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Probing the quench dynamics of antiferromagnetic correlations in a 2D quantum Ising spin system ELMER GUARDADO-SANCHEZ, PETER T. BROWN, DEBAYAN MITRA, TRITHEP DEVAKUL, DAVID A. HUSE, PETER SCHAUß, WASEEM S. BAKR, Princeton University — Simulating the real-time evolution of quantum spin systems far out of equilibrium poses a major theoretical challenge, especially in more than one dimension. We experimentally explore quench dynamics in a two-dimensional Ising spin system with transverse and longitudinal fields. We realize the system with a near unit-occupancy atomic array of over 200 atoms obtained by loading a spin-polarized band insulator of fermionic lithium into an optical lattice and induce short-range interactions by direct excitation to a low-lying Rydberg state. Using site-resolved microscopy, we probe antiferromagnetic correlations in the system after a sudden quench from a paramagnetic state and compare our measurements to exact calculations in the regime where it is possible. We achieve many-body states with longer-range antiferromagnetic correlations by implementing a near-adiabatic quench of the longitudinal field and study the buildup of correlations as we vary the speed with which we change the field.

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