Abstract Submitted
for the PSF17 Meeting of
The American Physical Society

Sequential Atomic Entangler for Heisenberg-Limited Atom Interferometry SYLVESTER AMOAH, KISHOR KAPALE, Department of Physics, Western Illinois University — Interferometry, where two light or matter waves are mixed with each other, allows precision measurement of small phase differences between the constituent waves. We are interested in the applications of interferometry to the fields of metrology, which deals with measuring physical quantities such as small electric, magnetic, and gravitational fields and small rotational velocities. Precise measurements of these quantities are important to meet a large class of technological needs of the humankind. Atomic interferometers offer sensitivities higher by a factor of about $(mc^2)/\hbar\omega \approx 10^{10}$, in comparison with optical interferometers employing laser light of angular frequency ω, even when the atoms passing through the interferometer are not entangled. We aim to employ Heisenberg-limited interferometric techniques, which employ correlated input states as opposed to traditional uncorrelated input states and have been successfully attained for optical interferometers, to atomic interferometry. We propose a cavity quantum electrodynamics based sequential N-atom Greenberger-Home-Zeilinger (GHZ) state generator, as a first step. The GHZ states can be easily converted to path-entangled N00N states, opening up new pathways for Heisenberg-limited atom interferometry.

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Date submitted: 30 Oct 2017 Electronic form version 1.4