

# Superfluidity and localization in bosonic glasses

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Abstract:

Bosons can exhibit superfluid, density-ordered, and even glassy phases. It is interesting to ask whether superfluidity and density order can coexist, which requires the simultaneous breaking of two symmetries with competing order parameters. We have analyzed a fully connected model of frustrated bosons, which indeed exhibits such an intermediate phase. Its hallmarks are anticorrelations between the local order parameters, and a non-monotonous superfluid order parameter as a function of  $T$ . To study transport, we extend this fully connected model to a Bethe lattice with finite but large connectivity. While thermodynamic properties are insensitive to quantum fluctuations, the latter play an important role for the dynamics in the glassy insulator. The glassy order is shown to affect significantly the superfluid-insulator transition, which is exactly solvable. In the glassy insulator we find a finite mobility edge for bosonic excitations, which does not close upon approaching the superfluid transition.