# Incoherent control of optical signals: Quantum-heat-engine approach

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Optical pump-probe signals can be viewed as work done by the matter while transferring the energy between two coherent baths (from pump to probe). In thermodynamics, a heat engine, such as a laser, is a device which performs similar work but operating between two thermal baths. We propose an "incoherent" control procedure for the optical signals using the physics of a quantum heat engine. By combining a coherent laser excitation of an electronic excited state of a molecule with thermal relaxation we introduce an effective thermal bath treating stimulated emission of probe photons as work performed by the heat engine. We optimize power and efficiency for the pump-probe signal using control parameters of the pump laser utilizing a four-level molecular model in the strong and weak coupling regime illustrating its equivalence with the thermodynamic cycle of the heat engine.

[1] M. Qutubuddin and K.E. Dorfman, Phys. Rev. Res. 3, 023029 (2021)