Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Decoherence and absorption spectra of impurities in ultracold quantum gases RICHARD SCHMIDT, ITAMP, CFA / Harvard University, 60 Garden Street, 02138 Cambridge, MA, DAVID BENJAMIN, EUGENE DEMLER, Harvard University, 17 Oxford Street Cambridge, Cambridge, MA, HOSSEIN SADEGHPOUR, ITAMP, CFA, 60 Garden Street, 02138 Cambridge, MA — We study the finite-mass corrections to the non-equilibrium dynamics of an impurity in a gas of lattice fermions after an interaction quench. Our emphasize is on the question under which conditions a heavy impurity immersed in a Fermi liquid is subject to the orthogonality catastrophe and complete loss of coherence. We calculate the time-dependent Ramsey interference signal using a novel hybrid approach which combines path integral and functional determinant methods. We find that a finite quasiparticle peak persists in d ? 2 in agreement with previous work and explore the influence of finite temperature and system size. Using our microscopic approach we study also the time evolution of a Bose-Einstein-Condensate after the excitation of a Rydberg atom and the formation of a sequence of giant molecular bound states. Our calculation reveals the emergence of a novel type of orthogonality catastrophe present in coupled BEC-Rydberg systems. We determine the absorption spectra of the system and we predict the non-equilibrium time evolution of various experimentally measurable observables following the sudden excitation of the Rydberg state and discuss possible experimental implementations.

Richard Schmidt
ITAMP, CFA / Harvard University, 60 Garden Street, 02138 Cambridge, MA

Date submitted: 01 Feb 2015 Electronic form version 1.4