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Blue fluorescent light marker in rubidium 5S-5P-5D excitation

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In this work we present the prospective application of blue fluorescence related to cascade level coupling ^{87}Rb $5S_{1/2}(F) \rightarrow 5P_{3/2}(F^{/}) \rightarrow 5D5/2(F^{//})$ as a monitor of existing coherence in the system. The blue fluorescence is a part of the spontaneous cascade decay . It acts as a monitor for the population at 5D level under two photon absorption. When an additional beam, which is in resonance with $5S_{1/2}(F) \rightarrow 5P_{3/2}(F^{/})$ is mixed with the pump-probe laser geometry, the system transforms into that of an inverted Y connection where two different dark states interact. It is possible to generate a new Dark State from this interaction where the contribution from probe beam can be almost nullified. This situation may be exploited in constructing an all optical attenuator. The behavior of the system resembles that of a combination logic gate. Simultaneous monitoring of blue light clearly explains the dynamics of the system. The optimum performance zone of such attenuator can also be clearly indicated by the corresponding blue light parameters. On the other hand the blue light can be utilized as an indicator for changing color of coherence in case of isolated cascade system, where no additional beam is used. A photon counting measurement of the blue light exhibits the journey of the cascade system from an incoherent (quasi-thermal Blue light, Bose-Einstein distribution)->coherent (Poisson distribution, uncorrelated)->two photon coherent state. Such diverse scope of application, which extends from monitoring the nature of interaction between nearly degenerate Dark states to predicting the changing form of coherence may open up newer way of exploration where in-depth study on important topics like non-classicality of photons can be carried out.

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