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New Insight into the Metal-to-Insulator Transition in Vanadium Dioxide.

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The metal-insulator transition (MIT) in VO2 is of both fundamental and technical interest, the former due to important questions about its origins, and the latter due to possible applications in electronic devices such as ultrafast optical switches and field effect transistors. In bulk VO2, a large structural distortion accompanies the conductivity transition from the metallic (rutile) to the insulating (monoclinic) phase, which is known to impose a significant bottleneck on the timescale of the transition. Recently, the ability to control the transition temperature of the MIT in VO2 through nanoscale engineering via mechanical stress has heralded renewed interest in the potential application of VO2 as a novel functional material.
I will present the results of photoemission, x-ray emission, resonant inelastic x-ray scattering, x-ray absorption, low energy electron microscopy, and photoelectron microscopy studies of the MIT in strained VO2 thin films. Our results reveal that the MIT may be driven towards a purely electronic transition, (i.e. one which does not involve a structural transition), by the application of mechanical strain. Our measurements have important implications for novel functional material engineering of VO2, suggesting a route towards circumventing the structural bottleneck in the ultrafast timescale of the MIT.

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