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Pflaum - C*-algebraic and topological study of quantum spin systems - 2

Friday, 13 March 2026 11:00 (1 hour)

In the first lecture, the fundamentals of the C*-algebraic approach to quantum many-body systems will be laid out. In particular, the topology and geometry of state spaces describing quantum lattice systems will be studied and a few old and new results on the state space of the quasi-local algebra of a quantum lattice spin system when endowed with either the natural metric topology or the weak* topology will be shown.

In the second lecture some recent results on the homotopy theory of quantum lattice systems will be explained. In particular a homotopy theoretic interpretation of topological phases will be given, and Kitaev's conjecture will be explained. The homotopy groups of the unitary group of a UHF algebra will then be determined and it will be indicated that the pure state space of any UHF algebra in the weak* topology is weakly contractible. In addition, I will show at the example of non-commutative tori that also in the case of a not commutative C*-algebra, the homotopy type of the state space endowed with the weak* topology can be non-trivial and is neither deformation nor Morita invariant. Finally, I indicate how such tools together with methods from higher homotopy theory such as E_∞ spaces may lead to a framework for constructing Kitaev's loop-spectrum of bosonic invertible gapped phases of matter.

The second part is essentially based upon joint work with Agnes Beaudry, Mike Hermele, and Daniel Spiegel.