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The Department of Mathematics
Presents

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University of California, Davis

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PB 194

Spectral Gaps in a Family of Quantum Spin Systems

Abstract:

The existence or non-existence of a spectral gap determines many qualitative properties of a given quantum spin system. Here a spectral gap refers to a positive distance between the bottom of the spectrum and the rest of the spectrum for the Hamiltonian. I will introduce a family of quantum spin 1/2 systems called the Product Vacua and Boundary State (PVBS) models defined on subsets of the d dimensional integer lattice with Hamiltonians composed of sums of noncommuting local projections. We will consider the model on half-spaces on the d dimensional integer lattice and prove that for any given set of system parameters, there is a simple geometric condition which determines whether or not the Hamiltonian has a spectral gap. This proves that there are families of quantum spin systems where the existence and non-existence of a spectral gap is decidable. As a corollary, we prove the existence or nonexistence of a spectral gap for the model defined on the entire d dimensional integer lattice Z.

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