北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

Exact fractional Chern insulators from Hubbard interactions

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Time: 10:30 am, Nov.26, 2026 (Thursday)

时间：2026年11月26日（周四）上午10:30

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

Laughlin's wavefunction and its parent interaction, Haldane's pseudopotential, underpin our analytic understanding of fractional quantum Hall effect. They are an exact pair in the sense that the wavefunction is the unique, zero-energy ground state of its frustration-free parent Hamiltonian. In this work, we propose exact pairs of many-body wavefunctions for fractional Chern insulators in tight binding models with onsite Hubbard interactions as their parents. The key to our construction is introduction of a \emph{Landau-dual Chern band}, a multi-orbital Chern band obtained from directly sampling the spin-s Dirac Landau level on a Bravais lattice. The exact many-body wavefunctions are given, analytically, in terms of the matrix coordinate $X+iY+J$, where (X,Y) are the lattice coordinates and J is a nilpotent matrix in spin space. The constructed exact pairs cover the fractional Chern states of the Laughlin, the Read-Rezayi, and the Halperin series. Our results prove that FCI ground states exist beyond ideal bands.

About the speaker

Chen Fang is a condensed matter theorist at Institute of Physics since 2015, Chinese Academy of Sciences. He graduated from Purdue University with the PhD degree in physics in 2011. He worked as a postdoctoral research associate at Princeton University and Massachusetts Institute of Technology from 2012-2014. His research interest includes the topological classification of bands, non-Hermitian physics, and more recently, fractional topological states.