Transition from supersonic to subsonic waves in superfluid Fermi gases

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Cold atomic gases have given a new boost to the research on superfluids. In this context, cold gases of paired fermions have attracted special attention due to the liberty they offer of tuning the interaction strength using a Feshbach resonance. This degree of freedom allowed for the observation of a resonantly interacting gas in the so-called unitary limit. A specificity offered by the controllable interactions is that the sound branch changes from a supersonic dispersion relation in the Bose-Einstein condensate (BEC) limit, where the pairs are tightly bound dimers, to a subsonic one in the Bardeen-Cooper-Schrieffer (BCS) limit of weakly correlated pairs.

We study the propagation of dispersive waves in superfluid Fermi gases in the BEC-BCS crossover. Unlike in other superfluid systems, where dispersive waves have already been studied and observed, Fermi gases can exhibit a subsonic dispersion relation for which the dispersive wave pattern appears at the tail of the wavefront. We show that this property can be used to distinguish between a subsonic and a supersonic dispersion relation at unitarity.