Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

**Spinor condensates of ortho- and para-positronium** YI-HSIEH WANG, Chemical Physics Program and Joint Quantum Institute, University of Maryland, CHARLES W. CLARK, Joint Quantum Institute — In 1994, Platzman and Mills [1] considered the possibility of making a Bose-Einstein condensate (BEC) of positronium atoms (Ps). There are four low-lying states of Ps: a singlet, often called parapositronium (p-Ps); and three triplet states, often referred to as orthopositronium (o-Ps). The lifetime against electron- positron annihilation for o-Ps is a thousand times longer than that of p-Ps. By converting a long-lived triplet o-Ps BEC to a p-Ps condensate with a magnetic field, strong $\gamma$-ray emission can be generated as the outcome of the annihilation of coherent p-Ps atoms. However, inelastic scattering processes which convert p-Ps atoms to o-Ps may deplete the p-Ps population and further quench the $\gamma$ emission. We investigate this possibility by treating the system as a spinor condensate, and use the coupled time dependent Gross-Pitaevskii (GP) equations to take into account possible population-exchanging scatterings and annihilation processes in the p-Ps/o-Ps BEC mixture. This GP simulation is used to predict the $\gamma$-ray yield in realistic experimental scenarios.

[1] P. M. Platzman and A. P. Mills, Jr.,*Phys. Rev. B* **49**, 454 (1994)

Charles W. Clark
Joint Quantum Institute

Date submitted: 28 Nov 2012 Electronic form version 1.4