

Alexander D. Mirlin

Institut für Nanotechnologie, Forschungszentrum Karlsruhe, 76021 Karlsruhe, Germany

Anderson transitions and wave function multifractality

Lecture 1. Quantum interference, localization, and field theories of disordered systems.

- quantum interference: diagrammatics, weak and strong localization, mesoscopic fluctuations
- field theories: non-linear sigma-models
- quasi-1D geometry: exact solution, strong localization
- renormalization group, metal-insulator transition, criticality
- quantum Hall effect

Lecture 2. Multifractality of critical wave functions at metal-insulator transitions

- wave function statistics
- multifractal wave functions at criticality, spectra of fractal exponents
- properties of multifractality spectra: ensemble-averaged vs. typical exponents, singularities, relations between exponents
- surface multifractality

Lecture 3. Systems and models

- Anderson transitions in D dimensional systems
- PRBM (power-law random banded matrix) model: 1D system with $1/r$ long-range hopping
- mechanisms of delocalization and criticality in quasi-1D and 2D systems
- quantum Hall transitions in normal and superconducting systems
- disordered Dirac fermions; disordered graphene