UNIVERSITÀ DEGLI STUDI DI PADOVA

DiSC

Lunedì **21 marzo 2022** alle ore **16:30** presso l'aula F

il **Dr. Gabriel Gil**

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terrà il seminario dal titolo:

Exciton transport channel and mechanism within the Fenna-Mattews-Olson complex

The Fenna-Matthews-Olson (FMO) protein-pigment complex from green sulfur bacteria is perhaps the most studied photosynthetic system, especially with regards to the energy transfer. Actually, the FMO has been at the center of the quantum biology debate of the last decade, since the discovery of wave-like (quantum) coherent transport taking place among its seven embedded bacteriochlorophyll pigments [1]. The former debate have mainly revolved around the implications of such coherences for biological processes and the possibility that they have been optimized by natural selection [2].
In 2009, an extra bacteriochlorophyll pigment per monomeric unit was detected at the interstices of adjacent monomers in the C3-symmetric FMO trimeric structure [3]. However unexpected, not only does the extra pigment improve the description of the full system but it may allow a better grasp of the issues involved by challenging our idea of the active channel and mechanism for the exciton transport within the FMO complex.
In fact, in a recent paper we find that an excitation channel (a) from the interstitial pigment to the next-nearest embedded pigments outperforms (b) that from the interstitial pigment to the nearest embedded pigments. Importantly, the mechanisms that can be active for each of this subsystems are different. Whereas the most explored case (b) relies on a wave-like coherent transport, the efficient alternative (a) arise from an interplay between an incoherent FRET process and the quantum coupling [4] of the embedded pigment that creates an optimized excitonic state, acting as an acceptor. The role of quantum mechanics for (a) is not to produce constructive interference between excitation pathways as in (b) but to enhance the quality of a delocalized acceptor state in every possible respect; namely, to increase the acceptor dipole magnitude, the donor-acceptor orientation factor and the donor-acceptor spectral overlap, while decreasing the donor-acceptor distance (cf. [5]). Remarkably, the competition between channels (a) and (b) is decided in favor of (a) for the youngest species of FMO (from C. tepidum) and not the oldest (from P. aestuarii) under study, which perhaps reflects that the exciton transport channel and mechanism entailed by (a) are emergent features within the evolution of the organisms depending on FMO.

References:

[1] Engel et al. Nature 446, 782-786 (2007).
[2] Kim et al., Quantum Reports 3, 1-48 (2021).
[3] Tronrud et al., Photosynthesis Research 100, 79–87 (2009).
[4] Collini, Physics 14, 140 (2021).
[5] Mattioni et al., PRX 11, 041003 (2021).

Sarà possibile seguire il seminario tramite zoom:
https://unipd.zoom.us/j/87486797709?pwd=VUNhUG1qNjJ2QXk0Vi94emtMS2pRQT09
Meeting ID: 874 8679 7709 Passcode: 527039

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Stefano Corni

Il Direttore del Dipartimento
Michele Maggini