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Storage of Multiple Images using a Gradient Echo Memory in a Vapor Cell ALBERTO MARINO, QUENTIN GLORIEUX, JEREMY CLARK, PAUL LETT, Joint Quantum Institute, National Institute of Standards and Technology and the University of Maryland, Gaithersburg, MD 20899 USA — The development of a quantum memory (QM) that can store quantum states of light without a significant degradation is an active field of research, as QMs play a fundamental role in quantum information science. A number of different techniques have been developed for their implementation. In particular, the gradient echo memory (GEM) offers a promising technique with high recovery efficiencies and the ability of temporal multiplexing. We show that it is possible to use GEM for the simultaneous storage of multiple images, thus extending the multiplexing properties of this technique to the spatial domain. In order to implement the QM we use a 7 cm-long ^{85}Rb vapor cell with Ne buffer gas at a pressure of 5 Torr and a linearly varying magnetic field of 15 μT/cm along the cell. We use this configuration for the storage of two different images with a temporal delay between them and show that it is possible to temporally distinguish them after the retrieval process. We have obtained recovery efficiencies up to 8 % and storage times over 4 μs while still retaining a good spatial fidelity between the input and retrieved images. Finally, we study the effect of atomic diffusion on the storage of images and find that it limits the spatial resolution of the retrieved images.

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