Adiabatic passage in solid state: from ultrastrong coupling to noise sensing

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Adiabatic passage is a powerful control technique atomic physics which is gaining interest also in the solid-state realm since it implements quantum operations weri robust against parametric fluctuations. We exploit the application of coherent techniques as coherent transport by adiabatic passage (CTAP) or stimulated Raman adiabatic passage (STIRAP) in quantum architectures where the robustness of the protocols may determine key advantages for selected tasks[1,2]. As an example we discuss quantum operation for modular computing in ultrastrongly coupled structures of artificial atoms [3] showing that CTAP-like manipulation ensure the suppression of unrecoverable errors due to the dynamical Casimir effect. A second example is noise classification in multilevel quantum structures where we propose a STIRAP-based supervised learning procedure to recognize energy-correlations of noise and their relation to the Markovianity of the environment [4].

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