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Transporting long-lived quantum spin coherence in a photonic crystal fiber MINGJIE XIN, WUI SENG LEONG, ZILONG CHEN, SHAU-YU LAN, Nanyang Technological University — Confining particles in hollow-core photonic crystal fibers has opened up new prospects to scale up the distance and time over which particles can be made to interact with light. However, maintaining long-lived quantum spin coherence and/or transporting it over macroscopic distances in a waveguide remain challenging. Here, we demonstrate coherent guiding of ground-state superpositions of 85Rb atoms over a centimeter range and hundreds of milliseconds inside a hollow-core photonic crystal fiber. The decoherence is mainly due to dephasing from residual differential light shift (DLS) from the optical trap and the inhomogeneity of ambient magnetic field. Our experiment establishes an important step towards a versatile platform that can lead to applications in quantum information networks and matter wave circuit for quantum sensing.

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