Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Probing the optical conductivity of harmonically-confined charge neutral quantum gases[1] EUGENE ZAREMBA, ZHIGANG WU, Queen's University, Canada, EDWARD TAYLOR, McMaster University, Canada — Using a linear response formulation, we study the centre-of-mass response of a harmonically trapped gas to a small amplitude, time-dependent displacement of the trap. We show that the response to this kind of excitation is directly related to the bulk optical conductivity. Thus, a measurement of the time-dependent centre-of-mass dynamics of the cloud provides information about the complex bulk conductivity tensor of the many-body system. For systems with pure harmonic confinement, the response is prescribed by the generalized Kohn theorem and is independent of interactions and quantum statistics. However, non-trivial responses and optical conductivities arise when the harmonicity of the system is compromised by the presence of an additional external potential, such as an optical lattice or impurity. We demonstrate the usefulness of this scheme by calculating the optical conductivity of a one-dimensional Mott insulator of Bose or Fermi atoms confined in a harmonic trap, as well as the optical Hall conductivity of an ideal rotating trapped gas interacting with a Gaussian impurity. Our calculations provide a proof-of-principle demonstration that our proposal should be able to give considerable information about the optical conductivity of strongly-correlated quantum gases.

[1]This work was supported by a grant from the Natural Sciences and Engineering Research Council of Canada

Eugene Zaremba
Queen's University

Date submitted: 15 Nov 2013 Electronic form version 1.4