IMPRS Seminar 30 November 2023
4:30 pm at MPI-PKS

Spin-anyon duality and Z2 topologically ordered states

Speaker: Peng Rao (MPI-PKS)

Abstract: The Toric Code (TC) is one of the simplest and most illustrative examples of Z2 topological order, and contains static, non-interacting anyons. More generally, the TC suggests a rewriting of the lattice spin-1/2 degrees of freedom in terms of these anyons, and can be used as a building block for constructing new Z2 topologically ordered states in which anyons can acquire dynamics and interact. In the talk, I will discuss an exact duality between the spin-1/2 Hilbert space on a two-dimensional periodic square lattice, and the Hilbert space of e-bosons and ε-fermions from the TC. The duality incorporates the mutual semionic statistics of e and ε (namely they are mutual π-vortices) and the global topological degrees of freedom due to lattice periodicity. This allows us to construct and study a class of Z2 topologically ordered states `enriched by translation symmetry' as topological superconductors of ε-fermions, and classify them in a Z×(Z2)^3 scheme extending the Chern number classification. In addition, I will discuss the Berry phases of e-particles (visons) renormalized by the superconducting vacua of these phases, and establish numerically their relations to the underlying topology of the system.