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Tunneling barrier height spectroscopy with single-electron tunneling events K AMBAL, C .C. WILLIAMS, C BOEHME, Department of Physics and Astronomy, University of Utah, Salt Lake City, 84112, USA — The energy of individual localized defect states in dielectric films has been measured by Dynamic Tunneling Force Microscopy [1]. Here, the tunneling dynamics of single electrons from a Fermi reservoir to these localized defect states in a silicon dioxide thin-film at 77K is studied using quartz tuning-fork based force detection with a Pt scanning-probe tip. When the tip-Fermi energy is aligned to a localized defect state, random tunneling of individual electrons between state and tip occurs, causing cantilever-detected electrostatic forces to exhibit random telegraph noise. The tunneling rate dependence on the tip-sample gap determines the local tunneling barrier height. The experiments demonstrate single-electron tunneling barrier height spectroscopy of individual defect states and suggest their applicability for tunneling based single-spin detection [2]. [1] Wang et al, Appl. Phys. Lett. 105, 052903 (2014) [2] Payne et al, Phys. Rev. B 91, 195433 (2015).

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