Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Toward a nanoscience emulator with two dimensional atomic gases[1] PING WANG, Q. MA, S. DUTTA, YONG P. CHEN, Purdue University — We report our experimental progress in constructing a cold atom apparatus for emulating phenomena in nanoscience using low dimensional atom gases. Our first experiments will be performed with a 2D ^{87}Rb Bose-Einstein condensate created in an optical lattice. Our compact vacuum system consists of two AR-coated glass cells — a low vacuum magneto-optical trap (MOT) chamber and a high vacuum "science chamber", connected by a 15cm-long tube for differential pumping. We have used elliptically shaped cooling laser beams and magnet field coils to realize an elongated MOT in the first chamber, and transferred the atoms to a second MOT in the science chamber by a push laser beam. In the science chamber, a 50W, 1550nm single frequency erbium fiber laser is used to produce an optical dipole trap and optical lattice.In addition, controllable disorder can be introduced with laser speckle and inter-atomic interactions can be tuned by atomic density or Feshbach resonance. We plan to explore important phenomena in nanoscience, such as 2D disorder-induced conductor-insulator transition, quantum Hall effect and graphene-like physics in such a tunable 2D atomic gas in optical lattices.

[1]Supported by ARO-Defense University Research Instrumentation Program.

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Date submitted: 24 Jan 2009 Electronic form version 1.4