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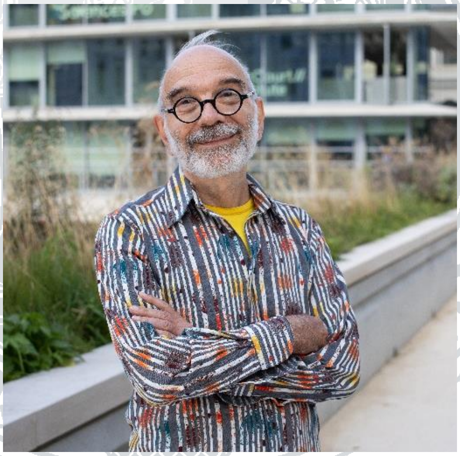


Dr. Serge Galam
CEVIPOF - Centre for Political Research, Sciences Po and CNRS, Paris, France

Sociophysics: From First Ingredients to Successful Predictions

29.04.2025
16^{30} Uhr
HS III

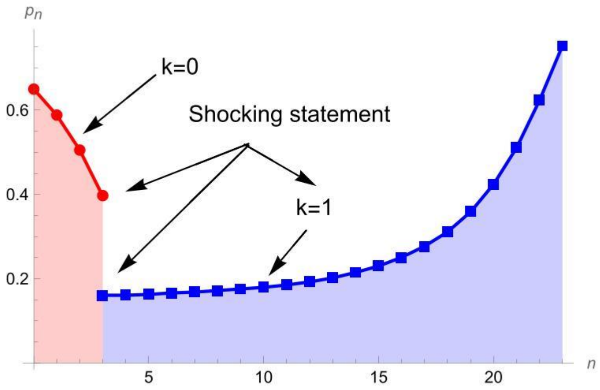
After a brief journey through the history of sociophysics, and a clear clarification of what sociophysics aims to be — and what it is not — I will illustrate its capability by presenting the foundational elements of the Galam Majority Model (GMM) of opinion dynamics. I will highlight the compelling mechanism of democratic minority spreading during open and free public debate. Drawing on the GMM, I will explain how I successfully predicted the unexpected victory of Donald Trump in the 2016 U.S. presidential election. I will also critically examine why my forecast for Trump's victory in the 2020 election against Joe Biden fell short. Finally, I will conclude by presenting my insights into the robustness of the model, especially in light of the second Trump victory in the 2024 election.

References

S Galam, Minority opinion spreading in random geometry, European Physical Journal B 25, 403-406 (2002)

S Galam, The Trump phenomenon: An explanation from sociophysics, International Journal of Modern Physics B 31 (10) 1742015 (2017)

S Galam, Will Trump win again in the 2020 election? An answer from a sociophysics model, Physica A 570, 125835 (2021)



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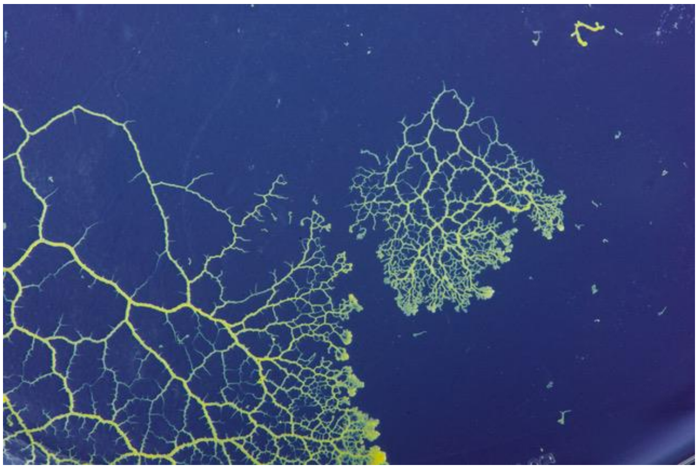
Prof. Dr. Karen Alim
Technische Universität München

Lesson from smart slime: How active flow networks process information for complex behaviour

13.05.2025
16^{30} Uhr
HS III

Propagating, storing and processing information is key to take smart decisions – for organisms as well as for autonomous devices. In search for the physical principles that allow for complex behaviour, the slime mould Physarum polycephalum stands out by solving complex optimization problems despite its simple make-up. Physarum’s body is an interlaced network of fluid-filled tubes lacking any nervous system, in fact being a single gigantic cell. Yet, Physarum finds the shortest path through a maze. We unravel that Physarum’s complex behaviour emerges from the physics of active flows shuffling through its tubular networks. Flows transport information, information that is stored in the architecture of the network. Thus, tubular adaptation drives processing of information into complex behaviour. Taking inspiration from the physical principles at work in Physarum we outline how to embed complex behaviour in active microfluidic devices and how to program human vasculature.



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Prof. Dr. Jochen Wosnitza
Hochfeld-Magnetlabor Dresden, Helmholtz-Zentrum Dresden-Rossendorf

Materials Research in Very High Magnetic Fields

27.05.2025
16^{30} Uhr
HS III

The application of magnetic fields is a commonly used instrument in materials-science research, since this allows to study, modify, and control the state of matter. Thereby, research at the highest possible magnetic fields becomes increasingly important. The High Magnetic Field Laboratory Dresden (Hochfeld-Magnetlabor Dresden, HLD) at the Helmholtz-Zentrum Dresden-Rossendorf (HZDR) makes available pulsed magnetic fields up to the 90 T range, on a 10 ms timescale, for internal and external users. In the pulsed magnets, a variety of experimental methods are available enabling to measure, for example, electrical transport, magnetization, dilatometry, ultrasound, ESR, and even NMR with very high resolution. Research of the HLD focuses on electronic properties of strongly correlated and topological materials at high magnetic fields. This includes the investigation of frustrated magnetic materials and the determination of Fermi surfaces of topological and correlated metals by means of measurements of magnetic quantum oscillations. We further investigate unconventional high-magnetic-field states of novel superconductors, but, beyond that, even field-induced plasma waves in liquid metals. Here, I will present a brief overview on the experimental infrastruc-ture and discuss some highlights of the research at the Dresden High Magnetic Field Laboratory, with a focus on magnetically frustrated materials.

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Großes Physikalisches Kolloquium an der Universität zu Köln

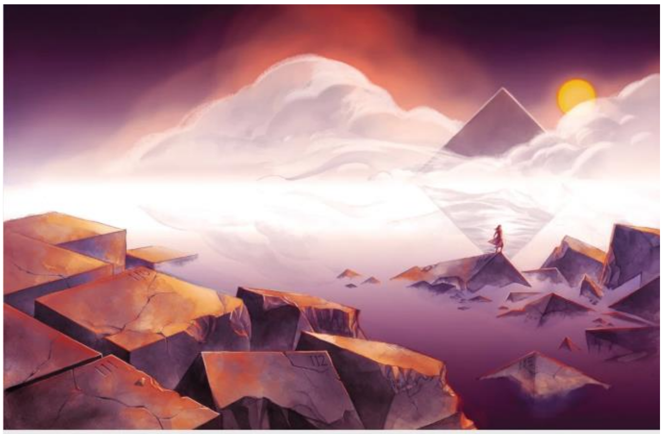
Dr. Michael Block
GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Helmholtz Institute Mainz und Johannes Gutenberg University Mainz

3.06.2025
16^{30} Uhr
HS III

Exploring the heaviest elements at the end of the Periodic Table

Where does the Periodic Table end, and what is the heaviest nucleus that can exist? Is there an "Island of Stability" for superheavy elements? Answering these fundamental questions is central to superheavy element research. These elements do not occur naturally on Earth and can only be synthesized in small quantities using particle accelerators. For over 50 years, research at the GSI in Darmstadt has significantly expanded our understanding of these elusive species, leading to the discovery of six new elements. At GSI, we conduct a comprehensive research program that addresses every aspect of superheavy elements, using a wide range of specialized setups and techniques. Recently, several pioneering experiments have provided crucial insights into the nuclear shell structure of the heaviest nuclei, the reason for their very existence. In addition, atomic properties, such as ionization potentials, have been measured, revealing the influence of relativistic effects. To this end, we have advanced Penning-trap mass spectrometry and laser spectroscopy through innovative approaches.

In my presentation, I will provide an overview of the status of the field and present highlights from recent measurement campaigns.



Michael Manomivibul

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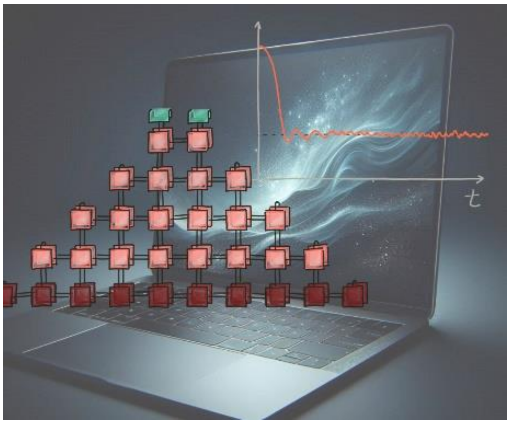
Dr. Dr. Mari Carmen Bañuls
Max Planck Institut für Quantenoptik and Munich Center for Quantum Science and Technology MCQST

24.06.2025
16^{30} Uhr
HS III

Tensor Networks: entanglement and the simulation of quantum many-body problems

The term Tensor Network (TN) States designates a number of ansatzes that can efficiently represent quantum many-body states. Ground states and thermal equilibrium of local Hamiltonians, and, to some extent, real time evolution, can be numerically studied with TNs. Quantum information theory provides tools to understand why they are good ansatzes for physically relevant states, and some of the limitations connected to the simulation algorithms.

The potential applications of TNS nowadays extend far beyond quantum many-body physics, for which they were originally introduced, into disciplines as quantum chemistry or quantum field theory. But out-of-equilibrium dynamics poses serious challenges for these techniques, due to the scaling of entanglement with time and system size. However, pushing TNS beyond the standard algorithms can open new windows onto interesting dynamical properties, such as thermalization of quantum systems evolving in isolation, which probes the intersection of statistical mechanics and quantum physics.



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