Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Harvesting singlet fission for solar energy conversion: one versus two-electron transfer electron transfer from the quantum superposition state WAI-LUN CHAN, Department of Physics and Astronomy, University of Kansas, JOHN TRITSCH, Texas Materials Institute, University of Texas, Austin, XIAOYANG ZHU, Department of Chemistry, Columbia University — Singlet fission (SF) is being explored to increase the efficiency of organic photovoltaics. A key question is how to effectively extract multiple electron-hole pairs from multiple excitons with the presence of other competing channels such as electron transfer from the singlet state. Recent experiments on the pentacene and tetracene show that a quantum superposition of the singlet (S_1) and multiexciton (ME) state is formed during SF. However, little is known about the kinetics of electron transfer from this quantum superposition. Here, we apply time-resolved photoemission spectroscopy to the tetracene/C_{60} interface to probe one and two electron transfer from S_1 and ME states, respectively. Because of the relatively slow (7 ps) SF in tetracene, both one- and two-electron transfer are allowed. We show evidence for the formation of two distinct charge transfer states due to electron transfer from photo-excited tetracene to the lowest unoccupied molecular orbital (LUMO) and the LUMO+1 levels in C_{60}. Kinetic analysis shows that 60% of the quantum superposition transfers one electron through the S_1 state to C_{60} while 40% undergoes two-electron transfer through the ME state.

Wai-Lun Chan
Department of Physics and Astronomy, University of Kansas

Date submitted: 06 Nov 2012 Electronic form version 1.4