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Polaronic model of Two Level Systems in amorphous solids KARTIEK AGARWAL, Harvard University, IVAR MARTIN, Los Alamos National Laboratory, EUGENE DEMLER, MIKHAIL LUKIN, Harvard University — Motivated by recent experiments studying effects of elastic strain on two level systems (TLSs) in Josephson Junctions, we consider interaction of the electronic TLS with phonons. We demonstrate that including strong polaronic effects is crucial for analyzing these systems. Our model not only gives a quantitative understanding of the TLS relaxation and dephasing as probed in Josephson junction qubits, but also provides a microscopic justification for phenomenological models used to describe experiments with bulk amorphous solids. Our model explains such surprising observations of recent experiments as the existence of minima in the energy of some TLSs as a function of strain and maximum of the relaxation time in such minima. We argue that better understanding of the microscopic nature of TLSs can be used to improve properties of quantum devices, from dramatic enhancement of TLS relaxation time by putting them inside phononic crystals to creating new types of strongly interacting optomechanical systems.

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