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Viscosity in dilute Fermi gases: spectral functions and sum rules[1]
EDWARD TAYLOR, MOHIT RANDERIA, The Ohio State University — Recently there has been considerable interest in the viscosity of strongly interacting systems, especially in regimes where the mean free path is of the order of the interparticle spacing and a quasiparticle description breaks down. We derive exact results for the spectral functions and sum rules for the shear and bulk viscosities, Re $\eta(\omega)$ and Re $\zeta(\omega)$, of strongly interacting Fermi and Bose systems. The zero-frequency limits of these functions give the viscosities measured in hydrodynamic damping experiments. For a two-component Fermi gas, we find the exact sum rules $\int_0^\infty d\omega$ Re$\eta(\omega)/\pi = \varepsilon/3 - 2\langle V\rangle/5$ and $\int_0^\infty d\omega$ Re $\zeta(\omega)/\pi = (\varepsilon + P)/3 - \rho c_s^2/2$, where ε is the internal energy density, $\langle V\rangle$ the potential energy density, P the pressure, ρ the mass density, and c_s the speed of sound. These results are valid at all temperatures and for all values of $1/(k_F a)$ through the BCS-BEC crossover. We will discuss the implications of these sum rules including universal high-frequency tails of the spectral functions.

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