

Abstract Submitted
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Non-Markovian Models for Photosynthetic Reaction Center¹

ZIBO WANG, ANTONIO LIM, IMRAN MIRZA, Miami University, MACKLIN QUANTUM INFORMATION SCIENCES GROUP TEAM — In the last decade, it has been theorized that inside the reaction center, three chlorophyll molecules act like a five-level quantum system². Based on this five-level scheme, we have revisited a Markovian master model for the photosynthesis³. However, the Born-Markov approximation and simple thermal bath treatment may not be the true depiction of reality as this five-level system couples strongly with the environment. Addressing this issue, in this talk, I'll present our recent work on the non-Markovian modeling of the photosynthetic reaction center based on a time-convolutionless non-Markovian treatment. The central aim of our study is to investigate if our more realistic non-Markovian model can predict higher photosynthetic yield compared to the already studied Markovian scenario. The results of our study will help to explain how plants and certain types of bacteria utilize incoherent light efficiently.

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²K. E. Dorfman, D. V. Voronine, S. Mukamel, and M. O. Scully, Photosynthetic reaction center as a quantum heat engine, PNAS, **110**, 2746-2751 (2013).

³Z. Wang and I. Mirza, "Dissipative Five-level Quantum Systems: A Quantum Model of Photosynthetic Reaction Centers," Frontiers in Optics / Laser Science, JM6B.26 (2020).

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