

Quantum walks on Cayley graphs of finite Coxeter groups, and their aggregations

Tuesday 7 July 2026 12:50 (25 minutes)

In this talk we discuss classical and quantum walks on Cayley graphs of finite Coxeter groups and their reductions obtained by suitable aggregations of the state space. We begin with the definition and classification of finite Coxeter groups, together with the associated Cayley graphs determined by Coxeter generating sets. We then show how graph symmetries and suitable partition properties can be used to reduce classical random walks and to analyse the corresponding quantum walks in the sense of Szegedy's construction.

Special attention is devoted to the Coxeter group of type (H_3) . We describe the corresponding Cayley graph and present reductions leading to graphs associated with the fullerene, the dodecahedron, the icosahedron and the icosidodecahedron. For selected reductions we present transition matrices and compare classical and quantum simulations, with particular emphasis on the reduced walk on the icosahedral graph.

We also discuss the Coxeter group (H_4) , whose geometry is related to highly symmetric four-dimensional polytopes, in particular the 120-cell and the 600-cell. We explain how certain graphs and their reductions can be obtained using fundamental weights, and how the resulting models provide examples of quantum walks on highly symmetric discrete spaces. The examples presented in the talk illustrate that Cayley graphs of Coxeter groups form a natural framework for studying the interplay between symmetry, aggregation and discrete quantum dynamics.

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