

Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Collective mode of an impurity and a Tonks-Girardeau gas¹

CHARLES MATHY, Institute for Theoretical Atomic, Molecular and Optical Physics, MIKHAIL ZVONAREV, EUGENE DEMLER, Physics Department, Harvard University — We investigate the quantum dynamics of an impurity immersed in a one-dimensional gas of strongly repulsive bosons, or equivalently fully-polarized fermions, interacting via a contact interaction. Using Bethe Ansatz we obtain essentially exact results at all timescales and for all couplings to the impurity. We find at strong coupling that if the impurity starts off with a momentum of the order of the Fermi momentum or higher a new type of collective mode is excited, corresponding to long lived oscillations of the impurity with respect to the background gas. We characterize this mode and discuss how it can be observed experimentally.

¹C.M. acknowledges support from the NSF through ITAMP at Harvard University and the Smithsonian Astrophysical Observatory.

Charles Mathy
Institute for Theoretical Atomic, Molecular and Optical Physics

Date submitted: 10 Nov 2011

Electronic form version 1.4