

Warman - Clifford-Hierarchy Gates from Group Quantum Doubles

Wednesday, 11 March 2026 11:00 (1 hour)

A critical mission for realizing large-scale quantum computing is the development of simple and resource-efficient implementations of logical non-Clifford gates. This talk discusses how novel protocols for their implementation can be obtained from topological field theory.

In the first part, based on arXiv:2510.20890, we present hybrid lattice surgery between Abelian and non-Abelian codes and show how it enables non-Clifford operations in the Z_2 surface code, including magic states and non-Clifford gates.

In the second part, based on arXiv:2512.13777, we construct transversal phase gates at arbitrary levels of the Clifford hierarchy purely in 2D, by encoding a logical qubit in the quantum double of a non-Abelian group on a triangular spatial patch and stacking a symmetry-protected topological (SPT) phase onto the spatial region. This construction remains purely 2D and preserves locality and fault tolerance.