

# Coherent many-body spin dynamics in a long-range interacting Ising chain

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**Author(s):**

Johannes Zeiher, Jae-yoon Choi, Antonio Rubio-Abadal, Thomas Pohl, Rick van Bijnen, Immanuel Bloch, Christian Gross

**Reference:**

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<https://arxiv.org/abs/1705.08372> [2]

Coherent many-body quantum dynamics lies at the heart of quantum simulation and quantum computation. Both require coherent evolution in the exponentially large Hilbert space of an interacting many-body system. To date, trapped ions have defined the state of the art in terms of achievable coherence times in interacting spin chains. Here, we establish an alternative platform by reporting on the observation of coherent, fully interaction-driven quantum revivals of the magnetization in Rydberg-dressed Ising spin chains of atoms trapped in an optical lattice. We identify partial many-body revivals at up to about ten times the characteristic time scale set by the interactions. At the same time, single-site-resolved correlation measurements link the magnetization dynamics with inter-spin correlations appearing at different distances during the evolution. These results mark an enabling step towards the implementation of Rydberg atom based quantum annealers, quantum simulations of higher dimensional complex magnetic Hamiltonians, and itinerant long-range interacting quantum matter.

- [12.10.+i Simulations of many-body interactions](#) [3]
- [RySQ](#) [4]
- [12.30.+u Universal quantum simulators with specific systems \(e.g. trapped ions, optical lattices, etc.\)](#) [5]
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