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Rapidity evolution after a trap quench in a 1D Bose gas NEEL MALVANIA, JOSH M. WILSON, YUAN LE, YICHENG ZHANG, Pennsylvania State University, JEROME DUBAIL, Universite de Lorraine, MARCOS RIGOL, DAVID S. WEISS, Pennsylvania State University — The momenta of the quasi-particles that emerge from interactions in many-body integrable quantum systems are referred to as the rapidities. Recently, we reported the first ever measurement of a distribution of rapidities by looking at the asymptotic momentum distribution after quenching an initially trapped Tonks-Girardeau (T-G) gas to a flat potential and letting the atoms expand [1]. Here, we extend our study of rapidities. We quench 1D Bose gases in both the strong and intermediate coupling regimes from an initial trap to a much deeper trap. After a variable evolution time in the deeper trap we perform rapidity measurements by suddenly turning off the trap. Unlike the momentum distributions after such a quench, which change shape as the gas undergoes a breathing oscillation, the rapidity distributions in the first period of oscillation is shown to evolve self-similarly. We compare our measurements to generalized hydrodynamics calculations. [1] J. M. Wilson, N. Malvania, Y. Le, Y. Zhang, M. Rigol, and D. S. Weiss, arXiv:1908.05364 (to appear in Science).

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