Optimal control of complex atomic quantum systems

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http://arxiv.org/abs/1511.02247 [2]

Quantum technologies will ultimately require manipulating many-body quantum systems with high precision. Cold atom experiments represent a stepping stone in that direction: a high degree of control has been achieved on systems of increasing complexity, however, this control is still sub-optimal. Optimal control theory is the ideal candidate to bridge the gap between early stage and optimal experimental protocols, particularly since it was extended to encompass many-body quantum dynamics. Here, we experimentally demonstrate optimal control applied to two dynamical processes subject to interactions: the coherent manipulation of motional states of an atomic Bose-Einstein condensate and the crossing of a quantum phase transition in small systems of cold atoms in optical lattices. We show theoretically that these transformations can be made fast and robust with respect to perturbations, including temperature and atom number fluctuations, resulting in a good agreement between theoretical predictions and experimental results.

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- H2020 [4]
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