Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Time dependent impurity in ultracold fermions: orthogonality catastrophe and beyond[1] MICHAEL KNAP, Department of Physics, Harvard University, ADITYA SHASHI, Department of Physics and Astronomy, Rice University, YUSUKE NISHIDA, Theoretical Division, Los Alamos National Laboratory, ADILET IMAMBEKOV, Department of Physics and Astronomy, Rice University, DMITRY A. ABANIN, EUGENE DEMLER, Department of Physics, Harvard University — The physics of impurities in metals and mesoscopic structures provided a deeper understanding of electrical and thermal transport properties, guided the development of new mathematical techniques, and gave useful insights into the behavior of more complicated strongly correlated materials. Ensembles of ultracold atoms offer new opportunities to study impurity physics in a well isolated, coherent setting with relatively slow time scales, that can be faithfully determined by a small number of precisely controllable parameters. In this talk, we outline a program of how to explore quantum impurity problems with ultracold atoms. In particular, we reconsider the problem of the orthogonality catastrophe (OC), which describes the dynamics of a localized impurity in a Fermi sea, and show that techniques from atomic physics, such as Ramsey pulses, spin-echo, and RF-spectroscopy, can be used to probe the OC in both time and energy domains. We present the complete solution of the OC using a combination of analytical and numerical techniques and discover new qualitative features which could not be observed in metallic systems.

[1]Harvard-MIT CUA, NSF DMR-07-05472, DMR-10-49082, FWF J3361-N20

Michael Knap
Department of Physics, Harvard University

Date submitted: 09 Nov 2012 Electronic form version 1.4