Eröffnungsvortrag

# Großes Physikalisches Kolloquium an der Universität zu Köln


## Prof. Dr. Paolo Giubellino

GSI Helmholtzzentrum für Schwerionenforschung
and Facility for Antiproton and Ion research,
Darmstadt, Germany


**17.10.2017**
16[45] Uhr / HS III

## *FAIR - The Universe in the Laboratory*

FAIR will be the next-generation facility for fundamental and applied research with antiprotons and ion beams. It will provide world-unique accelerator and experimental facilities, allowing for a great variety of unprecedented forefront research in physics and applied sciences. FAIR is an international project with 10 partner countries and more than 2500 scientists and engineers from more than 50 countries involved in the preparation of the experiments. FAIR research focuses on the structure and evolution of matter on both a microscopic and a cosmic scale, bringing our Universe into one laboratory. The FAIR four scientific pillars will expand our knowledge in various fields beyond current frontiers, addressing the structure of hadrons and nuclei, the properties of matter at extreme densities, the key processes in nuclear astrophysics and a variety of applications of nuclear beams to Biophysics and Material Science. The talk will introduce FAIR, its unique scientific Opportunities, and the status of the realization of the project.

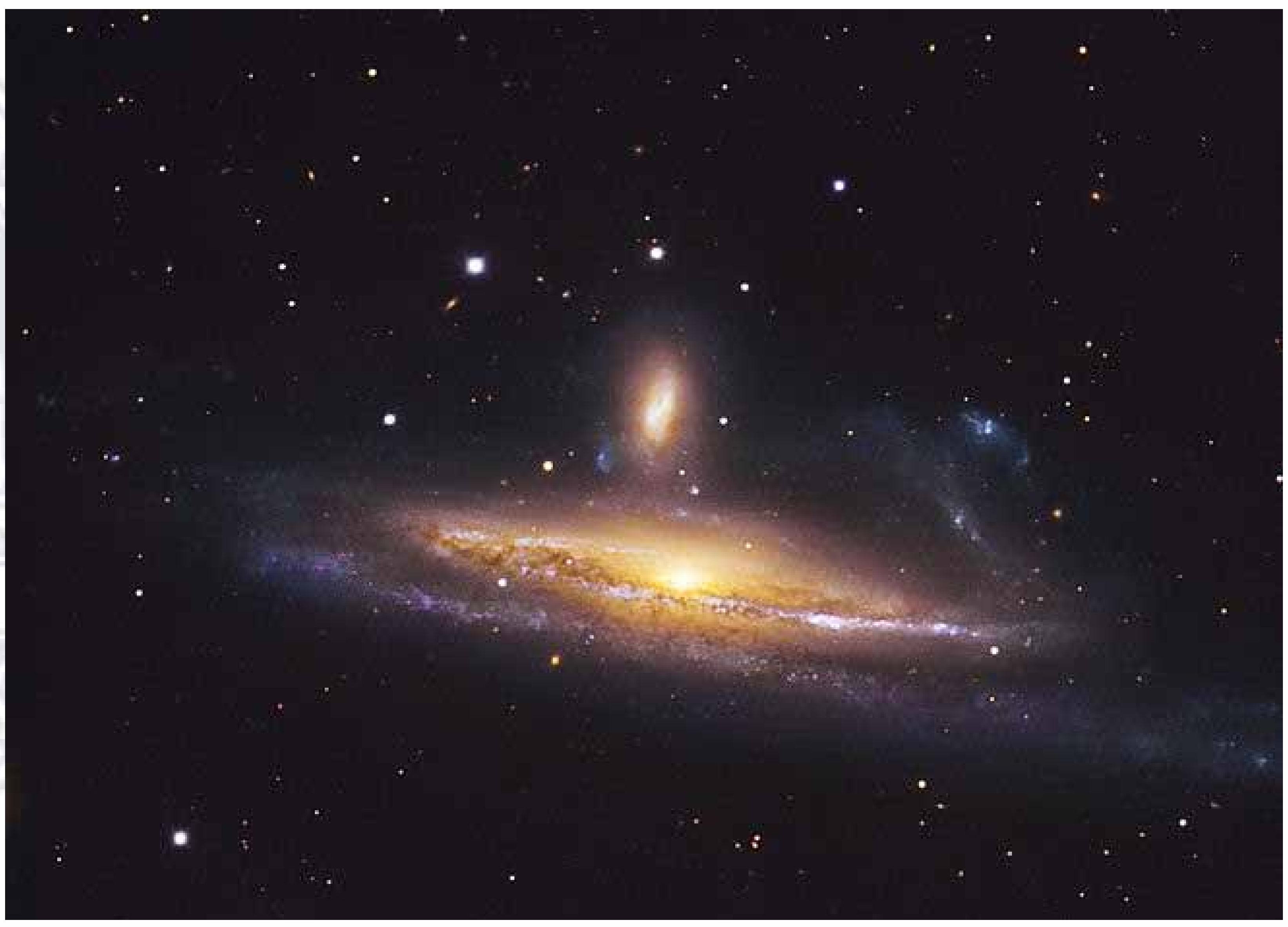
# Großes Physikalisches Kolloquium an der Universität zu Köln

**Prof. Dr. Eva K. Grebel**
Heidelberg University

**07.11.2017**
$16^{45}$ Uhr / HS III

## *Dwarf Galaxies - Fossils of Galaxy Evolution*

Dwarf galaxies are the most common type of galaxy in the Universe and include the most dark-matter-dominated objects known. They offer intriguing insights into evolutionary processes at low halo masses and low metallicities. Moreover, as survivors of a once much more numerous population of building blocks of larger galaxies, they are key to understanding very early star formation processes. The Local Group and particularly the Milky Way‘s dwarf galaxy entourage offer us the unique possibility to compare in detail dwarf and Galactic populations. This is an important step towards quantifying the magnitude and time scales of dwarf contributions to the build-up of the Milky Way and allows us to test predictions of cosmological theories and hierarchical structure formation.



# Großes Physikalisches Kolloquium an der Universität zu Köln

## Nina Müller
## Oliver Zingsheim

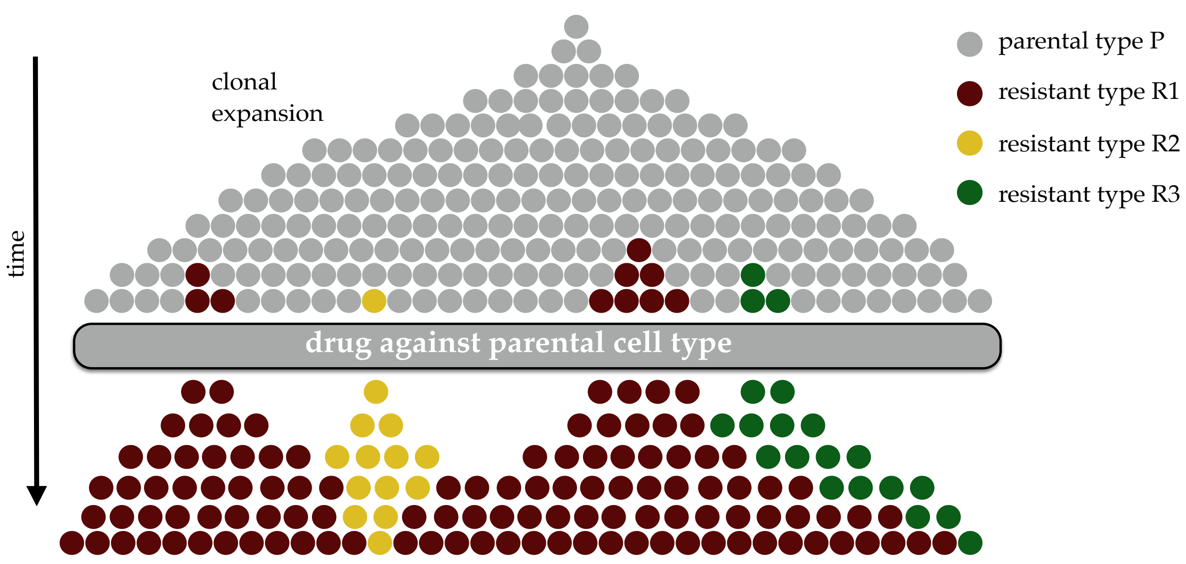
Bonn-Cologne Graduate School of Physics and Astronomy Best Poster Awardees

Bonn-Cologne Graduate School for Physics and Astronomy

**21.11.2017**
16$^{45}$ Uhr / HS III

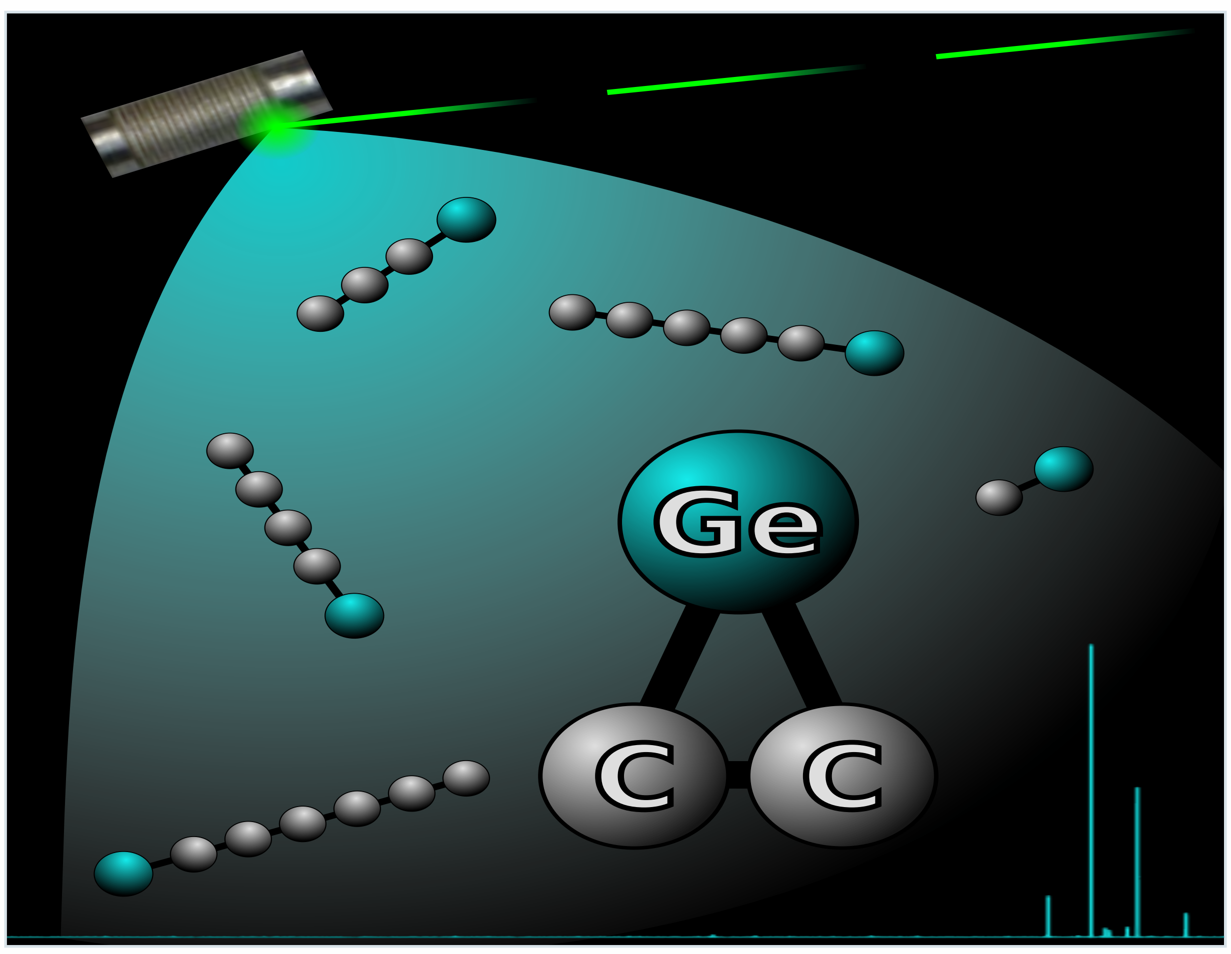
## *Cancer evolution and stochastic modeling of resistance to therapy (Nina Müller)*

Cancer is a class of diseases where uncontrolled cell growth leads to the formation of tumors. During the last few decades, there have been huge advances in therapies that exploit the biochemical differences between cancerous and normal cells and are less toxic than classical treatment. But the long-time efficacy of this targeted therapies is limited by the occurrence of resistance which is caused by small resistant sub-populations existing prior to treatment. In my PhD project, I approach the problem of cancer resistance from two sides: Theoretically, I study the dynamics of rare resistant mutants in a much bigger sensitive population. Experimentally, I isolate all available resistance mechanisms of a cancer cell line in a population of given size. The aim is to better understand the underlying principles of cancer evolution to ultimately improve therapy outcome.




## *Rotational spectroscopy: A powerful analytical tool (Oliver Zingsheim)*

Despite the harsh interstellar environment (UV starlight and fast protons from Supernovae events) almost 200 molecules have been found in space thanks to their “fingerprint”-like rotational spectra. Among them even precursors of life. Such molecules are investigated in the laboratory and illustrative examples are propanal (C3 H6O), a commonplace molecule found on earth and in space, as well as germanium dicarbide (GeC2 ), which has to be created under extreme conditions and –surprisingly- whose structure is under debate for a long time.



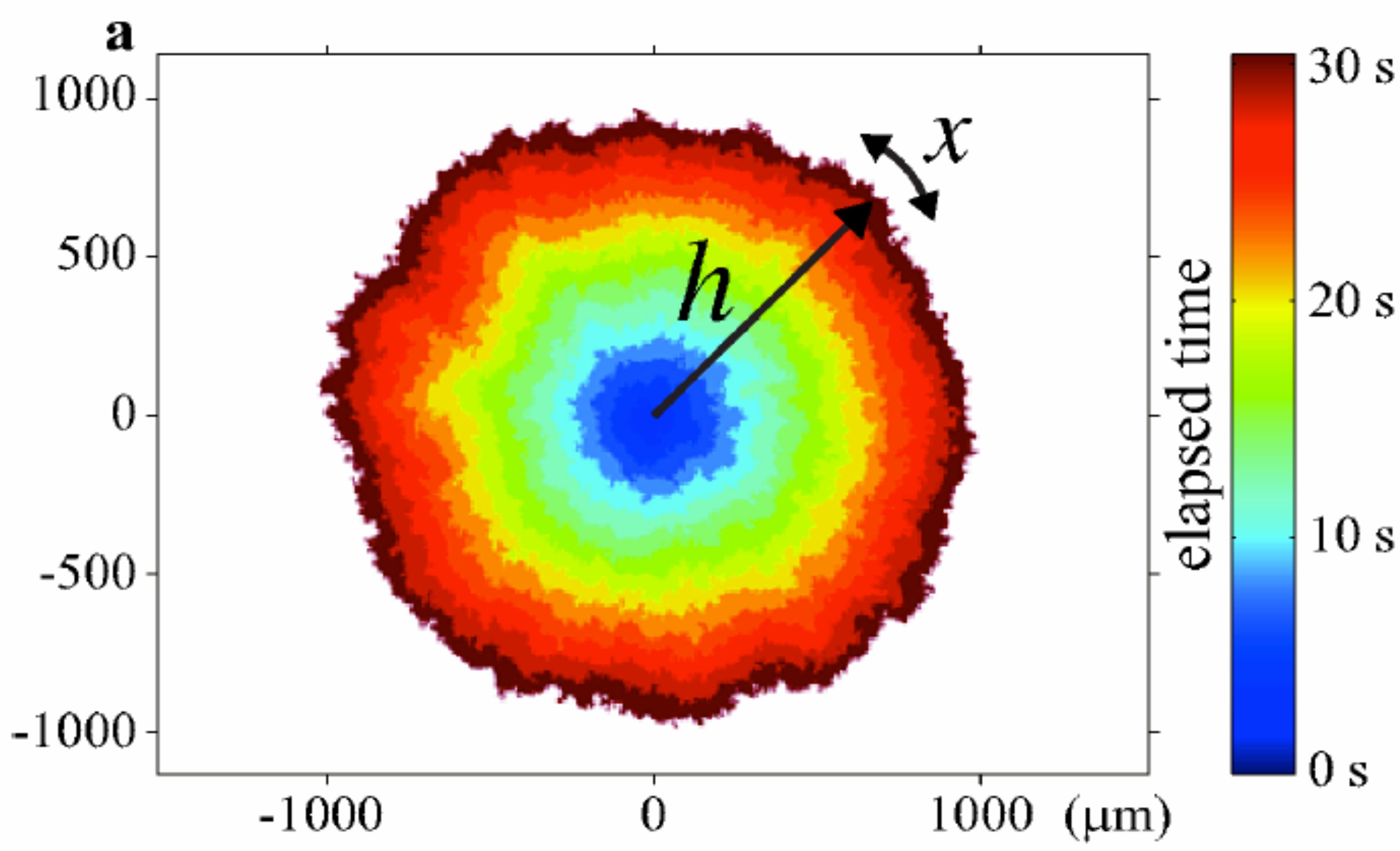
# Großes Physikalisches Kolloquium an der Universität zu Köln

**Prof. Dr. Satya Majumdar**
Université Paris-Sud

**05.12.2017**
$16^{45}$ Uhr / HS III

## *KPZ story*

The celebrated KPZ equation (Kardar, Parisi, Zhang, 1986) is an important milestone in statistical physics, originally introduced to describe the late time dynamics in two dimensional growth models. Over the last 30 years, the KPZ story has evolved in various interesting directions, making links on the way to different areas of physics and mathematics. This includes in particular the link to the famous Tracy-Widom distribution in random matrix theory. The story of KPZ is a very successful one, involving theoretical physics, mathematics and experiments--a fertile playground for interdisciplinary science. In this talk, I will review the evolution of the KPZ story, pointing out the important landmarks as I go along. At the very end, I will discuss some recent developments establishing a nice link between the KPZ height fluctuations and the edge physics in cold atom systems.



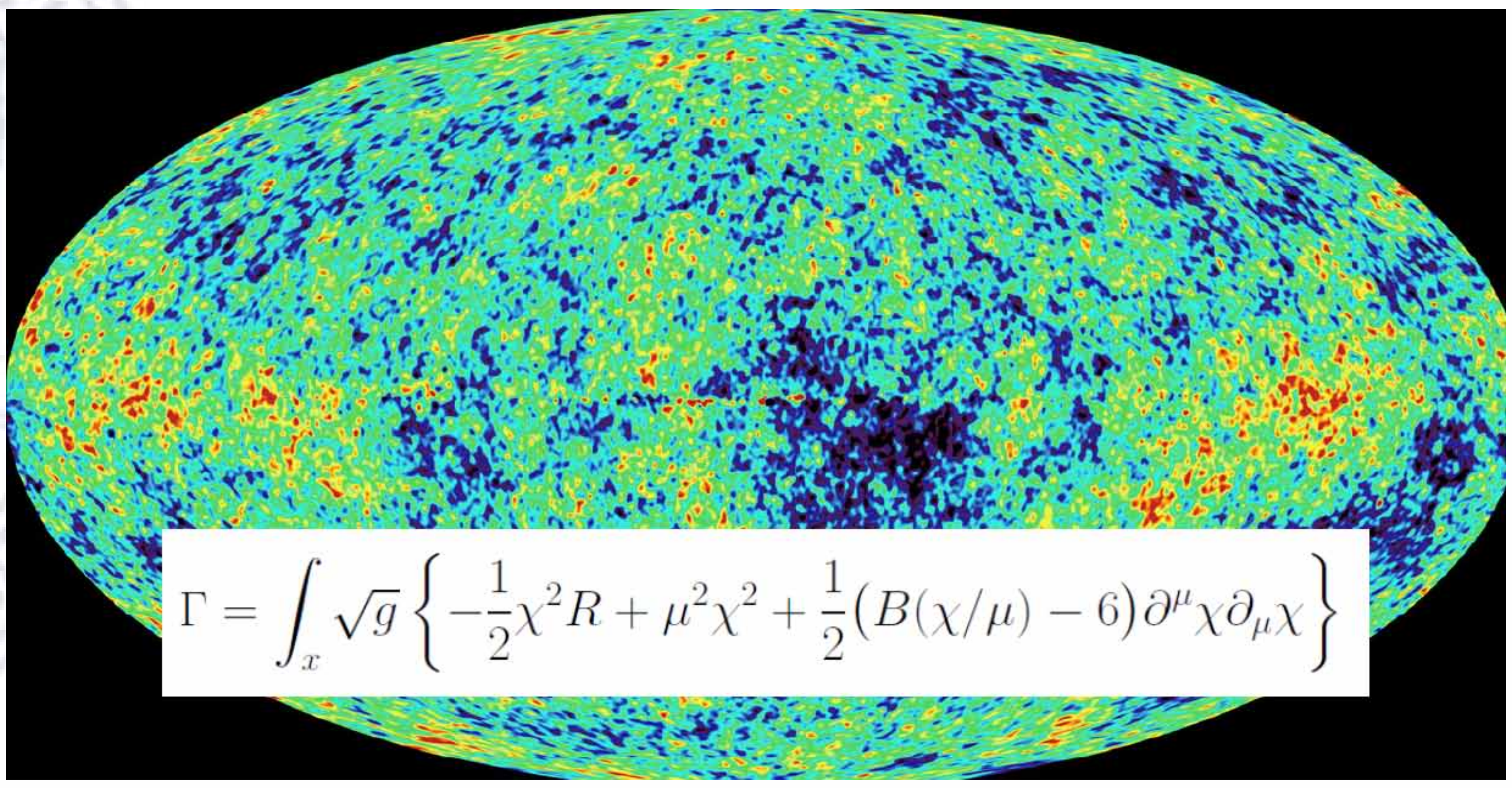
# Großes Physikalisches Kolloquium an der Universität zu Köln


**Prof. Dr. Christof Wetterich**
Universität Heidelberg


**19.12.2017**
$16^{45}$ Uhr / HS III

## *Quantum Gravity, Dark Energy, and the Origin of the Universe*


Quantum gravity is described as a non-perturbatively renormalizable quantum field theory for the metric and a scalar field, with ultraviolet and infrared fixed points. The approximate scale invariance close to the ultraviolet fixed point is reflected in cosmology in the almost scale invariant spectrum of primordial cosmic fluctuations, as observed in the microwave background. The approach to the infrared fixed point in the asymptotic future is characterized by the dynamics of an almost massless scalar field responsible for dynamical dark energy. The cosmological solution can be extrapolated to the infinite past in physical time - the Universe has no beginning and no physical singularity. A simple model is compatible with all present cosmological observations. It could be tested by the observation of huge lumps in the cosmic neutrino background, the detection of early dark energy, or rather large primordial graviton fluctuations generated during inflation.

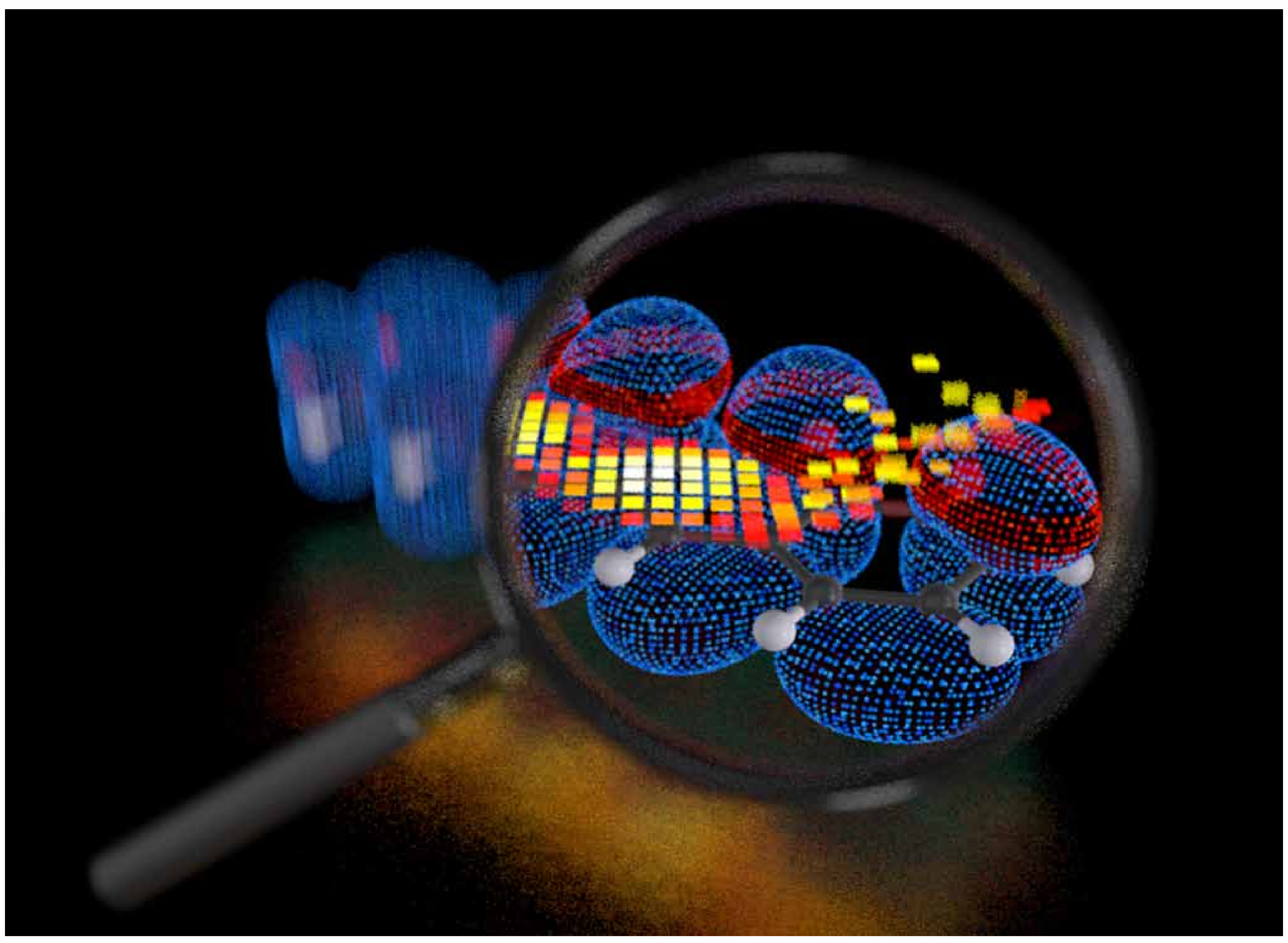
# Großes Physikalisches Kolloquium an der Universität zu Köln


**Prof. Dr. Rupert Huber**
University of Regensburg


**09.01.2018**
$16^{45}$ Uhr / HS III

## *Faster than a cycle of light*

Latest progress in ultrafast optics allows us to accelerate electrons in solids directly by the carrier wave of light. A fascinating quantum world unfolds on the sub-optical-cycle scale, including Bloch oscillations, quasiparticle collisions, and high-harmonic generation. By combining this approach with ultramicroscopy we take the first femtosecond snapshot image of a molecular orbital and the first femtosecond single-molecule movie.



# Großes Physikalisches Kolloquium an der Universität zu Köln

## Prof. Dr. Johan Elf
Uppsala University

**23.01.2018**
$16^{45}$ Uhr / HS III

## *Kinetics of dCas9 target search in Escherichia coli*

Cas9-based DNA targeting is radically different from that of transcription factors. Cas9 can be programmed by a guide RNA to target any sequence, at the price of the increased time required to open cellular dsDNA to test for complementarity. We have studied how much time it takes to located a singel target sequence in a living cell using single molecule fluorescence microscopy. We also measure how long time the bound dCas9 stays at a target sequences and what implications this has for repression of a targeted gene.