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Tuning the Kosterlitz-Thouless transition to zero temperature in anisotropic boson systems JHIH-SHIH YOU, HAO LEE, SHIANG FANG, Physics Division, National Center for Theoretical Sciences, Hsinchu, Taiwan, MIGUEL A. CAZALILLA, Graphene Research Centre National University of Singapore, 6 Science Drive 2, Singapore 117546, DAW-WEI WANG, Physics Division, National Center for Theoretical Sciences, Hsinchu, Taiwan — We study the two-dimensional Bose-Hubbard model with anisotropic hopping. Focusing on the effects of anisotropy on superfluid properties such as the helicity modulus and the normal-to-superfluid [Berezinskii-Kosterlitz-Thouless (BKT)] transition temperature, two different approaches are compared: large-scale quantumMonte Carlo simulations and the self-consistent harmonic approximation (SCHA). For the latter, two different formulations are considered, one applying near the isotropic limit and the other applying in the extremely anisotropic limit. Thus we find that the SCHA provides a reasonable description of superfluid properties of this system provided the appropriate type of formulation is employed. The accuracy of the SCHA in the extremely anisotropic limit, where the BKT transition temperature is tuned to zero (i.e., at a quantum critical point) and therefore quantum fluctuations play a dominant role, is particularly striking.

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