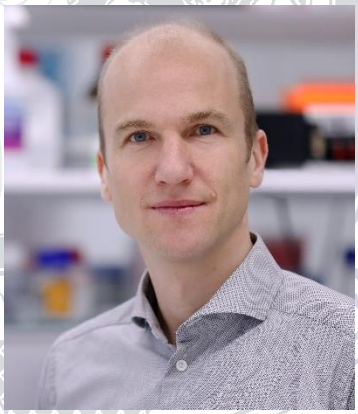
Großes Physikalisches Kolloquium an der Universität zu Köln

Joint Seminar with

Cologne Evolution Colloquium

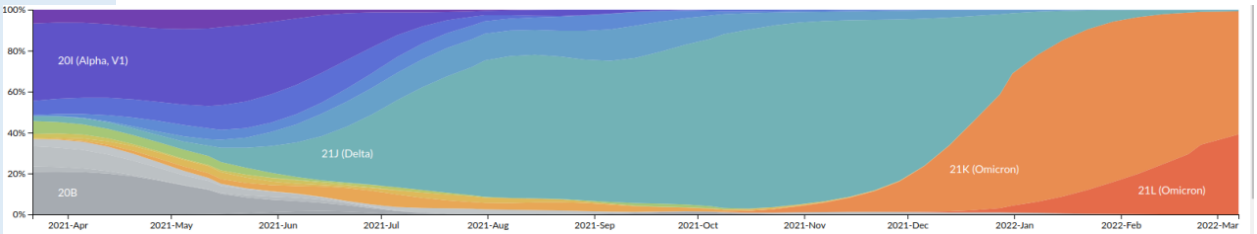


Prof. Dr. Richard Neher
Biozentrum, Universität Basel

Reconstructing, tracking, and predicting viral spread and evolution

10.05.2022
16^{30} Uhr
HS III

The SARS-CoV-2 pandemic has resulted in unprecedented genomic and epidemiological surveillance as well as virological characterization in record time. The volume of data and requirement for rapid feedback to decision makers required continuous data analysis and method development to make sense of the data. Multiple variants of SARS-CoV-2 have arisen independently from each other and swept the globe over the course of two years. In contrast, in endemic RNA viruses we often see co-circulation of variants and gradual emergence of one variant from another. This endemic circulation is characterized by an approximate equilibrium between the build-up and decay of immunity. I will discuss models of the transition from pandemic to endemic circulation, the possibility of speciation, and the drivers of antigenic evolution in SARS-CoV-2 and other viruses.



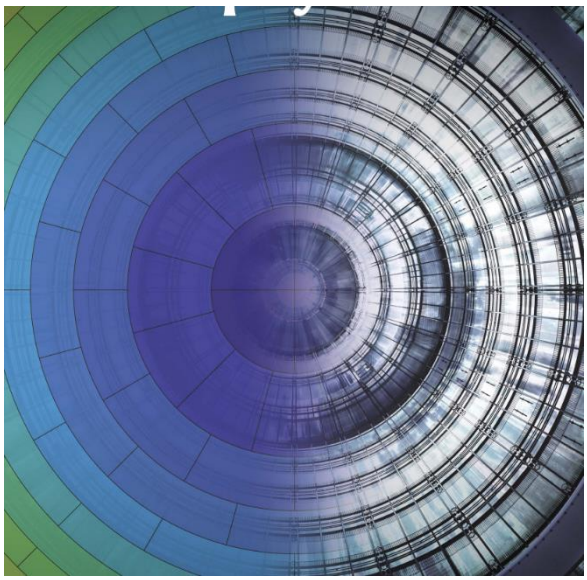
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Christian Weinheimer
Institut für Kernphysik,
Universität Münster

Sub-eV neutrino mass limit from KATRIN

17.05.2022
16^{30} Uhr
HS III

Since the discovery of neutrino oscillation we know that neutrinos have non-zero masses, but we do not know the absolute neutrino mass scale, which is as important for cosmology as for particle physics. The direct search for a non-zero neutrino mass from endpoint spectra of weak decays is complementary to the search for neutrinoless double beta-decay and analyses of cosmological data. The Karlsruhe Tritium Neutrino experiment KATRIN is investigating the endpoint region of tritium beta decay. KATRIN uses a strong windowless gaseous molecular tritium source combined with a huge MAC-E-Filter as electron spectrometer. To achieve the sensitivity, KATRIN has been putting many technologies at their limits and uses elaborated calibration techniques. From early 2019 on KATRIN is taking high statistics tritium data hunting for the neutrino mass. Already its data of 2019 provide a sub-eV sensitivity and neutrino mass limit. In addition to the presentation of the recent recults, the current status of the experiment and an outlook on future improvements will be given.



Großes Physikalisches Kolloquium im Sommersemester 2022 – Hörsaal III der Physikalischen Institute, Zülpicher Str. 77, 50937 Köln
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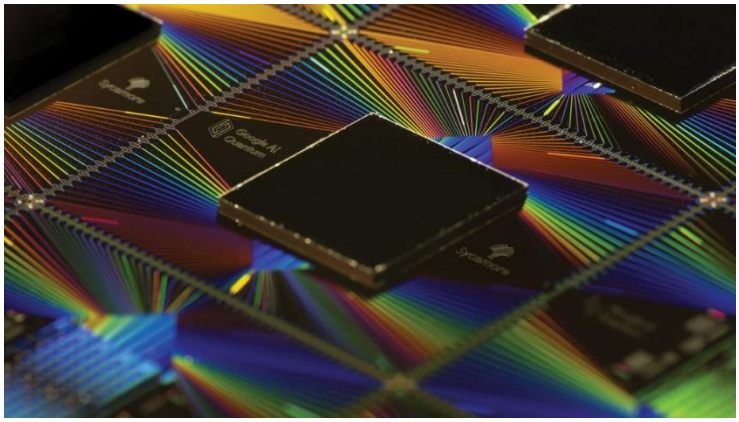
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Rami Barends
Peter Grünberg Institute for Functional Quantum Systems, Jülich Research Center / RWTH Aachen

Towards useful beyond-classical computing with superconducting quantum bits

24.05.2022
16^{30} Uhr
HS III

One of the outstanding scientific challenges of this decade is the construction of an architecture and development of a methodology that can enable useful quantum computing. Superconducting quantum circuits have demonstrated unparalleled performance, by outperforming the world's most powerful supercomputers on a specific sampling task. Yet, applying quantum computing to real-world problems has remained elusive. The performance of current systems is limited, and the development of algorithms that make efficient use of present-day hardware is only starting. I will discuss the challenges in going from the current exploratory phase towards one where addressing real-world problems could be accomplished.



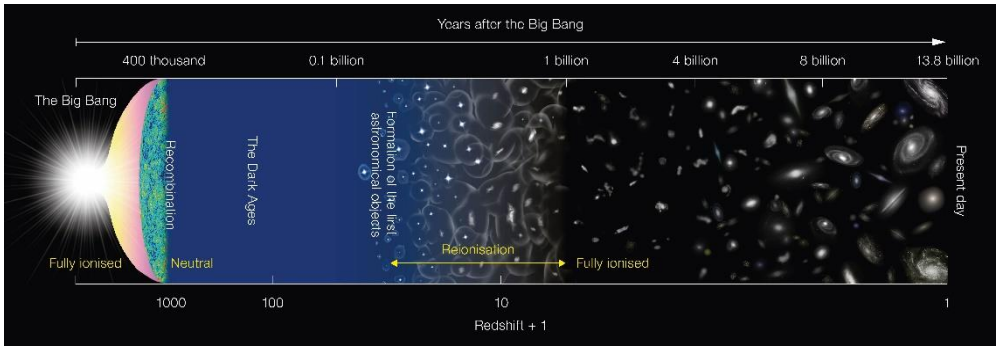
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Dominik A. Riechers
I. Physikalisches Institut,
Universität zu Köln

Charting the Evolution of Galaxies through 13 Billion Years of Cosmic History

31.05.2022
16^{30} Uhr
HS III

Interstellar gas and dust in galaxies has fuelled the birth sites of stars and planets since they first formed, beginning a few hundred million years after the Big Bang. In turn, the first generations of massive stars in the early universe have transformed the gas in between galaxies from a neutral to an ionized state, during the so-called "Epoch of Reionization" (EoR) that ended at a cosmic age of one billion years. The ancestors of galaxies like our Milky Way, as well as much more extreme systems, began their buildup around the same time. Thus, tracing the evolution of galaxies over the past 13 billion years since the onset of the EoR to the present day allow us to understand the formation history of the universe we live in at present day. I will describe the present state of our understanding in this key field of astrophysical research and the complex physical processes involved, as well as exciting new technical developments led out of Cologne and by our international collaborators that will push these studies to the next level.



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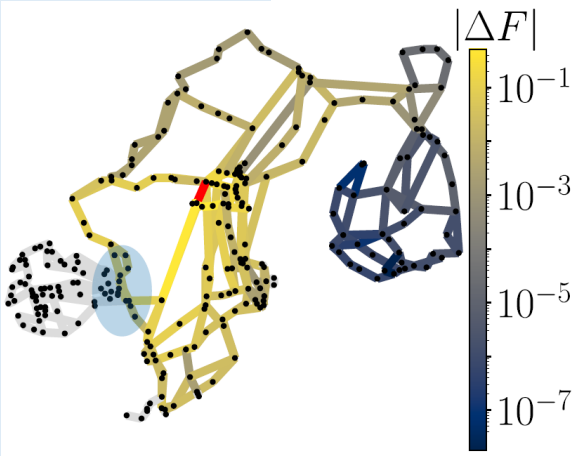
Großes Physikalisches Kolloquium an der Universität zu Köln

Prof. Dr. Dirk Witthaut
Institut für Energie- und Klimaforschung,
Forschungszentrum Jülich
Institut für Theoretische Physik, Universität zu Köln

21.06.2022
16[30] Uhr
HS III

Statistical Physics for Sustainable and Secure Energy Systems

The mitigation of climate change requires a comprehensive transformation of our energy system. Power plants based on fossil fuel must be replaced by renewable energy sources, which challenges the operation and stability of the electric power system. In my talk, I will review the key challenges and discuss how methods and ideas from theoretical physics can contribute to their solution.



I will focus on two topics: (i) Renewable power fluctuates on many time scales, making it increasingly difficult to balance generation and load. Methods from stochastic time series analysis are essential to quantify these fluctuations and to understand their impact on power system operation. (ii) Damages of transmission and generation infrastructures are the biggest threat for system stability. Network science helps to understand how failures spread and enables the design of resilient grid structures.

Großes Physikalisches Kolloquium an der Universität zu Köln

Jun.-Prof. Dr. Nele Callebaut
Institut für Theoretische Physik, Universität zu Köln

Emergent gravity from conformal field theory

28.06.2022
16^{30} Uhr
HS III

I will present three different, but not unrelated, mechanisms for the emergence of gravity from 2-dimensional conformal field theory (CFT). The most well-known involves a higher-dimensional theory of gravity that is dual to the CFT, and is thus holographic. The other mechanisms are non-holographic, and involve entanglement conditions in the CFT or specific deformations of the CFT. This work explores connections between gravity, quantum field theory and elements of quantum information theory.