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Evidence for unbounded growth of the number entropy in many-body localized phases MAXIMILIAN KIEFER-EMMANOUILIDIS, RAZMIK UNANYAN, MICHAEL FLEISCHHAUER, University of Kaiserslautern, JESKO SIRKER, University of Manitoba — In lattice systems with particle-number conservation the von Neumann entanglement entropy S_{ent} is the sum of number entropy S_{n} and configurational entropy S_{conf}. As shown recently both quantities can be obtained in an experiment from the full counting statistics. We numerically investigate the particle-number entropy S_n following a quench in one-dimensional interacting many-body systems with potential disorder. We find evidence that in the regime which is expected to be many-body localized and where the von-Neumann entanglement entropy is known to grow as $S_{\mathrm{ent}} \sim \ln t$ as function of time t, also the number entropy increases as function of time as $S_n \sim \ln \ln t$. If this growth continues in the thermodynamic limit for infinite times, it would signal (ultra-slow) ergodic behavior rather than localization of particles. We show furthermore that for free systems S_{ent} is completely fixed by S_{n}.

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