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Quantum simulator of an open quantum system using superconducting qubits: exciton transport in photosynthetic complexes SARAH MOSTAME, PATRICK REBENTROST, ALEXANDER EISFELD, Harvard University, ANDREW J. KERMAN, Lincoln Laboratory - Massachusetts Institute of Technology, DIMITRIS I. TSOMOKOS, University of London, ALAN ASPURU-GUZIK, Harvard University — In the initial stage of photosynthesis, light-harvested energy is transferred with remarkably high efficiency to a reaction center, with the vibrational environment assisting the transport mechanism. It is of great interest to mimic this process with present-day technologies. Here we propose an analog quantum simulator of open system dynamics, where noise engineering of the environment has a central role. In particular, we propose the use of superconducting qubits for the simulation of exciton transport in the Fenna-Matthew-Olson protein, a prototypical photosynthetic complex. Our method allows for a single-molecule implementation and the investigation of energy transfer pathways as well as non-Markovian and spatiotemporal noise-correlation effects.

Sarah Mostame
Harvard University

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