Spatially varying optical transparency in a combined Lambda and tripod atom-light coupling scheme

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Recently a scheme has been proposed for detection of the structured light by measuring the transmission of a vortex beam through a cloud of cold rubidium atoms with energy levels of the Lambda-type configuration [1]. This enables observation of regions of spatially dependent electromagnetically induced transparency (EIT) [2]. Here we suggest another scenario for detection of the structured light by measuring the absorption profile of a weak nonvortex probe beam in a highly resonant five-level combined tripod and Lambda (CTL) atom-light coupling setup [3]. We demonstrate that due to the closed-loop structure of CTL scheme, the absorption of the probe beam depends on the azymuthal angle and orbital angular momentum (OAM) [4] of the control vortex beams. This feature is missing in simple Lambda or tripod schemes, as there is no loop in such atom-light couplings. One can identify different regions of spatially structured transparency through measuring the absorption of probe field under different configurations of structured control light.

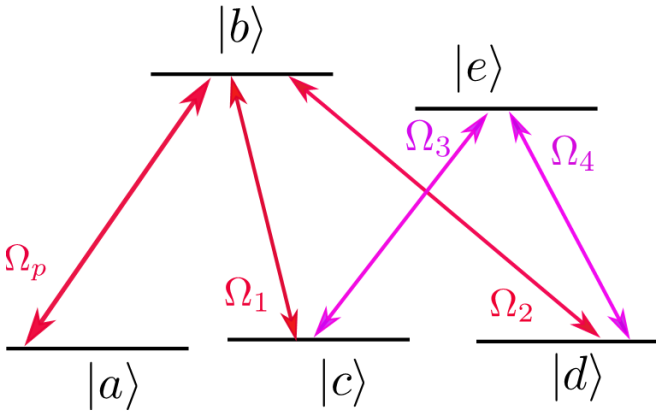

FIG. 1: five-level combined tripod and Lambda (CTL) atom-light coupling setup.

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