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Rotating bosonic ring lattice: Entanglement, Mott and Liftshitz-like Transitions ANA MARIA REY, ITAMP, Harvard -Smithsonian Center of Astrophysics, KEITH BURNETT, Clarendon Laboratory, University of Oxford, INDUBALA SATIJA, George Mason University, CHARLES CLARK, NIST — We study the effects of rotation on one-dimensional ultra-cold bosons confined to a ring lattice. In this talk we discuss the existence of a critical rotation frequency at which an infinitesimal interatomic interaction energy fragments the ground state of integer filled (commensurate) systems into a macroscopic superposition of two states with different circulation. The formation of such an entangled cat state is accompanied by an opening of a gap in the spectrum and a sudden rearrangement of the momentum distribution. These features are reminiscent of the topological changes in the Fermi surface that occurs in the Lifshitz transition in fermionic systems. The entangled nature of the ground state induces a strong enhancement in the quantum correlations and decreases the threshold of the Mott insulator transition. In contrast to the commensurate case, the incommensurate lattice is rather insensitive to rotation. In addition we discuss the usefulness of noise correlations as tool for identifying novel physics in strongly correlated systems.

Ana Maria Rey
ITAMP, Harvard -Smithsonian Center of Astrophysics

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