

Abstract Submitted
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Entanglement like properties in Spin-Orbit Coupled Ultra Cold Atom and violation of Bell like Inequality SANKALPA GHOSH, RAHUL KUMAR, Physics Department, Indian Institute of Technology, Delhi, India — We show that the general quantum state of synthetically spin-orbit coupled ultra cold bosonic atom whose condensate was experimentally created recently (Y. J. Lin *et al.*, Nature, **471**, 83, (2011)), shows entanglement between motional degrees of freedom (momentum) and internal degrees of freedom (hyperfine spin). We demonstrate the violation of Bell-like inequality (CHSH) for such states that provides a unique opportunity to verify fundamental principle like quantum non-contextuality for commuting observables which are not spatially separated. We analyze in detail the Rabi oscillation executed by such atom-laser system and how that influences quantities like entanglement entropy, violation of Bell like Inequality etc. We also discuss the implication of our result in testing the quantum non-contextuality and Bell's Inequality violation by macroscopic quantum object like Bose-Einstein Condensate of ultra cold atoms.

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