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**Mesoporous semiconductors for photocatalytic and photoelectrochemical reactions**

**Abstract:** Since the discovery of ordered mesoporous silica materials, mesoporous metal oxides have been a well-known material class for various applications. However, the preparation of mesoporous transition metal oxides, such as photocatalyst materials, via templating routes can be quite challenging due to the much faster hydrolysis and condensation reactions of transition metal precursors in sol-gel chemistry.

On the other hand, mesoporous photocatalysts typically have a much larger surface area for photocatalytic reactions, and charge carriers can diffuse very quickly through the pore walls of mesoporous materials. However, the accessibility of electrolytes and the release of gases to and from mesopores, for example during water splitting, are still up for debate.

This presentation will address recent results on the synthesis of mesoporous  $\text{TiO}_2$ ,  $\text{SrTiO}_3$  and  $\text{WO}_3$  absorber materials for different photocatalytic applications, including water splitting and dark photocatalysis for  $\text{N}_2$  reduction. The effect of pore ordering, pore size and surface defects will be discussed.

**Friday, March 6, 2026****Time: 15:30-16:30****Venue: E104, School of Science****Dr. Valentine I. Vullev**Professor,  
University of California,  
Riverside, USA**Friday, March 6, 2026****Time: 16:30-17:30****Venue: E104, School of Science****Title:****Dynamics in a Broad Scale**

**Abstract:** Charge transfer (CT) is fundamental for sustaining life on earth and for making the modern ways of living possible (Phys. Chem. Chem. Phys. 2020, 22, 21583). Exploring the effects of electric dipoles on pico- and nanosecond CT (Angew. Chem. Int. Ed. 2018, 57, 12365), we ask questions about the electronic coupling (Proc. Natl. Acad. Sci. U.S.A. 2021, 118, e2026462118) and the emergence of stochastic picosecond dipole fluctuations originating from solvent dynamics (J. Am. Chem. Soc. 2024, 146, 5162; J. Phys. Chem. Lett. 2026, 17, 1361). Overall, the effects of CT on femto- to nanosecond excited-state dynamics are enormous. Making nitroaromatics fluorescence (J. Phys. Chem. Lett. 2021, 12, 10295) and inducing anti-Kasha behavior (Chem. Sci. 2023, 14, 13537) are some of the examples. Shifting to microflows at low Reynolds numbers, precluding turbulence, opens doors for space-domain time-resolved exploration of spin-forbidden transitions and biological staining in the millisecond and second time domains (Anal. Chem. 2013, 85, 4567; J. Am. Chem. Soc. 2006, 128, 16062). This breath of dynamic scales, with synergy between them, offers avenues for exploration impacting a wide range of fields such as energy science, photonics and biomedical science and engineering.

**Osamu Ishitani & Manabu Abe**