



Scope

Emergent phenomena are the hallmark of many-body system and yet to unravel their nature remains one of the central challenges in condensed-matter physics. In order to advance our understanding it is crucial to learn from the different manifestations of emergence as well as from the interplay of different emergent phases, such as magnetism and superconductivity. For addressing such problems, it is necessary to master a broad spectrum of techniques from traditionally separate branches of research, ranging from ab-initio approaches based on density-functional theory to advanced many-body methods to electron-lattice coupling and dynamics. In this school we aim to analyze emergence in some of its major manifestations in the solid-state and compare methodologies used to address specific aspects. The aim of the school is to introduce advanced graduate students and up to the essence of emergence and the modern approaches for modeling emergent properties of correlated matter.

Lectures

Overview and Introduction

- Density-functional theory
- Second quantization and path-integrals
- Monte Carlo techniques
- Model Hamiltonians

Superconductivity

- Renaissance of superconductivity
- Electron-phonon coupling
- Eliashberg theory
- High-temperature superconductors
- Superfluidity

Magnetism

- Models and mechanisms
- Magnetism and correlations
- Molecular magnets
- Quantum spin-models

Methods

- Density-matrix renormalization group
- Tensor networks and entanglement
- Cluster methods
- Quantum Monte Carlo

General Information

Venue: The school will take place at the Forschungszentrum Jülich, in the lecture Hall of the Peter Grünberg Institute, from 23 to 27 September 2013.

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

Admission: Interested students should apply before May 31, 2013 via internet at the address www.cond-mat.de/events/correl13. Accepted applicants will be informed via e-mail shortly after the deadline for applications.

Accommodation: Applicants can apply for financial support to cover accommodation costs. Participants supported by the school will be accommodated in the Aachen Youth Hostel www.aachen.jugendherberge.de. Funding for accommodations is limited to about 30 students.

ICAM Junior Travel Awards: Eligible candidates can apply for an ICAM Junior Travel Award. Funding is limited to about 10 students. For more information see icam-i2cam.org and the application form at www.cond-mat.de/events/correl13.

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 these web-sites www.aachen-tourist.de and www.juelich.de/hotelsundpensionen.