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Abstract Submission Form

Name (including title):	**Professor David J. Fermin**
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Brief description of research activities:

David Fermin is the Professor of Electrochemistry at the University of Bristol and leads the Electrochemistry and Solar Research Group. His team is internationally recognized by their research on semiconductor electrodes, photoelectrochemistry, photovoltaic solar cells and electrocatalysis. He chaired the PVTEAM network (2014-2018), a consortium focused on solution processable thin-film solar cells encompassing over 10 universities and companies across the UK. He is a recipient of the Tajima Prize by the International Society of Electrochemistry, he held a Swiss National Science Foundation Professorial Fellowship (2003-2009) and visiting scholar posts at Caltech, ENS Cachan and the Universidad de Valparaiso (Chile). In 2018, he was admitted as Fellow of the Royal Society of Chemistry.

Presentation title:

The Secret Life of Kesterite Thin-Film Surfaces

Devendra Tiwari, Mattia Cattelan, Neil A. Fox and David J. Fermin

Presentation abstract:

Defect-tolerant semiconductors have had a profound impact in the field of photovoltaic (PV) solar cells, with $CuInGaSe_2$ (CIGS) being the most prominent example reaching power conversion efficiencies (η) of 21.7%. $Cu_2ZnSn(S,Se)_4$, commonly referred to as kesterite or CZTSSe, is an attractive alternative to CIGS, featuring Earth abundant elements. However, the efficiency of these devices is limited by open circuit voltages (V_{OC}) less than 50% of the maximum theoretical limit. In this talk, we correlate the performances of CZTSSe devices with the complex surface electronic landscape of the absorber layer as probed by energy-filtered photoemission electron microscopy. This technique unveils sub-micron photoemission hot spots, featuring local effective work functions 0.7 eV lower than those observed from the main phase. Analysis of surface spectral responses based on DFT calculations allows establishing a new rationale for V_{OC} losses in kesterite devices.

Selected publications:

1. Tiwari, D. et al., Mapping Shunting Paths at the Surface of $Cu_2ZnSn(S,Se)_4$ Films via Energy-Filtered Photoemission Microscopy. *iScience* **2018** doi:10.1016/j.isci.2018.10.004
2. Tiwari, D. et al., Above 600 mV Open Circuit Voltage BiI_3 Solar Cells. *ACS Energy Letters* **2018**, *3*, 1882-1886
3. Tiwari, D. et al., Spectroscopic and electrical signatures of acceptor states in solution processed $Cu_2ZnSn(S,Se)_4$ solar cells. *Journal of Materials Chemistry C* **2017,** *5* (48), 12720-12727
4. Tiwari, D. et al. Single Molecular Precursor Solution for $CuIn(S,Se)_2$ Thin Films Photovoltaic Cells: Structure and Device Characteristics. *ACS Applied Materials & Interfaces* **2017,** *9* (3), 2301-2308
5. Tiwari, D. et al. Cu_2ZnSnS_4 thin films generated from a single solution based precursor: the effect of Na and Sb doping. *Chemistry of Materials* **2016,** *28* (14), 4991-4997