Department Mathematik/Informatik
Prof. Dr. Alexander Drewitz

UNIVERSITÄT ZU KÖLN

Bonn Cologne Seminar on Mathematik and Physics

Am Mittwoch, 10.12.2025 um 17:45 Uhr, im Seminarraum 1 (Raum 005**)** der Abteilung Mathematik, Weyertal 86–90, 50931 Köln, spricht:

Dr. Giulia Sebastiani
(Universität Bonn)

zum Thema

From Parisi to Boltzmann: via GREM and TAP

Abstract

Introduced by Derrida in the 80s, the Generalized Random Energy Models (GREM) serve as simplified, abstract models that are completely solvable and have significantly contributed to our comprehension of specific facets within the Parisi theory for mean field spin glasses. In this talk, after an overview of Parisi's ultrametric principle for the free energy of the Sherrington-Kirkpatrick (SK) model, we will turn to the alternative approach due to Thouless, Anderson and Palmer (TAP). The TAP approach provides a representation of the SK free energy as the maximum of a random functional over local magnetizations. A simple reformulation reveals that, when evaluated at its critical points, the TAP free-energy becomes a nonlinear functional of empirical measures constructed from local fields. Motivated by this structure, we construct abstract GREM-like models whose Hamiltonians are nonlinear functionals of empirical measures associated with GREM-like variables. For the thermodynamic free energy of these abstract models, dual Parisi-like formulas hold and turn out to be finite-dimensional "collapsed" versions of the underlying infinite-dimensional Gibbs-Boltzmann principles. Crucially, the nonlinearity inherited from the TAP representation generates a correction term (absent in canonical GREM-like models) that substantially reduces the gap between the free energies of such abstract hierarchical models and Parisi's solution for the SK.

Interessenten sind herzlich eingeladen.

Die Dozenten der Stochastik