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Shear viscosity to entropy density ratios and implications for (im)perfect fluidity in Fermionic and Bosonic superfluids RUFUS BOYACK, James Franck Institute, University of Chicago, Chicago, IL, HAO GUO, Department of Physics, Southeast University, Nanjing 211189, China, K. LEVIN, James Franck Institute, University of Chicago, Chicago, IL — Recent experiments on both unitary Fermi gases and high temperature superconductors (arxiv:1410.4835 [cond-mat.quant-gas], arxiv:1409.5820 [cond-mat.str-el].) have led to renewed interest in near perfect fluidity in condensed matter systems. This is quantified by studying the ratio of shear viscosity to entropy density. In this talk we present calculations of this ratio in homogeneous bosonic and fermionic superfluids, with the latter ranging from BCS to BEC. While the shear viscosity exhibits a power law (for bosons) or exponential suppression (for fermions), a similar dependence is found for the respective entropy densities. As a result, strict BCS and (true) bosonic superfluids have an analogous viscosity to entropy density ratio, behaving linearly with temperature times the (T-dependent) dissipation rate; this is characteristic of imperfect fluidity in weakly coupled fluids. This is contrasted with the behavior of fermions at unitarity which we argue is a consequence of additional terms in the entropy density thereby leading to more perfect fluidity. (arXiv:1407.7572v1 [cond-mat.quant-gas])

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