Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Spin-boson models for periodic N-site systems VICTOR V. ALBERT, Department of Physics, Yale University — The single/multi-mode spin-boson model provides a description for numerous two-level exciton-phonon and atom-cavity systems. Existing many-level extensions conserve symmetries but quickly become intractable due to the inclusion of multiple interacting modes. Other ad-hoc single-mode extensions contain arbitrary numbers of parameters and often ignore the symmetries of their respective systems. This work presents a simple model for the interaction of a periodic system of N coupled sites with one or more non-interacting boson modes using a minimal number of parameters [1]. A group theoretic approach allows one to partially diagonalize the Hamiltonian, providing numerical advantages, physical insight, and a gateway to accurate approximations. The single-mode two-site system reduces to the single-mode spin-boson model, also known as the Rabi Hamiltonian. Two higher dimensional generalizations are reviewed in the exciton-phonon/atom-field interpretations and related to a new integrability criterion [2]. The model predicts that $2N$-level systems have parity symmetry and that the ground state of certain four-level atom-cavity systems will undergo parity change at large coupling.

[1] V. V. Albert, arXiv:1112.0849
[2] D. Braak, PRL **107**, 100401 (2011)

Victor V. Albert
Department of Physics, Yale University

Date submitted: 06 Dec 2011 Electronic form version 1.4