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Entanglement enhanced performance of atomic clocks in the presence of environmental noise ANDREW JACOBS, JAMES CLEMENS, Miami University — It has been proposed that a specific class of entangled states of N atoms known as Greenberger-Horne-Zeilinger (GHZ) states could be used to enhance the performance of atomic clocks with a sensitivity that scales as $1/N$ versus $1/\sqrt{N}$ for a standard atomic clock. However, this assumes that the GHZ state has been perfectly prepared. Here we investigate the fidelity of preparation of GHZ states of N qubits using a quantum circuit model with imperfect quantum gates caused by environmental noise. The symbolic calculations are carried out using the QDENSITY package for Mathematica. We find that the fidelity of the prepared state decreases with N. When applied to an atomic clock model this would cause the sensitivity to be decreased from it maximum value and yield an optimal value of N as a function of the noise intensity.

James Clemens
Miami University

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