

Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Prospects for Observation of a Tonks-Girardeau Gas in an Atom Chip Waveguide JASON ALEXANDER, VIOLETA PRIETO, CHRIS ROWLETT, PATRICIA LEE, WILLIAM GOLDING, Sensors and Electron Devices Directorate, Army Research Laboratory, Adelphi, MD — Bosons confined in (quasi) one dimension can enter a new state of matter, a Tonks-Girardeau gas, in which they behave like non-interacting fermions when the atom-atom repulsive interaction becomes much larger than the kinetic energy. However they can occupy the same momentum state and therefore the gas cannot be fully described by either Bose-Einstein or Fermi-Dirac statistics. The phase transition requires the combination of a highly anisotropic trapping potential, low temperature and a low density of atoms. Recently there has been evidence of this state of matter in optical lattices.¹ However, attempts to observe this state in magnetic atom chip waveguides have yet to meet success. We discuss the conditions for obtaining such a phase transition with ⁸⁷Rb atoms in our atom chip waveguide, propose a novel signature for the transition to a Tonks-Girardeau gas and discuss several independent methods of observing this signature in our system.

¹Paredes et al. *Nature* **429**, 277-281 (2004), Kinoshita et al **305** 1125 *Science* (2004)

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Date submitted: 04 Feb 2011

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