Topological order of the Ground state of Abelian n-lattice Gauge Theories.

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Abstract

In recent years, following the hype of the Kitaev's Toric Code and the spotlight and interest from the quantum information, quantum computation, condense matter and math- ematical physics communities, several attempts to generalize these types of lattice gauge theories have been carried out. The generalizations have been mainly based upon category theory methods (monoidal categories, 2-groups, etc) and algebraic methods (Quantum groups, Hopf's algebras, etc) that try to encompass the topological order properties of these models as well as to codify their exotic statistics. In this talk, we present a construction based on chain complexes of abelian groups which greatly simplifies the underlying general theory for already known constructions as well as to allowing to systematize the quantum characterization of the topological low energy topological phases. We present explicit calculations of ground state degeneracies for several models and establish a clear connection between them and its associated natural cohomology.