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Phase Dynamics in Electro-magnetically Induced Transparency[1]
FRANK A. NARDUCCI, JON P. DAVIS, Naval Air Systems Command — Electromagnetically induced transparency is often explained as a manifestation of destructive quantum interference between possible pathways for a probe photon to be absorbed. In this theoretical paper, we explore what determines the phase of this interference and how one might change destructive interference into constructive interference. Using a time-dependent model that describes a three-level lambda system, we explore the reaction of an EIT system to changes in the phase of either the coupling or the probe field, and show that, under the right conditions, enhanced transparency can be changed into enhanced absorption. This effect, different from what is commonly referred to "electro-magnetically induced absorption," is the result of *constructive* interference between possible absorption pathways, which occurs when the dipole moment and the effective fields are temporarily shifted out of the phase condition for destructive interference. We further demonstrate that this effect disappears with increasing coupling field, as the system moves from an EIT setting to an Autler-Townes setting.

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Frank A. Narducci
Naval Air Systems Command

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