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A photophysical investigation of bio-inspired molecular dyads by means of femtosecond transient absorption spectroscopy

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The remarkable efficiency and regulation of the initial, photophysical events in photosynthesis are a great source of inspiration for solar technologies. To make a physical solar cell using bio-inspired processes requires a simple, practicable model that makes use of the same photophysical principles as natural light-harvesting systems but with reduced molecular size and complexity. The simplest form of an artificial light harvesting system is known as a dyad and consists of a donor molecule and acceptor molecule, covalently bound to form a donor-acceptor dyad. We synthesized a photosensitive dyad consisting of fullerene C60, a carbon nanoball serving as the electron acceptor, bound to metal-porphyrin donor molecules. We developed a high-resolution ultrafast transient absorption spectroscopy setup to resolve optical density changes of <10-4 in the visible region and supplemented the results with measurements in the near-infrared region, to cover a full spectral window of 450 – 1250 nm. This enabled us to resolve the detailed charge transfer energy dynamics within the dyads and provided evidence of long-living electron-transfer states, an attractive property of a solar cell.

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