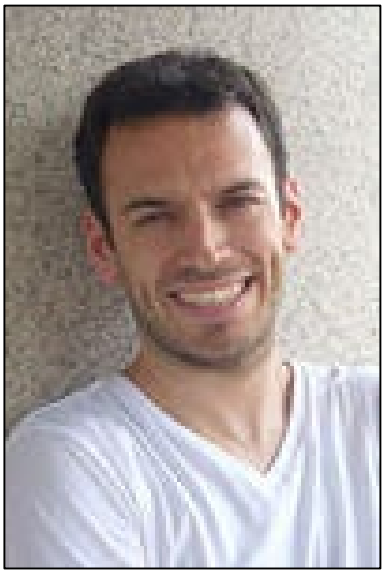
Physics & Astronomy Colloquium

Presents



Nir Navon

Assistant Professor
Yale University

Thursday, October 20, 2022
12:10 pm, Webster Room 11

Please meet our guest speaker and share in refreshments 11:45 a.m. -12:10 p.m. in the foyer on floor G above the lecture hall

"Fermions in an Optical Box"

For the past two decades harmonically trapped ultracold atomic gases have been used with great success to study fundamental many-body physics in flexible experimental settings. However, the resulting density inhomogeneity of gases in those traps makes it challenging to study paradigmatic uniform-system physics (such as critical behavior near phase transitions) or complex quantum dynamics.

The realization of homogeneous quantum gases trapped in optical boxes has marked a milestone in the quantum simulation program with ultracold atoms [1]. These textbook systems have proved to be a powerful playground by simplifying the interpretation of experimental measurements, by making more direct connections to theories of the many-body problem that generally rely on the translational symmetry of the system, and by enabling altogether previously inaccessible experiments.

I will present a set of studies with ultracold fermions trapped in a box of light. This system is particularly interesting to study problems of fermion stability, of which I will discuss two cases: the spin-1/2 Fermi gas with repulsive contact interactions [2], and the three-component Fermi gas with spin-population imbalance. Both studies lead to surprising results, highlighting how spatial homogeneity not only simplifies the connection between experiments and theory, but can also unveil unexpected outcomes. Finally, I will discuss two ongoing efforts to tackle far-from-equilibrium dynamics of uniform fermions. One focuses on an impurity embedded in a Fermi bath and strongly driven between internal states; the second one aims at understanding the strongly interacting fermion gas spatially driven on a large length scale, for which we observe nonlinear response of the lowest-lying collective mode.

[1] N. Navon, R.P. Smith, Z. Hadzibabic, Nat. Phys. 17, 1334 (2021)

[2] Y. Ji et al., arXiv:2204.03644, Phys. Lev. Lett (in press, 2022)

Host: Drs Peter Engels & Michael Forbes

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