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Implementation of protocols for measuring the rapidities distribution of a 1D Bose gas

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After relaxation, an integrable quantum system, in particular a one-dimensional gas of bosons, is characterized by the rapidities distribution, a quantity preserved throughout the dynamics. The rapidities distribution is nothing else than the asymptotic momentum distribution of particles after a one-dimensional expansion of the system. This definition is directly linked to an experimental procedure allowing to access this quantity. It is also possible to realize a bi-partite protocol: the rapidities distribution is then deduced by studying the deformation of the edge of a half-infinite cloud thanks to Generalized HydroDynamics, an emerging hydrodynamic theory applicable to quantum integrable systems. In our experiment, $87^{\wedge}$Rb atoms are trapped by an atom chip to reach the one-dimensional regime. A spatial selection tool has been integrated allowing to realize one-dimensional expansions of homogeneous clouds as well as to implement the bi-partite protocol. We will present the first measurements of rapidities distribution on our system using the two protocols described above.

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