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## Exact asymptotics for the Discrete Quantum Walk on the infinite line

### Abstract

Quantum walks are of interest because of their role in the theory of quantum algorithms. They can be thought of as quantum analogues of classical Markov processes, which are used both in classical algorithm theory and also in some parts of statistical physics.

This talk is concerned with the discrete quantum walk on the infinite line. Previous analyses of this system have employed two distinct methods, one based on the Schrödinger formulation of quantum mechanics, and one based on the Path Integral approach introduced by Feynman. Both of these methods have made significant progress but to date, neither has been able to offer a complete analysis. This talk will outline a new method for analysing these systems (also based on the Path Integral approach) which does give complete and uniformly convergent asymptotics for these systems. It also sheds light on the mathematical relationship between the two approaches. We already knew they must be related from Feynman's original arguments for the equivalence of these approaches, but few details of that relationship have been given before for these systems.

This is joint work with Mourad Ismail and Bruce Richmond.