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Observation of Collapse and Revival Dynamics in the Fermionic Component of a Lattice Bose-Fermi Mixture SEBASTIAN WILL, Massachusetts Institute of Technology, DEEPAK IYER, Penn State University, IMMANUEL BLOCH, Max-Planck-Institut für Quantenoptik, MARCOS RIGOL, Penn State University — The collapse and revival of quantum fields is one of the most pristine forms of coherent quantum dynamics very far from equilibrium. So far, it has only been observed in the dynamical evolution of bosonic fields, for example in a coherent light field interacting with a single atom in cavity QED or in the matter wave field of a Bose-Einstein condensate. Here we report on the first experimental observation of collapse and revival dynamics in a many-body state of fermionic particles. The experiment is performed using an interacting Bose-Fermi mixture of ^{87}Rb and ^{40}K atoms, loaded to an optical lattice. After simultaneous preparation of a bosonic superfluid and a metallic state of spin-polarized fermions, the lattice depth is rapidly increased and non-equilibrium dynamics are initiated. Mediated by interactions with the bosons, the fermions show long-lived dynamical evolution with more than ten revivals, observed in the fermionic momentum distribution after time-of-flight. Fourier transform of the evolution shows that the on-site interaction energy between bosons and fermions is the only relevant energy scale. Our observations demonstrate that, even in systems with short-range coherence, collapse and revival dynamics can be a sensitive probe for correlations.

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