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Noise induced quantum effects in photosynthetic complexes KONSTANTIN DORFMAN, DMITRI VORONINE, Texas A&M University, College Station, Texas 77843, SHAUL MUKAMEL, University of California, Irvine, California 92697, MARLAN SCULLY, Texas A&M University, College Station, Texas 77843 — Recent progress in coherent multidimensional optical spectroscopy revealed effects of quantum coherence coupled to population leading to population oscillations as evidence of quantum transport. Their description requires reevaluation of the currently used methods and approximations. We identify couplings between coherences and populations as the noise-induced cross-terms in the master equation generated via Agarwal-Fano interference that have been shown earlier to enhance the quantum yield in a photocell. We investigated a broad range of typical parameter regimes, which may be applied to a variety of photosynthetic complexes. We demonstrate that quantum coherence may be induced in photosynthetic complexes under natural conditions of incoherent light from the sun. This demonstrates that a photosynthetic reaction center may be viewed as a biological quantum heat engine that transforms high-energy thermal photon radiation into low entropy electron flux.

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