

# DIRECT MEASUREMENT OF CORE-LEVEL RELAXATION DYNAMICS ON A SURFACE-ADSORBATE SYSTEM.

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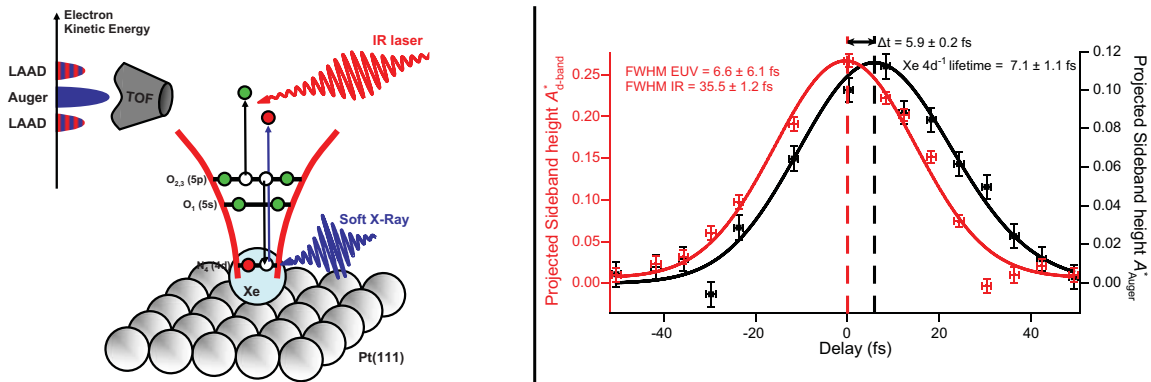
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Applying laser-assisted techniques to solid surfaces and, in particular, surface-adsorbate systems would open a new route towards understanding the fundamental steps in surface chemistry. Here, we place Xe atoms on a surface, and directly measure the time it takes for an electron to fill a core hole generated in the Xe adsorbate by a soft-x-ray (Fig. 1a).

In the presence of the IR field, the Xe/Pt(111) photoemission spectrum should be modified by the appearance of sidebands on the characteristic features of the spectrum i.e. the Pt d-band structure near the Fermi edge, the Auger *NOO* peaks, and the Xe 4d core-hole peaks. The time evolution of the sideband height for the Pt d-band electrons corresponds to the cross correlation between the SXR and the IR pulses (Fig. 1b). In contrast, the Auger electron sideband height trace is clearly shifted by 6 fs with respect to time-zero.

By fitting the Auger sideband height with the convolution of a decaying exponential with the cross correlation at the Pt d-band peak, we obtain a core-hole lifetime of  $7.1 \pm 1.1$  fs.

We report the first time domain measurement of a core-hole lifetime on a surface-adsorbate system [1]. Our measurements show that time resolved measurements are possible that can definitively identify the nature of spectral broadening in complex systems.



[1] L. Miaja-Avila, et al., in press (PRL).