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Collective quantum coherence in large superconducting circuits with approximate S_N symmetry DAVID FERGUSON, Northwestern University, ANDREW HOUCK, Princeton University, JENS KOCH, Northwestern University — The vast majority of superconducting circuits consist of a minimum number of circuit elements, following an implicit conjecture that any increase in circuit complexity thwarts quantum coherence. Recent experiments have evidenced that this conjecture is not compelling and quantum coherence can persist for much larger circuits [1]. A tool for the design of future circuits, we present theory for the fluxonium qubit, a device which includes a large number, N, of array junctions. Taking into account the degrees of freedom of all junctions and the approximate S_N permutation symmetry, we identify the relevant collective mode and pinpoint an approximate decoupling of additional modes. This allows us to derive the effective models previously used. We also discuss corrections going beyond these models which include subspaces of states that transform as non-trivial representations of the permutation group.
[1] V. E. Manucharyan, J. Koch, L. I. Glazman, and M. H. Devoret, Science **326**, 113 (2009)

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