Abstract Submitted
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Non-local propagation of correlations in long-range interacting quantum systems[1] A.C. LEE, P. RICHERME, Z.-X. GONG, C. SENKO, J. SMITH, M. FOSS-FEIG, JQI (Joint Quantum Institute, University of Maryland Dept. of Physics and NIST), S. MICHALAKIS, Institute for Quantum Information and Matter, Caltech, A.V. GORSHKOV, C. MONROE, JQI — The maximum speed with which information can propagate in a many body quantum system can dictate how demanding the system is to describe numerically and also how quickly disparate sites can become correlated. While these kinds of phenomena may be difficult or even impossible for classical computers to describe, trapped ions provide an excellent platform for investigating this rich quantum many-body physics. Using single-site resolved state-dependent imaging, we experimentally determine the spatial and time-dependent correlations of a far-from-equilibrium quantum many-body system evolving under a long-range Ising- or XY-model Hamiltonian. For varying interaction ranges, we extract the shape of the "light" cone and measure the velocity with which correlations propagate through the system. In many cases, we find increasing propagation velocities, which violate the prediction for short-range interactions and, in one instance, cannot be explained by any existing theory [1]. Our results show that even for modest system sizes, trapped ion quantum simulators are well poised to study complex many-body physics which are intractable to classical methods.

[1] P. Richerme, et al., arXiv:1401.5088

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