

On the mechanism of collisionless damping of sound in dilute Bose gas with condensate

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This work is devoted to the calculation of the sound decay decrement of Landau mechanism in rarefied gases with Bose-Einstein condensate. The investigations are conducted by using the general dynamics equations in such systems obtained in [1] through the first principles. The problem statement itself was arisen due to the doubts in the expressions for sound adsorption in such systems obtained by the other authors before, see, e.g. [2]. The authors of the latter and other papers use the equations obtained in the phenomenological uncontrolled approaches (e.g. From the uncontrolled modification of Gross-Pitaevsky equation [2]), as the initial ones. This circumstance explains the doubts mentioned above. The linearization of dynamics equations for rarefied Bose-gases with extracted condensate primarily obtained in the microscopic approach [1] in collisionless approximation, led to the general dispersion equation for this system. The analytical solutions of the dispersion equations in cases of low and high (but, naturally, lower than critical) temperatures were found. The calculated sound decay decrement in the low temperatures case significantly differs from that obtained in the phenomenological approaches before. Namely, the decrement in this case has a squared dependency on temperature, not the fourth power of temperature as it was considered before. Also it was shown that in the high temperatures domain the decrement has a linear growing temperature dependency that coincides with the results of other authors, [2].

1. S.V. Peletminskii, A.I. Sokolovskii, V.S. Schelokov, *Theoretical and Mathematical Physics*, **30**, (1977) 35; N.M. Lavrinenko, S.V. Peletminskii, Yu.V. Slyusarenko, *Low Temperature Physics*, **9**, (1983) 412.
2. L.P. Pitaevskii and S. Stringari, *Phys. Lett. A*, **235**, (1997) 398., L.P. Pitaevskii, *Physics-Usppekhi (Advances in Physical Sciences)* **41** (1998) 569.