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Nanoscale dynamics of the Insulator-to-Metal transition in VO_2
AARON STERNBACH, University of California, San Diego — We have improved upon the technique of time resolved scanning near-field optical microscopy to study the development of inhomogeneous phase transitions in the time domain with 20 nanometer spatial resolution and 100 femtosecond temporal resolution. In our present work, we study Vanadium Dioxide (VO_2), which is a canonical correlated electron system that exhibits an insulator-to-metal transition (IMT) above room temperature. We observe inhomogeneous dynamics that are related to mesoscopic strain variations. Our measurement resolves the dynamical evolution of the IMT on length scales that are short compared with the typical sizes of metallic domains in VO_2. By using Near-Infrared radiation, measured on a pulse-to-pulse basis, we are able to achieve an unprecedented Signal-to-Noise ratio. Our advances pave a pathway to study a wide range of systems with inhomogeneities properties on the nanoscale with high sensitivity, nanoscopic spatial, and ultrafast temporal resolution.

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