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Tunable anisotropic superfluidity in optical Kagome superlattice[1]

AXEL PELSTER, XUE-FENG ZHANG, Univ. of Kaiserslautern, Germany, TAO WANG, Harbin Institute of Technology, China, SEBASTIAN EGGERT, Univ. of Kaiserslautern, Germany — We study the extended Bose-Hubbard model for the optical Kagome superlattice which is generated by enhancing the long wavelength laser in one direction. By combining Quantum Monte Carlo simulations with the Generalized Effective Potential Landau Theory, we find not only the Mott insulator–superfluid quantum phase transition, but also striped solid phases with non-integer filling factors. Furthermore, we determine with high accuracy the quantum phase diagram for different trap potential offsets. Due to the delicate interplay between onsite repulsion and artificial symmetry breaking, the superfluid density turns out to be anisotropic which reveals its tensorial property. Counterintuitively, the bias of the anisotropy is alternating between x- and y-direction while tuning the particle number or the hopping strength. Finally, we discuss how to observe such phenomenon experimentally, in particular via time-of-flight absorption measurements.

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