DAMOP14-2014-020091

Abstract for an Invited Paper
for the DAMOP14 Meeting of
the American Physical Society

Quantum Dynamics of Many-body Spin Chains Using Atomic Ions[1]

CRYSTAL SENKO, Joint Quantum Institute, University of Maryland Department of Physics and National Institute of Standards and Technology, College Park, Maryland 20742

Quantum simulation, a field in which well-controlled quantum systems are used to study many-body physics that would otherwise be challenging to model, has undergone a great deal of progress in recent years. In particular, trapped ions have proven an excellent platform for simulating quantum magnetism, with their long-lived coherence times, tunable spin-spin interactions mediated by optical dipole forces, and ease of individual readout. The manipulation of more than 10 spins is now routine and has allowed the study of dynamics that will be difficult to simulate classically in larger systems, such as spectroscopy of excitation energies (arXiv 1401.5751) and the spread of spin correlations in a system with long-range interactions (arXiv 1401.5088). In the near future, we expect to apply these techniques to the study of a variety of phenomena such as prethermalization in an isolated quantum system, and to upgrade the apparatus so as to handle many tens of spins, a system size well beyond what is classically calculable.

[1]This work is supported by grants from the U.S. Army Research Office with funding from the DARPA OLE program, IARPA, and the MURI program; and the NSF Physics Frontier Center at JQI.