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Quantum entanglement in photosynthetic light harvesting MOHAN SAROVAR, AKIHITO ISHIZAKI, GRAHAM FLEMING, BIRGITTA WHALEY, University of California, Berkeley — Identification of non-trivial quantum mechanical effects in the functioning of biological systems has been a long-standing and elusive goal in the fields of physics, chemistry and biology. Recent progress in control and measurement technologies, especially in the optical spectroscopy domain, have made possible the identification of such effects. I examine light harvesting components of photosynthetic organisms – complex, coupled, many-body quantum systems – in which electronic coherence has recently been shown to survive for relatively long time scales despite the effects of their noisy environments. By constructing useful measures of entanglement for such systems, and using an accurate model of energy transfer dynamics in the presence of noise, I demonstrate the existence of quantum entanglement in a commonly studied light harvesting complex. The lifetimes and temperature dependency of entanglement are examined in detail. This study constitutes the first rigorous quantification of entanglement in a biological system.

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