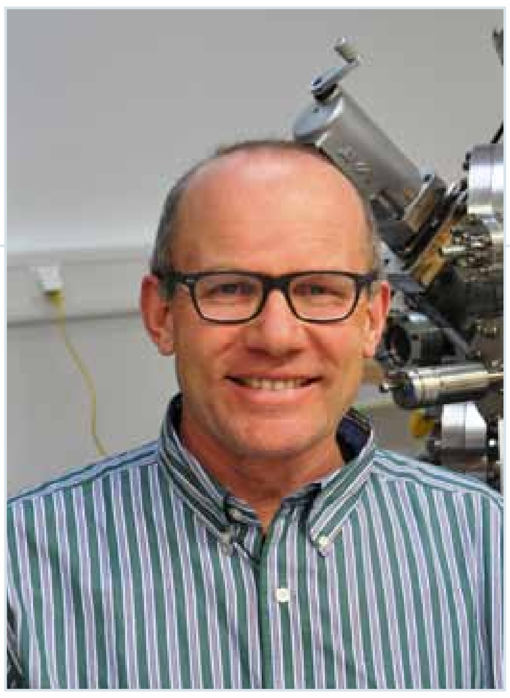
Großes Physikalisches Kolloquium an der Universität zu Köln

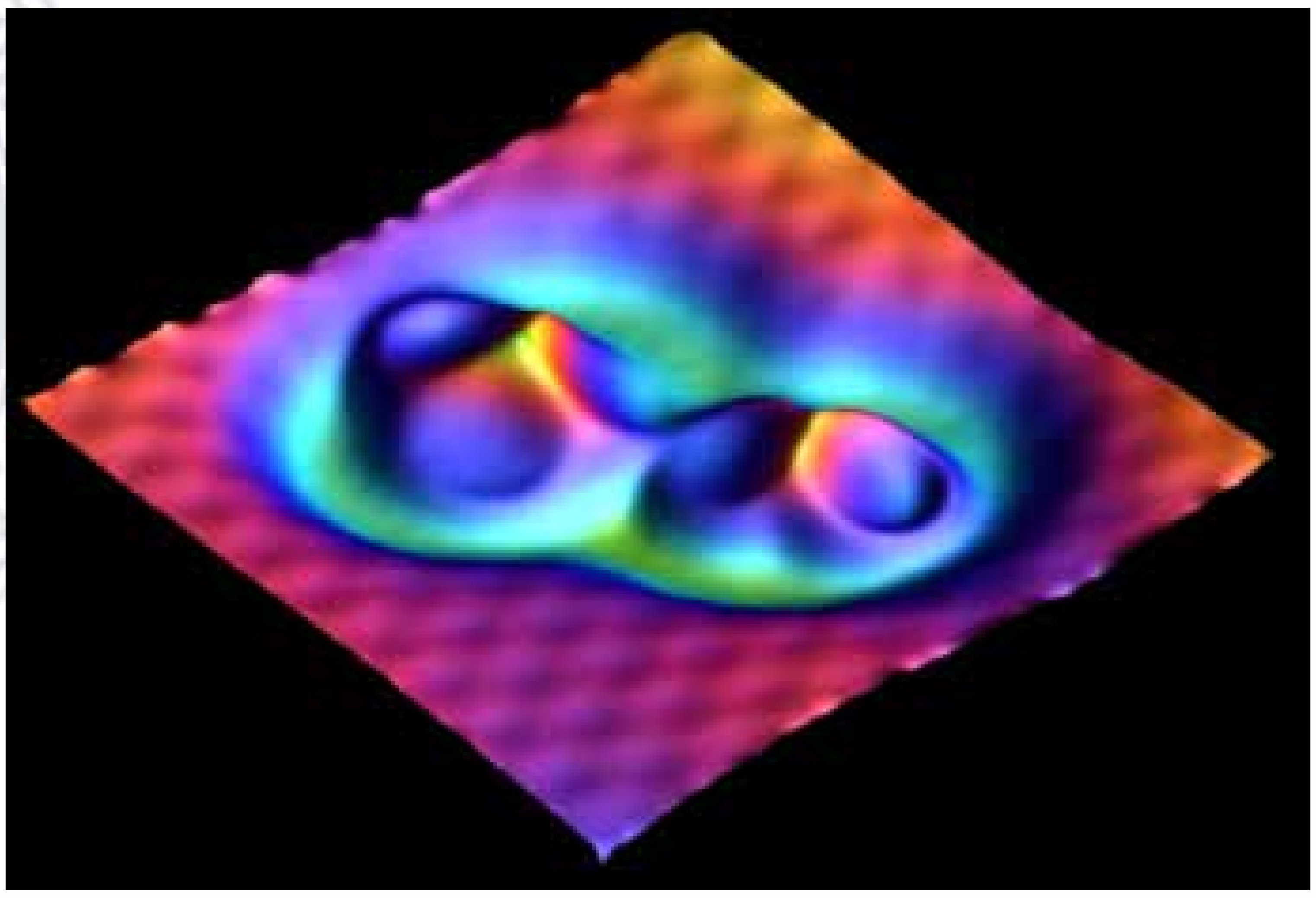


Prof. Dr. Franz J. Giessibl
Experimental and Applied Physics, University of Regensburg

25.04.2017
16^{45} Uhr / HS III

Advances in studying matter on the atomic scale

The scanning tunneling microscope (STM), invented in 1981 by Binnig and Rohrer, has opened a new era of small things. STM relies on vacuum tunneling with an exponential increase of a tunneling current between two biased conductive electrodes at a factor of ten per Å. If a tip has one atom that sticks out one Å more than all the others, this front atom carries ten times more current than the other atoms. The monotonic decrease of current with distance facilitates distance feedback and allows to scan the tip across a sample with atomic precision. In 1986, Binnig, Gerber and Quate introduced atomic force microscopy (AFM), a method that also images insulators by relying on forces. Unlike the current, the force between tip and sample is non-monotonic and includes long- and short range components. AFM has been inferior in resolution to STM for a long time. Today, it exceeds STM in spatial resolution. That progress was enabled by advances in measuring small forces and by the isolation of chemical bonding forces from strong background forces.



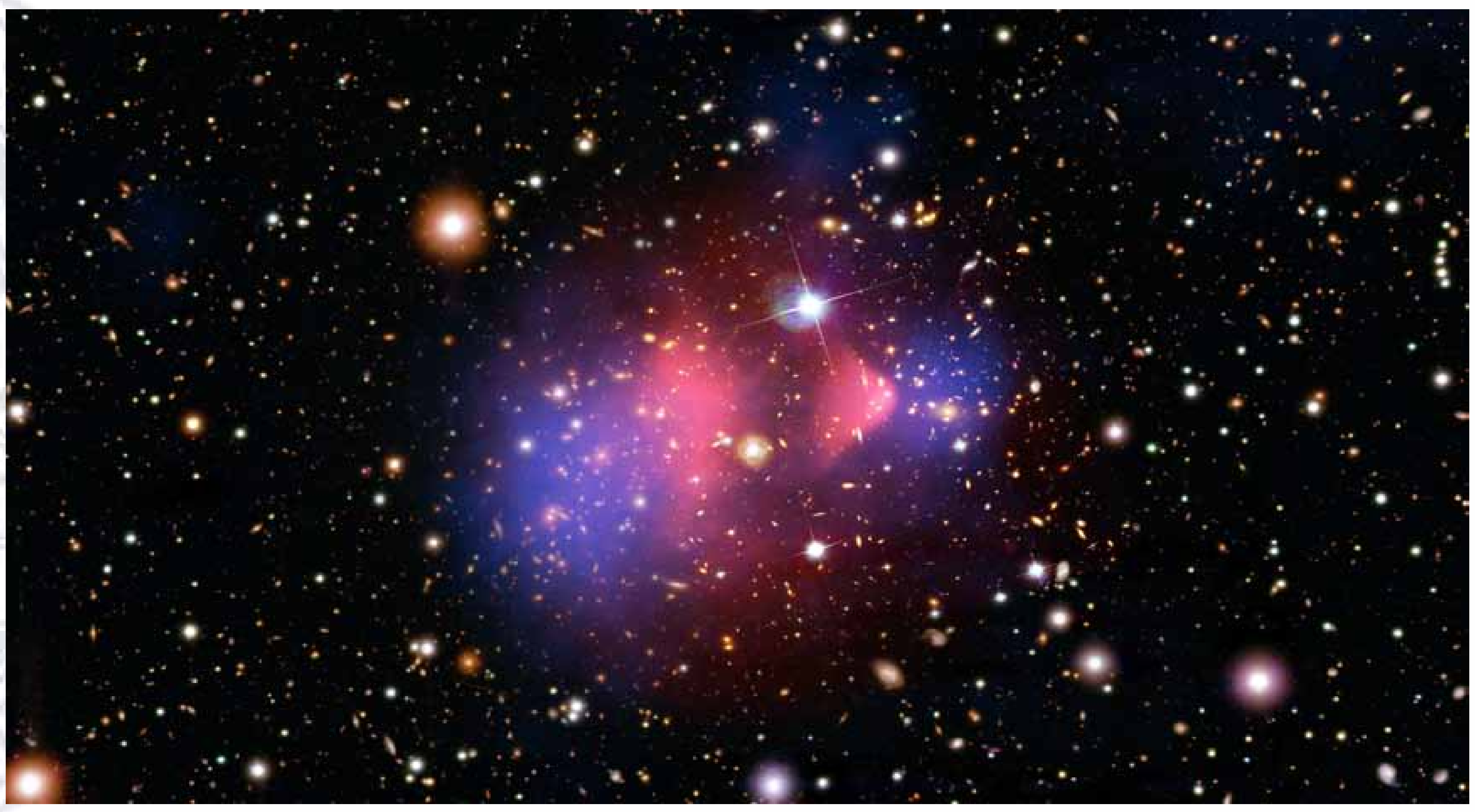
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Josef Jochum
Universität Tübingen

23.05.2017
16^{45} Uhr / HS III

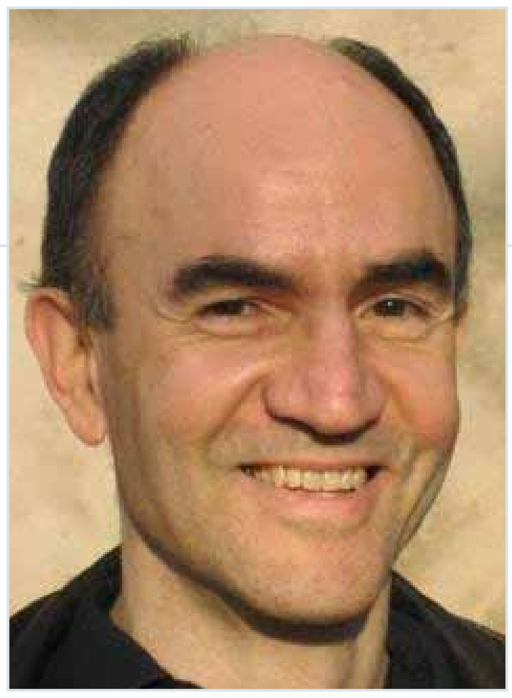
Dark Matter - connection between the structure of the universe and particle physics

Many observations in astrophysics show that so-called dark matter dominates the matter in the Universe. To clarify the yet unknown nature of dark matter is of very high interest for cosmology as well as for particle physics. The properties of dark matter are inconsistent with the standard model of particle physics. The spectrum of cosmic microwave anisotropy reveals a dominant role of particles without electromagnetic and strong interaction in the formation of structures in the Universe. Because relativistic particles cannot form structures in the Universe, there are no known particles left to explain the nature of dark matter. Dark matter is the strongest evidence for physics beyond the standard model. We will explain how the astrophysical observations necessarily lead to the conclusion of the existence of beyond the standard model physics and give an overview on the experimental and observational efforts to find out what kind of particles create dark matter.



Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Wolfgang Liebert
Institut für Sicherheits- und Risikowissenschaften, Universität für Bodenkultur (BOKU) Wien



13.06.2017
16^{45} Uhr / HS III

Technikfolgenabschätzung

Ausgehend vom US-Congress ist in den 1970er Jahren das Technology Assessment (TA) entstanden. Vor welchem gesellschaftspolitischen und wissenschaftlichen Hintergrund hat sich die TA entwickelt? Was sind ihre Hauptmotive, Zielsetzungen, Aufgaben und Funktionen? Wie geht TA vor? Heute zeigt sich eine große Vielfalt an TA-Konzeptionen und-Vorgehensweisen. Einheit besteht insbesondere in der Folgenorientierung, zunehmend auch in der Orientierung an Technikgestaltung innerhalb der Gesellschaft. Eine Frühzeitigkeitsorientierung wird insbesondere in der Prospektiven Wissenschafts-Technikfolgenabschätzung (ProTA) betont. Kann das denn gelingen? ProTA orientiert sich ausdrücklich auch am wissenschaftlichen-technischen Kern untersuchter Technologiefelder. Anhand von zwei Beispielen wird dies erläutert: Partitionierung und Transmutation von nuklearem Abfall, Aussichten für die Dünnschicht-Photovoltaik.

Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Tim Hugo Taminiau
QuTech, Delft University of Technology,
The Netherlands

11.07.2017
16^{45} Uhr / HS III

Playing Bell's game: quantum entanglement vs local realism

Quantum entanglement is one of the most intriguing phenomena in physics. Two particles that are entangled must be described as a single entity even when they are far apart. A measurement on one particle appears to have an instantaneous influence on the other particle. In this talk I will discuss our experiment with electron spins in diamond entangled over 1.3 km, which directly pitches this "spooky" non-locality of entanglement against local realism, the worldview that "the world is made up of real stuff changing only through local interactions".

Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Matthias Sperl
Deutsches Zentrum für Luft- und Raumfahrt,
Universität zu Köln

25.07.2017
16^{45} Uhr / HS III

Physics in a Sandbox: Dynamics of Granular Matter in Microgravity

Granular materials are both important in numerous applications as well as fascinating examples for the physics far from equilibrium. Many phenomena in granular materials are familiar from everyday experience. In contrast to their apparent simplicity, granular materials pose many challenges to both experiment and theory. In theory, the energy loss at the collision of particles breaks time-reversal symmetry and leads to emerging effects such as cooling and cluster formation. In experiments, the energy loss leads to quick sedimentation on ground and motivates experiments in microgravity. In a broad overview, the interplay between theory and experiment shall be presented for topics such as dynamics of granular gases, light scattering from granular fluids, force transmission in granular solids, rheology, and the migration of sand dunes. The picture below demonstrates an emerging granular cluster in a system of ellipsoidal candy measured on board the International Space Station (ISS).