center for excitonics

SEMINAR SERIES

The Center for Excitonics is an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science and Office of Basic Energy Sciences

Excitonic Quantum Random Walk in Biological Phycocyanin Nanowires

Yossi Paltiel
Department of Applied Physics, The Hebrew University of Jerusalem

Tues, Oct 6, 2015
4:30 PM
Room 36-428
OPEN TO ALL

The importance of quantum processes in biology is starting to be recognized. Quantum processes are being discussed in the context of enzyme function, olfaction, magnetic sensing and most prominently in photosynthetic light-harvesting complexes. These findings suggest that a key to the survival of quantum coherence at ambient temperatures is the interplay between long-lived vibrational modes and the electronic degrees of freedom that can lead to coherent effects. This coherence can explain the high yield of photosynthetic exciton transfer. Furthermore, it is fair to say that no device made by man so far has made use of all these properties at the same time.
Our aim is to develop a new class of quantum coherent devices. This can be achieved by understanding the underlying mechanisms driving photosynthetic processes with efficient long range energy transfer and harness this knowledge to advance innovative quantum technologies. Utilizing light harvesting complexes we were able to fabricate self-assembled nano-energy guides. We used isolated Phycocyanin (PC) proteins that can self-assemble into bundles of nanowires. We show two methods for controlling the organization of the bundles. The optically excited nanowires exhibit long range quantum energy transfer through hundreds of proteins. Such results may provide new building blocks for coherent based nano-devices. In vivo desert adapted cyanobacteria seems to use the same organization for efficient energy removal. The suggested results open many questions regarding the distribution and the efficiency of energy transfer mechanisms in biological systems.

rle AT MIT   MIT