

Superfluidity in systems breaking translational invariance

Monday, 11 September 2023 08:45 (35 minutes)

Lev Pitaevskii, to whom this talk is dedicated, always had the passion for superfluid phenomena, to which he gave fundamental contributions either before and after the experimental realization of Bose-Einstein condensation in atomic gases. In this presentation I will discuss some recent results concerning the consequences of the breaking of translational invariance on the superfluid fraction of a quantum many-body system at zero temperature. They include:

- Dilute BEC gases in the presence of an external periodic potential, where the superfluid fraction has been recently measured within a collaboration with the experimental team at the Collège de France, either evaluating the Leggett's upper bound and the velocity of sound [1].
- Superfluid Fermi gases in the presence of periodic potentials, where Leggett's bound deviates from the actual value of the superfluid fraction, due the occurrence of the superfluid pairing gap [2].
- Supersolid dipolar gases where the relation between the velocity of sound and the superfluid fraction is not as simple as in standard superfluids and is investigated using the hydrodynamic theory of supersolids [3]

[1] G. Chauveau et al., Superfluid Fraction in an Interacting Spatially Modulated Bose-Einstein Condensate, PRL 130, 226003 (2023)

[2] G. Orso and S. Stringari, Superfluid Fraction and Leggett's Bound in a Strongly interacting Density Modulated Fermi Gas, in preparation

[3] M. Sindik, T. Zawislak, A. Recati and S. Stringari, Sound, superfluidity and layer compressibility in a ring dipolar supersolid, in preparation

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Session Classification: Memoriam L. Pitaevskii

Track Classification: Superfluidity and Supersolidity