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Generating Greenberger-Horne-Zeilinger states with squeezing and postselection

Byron Alexander,[1,*] John J. Bollinger,[2,†] and Hermann Uys[1,3,‡]

[1]Department of Physics, Stellenbosch University, Stellenbosch Central 7600, Stellenbosch, South Africa

[2]National Institute of Standards and Technology, Boulder, Colorado 80305, USA

[3]Council for Scientific and Industrial Research, National Laser Centre, Brummeria, Pretoria 0184, South Africa

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Abstract

Many quantum state preparation methods rely on a combination of dissipative quantum state initialization followed by unitary evolution to a desired target state. Here we demonstrate the usefulness of quantum measurement as an additional tool for quantum state preparation. Starting from a pure separable multipartite state, a control sequence, which includes rotation, spin squeezing via one-axis twisting, quantum measurement, and postselection, generates highly entangled multipartite states, which we refer to as projected squeezed (PS) states. Through an optimization method, we then identify parameters required to maximize the overlap fidelity of the PS states with the maximally entangled Greenberger-Horne-Zeilinger (GHZ) states. The method leads to an appreciable decrease in the state preparation time of GHZ states for successfully postselected outcomes when compared to preparation through unitary evolution with one-axis twisting only.