

QCCC/TopMath-Vortrag

30. Juli 2009, 14 Uhr c.t.

Mathematik-Informatik-Gebäude am Campus Garching (Boltzmannstr. 3)

Raum 00.07.011

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(University of Illinois at Chicago, USA)

## Topological Quantum Information Theory

In this talk we discuss relationships between topology and quantum computation. Since the discovery of Peter Shor's quantum algorithm for the prime factorization of natural numbers, there has been intense interest in the discovery of new quantum algorithms and in the construction of quantum computers. It is possible that topology will enter in a deep way in the construction of quantum computers based on phenomena such as the quantum Hall effect, where braiding of quasi-particles describes unitary transformations rich enough to produce the quantum computations. This talk will describe the mathematics of such braiding and its relationship with algorithms to compute topological invariants such as the Jones polynomial. Just so, relationships with braiding go beyond the quantum Hall effect and are of interest for constructing quantum gates and quantum algorithms. The talk will discuss these directions and our present project in collaboration with the research group of Prof. Glaser (on this campus) to instantiate quantum algorithms for the Jones polynomial using NMR (Nuclear Magnetic Resonance Spectroscopy). The talk will be self-contained both in terms of mathematics and physics.