Title:
**Symmetry Analysis of Reversible Markov Chains**

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Abstract:

We show how to use subgroups of the symmetry group of a reversible Markov chain to give useful bounds on eigenvalues of their multiplicity. We supplement classical representation theoretic tools involving a group commuting with a self-adjoint operator with criteria for an eigenvector to descend to an orbit graph. As examples, we show that the Metropolis construction can dominate a max-degree construction by an arbitrary amount and that, in turn, the fastest mixing Markov chain can dominate the Metropolis construction by an arbitrary amount.