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An Evaluation of Temperature Dependent Mean Energies of Excitation of Bose-Einstein Condensate

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ABSTRACT

This paper present, using the gapless second order theory, the excitation energies and dynamics of the collective excitation for a partially condensed harmonic trapped quasi two dimensional bosonic gas. For numerical estimation we have taken a model of pancake shaped cloud consisting of $N=2000^{23}$ Na atom trapped with trapping frequency ω_c = 25 x 350 Hz. We have shown the evaluated result of temperature dependent mean energies of the excitation using second order theory together with HFB-Popov theory and exact energy of Kohn modes. According to Kohn theorem a system of harmonically trapped interacting particle in any eigenstate of the Hamiltonian has an eigenstate with the amount $\hbar\omega_i$. In higher order theories, the dynamics of the thermal gas and its interaction with the condensate have to be taken into account accurately obtained results in agreement with Kohn theorem. In our calculation, it is shown that within the second order theory, the energies of the Kohn mode is very close to $\hbar\omega$ for temperature $T< 0.8T_c$.

Keywords : HFB-Popov Approximation, Second Order Theory, Collective Mode, Bose-Einstein Condensation.