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Equations of state and superfluid transition of a two-dimensional Bose gas. LAURIANE CHOMAZ, RÉMI DESBUQUOIS, Laboratoire Kastler Brossel, TARIK YEFSAH, Massachusetts Institute of Technology, CHRISTOF WEITENBERG, JÉRÔME BEUGNON, JEAN DALIBARD, Laboratoire Kastler Brossel, JEAN DALIBARD'S GROUP TEAM — Two-dimensional (2D) systems cannot undergo phase transitions associated with continuous symmetry breaking. Nevertheless, they may exhibit a continuous transition to a superfluid phase with quasi-long range order, via the Berezinskii-Kosterlitz-Thouless (BKT) mechanism. I will present our experimental results in which we characterized the thermodynamical and dynamical properties of the 2D gas in the normal, in the critical and in the superfluid regions. Using local density approximation (LDA) and density measurement in a trapped quasi-2D gas, we infer equations of state for the homogeneous 2D gas and compare them to theories. We confirm the predicted scale invariance and identify a critical region in terms of the unique dimensionless parameter μ/k_BT, ratio of the chemical potential μ on the temperature T. We also probe the transport properties of our gases according to mu/k_BT by stirring a micron-sized obstacle on circular trajectories centered on the cloud. We measure the heating generated by the stirring at the radius r and using LDA, deduce the heating behavior of the homogeneous gas at the corresponding chemical potential $\mu(r)$. We identify a transition from a normal dissipative regime to a superfluid frictionless behavior at critical $mu/k_BT|_c$.

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