Ponderomotive encoding

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Abstract

Recently, a scheme has been proposed for constructing quantum error-correcting codes that embed a finite-dimensional code space in the infinite-dimensional Hilbert space of a system described by continuous quantum variables [D. Gottesman, *et al.*, Phys. Rev. A **64**, 012310 (2001)]. The main difficult of this scheme relies on the preparation of the encoded states. We show that ponderomotive interaction suffices to this end. As matter of fact, such interaction between a system and a meter causes a frequency change on the meter proportional to the position quadrature of the system. Then, a phase measurement of the meter leaves the system in an eigenstate of the stabilizer generators, provided that system and meter's initial states were suitable prepared. We then propose several physical realizations of this interaction involving atom-optics systems as well as micro-opto-mechanical systems, and we carefully study the encoding procedure within them. Imperfections on initial states and on measurements are taken into account and the stability of the codes accordingly defined.

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