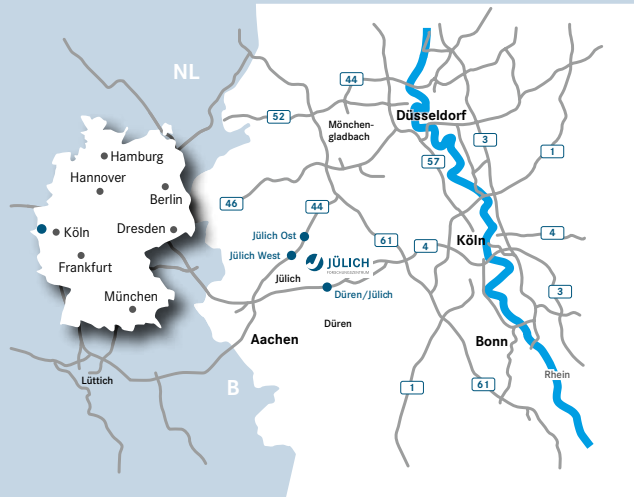


Lecturers

- Bernard Amadon (Paris)
- Eva Benckiser (Stuttgart)
- Arnout Ceulemans (Leuven)
- Jak Chakhalian (Rutgers)
- Robert Eder (Karlsruhe)
- Andreas Grüneis (Wien)
- Erik Koch (Jülich)
- Nicola Lanata (Rochester)
- Alexander Lichtenstein (Hamburg)
- Takashi Mizokawa (Waseda)
- Andrzej Oles (Krakow)
- Eva Pavarini (Jülich)
- Mark Pederson (El Paso)
- Hao Tjeng (Dresden)
- Simon Trebst (Köln)
- Jeroen van den Brink (Dresden)
- Matthias Vojta (Dresden)

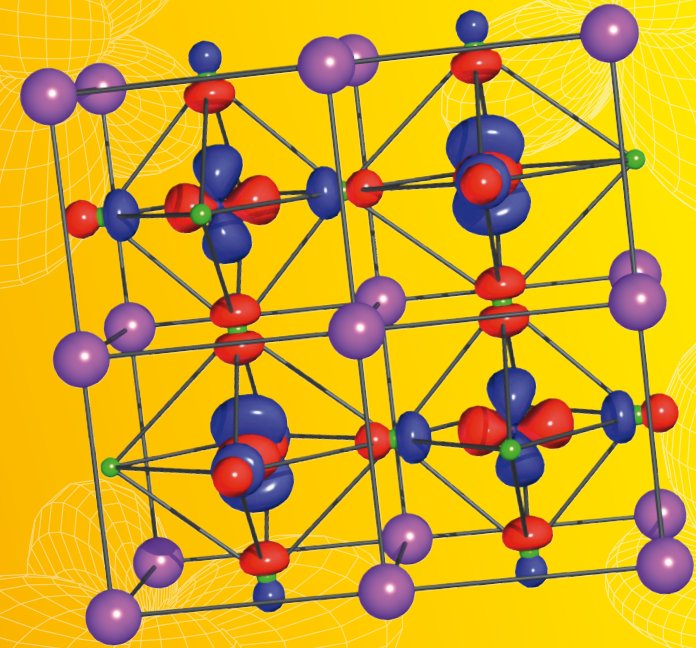


Organizers

Eva Pavarini, Forschungszentrum Jülich
Erik Koch, Forschungszentrum Jülich

Further information

Please refer to www.cond-mat.de/events/correl23
for updated details of arrangement and final program.
For further questions, please write to
correl23@fz-juelich.de

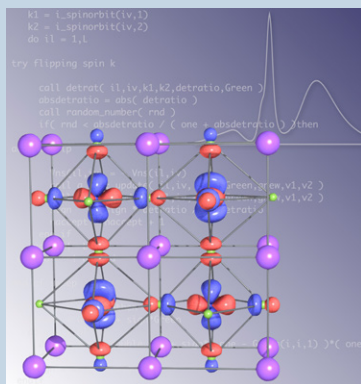


Autumn School on Correlated Electrons

Orbital Physics in Correlated Matter

18 – 22 September 2023
Forschungszentrum Jülich





In a classic paper 50 years ago, Kugel and Khomskii demonstrated that in strongly-correlated systems orbital ordering can arise from a purely electronic super-exchange mechanism and not just the conventional co-operative Jahn-Teller effect. This work opened the field of orbital physics which, since then, is undergoing continuous growth. It was understood that, besides orbital ordering, super-exchange can give rise to the orbital analogue of spin-liquid states. It was shown that the directional character of the orbitals can introduce anisotropic super-exchange interactions, which, in a simplified setting, are described by compass models, a prototype for the Kitaev model. More surprising phenomena arise from the entanglement of spin and orbital degrees of freedom. New developments aim at tuning orbital occupations by pushing the system out of equilibrium, and at orbital-controlled electronics.

The goal of this year's school is to provide students with an overview of the state-of-the art in the field of orbital physics in strongly correlated systems and the techniques used to investigate them. After introducing fundamental models and effects, lectures will focus on these effects in real materials. Advanced lectures will address orbital phases and Kitaev materials, as well as theoretical approaches and experimental probes of spin, orbital, and charge degrees of freedom.

Lectures

Concepts

- symmetry
- Jahn-Teller effect
- spin-orbit coupling
- multiplet theory
- exchange mechanisms

Methods

- density-functional theory
- self-interaction corrections
- slave-boson approaches
- coupled-cluster theory
- dynamical mean-field theory

Orbital Physics

- orbital ordering
- quantum criticality
- spin-orbital entanglement
- orbital-Peierls phenomena

Materials

- X-ray spectroscopy
- surfaces and heterostructures
- probing spin, charge and orbitals
- imaging orbitals

General Information

Venue: The school will take place at the Forschungszentrum Jülich, in the lecture hall of the Peter Grünberg Institute, from **18 to 22 September 2023**.

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, 2023** at www.cond-mat.de/events/correl23. 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/correl23.

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.