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Interplay of classical and quantum dynamics in an ensemble of hot atoms[1] ARIF LASKAR, NIHARIKA SINGH, ARUNABH MUKHERJEE, SAIKAT GHOSH, Indian Inst of Tech-Kanpur — When a transparency window opens up for a probe light, transmitted through a resonant thermal ensemble of atomic system driven by a strong classical field, how much of it is actually due to quantum superposition of states and how it develops in the midst of classical processes like optical pumping and thermal diffusion? Here we address these questions by stroboscopically probing a closed Λ-like atomic system in a Rubidium vapor cell, driven by coherent and incoherent field, with a 100 ns probe pulse. Time evolution of transmitted probe peak shows an overshoot with turn-on of control, indicating signatures of lasing without inversion. Corresponding rise time is controlled by the driven field with a distinct signature of half cycle Rabi flop. Then optical pumping process leads to a steady state over a longer time scale, that sustain the dark state, which usually probed in EIT like spectrum. Eventual turning-off of control leads to sudden fall in transmission, which carry a unique signature to quantify close and open system, and in particular, induced coherence in the system. We use detailed numerical simulation and toy models to explain our observations and support our claims. We believe our results can provide a metric for testing competing quantum or classical hypothesis.

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