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Low energy damping of collective modes in spinor Bose-Fermi mixtures JEDEDIAH PIXLEY, XIAOPENG LI, Condensed Matter Theory Center and Joint Quantum Institute, Department of Physics, University of Maryland, College Park — Motivated by the recent experimental push to study quasiparticle excitations in Bose-Fermi mixtures [1,2] we theoretically study the low energy bosonic excitations in an ultra-cold three-dimensional spinor Bose-Fermi mixture [3]. In particular, we consider a spin-1 Bose gas forming either a ferromagnetic or polar superfluid interacting with a spin-1/2 Fermi gas. Using field theoretic techniques we show the Bogoliubov quasiparticles become damped at low energy with a damping rate that is linear in momentum while the linear dispersion is preserved with a renormalized sound velocity. For the polar superfluid we find both density and spin modes become damped, whereas for the ferromagnetic superfluid only the density mode becomes damped. Such a damping mechanism is drastically different then known damping mechanisms in Bose gases (Baliaev and Landau) and is due to the presence of the Fermi surface and gapless particle-hole excitations.

[1] H. Hara, et. al. , Journal of the Physical Society of Japan 83, 014003 (2014).
[2] I. Ferrier-Barbut, et. al., Science 345, 1035 (2014).
[3] J. H. Pixley, X. Li, and S. Das Sarma, arXiv:1501.05015 (2015).

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