Exciton Dynamics and Solar H2 Generation in Quantum Confined Nanoheterostructures

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摘要(Abstract)：

Quantum confined semiconductor nanocrystals (0D quantum dots, 1D quantum rods and 2D quantum wells) have been intensively investigated as light harvesting and charge separation materials for photovoltaic and photocatalytic applications. The efficiency of these semiconductor nanocrystal-based devices depends on many fundamental processes, including light harvesting, carrier relaxation, exciton localization and transport, charge separation and charge recombination. The competition between these processes determines the overall solar energy conversion (solar to electricity or fuel) efficiency. Quantum confined semiconductor nano-heterostructures, combining two or more material components (such as CdSe/CdS dot-in-rod nanorods or core/crown nanosheets), offer unique opportunities to control their charge separation properties by tailoring their compositions, dimensions and spatial arrangement. Further integration of catalysts (heterogeneous or homogeneous) to these materials form multifunctional nano-heterostructures, such as CdSe/CdS/Pt, that are shown to be efficient photocatalysts for light driven H2 generation. Using 0D, 1D and 2D nano-heterostructures as model systems, we directly probe the above-mentioned fundamental exciton and carrier processes by transient absorption and time-resolved fluorescence spectroscopy. We are examining how to control these fundamental processes through the design of heterostructures to achieve long-lived charge separation and efficient H2 generation. In this talk, we will discuss the mechanism of exciton transport, dissociation, and key factors limiting H2 generation efficiency in 1D and 2D nano-heterostructures.

个人简介 (Biographical sketch)：

Tianquan (Tim) Lian received MS degree from Fujian Institute of Research on the Structure of Matter (under the supervision of Prof. Hongyuan Shen) and PhD degree from University of Pennsylvania (under the supervision of late Prof. Robin Hochstrasser) in 1993. After postdoctoral training with Prof. Charles B. Harris in the University of California at Berkeley, Tim Lian joined the faculty of chemistry department at Emory University in 1996, where he was promoted to Associate Professor in 2002, Full Professor in 2005, Winship Distinguished Research Professor in 2007, and William Henry Emerson Professor of Chemistry in 2008. Tim Lian is currently the Editor-in-Chief of the Journal of Chemical Physics (since Jan. 1, 2019). Tim Lian was an Editor of Chemical Physics (2012-2018), and has received a few notable recognitions including: Kavli Frontier of Science fellow (since 2012), APS fellow (since 2015), NSF CAREER award and Alfred P. Sloan fellowship. Tim Lian’s research interest is focused on ultrafast energy and charge transfer dynamics in photovoltaic and photocatalytic nanomaterials and at their interfaces.