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Coherent mechanically-mediated state transfer between a superconducting qubit and a cavity HUGO RIBEIRO, Department of Physics, McGill University, Montreal, Quebec H3A 2T8, Canada, YING-DAN WANG, Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing 100190, China, AASHISH CLERK, Department of Physics, McGill University, Montreal, Quebec H3A 2T8, Canada — We study coherent state transfer between a superconducting qubit and a cavity coupled via a nanomechanical resonator. There are two major challenges relating to state transfer of such systems. First, the duration of the protocol needs to be shorter than the shortest time-scale associated with dissipation (qubit relaxation, mechanical damping, cavity decay...). This constraint implies that most of the well-known adiabatic transfer protocols cannot be used as is. Second, a fast double swap protocol, where the state of the qubit is first transfered to the mechanical degree of freedom and then to the cavity, is the most sensible scheme to mechanical dissipation. Here, we present some protocols that take into account both constraints and optimize the fidelity of the coherent state transfer.

Hugo Ribeiro
McGill University

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