Analogue Gravity from Quantum potential induced Bose-Einstein Condensates (BEC): UV-IR Coupling in Analogue Hawking radiation

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ABSTRACT

The presence of the Lorentz-breaking quantum potential term in the non-local BEC model apparently gives rise to the massive scalar excitations for large wavelength phonon modes (of $\mathcal{O}(1/\xi)$) characterized by a 'massive' minimally coupled free Klein-Gordon equation in the context of experimental observations of analogue Hawking radiation where at least one spatial dimension is kept free to allow for the source/sink of the background fluid flow [1]. Thus arising out of a non-relativistic non-local BEC, an Analogue gravity model is formulated upto $\mathcal{O}(\xi^2)$ accuracy in the presence of the quantum potential term for a canonical acoustic black hole in $(3+1)$-d spacetime. A UV-IR coupling between short wavelength 'primary' modes (which are supposedly Hawking radiated through the sonic event horizon) and the large wavelength 'secondary' modes is the striking upshot which is inevitable in the quantum gravity experiments of analogue Hawking radiation in the laboratory. These 'secondary' modes would grow over space by gaining energy from the Hawking radiated quanta ('primary' modes) that are distinguished by their characteristic features of the respective growth rates [2]. .

References

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