

Lecturers

- Thomas Aryal (Eviden)
- Krzysztof Byczuk (Warszawa)
- Luca De Medici (Paris)
- Claude Ederer (Zürich)
- Karen Hallberg (Bariloche)
- Karsten Held (Wien)
- Robert Jones (Jülich)
- Erik Koch (Jülich)
- Alexander Lichtenstein (Hamburg)
- Walter Metzner (Stuttgart)
- Eva Pavarini (Jülich)
- Jan Tomczak (London)
- Dieter Vollhardt (Augsburg)
- Xavier Waintal (Grenoble)
- Tim Wehling (Hamburg)
- Philipp Werner (Fribourg)



Organizers

Eva Pavarini, Forschungszentrum Jülich
Erik Koch, Forschungszentrum Jülich
Alexander Lichtenstein, Universität Hamburg
Dieter Vollhardt, Universität Augsburg

Further information

Please refer to www.cond-mat.de/events/correl25
for updated details of arrangement and final program.
For further questions, please write to
correl25@fz-juelich.de

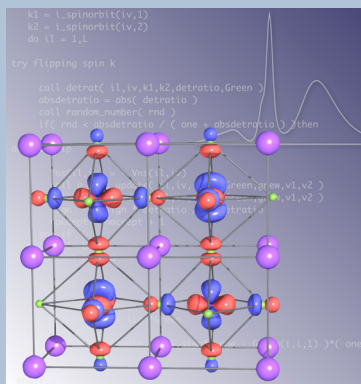


Autumn School on Correlated Electrons

Understanding Correlated Materials with DMFT

22 – 26 September 2025
Forschungszentrum Jülich





Dynamical Mean-Field Theory has established itself as the method of choice for dealing with emergent phases in strongly correlated materials. In fact, its combination with density-functional theory via the construction of materials-specific models has opened the path to the description of correlation effects beyond the level of generic models. This, together with the development of powerful quantum-impurity solvers, and the help of modern massively-parallel supercomputers, provides powerful tools for understanding correlation effects and has revolutionized the field of correlated materials science.

The goal of this year's school is to provide students with an overview of the method and its application to materials, with a view towards the future of many-body simulations. The program will start with fundamental models and concepts, introducing the Hubbard model, density-functional theory and the principles of DMFT. More advanced lectures will focus on the DFT+DMFT approach and its extensions. Specialized lectures will then demonstrate how the approach can be used to unravel the mechanism of paradigmatic emergent phenomena in materials: non-conventional superconductivity, orbital ordering, Mott phases, disorder, Hund's metal behavior, and pseudogap phases. The topics will be treated with a focus on explaining key experiments in a realistic setting and with an outlook on materials design.

Lectures

Fundamentals

- Hubbard models
- mean-field theories
- density-functional theory
- model parameters

Approaches

- dynamical mean-field theory
- non-local extensions
- dynamical vertex approximation
- dual fermions and bosons
- out-of-equilibrium effects

Methods

- charge self-consistency
- fRG, DMRG, and tensor trains
- quantum Monte Carlo
- analytic continuation
- quantum-computing solvers

Materials

- spin and orbital physics
- Mott transition
- Hund's metals
- unconventional superconductivity
- Moire materials
- disordered systems

General Information

Venue: The school will take place at the Forschungszentrum Jülich, in the lecture hall of the Peter Grünberg Institute, from **22 to 26 September 2025**.

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, 2025** at www.cond-mat.de/events/correl25. 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.jugendherberge.de/en/youth-hostels/aachen. 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/correl25.

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 Aachen or Jülich through the sites and www.aachen-tourist.de and www.juelich.de/hotelsundpensionen.