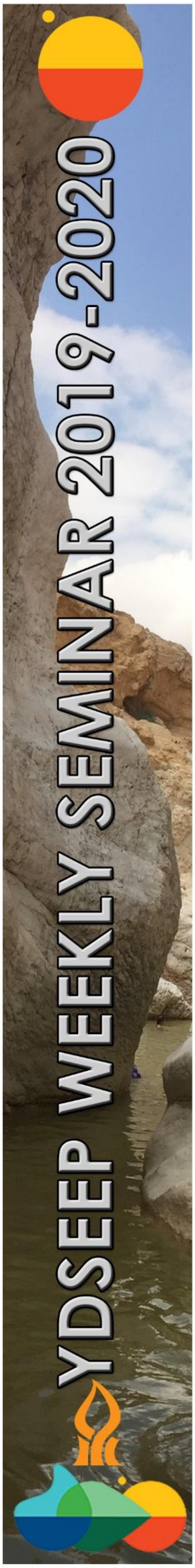

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Cyanobacterial strategies for tuning the energy transfer efficiency in their light-harvesting antennae

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Abstract:

The cyanobacterial phycobilisome (PBS) is an impressively versatile and efficient light harvesting and energy transfer apparatus. With hundreds to thousands of pigments in a PBS structure and 1-3 nanometer distances between these pigments, the mechanisms underlying its function require an understanding of processes on the quantum/classical border. Quantum mechanics diverges from the classical description of our world when very small scales or very fast processes are involved. It is relevant when explaining the properties of matter and its interactions with energy on the scale of a few hundreds of atoms. At room temperature, this scale reaches the dimensions of proteins or complexes of proteins, ranging from 1-100 nm. Unlike classical mechanics, quantum effects cannot be easily related to our everyday experience and the result of quantum behavior are often counterintuitive to us. Nevertheless, the dimensions and time scales of the photosynthetic energy transfer processes puts them close to the quantum/classical border[1]. **Our work on energy transfer in the PBS antenna of desert crust cyanobacteria suggests that effects on the quantum classical border may play a role in controlling the efficiency of energy transfer** in the hydrated (active) and desiccated (inactive) states[2,3]. Based on these data and on research performed by other groups in the field, we suggest that photosynthetic processes can take advantage of the coupling of delocalized excited states to the environmental "noise" as means of tuning Exciton Energy Transfer efficiency. Our current work on marine cyanobacteria PBS systems provides further support to this hypothesis.

1. Keren, N. & Paltiel, Y. Photosynthetic Energy Transfer at the Quantum/Classical Border. *Trends Plant Sci.* **23,** 497–506 (2018).
2. Eyal, L. B. *et al.* Changes in aggregation states of light-harvesting complexes as a mechanism for modulating energy transfer in desert crust cyanobacteria. *Proc. Natl. Acad. Sci.* **114,** 9481–9486 (2017).
3. Bar-Eyal, L. *et al.* An easily reversible structural change underlies mechanisms enabling desert crust cyanobacteria to survive desiccation. *Biochim. Biophys. Acta - Bioenerg.* **1847,** 1267–1273 (2015).

Date & Location:

Tuesday, November 19, 2019, 11:00
Lecture room, Physics Building (ground floor)