Abstract Submitted
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Bang-bang shortcut to adiabaticity in trapped ion quantum simulators[1] JAMES FREERICKS, Georgetown University, SHANKAR BALASUBRAMANIAN, Massachusetts Institute of Technology, SHUYANG HAN, BRYCE YOSHIMURA, Georgetown University — We model the bang-bang optimization protocol as a shortcut to adiabaticity in the ground-state preparation of an ion-trap-based quantum simulator. The bang-bang protocol is a double quench of the field with a hold time in between. We compare the ground-state population after the "diabatic" preparation protocol for a locally adiabatic ramp of the field, an exponential ramp of the field, and the bang-bang shortcut. We find that for long-range spin-spin couplings, the bang-bang protocol is superior, being overtaken by the locally adiabatic one as the range of the interaction shrinks. It is always better than an exponential ramp. But, unlike the locally adiabatic ramp, which requires detailed knowledge of the energy spectra for all field values, the bang-bang approach can be optimized knowing nothing about the underlying Hamiltonian. Hence, this method may be advantageous in examining properties of complex systems, especially those for which we do not know the low-lying energy spectra a priori. Examples of the bang-bang approach and an explanation for why it works will be given in the presentation as well.

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