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Onset of thermalization in a nearly integrable 1D Bose gas NEEL MALVANIA, JEAN-FELIX RIOU, LAURA ZUNDEL, JOSHUA WILSON, LIN XIA, DAVID WEISS, Pennsylvania State University — Because of their many conserved quantities, integrable systems long after a quench are not reliably described by statistical mechanics. A small amount of non-integrability compromises the conserved quantities, but it is not theoretically clear that this is always sufficient to recover the statistical mechanics result. We attempt to clarify the situation using out-of-equilibrium 1D Bose gases, excited in so-called quantum Newton's cradles [Kinoshita, T. et al. *Nature* **440**, 900, (2006)]. The evolution of momentum proceeds due to three mechanisms: spontaneous emission of lattice light, the effect of which we model in a semi-classical Monte Carlo simulation; inelastic 3-body loss, for which we measure the collisional energy dependence and then calculate the associated heating; and diffractive (i.e., elastic momentum changing) 3-body collisions. Diffractive collisions, which can only arise from non-integrable terms in the Hamiltonian, can lead to evaporative cooling. By measuring the energy change of the gases as a function of time, we can infer the thermalization rate, which we find to be non-zero. Using 3-body inelastic loss as a calibration, we infer the diffractive 3-body collision rate from the thermalization rate. We then compare the thermalization rate to theoretical expectations due to the leading non-integrable term, virtual transverse excitation during a 3-body collision [Mazets, I. E. et al. *N. J. Phys.* **12**, 055023 (2010)], to determine whether proximity to integrability reduces the effectiveness with which diffractive 3-body collisions cause thermalization.

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