Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Optimized Double-Well Quantum Interferometry with Gaussian Squeezed States[1] YUPING HUANG, MICHAEL MOORE, Michigan State University — Previous Hiesenberg-limited interferometry schemes using NOON, Twin-Fock and similar states perform worse than shot-noise when measuring a nonzero phase. We have found that a Mach-Zehnder interferometer with a Gaussian number-difference squeezed input state can exhibit sub-shot-noise phase resolution over a large phase interval, accomplished by optimizing the level of squeezing based on the phase interval $\Delta\theta_0$ and particle number N [1]. This can be combined with an adaptive measurement sequence in which the amount of squeezing is increased with each measurement, with the result that any phase on $(-\Delta\theta_0, \Delta\theta_0)$ can be measured with a precision of $3.5/N$, requiring only 2-4 measurements, provided only that $N\tan(\Delta\theta_0) < 10^{40}$. In a double-well Bose-Einstein condensate, the optimized input states can be created by adiabatic manipulation of the interaction to tunneling ratio, and is robust against imprecise control of squeezing and inaccurate knowledge of N. [1] Y. P. Huang and M. G. Moore, Phys. Rev. Lett. 100, 250406 (2008).

[1]Supported by NSF Atomic Theory Grant #PHY-0653373.

Michael Moore
Michigan State University

Date submitted: 24 Jan 2009 Electronic form version 1.4