Superfluidity from correlations in driven boson systems

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We study a one-dimensional Bose-Hubbard gas in a lattice whose hopping energy is made to oscillate with zero time average. At high frequencies, such a driving gives rise to a static effective model where first-order particle hopping is suppressed while processes of even order in the hopping are allowed, which results in a dynamics that is entirely driven by multi-particle correlations [1]. At a critical value of the driving amplitude, the system passes from a Mott insulator to an exotic superfluid phase whose cat-like ground state consists of two branches characterized by the preferential occupation of opposite momentum eigenstates [2]. We discuss how this non-equilibrium superfluid phase, without autonomous single-particle hopping and thus exclusively based on correlations, differs qualitatively from conventional superfluidity. The effect is robust against variations in experimental details [3]. We thus show that driving the tunnelling ("kinetic driving") provides a novel form of Floquet engineering, which enables atypical Hamiltonians and exotic states of matter to be produced and controlled.

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