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Coherent Enhanced Absorption in an Intracavity Atomic Medium DAVID D. SMITH, NASA Marshall Spaceflight Center, Huntsville, AL 35812, KRISHNA MYNENI, U.S. Army RDECOM, HONGROK CHANG, JAMIU A. ODUTOLA, Alabama A&M University, Department of Natural Sciences, Normal, AL 35762 — The conditions for coherent enhanced absorption of an intracavity atomic medium are discussed. For a symmetric cavity, a specific amplitude and phase relationship between two oppositely oriented input beams results in coherent perfect absorption by the medium [1]. In contrast, for a single input beam, perfect absorption requires a perfectly asymmetric, i.e., single port, cavity. Even when the cavity is not perfectly asymmetric or lossless, we find that enhanced absorption can occur. For a single input to an asymmetric cavity, as the input intensity is increased and the medium saturates, the cavity passes from the over-coupled to the under-coupled regime. We find the counterintuitive result that the cavity absorptance can increase with increasing input intensity in the over-coupled regime, i.e., the atom-cavity system behaves as a reverse saturable absorber. These results were compared with measurements performed using a tunable laser incident on a Fabry-Perot cavity containing an Rb87 cell, taking into account the effects of saturation and beam divergence.

[1] Y. D. Chong, L. Ge, H. Cao, and A. D. Stone, Physical Review Letters 105, 053901 (2010).

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