Experimental test of Generalized Hydrodynamics in 1D Bose gases and extension of the notion of rapidity distribution to the framework of classical non-linear physics.

Isabelle Bouchoule[1],

Laboratoire Charles Fabry, Institut d'Optique, CNRS, 2 avenue Augustin Fresnel, Palaiseau
isabelle.bouchoule@institutoptique.fr

Long time behavior of isolated chaotic quantum many-body system is now well established : as long as local observable are concerned, the system relaxes towards a thermal equilibrium which is parameterized by a few quantities. A key recent theoretical advance is the understanding of relaxation in quantum integrable systems solvable by Bethe-Ansatz : one also expects relaxation ; the relaxed state, however, is characterized by a full function, the rapidity distribution. This notion of relaxation is at the heart of the generalized hydrodynamic theory, which describes the slow and long wave-length dynamics in integrable systems, assuming local relaxation of the gas. It amounts to an equation giving the time evolution of the spatially-dependent rapidity distribution. In this seminar we will present the experimental test of the generalized hydrodynamic theory[1], which has been realized in 1D Bose gases well described by the Lieb-Liniger model.

At the heart of GHD is the notion of rapidity distribution. Extending this notion to the classical field framework is very interesting since it permits to apply results obtained for quantum system to the classical field domain. We propose to do so using the difinition of the rapidity distribution as the asymptotic momentum distribution after a very large expansion. Focusing on the Non-Linear Shrödinger Equation model, which is the classical limit of the Lieb-Liniger model, we use this definition to derive the relation between the rapidity distribution and inverse scattering constant of motions, obtained as the trace of the monodromy matrix, parameterized by the spectral parameter [2].

Références

1. M. Schemmer, I. Bouchoule, B. Doyon, and J. Dubail, *Phys. Rev. Lett.*, **122**, 090601, (2019).
2. Y. Bezzaz , L. Dubois and I. Bouchoule, *to be published*, (2023).