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Hydrodynamics for integrable systems out of equilibrium

Hydrodynamics is a powerful framework for describing the large-scale behaviours of many-body systems in inhomogeneous, non-stationary states. Until recently, however, it was restricted to non-integrable models, as the assumption of local thermodynamic equilibrium is broken by the large amount of conserved charges afforded by integrability. I will describe how to generalize hydrodynamics to integrable systems. The resulting Euler-scale theory has a rich structure. It allows us to solve experimentally relevant setups such as the famous "quantum Newton's cradle" in cold atomic gases, and to evaluate exact non-equilibrium currents, correlations, Drude weights and scaled cumulants of non-equilibrium transport. It applies to large families of quantum and classical field theories, chains and gases. I will introduce generalized hydrodynamics and state its main results.