MAR12-2011-000498

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Quantum mechanical light harvesting mechanisms in photosynthesis

GREGORY SCHOLES, University of Toronto

More than 10 million billion photons of light strike a leaf each second. Incredibly, almost every red-coloured photon is captured by chlorophyll pigments and initiates steps to plant growth. Last year we reported that marine algae use quantum mechanics in order to optimize photosynthesis [1], a process essential to its survival. These and other insights from the natural world promise to revolutionize our ability to harness the power of the sun. In a recent review [2] we described the principles learned from studies of various natural antenna complexes and suggested how to utilize that knowledge to shape future technologies. We forecast the need to develop ways to direct and regulate excitation energy flow using molecular organizations that facilitate feedback and control–not easy given that the energy is only stored for a billionth of a second. In this presentation I will describe new results that explain the observation and meaning of quantum-coherent energy transfer.

[1] Elisabetta Collini, Cathy Y. Wong, Krystyna E. Wilk, Paul M. G. Curmi, Paul Brumer, and Gregory D. Scholes, "Coherently wired light-harvesting in photosynthetic marine algae at ambient temperature" Nature 463, 644-648 (2010).
[2] Gregory D. Scholes, Graham R. Fleming, Alexandra Olaya-Castro and Rienk van Grondelle, "Lessons from nature about solar light harvesting" Nature Chem. 3, 763-774 (2011).