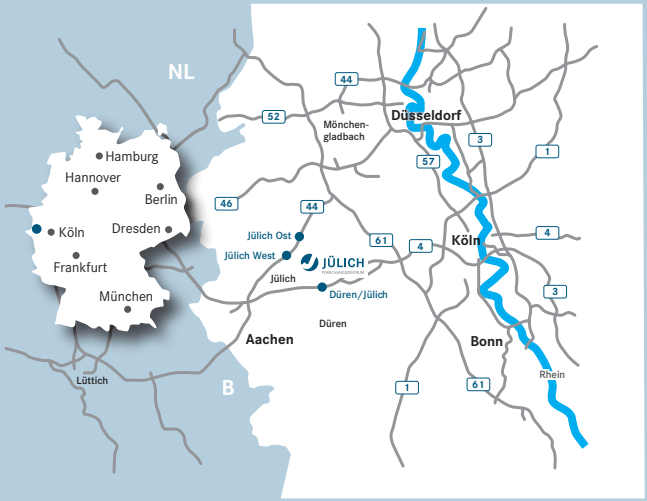
Lecturers

- Kieron Burke (Irvine)
- Maria Daghofer (Stuttgart)
- David DiVincenzo (Jülich)
- Klaus Doll (Stuttgart)
- Robert Eder (Karlsruhe)
- Walter Hofstetter (Frankfurt)
- Václav Janiš (Prague)
- Erik Koch (Jülich)
- Thomas Lippert (Jülich)
- Kristel Michielsen (Jülich)
- Eva Pavarini (Jülich)
- Catherine Pépin (Saclay)
- Pina Romaniello (Toulouse)
- Christian Schilling (München)
- Gianluca Stefanucci (Rome)
- Libor Veis (Prague)



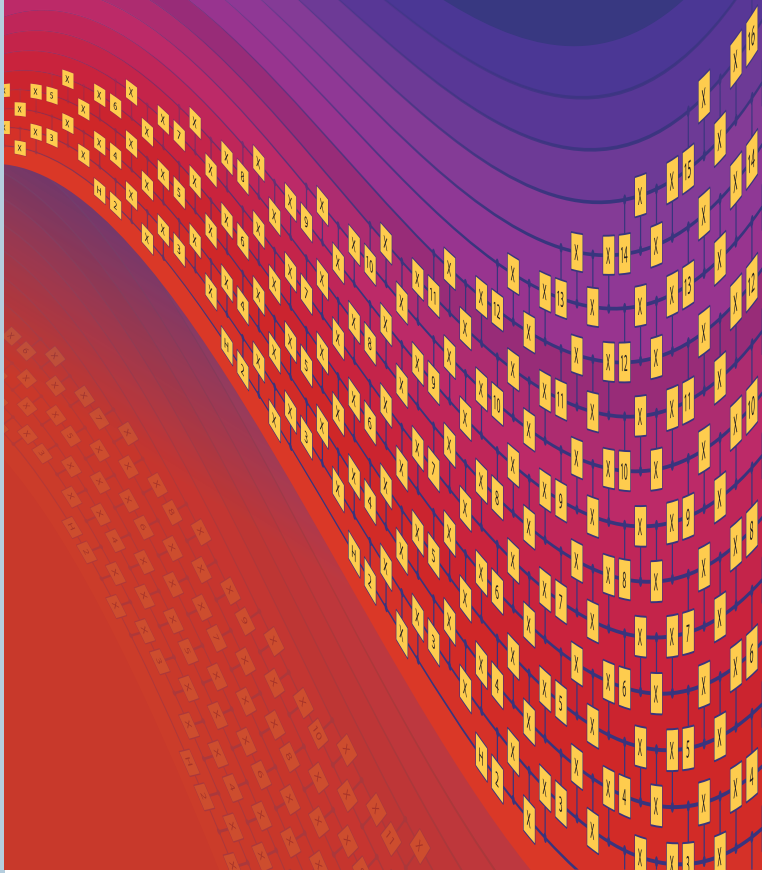
Organizers

Eva Pavarini, Forschungszentrum Jülich

Erik Koch, Forschungszentrum Jülich

Further information

Please refer to www.cond-mat.de/events/correl 21 for updated details of arrangement and final program. For further questions, please write to correl21@fz-juelich.de



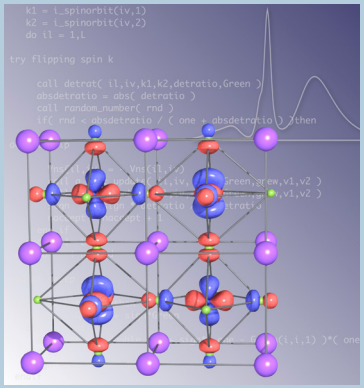
Autumn School on Correlated Electrons

Simulating Correlations with Computers

20 – 24 September 2021
Forschungszentrum Jülich

JÜLICH Forschungszentrum

ICAM-I2CAM Institute for Complex Adaptive Matter



The combinatorial growth of the Hilbert space makes the many-electron problem a grand challenge. Progress relies on the development of non-perturbative methods, based on either wavefunctions or self-energies. This made, in recent years, calculations for strongly-correlated materials a reality. These simulations draw their power from three sources: theoretical advances, algorithmic developments and the raw power of massively parallel supercomputers. Turning to quantum hardware could give quantum materials science the ultimate boost. Before quantum parallelism can be exploited, however, many questions, algorithmic and engineering, need to be addressed.

The school will provide students with an overview of the state-of-the-art of many-body simulations and the promises of quantum computers. After introducing the basic modeling techniques and the concept of entanglement in correlated states, lectures will turn to methods that do not rely on wavefunctions, comparing density functional theory, the GW method and dynamical mean-field theory. Advanced lectures will broaden the discussion, addressing topics from the Luttinger-Ward functional to non-equilibrium Green functions. As a glimpse of future possibilities, the basics of quantum computing and its possible uses in materials simulations will be outlined.

Lectures

Concepts

- quantum chemistry
- many-body perturbation theory
- dynamical mean-field theory
- Jordan-Wigner transforms
- quantum simulations

Models

- entanglement and correlations
- Hubbard model: DFT, GW and DMFT
- correlations and superconductivity
- frustrated quantum magnets

Green functions

- Hedin's GW method
- the LDA+DMFT approach
- Luttinger-Ward functional
- renormalization and disorder
- non-equilibrium Green functions

Quantum computing

- analog simulators
- digital hardware
- quantum annealing
- quantum-gate programming

General Information

Venue: The school will take place at the Forschungszentrum Jülich, in the lecture hall of the Peter Grünberg Institute, from **20 to 24 September 2021**.

Participation: The school is intended for advanced graduate or PhD students and postdocs in the field of electronic structure of materials.

Admission: Interested students should apply before **May 31, 2021** at **www.cond-mat.de/events/correl21**. Accepted applicants will be informed by e-mail shortly after the deadline.

Accommodation: Students can apply for financial support to cover accommodation costs. Participants supported by the school will stay in the Aachen Youth Hostel **www.aachen.jugendherberge.de**. Funding for accommodation is limited.

ICAM Junior Travel Awards: We might be able to provide a limited number of ICAM Junior Travel Awards. For more information see **icam-i2cam.org** and the application form at **www.cond-mat.de/events/correl21**.

Transport: A shuttle bus will be operating in the mornings and evenings between the Youth Hostel in Aachen and the Forschungszentrum Jülich.

Hotels in Aachen and Jülich: Participants for whom no low-cost accommodation can be found or who wish to stay in a hotel may find hotels in Jülich or Aachen through the sites **www.aachen-tourist.de** and **www.juelich.de/hotelsundpensionen**.