Quantum coherence in photosynthetic exciton dynamics

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Recent experiments suggest that quantum coherence survives in photosynthetic light-harvesting complexes for up to a picosecond despite strong vibrational and polarization environmental fluctuations. This has led to speculations that the lossless exciton transfer is a result of quantum coherent dynamics. I will present numerically exact results for the electronic energy transfer dynamics in the Fenna-Matthews-Olson (FMO) molecular aggregate. In particular, we determine its single excitation subspace dynamics within an open quantum dynamics approach. Depending on the model used, we find quantum coherent dynamics with coherence times exceeding experimentally observed times but also shorter times and even strongly overdamped decay of the site populations. Thus, theoretical understanding at the present stage can neither support nor rule out a picture of quantum coherent energy transfer in natural photosynthesis.