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Equations of State of Strongly Interacting Two-dimensional Bose Gases LI-CHUNG HA, CHEN-LUNG HUNG[1], XIBO ZHANG[2], University of Chicago, ULRICH EISMANN, University of Chicago, ENS Paris, SHIH-KUANG TUNG, ERIC L. HAZLETT, CHENG CHIN, University of Chicago — We study strongly interacting two-dimensional Bose gases based on *in situ* density profiles of the sample in the superfluid and critical fluctuation regimes. By using a Feshbach resonance and imposing an optical lattice we are able to achieve strong interactions. In the superfluid phase, the measured compressibility deviates from the mean-field prediction when the interaction is strong, and are in better agreement with the renormalization calculation. Near the critical point of the superfluid transition, we find that the equations of state scale universally with respect to the interaction strength for the strengths we investigate. This allows for the extraction of critical chemical potentials and densities as well as the renormalized interactions strengths. We compare these results to the mean-field, classical field, Monte Carlo, and renormalization calculations.

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