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High Storage Efficiency and Large Fractional Delay of EIT-Based Memory YI-HSIN CHEN, MENG-JUNG LEE, I-CHUNG WANG, National Tsing Hua University, SHENGWANG DU, The Hong Kong University of Science and Technology, YONG-FAN CHEN, National Cheng Kung University, YING-CHENG CHEN, Institute of Atomic and Molecular Sciences, Academia Sinica, ITE A. YU, National Tsing Hua University — In long-distance quantum communication and optical quantum computation, an efficient and long-lived quantum memory is an important component. We first experimentally demonstrated that a time-space-reversing method plus the optimum pulse shape can improve the storage efficiency (SE) of light pulses to 78% in cold media based on the effect of electromagnetically induced transparency (EIT). We obtain a large fractional delay of 74 at 50% SE, which is the best record so far. The measured classical fidelity of the recalled pulse is higher than 90% and nearly independent of the storage time, implying that the optical memory maintains excellent phase coherence. Our results suggest the current result may be readily applied to single-photon quantum states due to quantum nature of the EIT light-matter inference. This study advances the EIT-based quantum memory in practical quantum information applications.

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