Deep-UV probing method detects electron transfer in photovoltaics

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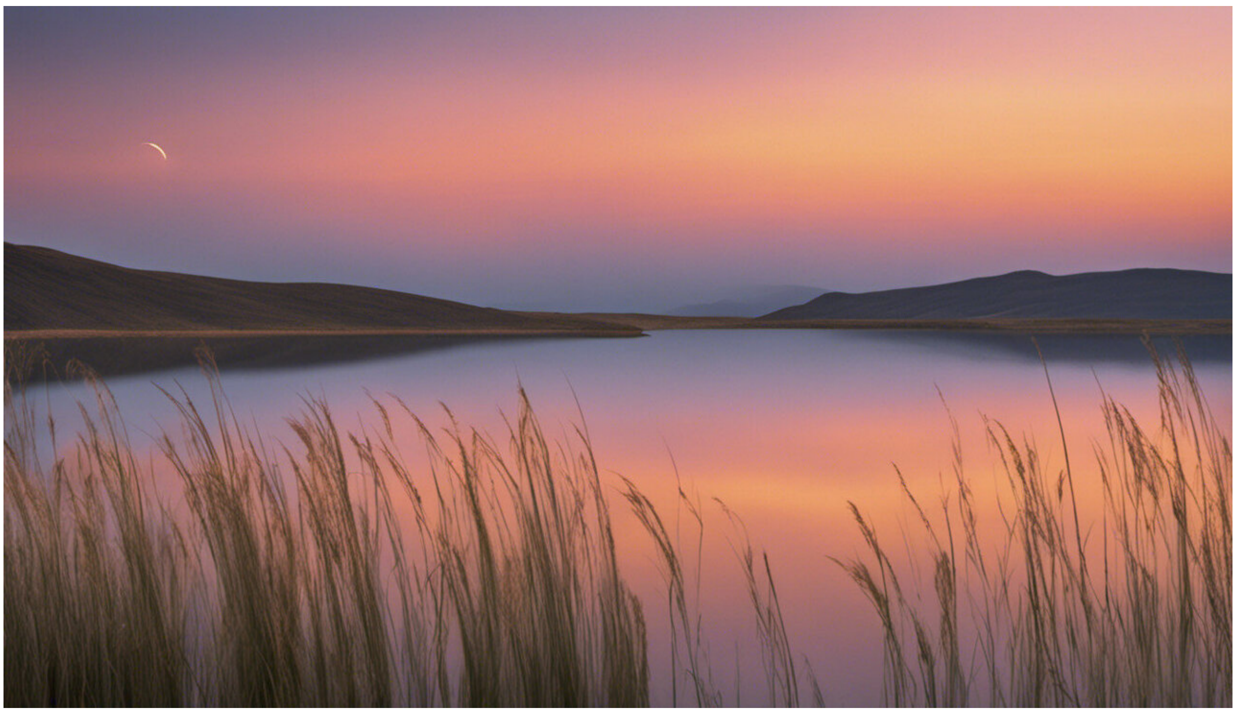

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Sensitized solar cells consisting of a molecular or solid-state sensitizer that serves to collect light and inject an electron into a substrate that favors their migration are among the most studied photovoltaic systems at present. Despite its importance in determining the potential of a photovoltaic device, current methods for monitoring the interfacial electron transfer remain ambiguous. Now, using deep-ultraviolet continuum pulses, EPFL scientists have developed a substrate-specific method to detect electron transfer. The work is published in the *Journal of the American Chemical Society*.

The work was carried out by the lab of Majed Chergui at EPFL, which specializes in ultrafast spectroscopy. The group focused on two types of dye-sensitized solar conversion systems: one based on titanium dioxide, the other on zinc-oxide nanoparticles, both of which belong to the category of transition-metal oxide (TMO) substrates. These TMOs are characterized by specific absorption bands, which are fingerprints of the system and are due to neutral electron-hole pairs, called an exciton.

The EPFL team aimed to overcome the limitations of current methods of measuring electron transfer, which all use light in the visible-to-terahertz frequencies (wavelengths around 400 – 30000 nm). However, this approach is sensitive to carriers that remain free in the TMO substrate. They are therefore unspecific to the type of substrate and cannot be extended to the new generation of solid-state-sensitized solar cells (such as those using perovskites as sensitizers).

Instead, the researchers at EPFL used deep-ultraviolet (260-380 nm wavelength) continuum pulses to probe the TMO substrates in the region of their excitonic transitions and detect electron transfer, via their response. This opens a route to the study of solid-state sensitized cells, as there is hope that the response of the substrate will be distinguished from that of the sensitizer.

More information: Edoardo Baldini et al. Interfacial Electron Injection Probed by a Substrate-Specific Excitonic Signature, *Journal of the American Chemical Society* (2017). DOI: 10.1021/jacs.7b06322

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