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# Moroz - Spontaneously Broken Non-Invertible Symmetries in Transverse-Field Ising Qudit Chains - 1

*Monday, 9 March 2026 15:00 (1 hour)*

Recent developments have revealed that symmetries need not form a group, but instead can be non-invertible. In these lectures I will use analytical arguments and numerical evidence to illuminate how spontaneous symmetry breaking of a non-invertible symmetry is similar yet distinct from ordinary symmetry breaking. I will consider one-dimensional chains of group-valued qudits, whose local Hilbert space is spanned by elements of a finite group G (reducing to ordinary qubits when G=Z/2Z). I will construct Ising-type transverse-field Hamiltonians with Rep(G) symmetry whose generators multiply according to the tensor product of irreducible representations (irreps) of the group G. For non-Abelian G, the symmetry is non-invertible. In the symmetry broken phase there is one ground state per irrep on a closed chain. The symmetry breaking can be detected by local order parameters but, unlike the invertible case, different ground states have distinct entanglement patterns. I will show that for each irrep of dimension greater than one the corresponding ground state exhibits string order, entanglement spectrum degeneracies, and has gapless edge modes on an open chain – features usually associated with symmetry-protected topological order. Consequently, domain wall excitations behave as one-dimensional non-Abelian anyons with non-trivial internal Hilbert spaces and fusion rules. If time permits, I will discuss how these phenomena can be probed on existing quantum hardware and the new questions they raise for quantum computing.