COLLOQUIUM

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Graphs and Matrices in Continuous Quantum Walks

Mathematics and Statistics

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Abstract:

Let G be a graph with adjacency or Laplacian matrix M. A continuous quantum walk on G is determined by the complex unitary matrix $U(t) = \exp(itM)$, where $i^2 = -1$ and t is a real number. Here, G represents a quantum spin network, and its vertices and edges represent the particles and their interactions in the network. The propagation of quantum states in the quantum system determined by G is then governed by the matrix $U(t)$. In particular, $|U(t)_{u,v}|$ may be interpreted as the probability that the quantum state assigned at vertex u is transmitted to vertex v at time t. Quantum walks are of great interest in quantum computing because not only do they produce algorithms that outperform classical counterparts, but they are also promising tools in the construction of operational quantum computers. In this talk, we give an overview of continuous quantum walks, and discuss old and new results in this area with emphasis on the concepts and techniques borrowed from graph theory, matrix theory and other areas of mathematics.

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