

Caltech Mathematical Physics Seminar
Winter 2008–09

Quantum Random Walk and CMV Matrices

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Abstract. A new research topic in the field of computer science has been developed in the last years: the quantum random walks (QRW). It is known that classical random walk can be described in terms of Jacobi matrices related to the theory of orthogonal polynomials on the real line.

We will show that, analogously, the evolution of QRW can be described in terms of orthogonal polynomials on the unit circle (OPUC) and CMV matrices. These tools provide the translation to the quantum case of classical techniques and, moreover, permit us to analyze new models of QRW not accessible by the “old” methods.

For these new models, as well as for the other ones very well known, we will identify probabilistic properties of QRW in terms of OPUC what will allow us to make explicit calculations.