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Accounting for on-site correlations with a generalized Bose-Hubbard model KADEN HAZZARD, ERICH MUELLER, Cornell University — Near a Feshbach resonance, on-site correlations limit the applicability of the standard Bose-Hubbard model. We present a generalized Bose-Hubbard model which transcends this problem. This model accommodates arbitrary on-site correlations – even those found in exotic situations, such as when rapid rotation of each site creates an array of coupled fractional quantum Hall puddles. One of the remarkable strengths of our model is that even a mean field approximation includes all on-site correlations. We describe how these on-site correlations modify the phase diagram, deplete the condensate, and even deep in the superfluid give rise to features characteristic of strongly interacting Bose gases. We argue that current attempt to quantitatively describe cold atom emulations of condensed matter models must include these correlations.

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