Seminar

Chiral Color Code

Beni Yoshida

Perimeter Institute for Theoretical Physics

Time: 10:30 am, Aug.13, 2025 (Wednesday)

时间：2025年8月13日（周三）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

We present a family of simple three-dimensional stabilizer codes, called the chiral color codes, that realize fermionic and chiral topological orders. In the qubit case, the code realizes the topological phase of a single copy of the fermionic toric code. For qudit systems with local dimension d, the model features a chiral parameter α and realizes 3D topological phases characterized by anomalous chiral surface topological order. with Z_d^alpha anyons. On closed manifolds, the code has a unique ground state after removing bulk transparent fermions or bosons. Furthermore, we prove that the bulk is short-range entangled by constructing an explicit local quantum channel (i.e. quantum cellular automata) that prepares the ground state. The chiral color codes are constructed within the gauge color code, and hence inherit its fault-tolerant features, admitting single-shot error correction and allow code switching to other stabilizer color codes. These properties set the chiral color codes as particularly useful platforms for realizing and manipulating fermions and chiral anyons. Based on an upcoming work with my PhD student Dongjin Lee.

About the speaker

Beni Yoshida is a faculty member at the Perimeter Institute for Theoretical Physics. As a member of It from Qubit, he was a five-year senior postdoctoral researcher at Perimeter. He received his Ph.D. in physics in 2012 from the Massachusetts Institute of Technology under the supervision of Edward Farhi and Peter Shor. Afterward, he was awarded the David and Ellen Lee Postdoctoral Scholarship in Theoretical Physics at California Institute of Technology (2012–2015) working in John Preskill's group.