

## Supporting Information

## Supporting Information

### **Spatially Resolved Carrier Dynamics at MAPbBr<sub>3</sub> Single Crystal-Electrode Interface**

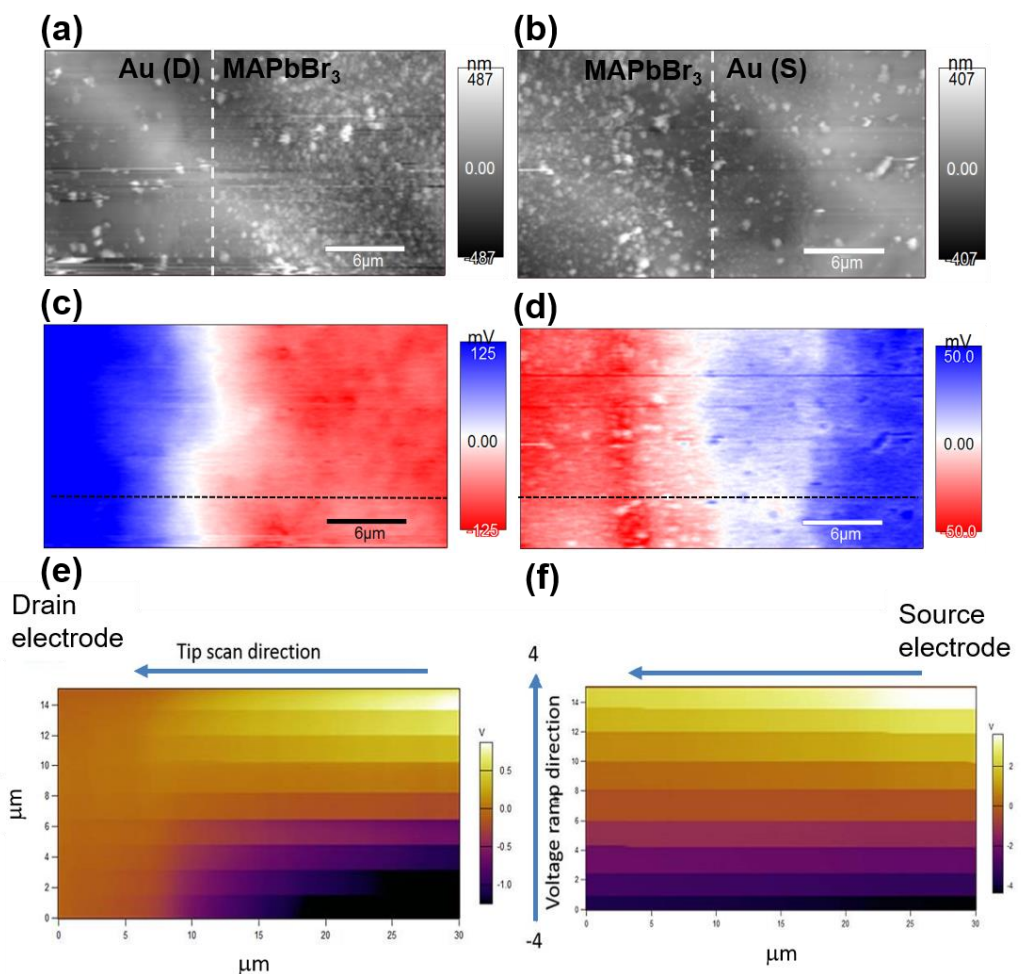
Mahshid Ahmadi<sup>1\*</sup>, Liam Collins<sup>2</sup>, Kate Higgins<sup>1</sup>, Dohyung Kim<sup>1</sup>, Eric Lukosi<sup>3</sup>, Sergei V. Kalinin<sup>2</sup>

<sup>1</sup> *Joint Institute for Advanced Materials, Department of Materials Science and Engineering, University of Tennessee, Knoxville 37996, USA*

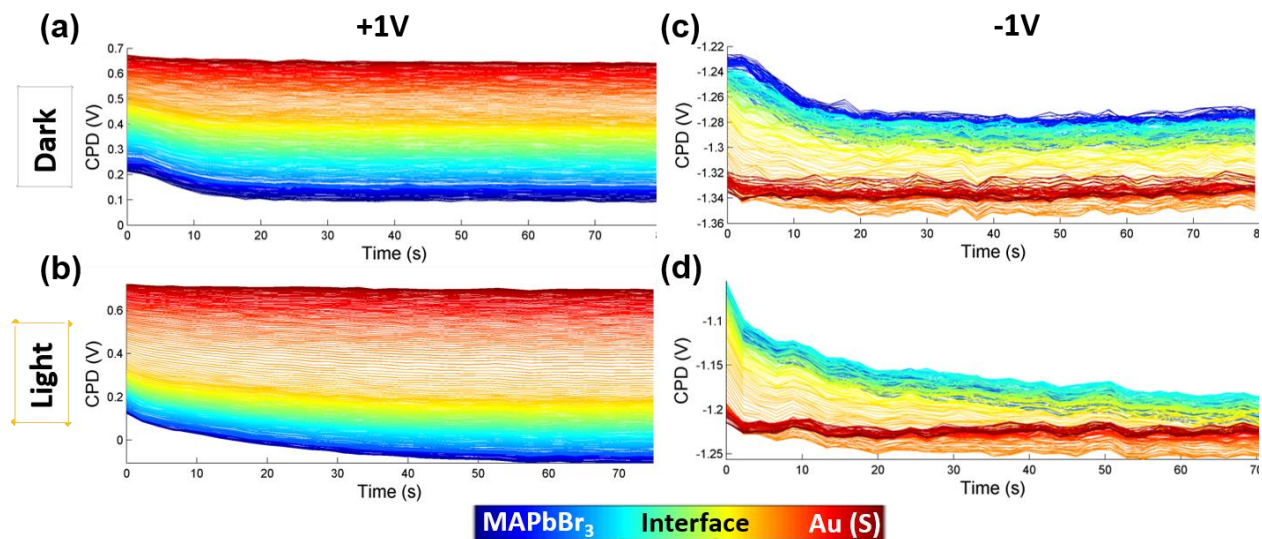
<sup>2</sup> *Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA*

<sup>3</sup> *Joint Institute for Advanced Materials, Department of Nuclear Engineering, University of Tennessee, Knoxville 37996, USA*

\*Corresponding author email: [mahmadi3@utk.edu](mailto:mahmadi3@utk.edu)

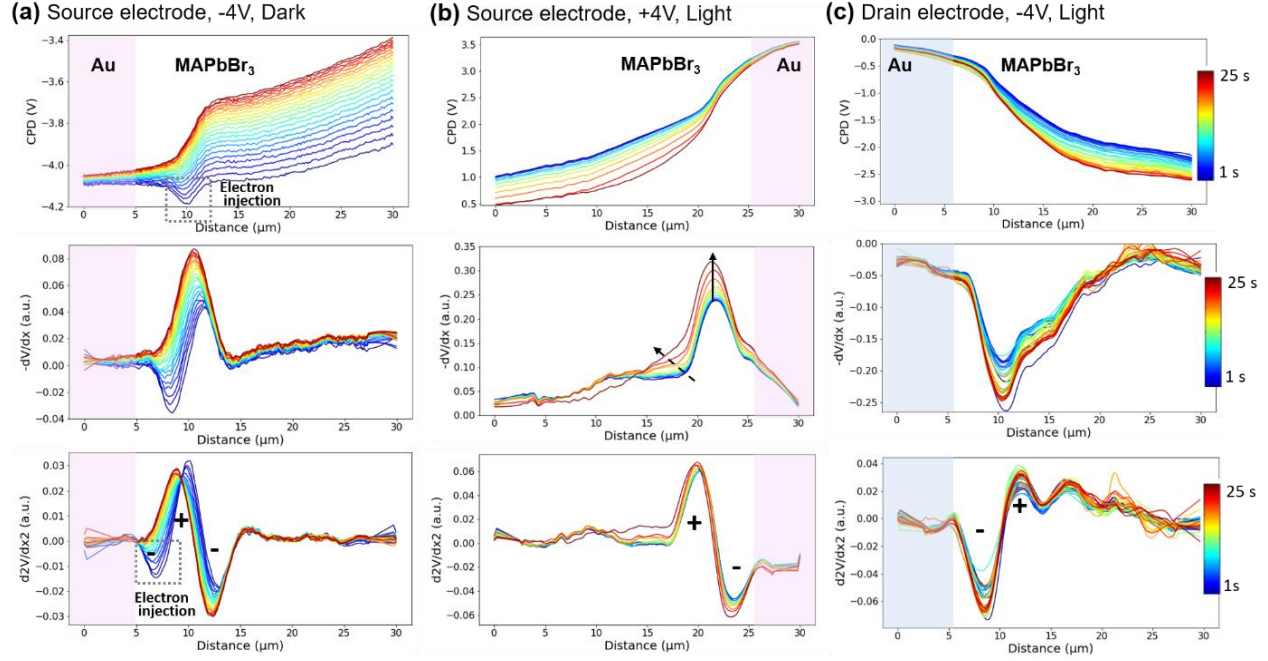


**Figure S1:** KPFM topography and CPD at the (a, c) MAPbBr<sub>3</sub>/drain and (b, d) MAPbBr<sub>3</sub>/source electrode in dark condition, respectively and (e, f) details of the tip scanning and voltage ramping direction for bias spectroscopy KPFM. For bias spectroscopy, the scan rate was set at 1 Hz and the tip velocity was 48  $\mu\text{m/s}$ . The total image was recorded in 6.11 minutes with 128 $\times$ 256 (lines  $\times$  pixels) resolution. It took around 2.8 seconds for every KPFM readout in dual pass mode. For this measurement voltage was stepped every 14 lines.



**Figure S2:** Time evolution of potential across the MAPbBr<sub>3</sub>/Au source electrode for forward (a,b) and (c,d) reverse biasing with 1 V under dark and illuminated conditions.

As can be seen in **Figure S2 (c,d)** at -1V, the potential inside the electrode and further into the crystal is negative indicating the electron injection at this interface.



**Figure S3. Time evolution of spatially resolved distribution of potential, electric-field and charge carriers at MAPbBr<sub>3</sub>- electrode interface:** from top to bottom, CPD,  $E_{field}$  and charge carrier distribution at (a) source/MAPbBr<sub>3</sub> SC interface after the application of -4V in dark condition, (b) at the source/ MAPbBr<sub>3</sub> SC interface after the application of +4V under illumination and (c) at the drain/ MAPbBr<sub>3</sub> SC interface after the application of -4V under illumination.