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Electrical scanned probe microscopy impedance model reveals transient photoconductivity in a Ruddlesden-Popper 2D lead-halide perovskite RYAN DWYER, University of Mount Union, JOHN MAROHN, Cornell University — Electrical force microscopy (EFM) experiments such as Kelvin probe force microscopy can locally measure semiconductor properties correlated with overall device performance and degradation. What sample properties are probed by these measurements, however, remains an open question. The typical model used to interpret these experiments incorrectly assumes that tip and sample charge responds instantaneously to changes in the applied tip-sample voltage. Dwyer, Marohn and coworkers developed an impedance model of KPFM that correctly accounts for tip-sample charge motion for both frequency-domain and time-resolved EFM experiments. As an application of the model, time and frequency-resolved electric force microscopy experiments were performed on a film of butylammonium lead iodide, a 2D Ruddlesden–Popper perovskite semiconductor. These experiments revealed the sample's transient photoconductivity, which had a rise time and decay time of $\sim 100\ \mu s$. To enable the broader community of KPFM users to use this powerful theory, we developed an open-source Python package and website that can simulate or fit experimental data using the model and information about the tip geometry and sample parameters.

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