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Criterion for bosonic superfluidity in an optical lattice ROBERTO DIENER, QI ZHOU, HUI ZHAI, TIN-LUN (JASON) HO, Department of Physics, The Ohio State University — We show that the current method of determining superfluidity in optical lattices based on a visibly "sharp" bosonic momentum distribution $n(\mathbf{k})$ can be misleading, for even a *normal* Bose gas can have a similarly "sharp" $n(\mathbf{k})$. We show that superfluidity can be detected from the so-called "visibility" (v) of $n(\mathbf{k})$ − that v must be 1 within $O(N^{-2/3})$, where N is the number of bosons. Many current experiments, however, have interpreted states with $v < 1$ as superfluid. Such states are in fact normal, reflecting strong temperature effects in the system. These normal states, however, allow one to explore the physics in the quantum critical regime.

Roberto Diener
Department of Physics, The Ohio State University

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