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A Quantum Phase Estimation Algorithm with Gaussian Spin States

Quantum phase estimation (QPE) is a most important subroutine in quantum computation. In general applications, however, current QPE algorithms either suffer an exponential time overload or require a set of, notoriously quite fragile, GHZ or NOON states. These limitations have prevented so far the demonstration of QPE beyond proof-of-principles. I present a new QPE algorithm that scales linearly with time and is implemented with a cascade of Gaussian spin states (GSS). GSS are renownedly resilient and have been created experimentally in a variety of platforms, with hundreds of ions up to millions of cold neutral atoms.The protocol achieves a QPE sensitivity overcoming previous bounds, including those obtained with GHZ and NOON states, and is robustly resistant to several sources of noise and decoherence. This paves the way toward the realistic quantum advantage demonstration of the quantum phase estimation.

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