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Quantum simulation of the transverse field Ising model with trapped atomic ions[1] S. KORENBLIT, E.E. EDWARDS, R. ISLAM, K. KIM, M.-S. CHANG, JQI: Dept of Physics, University of Maryland, and NIST, G.-D. LIN, L.-M. DUAN, MCTP, Dept of Physics, University of Michigan, C. NOH, H. CARMICHAEL, Dept of Physics, University of Auckland, C.-C. WANG, J. FREERICKS, Dept of Physics, Georgetown University, C. MONROE, JQI: Dept of Physics, University of Maryland, and NIST — We simulate an fully-connected ferromagnetic Ising model in a transverse magnetic field using a chain of spins, each represented by the ground states within the hyperfine manifold of a 171-Yb+ ion. We observe the transition from paramagnetic to ferromagnetic ground state spin order as the ratio of the transverse field to Ising couplings is varied. The crossover curves get 'sharper' as the system size is increased, from N=2 to 9 ions, heralding the expected quantum phase transition in an infinite size system. Sources of error and insight from numerical simulations will be discussed and we expect these results will guide future experiments that will simulate quantum magnetic models that are intractable using classical computers.

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