Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Dynamic impurities coupled to two host Fermi Seas JHIH-SHIH YOU, Department of Physics, Harvard University, RICHARD SCHMIDT, Department of Physics, Harvard University; ITAMP, Harvard-Smithsonian Center for Astrophysics, DMITRI A. IVANOV, Institute for Theoretical Physics, ETH Zurich; Institute for Theoretical Physics, University of Zurich, MICHAEL KNAP, Department of Physics, Walter Schottky Institute, and Institute for Advanced Study, Technical University Munich, EUGENE DEMLER, Department of Physics, Harvard University — We propose an ultracold atom setup, analogous to a spintronics device, which allows one to study non-equilibrium spin transport and statistics of fluctuations. This setup can be realized in the currently available experiments by using quantum impurities to induce tunneling between two imbalanced host fermion gases. Non-equilibrium spin accumulation, full counting statistics and the waiting time distributions are discussed in various regimes. Moreover, by employing the Ramsey interferometry, one can reach the dynamic impurity response for full times, which could not be accessed in solid-state systems. This impurity response exhibits a non-trivial exponential decay, different from the standard power-law decay of Anderson's orthogonality catastrophe, which is expected in the case of single host fermions. By mapping this system to a multi-Fermi edge problem, we provide analytical expressions for the impurity response for long time dynamics. Our scheme paves a way for controlling and harnessing fermionic many-body states in atomtronics.

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Date submitted: 11 Nov 2016 Electronic form version 1.4