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Revealing "Hidden" Antiferromagnetic Correlations in Doped Hubbard Chains via String Correlators GUILLAUME SALOMON, TIMON HILKER, MARTIN BOLL, AHMED OMRAN, JAYADEV VIJAYAN, JOANNIS KOEPSELL, IMMANUEL BLOCH, CHRISTIAN GROSS, Max-Planck Institute for Quantum Optics, 85748 Garching, Germany, FABIAN GRUSDT, EUGENE DEMLER, Department of Physics, Harvard University, Cambridge, Massachusetts 02138, USA — Topological phases, among them the celebrated Haldane phase in spin-1 chains, defy characterization through local order parameters. Instead, non-local string order parameters can be employed to reveal their hidden order. Similar diluted magnetic correlations appear in doped 1d systems due to the remarkable phenomenon of spin-charge separation. Here we report on the direct observation of such hidden magnetic correlations via quantum gas microscopy of hole-doped ultracold Fermi- Hubbard chains. The measurement of non-local spin-density correlation functions reveals a hidden finite-range antiferromagnetic order, a microscopic manifestation of spin-charge separation. Our technique, which can be directly extended to higher dimensions, enable the study of the complex interplay between magnetic order and density fluctuations and show how topological order can be directly measured in experiments.

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