The hydrodynamics of integrable systems, and an experimental confirmation

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Hydrodynamics proposes that the effective dynamical degrees of freedom of a many-body system can be reduced, at large scales, to those given by the available local conservation laws. Applied to integrable systems, this gives the powerful framework of “generalised hydrodynamics” (GHD). Very different phenomena are observed as compared to conventional hydrodynamics due to the lack of ordinary thermalisation, such as a continuum of propagation velocities and the absence of shocks. In particular, GHD reproduces the observations made in the famous quantum Newton cradle experiment. I will overview the main ingredients of GHD as applied to the Lieb-Liniger model for ultracold atomic gases in one dimension, and describe the results of our recent experiment (with M. Schemmer, I. Bouchoule and J. Dubail) where GHD is checked explicitly.