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Many-Body Dephasing in a Trapped-Ion Quantum Simulator¹ WEN LIN TAN, HARVEY KAPLAN, ARINJOY DE, GUIDO PAGANO, CHRISTOPHER MONROE, Joint Quantum Institute, Department of Physics and Joint Center for Quantum Information and Computer Science, University of Maryland, College Park, LINGZHEN GUO, FLORIAN MARQUARDT, Max Planck Institute for the Science of Light — We observe and analyze the persistent temporal fluctuations after a quantum quench of a tunable long-range interacting transversefield Ising Hamiltonian realized with a trapped-ion quantum simulator [1]. By measuring temporal fluctuations in the average magnetization of a finite-size system of spin-1/2 particles encoded in an array of 171Yb+ atomic ions, we observe experimental evidence for many-body dephasing [2]. The properties of the system are closely related to that of an integrable Hamiltonian with a uniform spin-spin coupling, which enables approximate analytical predictions even for the long-time non-integrable dynamics. We find that the measured fluctuations are exponentially suppressed with increasing system size, consistent with theoretical predictions. [1] H. B. Kaplan, et al., arXiv: 2001.02477 (2020). [2] T.Kiendl, F.Marquardt, Phys. Rev. Lett. 118, 130601 (2017)

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