Contribution ID: **8** Type: **Poster**

Collective excitations of a Bose-condensed gas: Fate of second sound in the crossover regime between hydrodynamic and collisionless regimes

Monday 2 September 2024 17:00 (2 hours)

We develop the moment method for Bose-Einstein condensates at finite temperatures that enable us to study collective sound modes from the hydrodynamic to the collisionless regime [1]. In particular, we investigate collective excitations in a weakly interacting dilute Bose gas by applying the moment method to the Zaremba-Nikuni-Griffin equation, which is the coupled equation of the Boltzmann equation with the generalized Gross-Pitaevskii equation. Utilizing the moment method, collective excitations in the crossover regime between the hydrodynamic and collisionless regimes are investigated in detail. In the crossover regime, the second sound mode loses the weight of the density response function because of the significant coupling with incoherent modes, whereas the first sound shows a distinct but broad peak structure. We compare the result obtained by the moment method with that of the Landau two-fluid equations and show that the collective mode predicted by the Landau two-fluid equations well coincides with the result from the moment method even far from the hydrodynamic regime, whereas clear distinction also emerges in the relatively higher momentum regime.

References

[1] Hoshu Hiyane, Shohei Watabe, and Tetsuro Nikuni. Collective excitations of a bose-condensed gas: Fate of second sound in the crossover regime between hydrodynamic and collisionless regimes. Phys. Rev. A, 109:033302, Mar 2024

Short bio (50 words) or link to website

My name is Hoshu Hiyane, a fourth year PhD student at the Quantum Systems Unit at the Okinawa Institute of Science and Technology. I received my bachelor's degree at Tokyo University of Science. I will talk about my recent work on the dynamical properties of finite-temperature Bose-Einstein condensates.

Relevant publications (optional)

Career stage

Student

Authors: HIYANE, Hoshu (Okinawa Institute of Science and Technology); Prof. WATABE, Shohei (Faculty of Engineering, Computer Science and Engineering, Shibaura Institute of Technology); Prof. NIKUNI, Tetsuro (Department of Physics, Tokyo University of Science)

Presenter: HIYANE, Hoshu (Okinawa Institute of Science and Technology)

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