Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Apparent Low-Energy Scale Invariance in Two-Dimensional Fermi Gases[1] EDWARD TAYLOR, McMaster University, MOHIT RANDERIA, The Ohio State University — Recent experiments on a 2D Fermi gas find an undamped breathing mode oscillating at twice the trap frequency over a wide range of parameters [1]. To understand this seemingly scale-invariant behavior in a system with an energy scale, the dimer binding energy, we derive two exact results valid across the entire BCS-BEC crossover at all temperatures [2]. We relate both the shift of the mode frequency from its scale-invariant value as well as a sum rule characterizing the low-energy spectral weight in the bulk viscosity to a single parameter. This parameter characterizes the deviation from scale invariance at low energies and remarkably, vanishes exactly at zero temperature within mean-field BCS theory. Only thermal and quantum fluctuations contribute a nonzero value for this parameter and hence, break the low-energy, effective scale invariance. We discuss reasons why, in 2D with an interaction that depends logarithmically on the density, these fluctuations contribute very weakly.

[1] E. Vogt, M. Feld, B. Frohlich, D. Pertot, M. Koschorreck, and M. Kohl, Phys. Rev. Lett. 108, 070404 (2012).
[2] E. Taylor and M. Randeria, Phys. Rev. Lett. 109, 135301 (2012).

[1]MR was supported by NSF Grant No. DMR-1006532 (MR). ET was supported by NSERC and the Canadian Institute for Advanced Research (CIFAR).

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Date submitted: 20 Dec 2012 Electronic form version 1.4