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Adiabatic state preparation of interacting two-level systems RICHARD BRIERLEY, CELESTINO CREATORE, Cavendish Laboratory, JJ Thomson Avenue, Cambridge, CB3 0HE, UK, PETER LITTLEWOOD, Argonne National Laboratory, 9700 S Cass Ave., Argonne, IL 60439, USA, PAUL EASTHAM, School of Physics, Trinity College, Dublin 2, Ireland — We consider performing adiabatic rapid passage (ARP) using frequency-swept optical pulses to excite a collection of interacting two-level systems. Such a model arises in a wide range of many body quantum systems, such as circuit QED or interacting quantum dots, where a nonlinear component couples to light. We analyse the one-dimension case using the Jordan-Wigner transformation. In the mean field limit, the system can be described by a Lipkin-Meshkov-Glick Hamiltonian. Both approaches provide complementary insights into the behaviour of an interacting model under ARP, suggesting our results are generically applicable. We find ARP can still be used for state preparation in the presence of interactions but the parameters required to achieve full occupation depend on the strength of the interaction. In particular, for a fixed pulse time, stronger interactions require a larger pulse bandwidth, introducing new restrictions on the pulse form required.

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