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Local Probing of Phase Coherence in a Strongly Interacting 2D Quantum Gas NICLAS LUICK, JONAS SIEGL, KLAUS HUECK, KAI MORGENER, THOMAS LOMPE, WOLF WEIMER, HENNING MORITZ, Institut für Laserphysik, Universität Hamburg — The dimensionality of a quantum system has a profound impact on its coherence and superfluid properties. In 3D superfluids, bosonic atoms or Cooper pairs condense into a macroscopic wave function exhibiting long-range phase coherence. Meanwhile, 2D superfluids show a strikingly different behavior: True long-range coherence is precluded by thermal fluctuations, nevertheless Berezinskii-Kosterlitz-Thouless (BKT) theory predicts that 2D systems can still become superfluid. The superfluid state is characterized by an algebraic decay of phase correlations $g_1(r) \propto r^{-\tau/4}$, where the decay exponent τ is directly related to the superfluid density n_s according to $\tau = 4/(n_s \lambda_{\mathrm{dB}}^2)$. I will present local coherence measurements in a strongly interacting 2D gas of diatomic ^{6}Li molecules. A self-interference technique allows us to locally extract the algebraic decay exponent and to reconstruct the superfluid density. We determine the scaling of the decay exponent with phase space density to provide a benchmark for studies of 2D superfluids in the strongly interacting regime.

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