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**Dynamical Structure Factors in Cold Atoms with Random Phase Approximation** PATRICK KELLY, ETTORE VITALI, California State University, Fresno — Cold atomic gases provide an excellent test ground, for both experimentalists and theorists, to study the exotic and sometimes counterintuitive behavior of quantum many-body problems. Of particular interest is the appearance of collective excitations in these systems, such as the famous Goldstone mode and the elusive Higgs mode. It is important to assess the robustness of theoretical and computational techniques to study these excitations. We build on the unprecedented opportunity provided by the fact that, in some cases, exact numerical predictions can be obtained through quantum Monte Carlo. We use such predictions to assess the accuracy of the random phase approximation, which is widely considered to be a method of choice for the study of the collective excitations in a cold atomic Fermi gas modeled with a Fermi-Hubbard Hamiltonian. We found good agreement between the two methodologies for the dynamic properties and in particular for the position of the Goldstone mode. We also explored the possibility of using a renormalized, effective potential in place of the physical potential. We determined that using a renormalized potential is likely too simplistic a method for improving the accuracy of the random phase approximation and that a more sophisticated approach is needed.

Patrick Kelly
California State University, Fresno

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