

**Electromagnetically Induced Transparency in a Four-Level W Scheme:**

**Investigation of Simultaneous Propagation**

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Electromagnetically induced transparency is a quantum interference technique which eliminates the effect of the medium on an incident beam of electromagnetic radiation. The basic principles of electromagnetically induced transparency and its effect on the complex optical susceptibilities are investigated. Variation in the optical susceptibilities leads to a change in group velocities of incident pulses which can be manipulated through the variation of beam intensities and phases. This is then applied to a four level atomic system in which the first excited state of a magnesium atom is split into three Zeeman states; allowing for the simultaneous co-propagation of two incident beams. To account for the ultracold, low density medium through which the beams propagate, the group velocities of the probe beams are obtained using the solution of the density matrix master equation. Parameters are optimized such that both beams propagate with similar group velocities for the purpose of enabling the transfer of information.