Bose-Hubbard model on a checkerboard superlattice[1] MENDERES
ISKIN, Koç University — We study the ground-state phases of the Bose-Hubbard
model on a checkerboard superlattice in two dimensions, including the superfluid
phase and the Mott and charge-density-wave insulators. First, we discuss the single-
particle Hofstadter problem, and show that the presence of a checkerboard superlat-
tice gives rise to a magnetic flux-independent energy gap in the excitation spectrum.
Then, we consider the many-particle problem, and derive an analytical mean-field ex-
pression for the superfluid-Mott and superfluid–charge-density-wave insulator phase
transition boundaries. Finally, since the phase diagram of the Bose-Hubbard model
on a checkerboard superlattice is in many ways similar to that of the extended Bose-
Hubbard model, we comment on the effects of magnetic field on the latter model,
and derive an analytical mean-field expression for the superfluid-insulator phase
transition boundaries as well.

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