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Exploring classical and quantum criticality in two-dimensional quantum gases CHEN-LUNG HUNG, XIBO ZHANG, LICHUNG HA, SHIHKUANG TUNG, NATHAN GEMELKE[1], CHENG CHIN, The University of Chicago — Continuous phase transitions in two dimensions (2D) are expected to exhibit intriguing universal behaviors near the critical point. Prominent examples include the Berezinsky-Kosterlitz-Thouless (BKT) transition and the superfluid (SF) to Mott insulator (MI) transition described by the Bose-Hubbard model. Both transitions are investigated in our system based on ultracold Bose gases confined in a pancake-like optical trap with or without an optical lattice potential. In this talk, we will present a study of the universal behavior near the BKT transition by probing the density profiles and their fluctuations at various temperatures and atomic interaction strengths. We report the observation of global scale-invariance and universality in scaled thermodynamic observables. Our measurement agrees with the classical field theoretical prediction as well as the Monte Carlo calculations, and shows growing density-density correlations in the critical regime. Further extensions of this work, including exploration of quantum criticality near the SF-MI phase boundary, will be discussed.

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