Exotic superfluidity from correlations

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We study a one-dimensional Bose-Hubbard gas in a lattice whose hopping energy is made to oscilate with zero time average. Such a driving suppresses first-order particle hopping while allowing higher-order, even processes [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 consist of two branches characterized by the preferencial occupation of opposite momentum eigenstates [2]. In the absence of autonomous single-particle hopping, the resulting superfluidity is exclusively driven by correlations. We discuss how such a phase differs qualitatively from conventional superfluidity. The effect is robust against variations in experimental details [3].

Figures

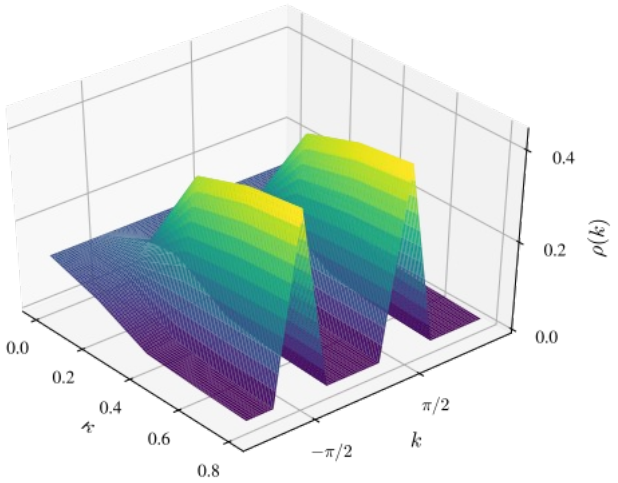

Figure 1: Momentum density vs. the driving parameter κ vs. the set of momenta of the reciprocal lattice k for the ground state of the system.

References

[1] G. Pieplow, F. Sols, C. E. Creffield, New J. Phys., 20 (2018) 073045
[2] G. Pieplow, C. E. Creffield, F. Sols, Phys. Rev. Research, 1 (2019) 033013
[3] J. Mateos, G. Pieplow, C. E. Creffield, F. Sols, Eur. Phys. J. Spec. Top., 230 (2021) 1013-1019