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Proton Tunneling: A Decay Channel of the O-H Stretch Mode in $KTaO_3$ ERIK SPAHR, College of William and Mary, MICHAEL STAVOLA, Lehigh University, LANLIN WEN, Lehigh Universtiy, LYNN BOATNER, Oak Ridge National Lab, LEONARD FELDMAN, Vanderbilt, Rutgers, NORMAN TOLK, GUNTER LÜPKE, College of William and Mary — Proton vibrational dynamics play a key role in the important processes of hydrogen diffusion and transport. In particular, perovskite structured proton conductors are an important class of hydrogen transport materials with a wide range of potential applications. We have measured for the first time the vibrational lifetimes of the O-H and O-D stretch modes in the perovskite oxide, $KTaO_3$, by pump-probe infrared spectroscopy. Both stretch modes are exceptionally long lived and exhibit a large "reverse" isotope effect, due to a phonon-assisted proton tunneling process, which involves the O-Ta-O bending motion. The excited-state tunneling rate is found to be seven orders of magnitude larger than from the ground state in the proton conducting oxide, $BaCeO_3$ [1]. [1] I. Kuskovsky et al., Phys. Rev. B **60**, R3713 (1999).

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