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Environment-assisted quantum transport in photosynthetic complexes.

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Transport phenomena at the nanoscale are of interest due to the presence of both quantum and classical behavior. In this work, we demonstrate that quantum transport efficiency can be enhanced by a dynamical interplay of the system Hamiltonian with the pure dephasing dynamics induced by a fluctuating environment. This is in contrast to fully coherent hopping that leads to localization in disordered systems, and to highly incoherent transfer that is eventually suppressed by the quantum Zeno effect. We study these phenomena in the Fenna-Matthews-Olson protein complex as a prototype for larger photosynthetic energy transfer systems. We also show that disordered binary tree structures exhibit enhanced transport in the presence of dephasing. We address the question of the role of coherence in the energy transfer in the FMO complex and discuss details about the theoretical modeling of photosynthetic oomplexes and organic photovoltaic materials.