SJSR Singapore Journal of Scientific Research

OPEN ACCESS

News & Comments

One Sound Heard Twice in a 3D Quantum Gas

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After studying hybrid sound modes in one-dimensional quantum liquids, the speed of sound in quantum gases has now been observed to vary.

Simply put, if someone is hearing a sound in 3D gas (used in this study), he will hear the sound twice because identical sound waves are traveling at different speeds and are carried by a single sound. This study is a new benchmark in the field of super fluidity, which is the study of fluids with no viscosity that can flow without any loss of energy.

The gas used in this study follows Landau's two-fluid model with respect to its density and velocity. The same rules seem to apply to quantum gas setups.

Researchers trapped atoms of potassium in a vacuum chamber by cooling them down to less than a millionth of a degree above absolute zero (Bose-Einstein condensate), then the interactions between the atoms were artificially increased to make the gas more fluid (hydrodynamic).

The author of the study said, "We observed both first and second sound in a 3D ultra cold Bose gas that is sufficiently strongly interacting to be hydrodynamic, but is still highly compressible."

Due to the quantum nature of the gas, the two sounds are explained - one representing a compressed particle wave, the other representing thermal fluctuations that act like particles.

According to the study author, in years to come, this first demonstration of sound moving at two different speeds in a quantum gas will serve as a springboard for other types of experiments.

KEYWORDS

Atomic, Molecular & Optical, Condensed Matter, Materials & Applied Physics, Fluid Dynamics, Bose gases, Bose-Einstein condensate, Quantum fluids & solids, Superfluidity