Abstract Submitted
for the DAMOP13 Meeting of
The American Physical Society

Simulating an interacting gauge theory with ultracold Bose gases
MATTHEW EDMONDS, MANUEL VALIENTE, Heriot-Watt University, GEDIMINAS JUZELIUNAS, Vilnius University, Lithuania, LUIS SANTOS, Leibniz Universität, Germany, PATRIK OHBERG, Heriot-Watt University — Here, we will discuss how one can create artificial gauge fields for an ensemble of interacting ultracold bosonic atoms using the interacting dressed states of the light-matter coupling. Until now, all experimental gauge potentials have been static. We will show how to induce a U(1) interacting gauge field, such that there is an effective back-action between the emergent gauge potential and the matter field. By performing the appropriate transformation, the gauge field appearing in the quasi one-dimensional many-body equation of motion can be shown to be equivalent with a current operator. The resulting non-linear equation of motion can be solved exactly to yield chiral solitons as well as critical particle numbers required for the onset of rotation of a condensate in a ring geometry Finally, we will discuss the conditions relevant for observation of the above effects in terms of scattering lengths and the two-photon Rabi frequency.

Matthew Edmonds
Heriot-Watt University

Date submitted: 22 Jan 2013 Electronic form version 1.4