Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Radio frequency spectroscopy of polarons in ultracold Bose gases
ADITYA SHASHI, Rice University, FABIAN GRUSDT, University of Kaiserslautern, DMITRY ABANIN, Perimeter Institute, EUGENE DEMLER, Harvard University — Recent experimental advances enabled the realization of mobile impurities immersed in a Bose-Einstein condensate (BEC) of ultracold atoms. We consider impurities with two or more internal hyperfine states, and study their radio-frequency (RF) absorption spectra, which correspond to transitions between two different hyperfine states. We calculate RF spectra for the case when one of the hyperfine states involved interacts with the BEC, while the other state is non-interacting, by performing a non-perturbative resummation of the probabilities of exciting different numbers of phonon modes. We discuss both the direct RF measurement, in which the impurity is initially in an interacting state, and the inverse RF measurement, in which the impurity is initially in a non-interacting state. In the latter case, in order to calculate the RF spectrum, we solve the problem of polaron formation: a mobile impurity dynamically gets dressed by Bogoliubov phonons, using a time-dependent variational ansatz of coherent states.

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Date submitted: 31 Jan 2014 Electronic form version 1.4