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Quantum control of EIT dispersion via atomic tunneling in a double-well Bose-Einstein condensate JAMES WEATHERALL, CHRISTOPHER SEARCH, MARKKU JAASKELAINEN, Department of Physics and Engineering Physics, Stevens Institute of Technology — We consider electromagnetically induced transparency (EIT) in an atomic Bose-Einstein Condensate (BEC) trapped in a double well potential. A weak probe propagates through one of the wells and interacts with atoms in a three-level Λ configuration. The well through which the probe propagates is dressed by a strong control beam with Rabi frequency Ω_μ, as in standard EIT systems. Tunneling between the wells at the frequency g provides a coherent coupling between identical electronic states in the two wells that leads to the formation of inter-well dressed states. The tunnel coupling results in the formation of two ultra-narrow absorption resonances for the probe field that are inside of the ordinary EIT transparency window, which can be interpreted in terms of the inter-well dressed states and the formation of a novel type of dark state involving the coupling laser and the inter-well tunneling. To either side of these ultra-narrow resonances there is normal dispersion with ultra-large slope controlled by g. For realistic values of g, the large slope of this dispersion yields group velocities for the probe field that are two orders of magnitude slower than standard EIT systems. Additionally, we discuss the effects of the inter-well coupling on the nonlinear susceptibility, $\chi^{(3)}$.

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