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Abnormal Superfluid Fraction of Harmonically Trapped Few-Fermion Systems[1] YANGQIAN YAN, D. BLUME, Washington State University — Superfluidity is a fascinating phenomenon that, at the macroscopic scale, leads to dissipationless flow and the emergence of vortices. While these macroscopic manifestations of superfluidity are well described by theories that have their origin in Landau's two-fluid model, our microscopic understanding of superfluidity is far from complete. Using analytical and numerical *ab initio* approaches, this work determines the superfluid fraction and local superfluid density of small harmonically trapped two-component Fermi gases as a function of the interaction strength and temperature. At low temperature, we find that the superfluid fraction is, in certain regions of the parameter space, negative. This counterintuitive finding is traced back to the symmetry of the system's ground state wave function, which gives rise to a diverging quantum moment of inertia $I_{\rm q}$. Analogous abnormal behavior of $I_{\rm q}$ has been observed in even-odd nuclei at low temperature. Our predictions can be tested in modern cold atom experiments.

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