Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

White Light Cavity Enhanced Spin Squeezing for Creating Schroedinger Cat States to Achieve Heisenberg Limited Sensitivity with Increased Quantum Noise[1] SELIM SHAHRIAR, JINYANG LI, Northwestern University — One axis twist squeezing (OATS) using non-linear interaction in a cavity can increase the sensitivity of metrological devices beyond the standard quantum limit (SQL). When the squeezing parameter is tuned to a critical value, OATS produces the Schroedinger Cat (SC) state, which is an equal superposition of all atoms being spin-up and all atoms being spin-down. However, the orientation of the SC state depends critically on the parity of the number of atoms, N. Changing N by unity causes the orientation to change by ninety degrees. For an experiment employing atoms released from a trap, for example, the parity of N fluctuates between odd and even, thus washing out the SC state. We describe a protocol which, for a given parity, produces a phase magnification by a factor of N, while increasing quantum noise by a factor of root-N, thus reaching the Heisenberg Limit (HL). However, the signal for one parity is filtered out, thus making it possible to achieve the HL within a factor of root-2. The increased quantum noise makes it very robust against classical noise. We also show that the use of a white light cavity for OATS makes it possible to reach the necessary critical value of the squeezing parameter very quickly, before degradation via dissipative processes.

[1]AFOSR Grant Number FA9550-18-01-0401

Selim Shahriar
Northwestern University

Date submitted: 01 Feb 2019 Electronic form version 1.4