Phonons and the metal-insulator transition in VO$_2$

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— VO$_2$ undergoes a metal-insulator transition (MIT) at $T_C = 340$ K, which is accompanied by a structural phase transition from a high temperature rutile phase to a low temperature monoclinic phase. Although VO$_2$ has been studied extensively for over 40 years, a clear understanding of the origin of the phase transition has not been forthcoming. Still at issue is the relative importance of electron-lattice and electron-electron interactions as driving mechanisms for the MIT. Here, we report the phonon dispersion of VO$_2$, measured along the rutile Γ-R direction using high resolution inelastic X-ray scattering. Unusual phonon behavior at the R point, as the MIT is approached, suggests significant electron-phonon coupling.