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Microwave-to-optical transduction and quantum memory in Rb vapors ANDREI TRETIAKOV, TIMOTHY LEE, CLINTON POTTS, JOHN DAVIS, LINDSAY LEBLANC, University of Alberta — Quantum memory, which stores quantum information and retrieves it on demand, is an essential part of a quantum computer. Working with signals at microwave frequencies is of particular interest since it is the range of common quantum processors, i.e. superconducting devices and highly-excited atoms. On the other hand, for efficient transfer of a signal, optical wavelengths are preferable. In this project, we study the interaction between a rubidium-87 vapor and an oscillating magnetic field inside a high-Q microwave resonator for quantum memory and wavelength conversion applications. First, we focus on demonstrating microwave-to-optical signal conversion in warm vapor using nonlinear wave-mixing or adiabatic transfer, as well as proof-of-principle storage protocols. Finally, we consider repeating these experiments using an ultracold gas, where the microwave resonator will be placed inside our ultracold quantum gases apparatus under ultra-high vacuum conditions. Working in the ultracold regime increases the time during which the atoms maintain their quantum states, which will increase the efficiency of the transduction protocols.

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