Jorge Acuña Flores

Higher Abelian Quantum Double Models

Abstract: Abstract: Higher Abelian Quantum Double Models are quantum spin systems defined in arbitrary finite dimensions that generalize the Toric Code introduced by Alexei Kitaev. In this talk, we present a pedagogical introduction to the formalism underlying these models, with particular emphasis on a detailed characterization of their frustration-free ground state space. Furthermore, we demonstrate how this ground state space can encode both classical bits and quantum bits (qubits), providing a quantitative description of its intrinsic information storage capacity. This is based on joint work with Giuseppe De Nittis and Javier Lorca Espiro.

Lennart Becker

Automorphic Equivalence and an Adiabatic Theorem for Infinite Lattice Systems

Abstract: I will present two results on adiabatic transport for infinite-volume fermionic lattice systems. The first is an automorphic equivalence theorem showing that any differentiable path of gapped ground states can be implemented by a quasi-local automorphism generated by an explicit interaction.

The second part of the talk explains a generalized many-body adiabatic theorem for time-dependent Hamiltonians that may close the spectral gap under perturbations. The result provides quasi-local states that satisfy the Heisenberg evolution up to errors $\mathcal{O}(\eta^\infty)$.

Yoon Jun Chan

Renewal Theory for Transfer Operators and Point Processes on the Line

Abstract: We consider a one-dimensional particle system in the continuum, where each particle interacts only with its k nearest neighbours for some fixed k.
Using a transfer operator approach, we reformulate the study of such particle systems as the analysis of certain Markov chains.
We identify conditions under which the renewal theorem can be applied to establish exponential decay of correlations.
As an example, we discuss the Lennard–Jones potential.
This is joint work with Markus Heydenreich and Sabine Jansen.

Eddy de Leon

Numerical solutions to evolution PDEs

Abstract: In this talk I will present two different approaches to construct the numerical solution to evolution PDEs, such as the Schrödinger equation. To this end, we consider a combination of parametrization (time-dependent complex parameters) and time discretization processes. The order in which this combination is done is important and the main differences will be discussed throughout the talk.

Larry Read
Spectral estimates for Schrödinger operators

Abstract: Spectral inequalities such as the Lieb–Thirring and Cwikel–Lieb–Rozenblum bounds relate the potential of a Schrödinger operator to its spectrum. I will introduce these estimates through semiclassical heuristics, explain their connection to Sobolev inequalities, and highlight the diverse analytic methods used to prove them.

Barbara Roos
Superconductivity

Abstract: The understanding of superconductivity is far from complete. I will provide an overview of how Bardeen-Cooper-Schrieffer (BCS) theory, a successful physical model for superconductivity, connects with other models of superconductivity, highlighting open questions and recent developments in the field.

Severin Schraven
Schrödinger operators and compact resolvents

Abstract: We all know from introductory quantum mechanics that the spectrum of the harmonic oscillator consists of eigenvalues of finite multiplicity tending to infinity. We will have a glimpse of what is known for more general polynomial potentials and which questions are still open.

Sebastian Stengele
Tired of Stable Quantum Codes? Try Modified Logarithmic Sobolev Inequalities for RAPID Information Loss Today!

Abstract: Calderbank–Shor–Steane (CSS) codes, such as the Toric code, are a widely studied class of quantum error-correcting codes. Understanding the thermalization time of these systems is important not only for error correction but also for applications like Gibbs sampling. I will give a short introduction on these systems and how one models thermalization and then show how we employ modified logarithmic Sobolev inequalities to bound their mixing time and, furthermore, how certain systems, such as the 2D and 3D Toric codes, exhibit rapid loss of quantum information at any positive temperature. This is based on joint work with Ángela Capel, Li Gao, Angelo Lucia, David Pérez-García, Antonio Pérez-Hernández, Cambyse Rouzé, and Simone Warzel.

Cornelia Vogel
Normal and Dynamical Typicality in a Random Matrix Model

Abstract: We consider a closed macroscopic quantum system in a pure state evolving unitarily and take for granted that different macro states correspond to mutually orthogonal subspaces (''macro spaces'') of the system's (high-dimensional) Hilbert space. We are interested in what the evolution of the system's wave function looks like macroscopically, in particular, how much of it lies in a certain macro space. Two important related phenomena are the ones of normal typicality (a type of long-time behavior) and dynamical typicality (a type of similarity of the time evolution for initial states from a certain macro space). We prove normal as well as dynamical typicality for a (centered) random block-band matrix model with block-dependent variances. A key feature of our model is that we achieve intermediate equilibration times, an aspect that has not been proven rigorously in any model before. Our proof builds on recently established concentration estimates for products of resolvents of Wigner-type random matrices and an intricate analysis of the deterministic approximation. This is joint work with László Erdős and Joscha Henheik.