Superfluidity and coherence in uniform two-dimensional Bose gases

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In uniform two-dimensional systems symmetry breaking phase transitions, like Bose-Einstein condensation for an assembly of bosons, are forbidden. Nevertheless, a topological phase transition of Kosterlitz-Thouless type can takes place at low temperature. Below this critical temperature a superfluid phase appears and the phase coherence of the system presents quasi-long range order.

In our team we have developed an experimental apparatus allowing us to trap and manipulate uniform two-dimensional clouds of ultracold weakly interacting bosons in arbitrary geometries [1,2]. In this talk, I will first present recent results describing the characterization of the superfluid behavior of the system thanks to the measurement of the speed of second sound. I will also describe measurements of phase coherence decay with distance between particles.

[1] J.L. Ville, T. Bienaimé, R. Saint-Jalm, L. Corman, M. Aidelsburger, L. Chomaz, K. Kleinlein, D. Perconte, S. Nascimbène, J. Dalibard, and J. Beugnon, *Loading and compression of a single two-dimensional Bose gas in an optical accordion*, Phys. Rev. A. **95**, 013632 (2017).

[2] M. Aidelsburger, J.L. Ville, R. Saint-Jalm, S. Nascimbène, J. Dalibard, and J. Beugnon, *Relaxation dynamics in the merging of N independent condensates*, Phys. Rev. Lett. **119**, 190403 (2017).