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Electromagnetically induced transparency in rubidium: An advanced undergraduate laboratory SHANNON MAYER, ABRAHAM OLSON, University of Portland — Electromagnetically induced transparency (EIT) is a quantum interference effect used to modify the optical response of an atomic medium to a resonant laser field. In EIT, a non-resonant pump laser beam can result in the reduction of absorption of a weak, resonant probe laser beam, provided the fields are coherently coupled by a common state. EIT provides a unique means of coherently controlling photons and has potential applications in fields ranging from quantum computing to telecommunications. In this advanced laboratory we describe the theory and experiment for investigating ladder-type EIT in rubidium gas. The theoretical absorption profile of a weak probe laser beam tuned across the 5S 1/2 to 5P 3/2 transition (780.2 nm) is modeled in the presence of a strong coupling laser beam tuned to the 5P 3/2 to 5D 5/2 transition (776.0 nm) and the absorption transparency window is characterized. Using grating-feedback diode lasers, we observe EIT experimentally in rubidium gas and compare the results to the theoretical model. Applications of EIT to high-resolution two-photon spectroscopy are also discussed. This laboratory uses much of the same equipment as the saturated absorption experiment commonly performed on the D2 line in rubidium, so it is easily implemented in laboratories with the equipment to conduct that experiment.

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