Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Nambu-Goldstone modes of an ultracold $^{6}Li-\ ^{40}K$ mixture in an optical lattice ZLATKO KOINOV, Department of Physics and Astronomy, University of Texas at San Antonio, San Antonio, TX 78249, SHANNA PAHL, RAFAEL MENDOZA, Department of Physics and Astronomy, University of Texas at San Antonio, San Antonio, TX 78249, USA — A low-energy theory of the Nambu-Goldstone excitation spectrum and the corresponding speed of sound of an interacting Fermi mixture of Lithium-6 and Potassium-40 atoms in a two-dimensional optical lattice at finite temperatures with the Fulde-Ferrell order parameter is presented. We assume that the interacting fermions are in a sufficiently deep periodic lattice potential described by the Hubbard Hamiltonian. The discussion is restricted to the BCS side of the Feshbach resonance where the Fermi atoms exhibit superfluidity. The quartic on-site Hubbard interaction is decoupled via a Hubbard-Stratonovich transformation. The numerical solution of the Bethe-Salpeter equation in the generalized random phase approximation shows that the two-species Fermi gas has a superfluid phase revealed by two rotonlike minima in the asymmetric collective-mode energy. At some values of polarization, interacting strength and temperature, the dispersion relation of the Nambu-Goldstone excitation $\omega(Q)$ initially bends upward as the quasimomentum Q increases before bending over. Due to this anomalous dispersion one long-wavelength phonon can decay into another one by absorbing a second phonon Landau damping), or one phonon can decay into two others (the Beliaev damping).

Zlatko Koinov
Department of Physics and Astronomy,
University of Texas at San Antonio, San Antonio, TX 78249

Date submitted: 07 Nov 2014 Electronic form version 1.4