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Anomalous diffusion of atoms in a 1D damped lattice YOAV SAGI, MIRI BROOK, IDO ALMOG, NIR DAVIDSON, Department of Physics of Complex Systems, Weizmann Institute of Science, Rehovot 76100, Israel — We study experimentally the anomalous diffusion of atoms in one dimension. The ultra-cold atoms continuously scatter photons from a lattice which is in a configuration identical to the one used in the well-known Sisyphus cooling scheme. This produces a steady-state atomic velocity distribution which is a power law, with an exponent that depends on the lattice depth [1]. We image the atomic density distribution after a varying waiting time. The width of the atomic cloud exhibits a power law time dependence, and we extract its characteristic exponent for various lattice depths. We also show that the density distribution at different times is self-similar with the same characteristic exponent, in accordance with the predictions of a fractional diffusion equation [2].

[1] P. Douglas, S. Bergamini, and F. Renzoni, Phys. Rev. Lett. 96, 110601 (2006).
[2] R. Metzler and J. Klafter, Physics Reports 339, 1 (2000).

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