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High-efficiency Coherent Optical Memory based on Electromagnetically Induced Transparency. YING-CHENG CHEN, Inst. of Atomic and Molecular Sci., Academia Sinica, Taiwan, YA-FEN HSIAO, Molecular Science and Technology, Taiwan International Graduate Program, Academia Sinica and National Central University, Taiwan, PIN-JU TSAI, Department of Physics, National Taiwan University, Taiwan, HUNG-SHIUE CHEN, Institute of Atomic and Molecular Sciences, Academia Sinica, Taiwan, SHENG-XIANG LIN, CHIH-CHIAO HUNG, CHIH-HSI LEE, Department of Physics, National Taiwan University, Taiwan, YI-HSIN CHEND, Department of Physics, National Tsing Hua University, Taiwan, YONG-FAN CHEN, Department of Physics, National Cheng Kung University, Taiwan, ITE ALBERT YU, Department of Physics, National Tsing Hua University, Taiwan — Quantum memory is a crucial component in the long-distance quantum communication based on quantum repeaters. To outperform the direct transmission of photons with quantum repeaters, it is crucial to develop quantum memories with high fidelity, high efficiency and a long storage time. Here, we present our work to achieve a storage efficiency of larger than 90% for a coherent memory based on the electromagnetically induced transparency (EIT) scheme in cold atomic media with an optical depth of ˜1000. At a storage efficiency of 50%, we also obtain a fractional delay of 1200. At high optical depths, nonlinear optical effects, such as the photon switching and four-wave mixing due to the off-resonant excitation of the EIT control field, may become significant and introduce complications in quantum memory applications. We discuss and present methods to reduce these complications.

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