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Long-lived quantum coherences in symmetric V-system strongly driven by incoherent light SUYESH KOYU, TIMUR TSCHERBUL, University of Nevada, Reno — The three-level V-system is a prototype model of quantum coherent dynamics in multilevel systems, including photosynthetic light-harvesting complexes and photovoltaic devices. The symmetric V-system weakly irradiated by incoherent light undergoes coherent dynamics under certain conditions [1]. Here, we explore the coherent dynamics in the limit where incoherent driving is fast compared to the radiative decay rates. The two-photon quantum coherences between the excited levels of the symmetric V-system display an oscillatory behavior in the underdamped regime ($\Delta/\gamma > \bar{n}$) and reach a long-lived quasi-stationary state in the overdamped regime ($\Delta/\gamma < \bar{n}$) for the effective photon occupation numbers $\bar{n} \gg 1$. The lifetime of the long-lived coherent state scales as $\bar{n}(\Delta/\gamma)^{-2}$ for $p > p_c$, where p_c is a critical value of the transition dipole alignment factor ($p_c = 1 - \varepsilon$ with $\varepsilon \to 0$ over a wide range of excited-level splittings Δ and radiative decay rates γ). For $p < p_c$ the coherence lifetime decreases sharply and becomes comparable to that of the excited levels.
[1] A. Dodin, T.V. Tscherbul, and P. Brumer, J. Chem. Phys. **144**, 244108 (2016); **145**, 244313 (2016).

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