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Quantum and fractional automorphisms of graphs

We consider two generalizations of graph automorphisms.

A *quantum permutation* of index d is an $n \times n$ matrix whose entries are $d \times d$ projections, such that each row sums to I_d. (A quantum permutation of index one is an ordinary permutation.) A quantum permutation $\mathcal{P}$ of index d is a *quantum automorphism* of the graph X if $\mathcal{P}$ and $A(X) \otimes I_d$ commute.

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A *fractional automorphism* of a graph is a doubly stochastic matrix S such that $AS = SA$. Any permutation matrix that commutes with $A(X)$ is a fractional automorphism.

These two extensions are related. If $\mathcal{P}$ is a quantum automorphism of X with index d, then for each $d \times d$ positive semidefinite matrix D with trace one, we can derive a fractional automorphism of X.

In my talk I will explain some of the relations between these extensions, and some of the reasons they are interesting.