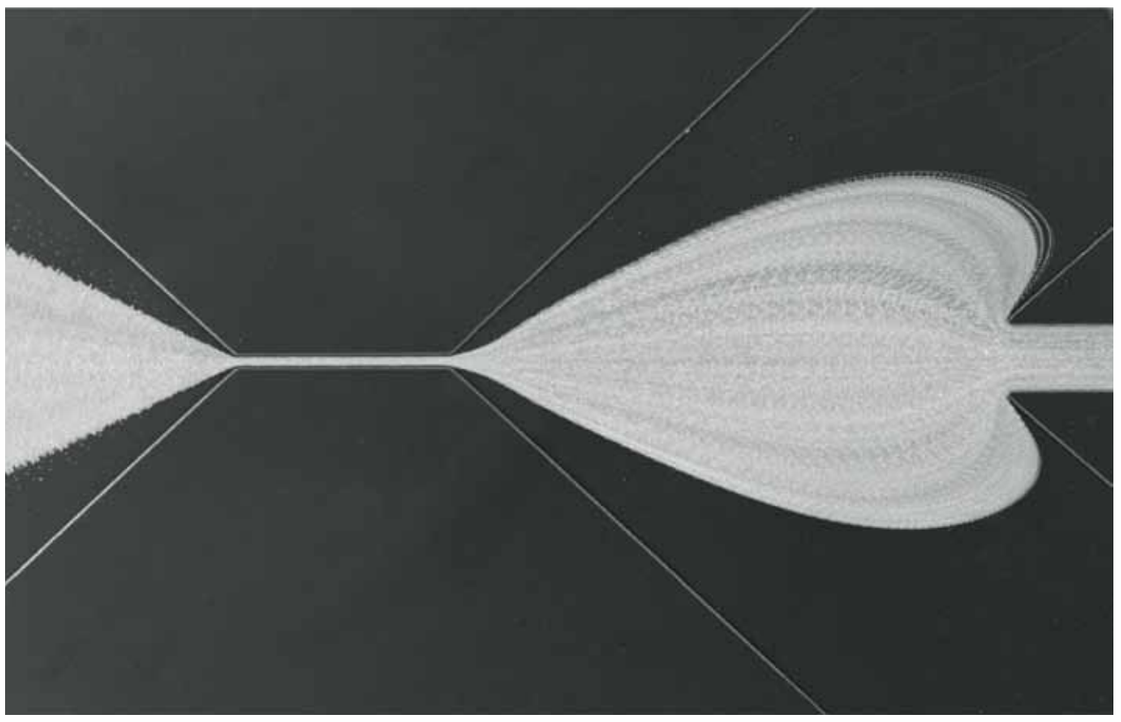
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Jochen Guck
Technische Universität Dresden

23.06.2015
16[45] Uhr / HS III

Do biological cells care about physics?

While most current biological research focuses on molecular, biochemical aspects of cell and their functioning, we are interested in their global physical properties. I will discuss our recent findings that the mechanical properties of cells determine the physical limits of cell function, for example in cell migration. Cell mechanics can therefore be used to characterize cells, to monitor physiological changes and to diagnose pathological alterations, such as cancer progression. Another example for the importance of physics in biology are the optical properties of cells, specifically in the retina. We have shown that there are cells in the retina that act as optical fibers and that photoreceptor cells even invert their usual nuclear chromatin arrangement to turn them into micro-lenses. Both aspects improve the light transmission through the retina and help to mitigate the disadvantage of its inverted structure. These results provide novel insight into the importance of physics for biological function and even offer new diagnostic and therapeutic avenues for further exploration.



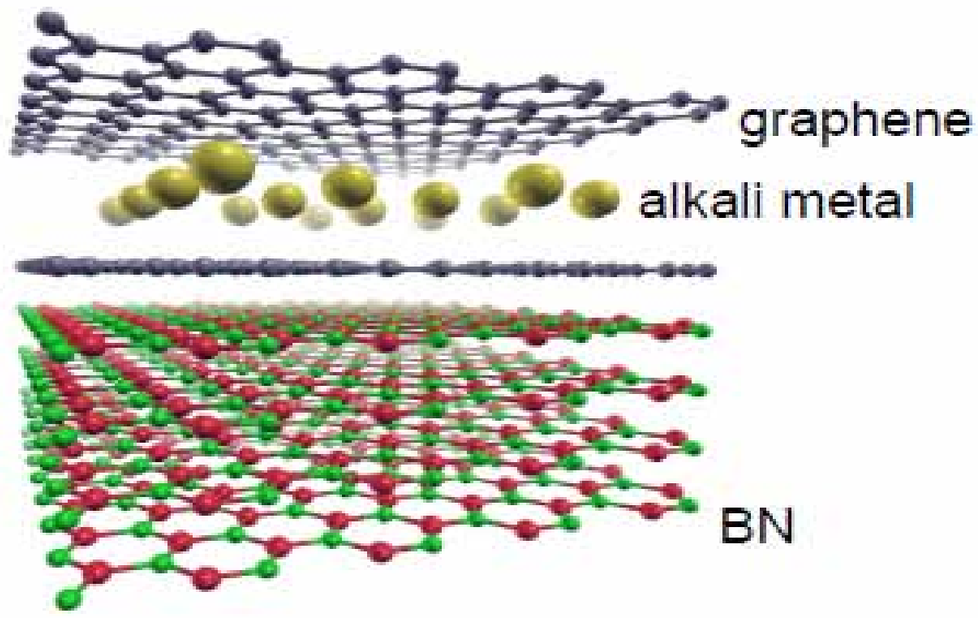
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Alexander Grüneis
Universität zu Köln

07.07.2015
16[45] Uhr / HS III

Quasiparticle dynamics and optical properties of 2D materials

The goal of my group‘s research is to prepare and chemically functionalize layered materials and then to characterize them in-situ using a novel combination of photoelectron and optical spectroscopies. This approach provides a solution to the intense research efforts in trying to engineer, probe and unravel many-body physics and the superconducting coupling mechanism in layered solids. Regarding the materials under investigation, I will show results from the growing family of 2D materials such as graphene, hexagonal boron nitride, transition metal dichalcogenides and phosphorene. Chemical functionalization using dopants allows for an unprecedented control over their physical properties. The proposed material systems provide a new arena to explore diverse condensed matter phenomena such as electron correlation, electron-phonon coupling and superconductivity.



Eröffnungsvortrag

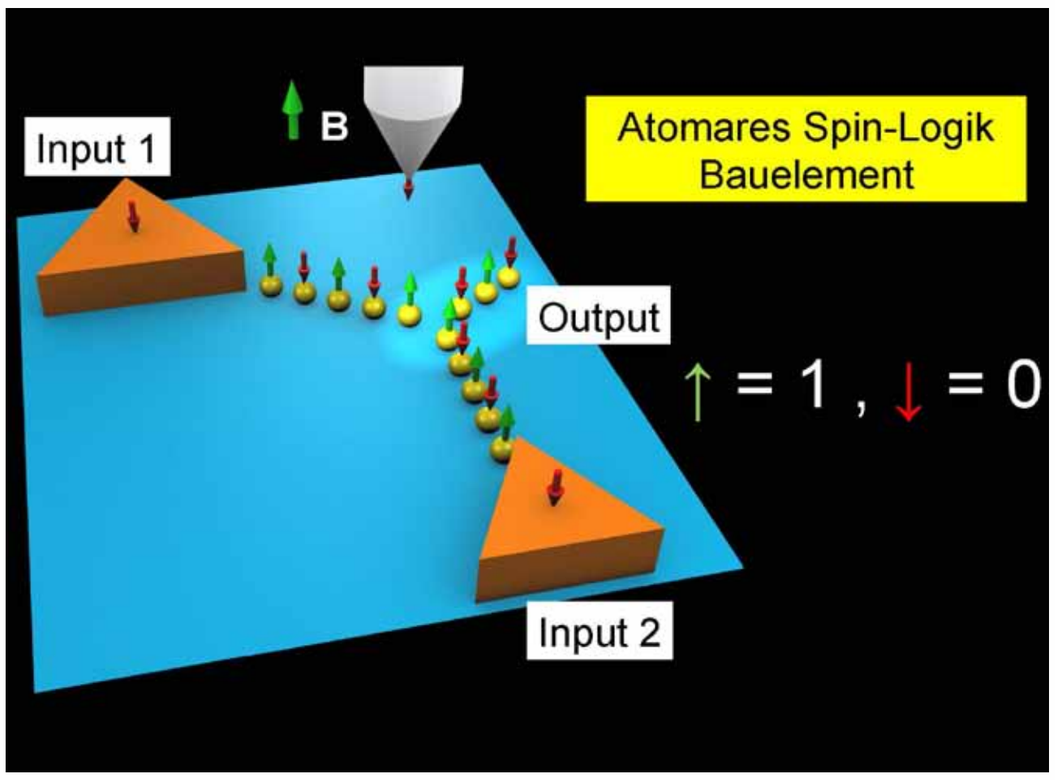
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Roland Wiesendanger
Interdisziplinäres Nanowissenschafts-Centrum Hamburg, Universität Hamburg

14.04.2015
16[45] Uhr / HS III

Ultradichte magnetische Datenspeicher und energieeffiziente Spin-Logik-Bauelemente auf atomarer Skala: Neueste Beiträge aus der Grundlagenforschung

Magnetische Datenspeicher und Logikelemente auf atomarer Skala: was heute noch Vision ist, könnte eines Tages Wirklichkeit werden. Neue Methoden der atomar auflösenden Mikroskopie erlauben den direkten Zugang zu magnetischen Strukturen und dynamischen Prozessen auf atomarer Skala. Dabei werden nicht nur neue magnetische Zustände entdeckt, sondern auch die fundamentalen magnetischen Wechselwirkungen zwischen einzelnen magnetischen Atomen erforscht. Mit Hilfe der gezielten Manipulation einzelner magnetischer Atome und Nanostrukturen auf Oberflächen lassen sich bereits heute funktionale Bauelemente maßschneidern. Dies könnte die Informations- und Kommunikationstechnologie in gleicher Weise revolutionieren wie wir dies in den vergangenen dreißig Jahren erlebt haben.



Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Björn Hof
Institute of Science and Technology Austria

28.04.2015
16[45] Uhr / HS III

The onset of turbulence

How turbulence arises in simple shear flows, such as pipes and channels has been an open question for over a century. In these flows turbulence is found despite the linear stability of the laminar flow and transition is caused by finite amplitude perturbations. Despite numerous experimental and theoretical studies it has not been possible to determine a well defined critical point nor to clarify the nature of the transition. It will be shown for the examples of pipe and Couette flow that the onset of sustained turbulence is a nonequilibrium phase transition. The critical point is determined by resolving the extremely long time scales of the underlying growth and decay processes. By detailed numerical simulations and experimental measurements close to the transition point we also determine the critical exponents and show that this transition falls into the directed percolation universality class.