Spectral Analysis of Schrödinger Operators
Poster Session Abstracts
Wednesday, August 21, 2024

Bulk and edge phenomena in deformed square lattice media
Jonah Chaban, Columbia University

The band structure encodes properties of wave propagation in energy-conserving periodic media. In media with square lattice symmetry, bands may touch quadratically at the vertices of the Brillouin zone. Under typical linear deformations, these quadratic band degeneracies split into pairs of tilted, elliptical Dirac (conical) points. Further, in the presence of perturbations which break time-reversal symmetry, the degeneracies are lifted and bands acquire nonzero topological indices (the first Chern number). Finally, we consider analogous media with line defects and discuss the appearance of edge states: these propagate along, but are localized transverse to the defect. The behavior of the family of edge states is related to the topology of the essentially bulk media far from the edge; a result known as the bulk-edge correspondence.

On the onset of Quantum Boltzmann fluctuation dynamics near a dense BEC
Michael Hott, UMN

Deriving a Quantum Boltzmann equation (QBE) from first principles is a long-standing open problem in mathematical physics. Assuming a dense initial Bose-Einstein Condensate (BEC), together with quasifree thermal excitations, it is known that quasifreeness is preserved for short times. The resulting leading order BEC dynamics coupled with the leading order fluctuation dynamics is known to be given by the Hartree-Fock-Bogoliubov (HFB) dynamics. We show that beyond this order, corrections lead to the renormalization of the HFB dynamics in addition to the emergence of a QBE.

Radiative Decay of Edge States in a Time-Forced SSH Model
Remy Kassem, Columbia University

We study the effect of time-periodic forcing on the edge state of the semi-infinite Su–Schrieffer–Heeger (SSH) model, a 1D tight-binding model. Numerical simulations and an asymptotic expansion demonstrate that if the frequency of forcing is in resonance with the continuous spectrum of the unforced Hamiltonian H, then on a time scale proportional to the inverse square of the forcing amplitude, the edge state decays in amplitude due to the radiation of its energy into the bulk. A proof is work in progress, and makes use of a new dispersive decay estimate for the H induced time-evolution.

Scattering of Vlasov-Riesz systems in the three dimensions
Hyunwoo Kwon, Brown University

We consider an asymptotic behavior of solutions to the Vlasov-Riesz system of order α in $\mathbb{R}^3$ which is a kinetic model induced by Riesz interactions. We prove small data scattering when $1/2<\alpha<1$ and modified scattering when $1<\alpha<1+\delta$ for some $\delta>0$. Moreover, we show the existence of (modified) wave operators for such a regime. To the best of our knowledge, this is the first result on the existence of modified scattering with polynomial correction in kinetic models.

Global dynamics for the Maxwell-Dirac system
Kiyeon Lee, KAIST

In this poster, we study the (1+3) dimensional massive Maxwell-Dirac system in the context of global existence and asymptotic behavior of solutions under the Lorenz gauge condition, as well as the modified and linear scattering phenomena for the Dirac spinor and the electromagnetic potential, respectively. We employ a vector fields energy method combined with a detailed analysis of the space-time resonance argument. This approach allows us to establish decay estimates and energy bounds crucial for proving the main theorems. Especially, we provide the explicit phase correction arising from the strong nonlinear resonances.

Boundary Stabilisation of Waves on Product Manifolds
Ruoyu Wang, Yale University

We present recent results on the damped wave equation, a second-order hyperbolic linear partial differential equation that describes the behaviour of mechanical and acoustic waves whose energy are lost due to viscous damping.

N-Soliton Solutions of the Hartree equation
Yutong Wu, Yale University

Consider the three-dimensional gravitational Hartree equation. We prove the existence of multisoliton solutions with gravitational interaction of hyperbolic, parabolic and hyperbolic-parabolic types.

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