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Collisional hydrodynamic mode frequencies in the BCS-BEC crossover near unitarity[1] ALLAN GRIFFIN, EDWARD TAYLOR, University of Toronto — In the collisional region at finite temperatures (produced by the large value of the s-wave scattering length), the collective modes of a superfluid Fermi gas are expected to be described by the Landau two-fluid hydrodynamic equations. These equations predict two types of modes: an in-phase oscillation of the normal and superfluid components as well as an out-of-phase oscillation. We prove that at unitarity and at all temperatures, the in- phase breathing mode solution of the two-fluid equations has a frequency identical to that calculated at $T = 0$ by Cozzini and Stringari. This temperature-independence has been verified in recent experiments by Thomas and coworkers. For the special case of an isotropic trap, we find the temperature-independent frequency $\omega = 2\omega_0$, a result predicted to be valid under all conditions at unitarity by Castin. We also discuss the more interesting finite-T out-of–phase (the analogue of second sound) breathing mode frequency given by the Landau-two- fluid equations at unitarity.

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