Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Multi-photon Photoemission Dynamics in TiO_2 ADAM ARGONDIZZO, University of Pittsburgh, XUEFENG CUI, University of Science and Technology of China, CONG WANG, University of Pittsburgh, HUIJUAN SUN, HONGHUI SHANG, JIN ZHAO, University of Science and Technology of China, HRVOJE PETEK, University of Pittsburgh — TiO_2 is a material of interest in photocatalytic and photovoltaic applications. Until recently, however, the ability to probe the electron dynamics of this system has been limited to optical experiments. By probing the rutile $TiO_2(110)$ surface using two-photon photoemission (2PP) with a tunable ultrashort ($\sim$20 fs) laser pulse we investigated the dynamics of electrons excited to its conduction band. Previous 2PP experiments on protic solvent covered TiO_2 surfaces using 400 nm (3.1 eV) light revealed the presence of an unoccupied surface adsorbate-induced wet electron state. By expanding such measurements at higher photon energy we have found a pair of new nearly degenerate unoccupied states located at 2.7 and 2.8 eV above the Fermi level. Based on the calculated electronic structure and optical transition moments, as well as related spectroscopic evidence, we assign these resonances to transitions between Ti-3d bands of nominally t_{2g} and e_g symmetry, which are split by crystal field. A detailed understanding of the t_{2g}-e_g transitions is essential for the characterization of electron dynamics and adsorbate induced resonances in photocatalytic processes on TiO_2.

Adam Argondizzo
University of Pittsburgh

Date submitted: 06 Nov 2015 Electronic form version 1.4