Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Generation of atomic holograms using interferometry, digital holography and BEC RENPENG FANG, MOHAMED FOUDA, MEHJABIN MONJUR, MAY KIM, JONATHAN TROSSMAN, JOHN KETTERSON, SELIM SHAHRIAR, Northwestern University — We describe a technique where atomic interferometry along with light-shift induced, two dimensional phase imprinting are used to produced 3D holograms of atoms, using a BEC. The condensate is first split into two components, using a Raman pulse. Optical pulses are then used to imprint the desired holographic phase profile (HPP) on one of the split components. To produce the HPP, we first detect, with a focal plane array (FPA), the interference between a plane optical wave and the optical field produced via illumination of a 3D object. The signal is processed for atomic holography, and transferred to a spatial light modulator, which produces the two-dimensional optical pulse that imprints the HPP. The atoms form a 3D hologram upon recombination of the two parts. This technique could be used to produce various topological patterns of condensates for fundamental studies as well for selective population of lattice traps for application to quantum computing. We used the Gross-Pitaevskii equations to model the evolution of the condensate order parameter through free space as well as during interaction with the optical fields. In this talk, we present results of complete simulations of the process for typical three-dimensional patterns, and describe the status of experimental efforts.

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Date submitted: 25 Jan 2013 Electronic form version 1.4