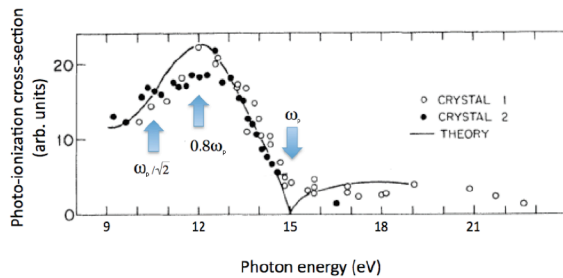


## Surface Photoelectric effect in Al.

In the 1905 explanation of the photoelectric effect Einstein point out that the gradient in the potential at the surface gives a source of conservation of momentum. Therefore, in a free electron metal the surface is the source of photo-emitted electrons. In 1979, my student Harry Levinson measured the photoionization cross section for excitation of electrons in the surface state on Al(001) and from the Fermi energy. The measurements from the Fermi energy are shown in the figure and compared to calculations by



The Photo-ionization cross section from the Fermi level in Al(100).

Feibelman for the local electromagnetic field. The cross section goes to zero for a photon energy equal to the bulk plasmon energy ( $\omega_p$ ). The high enhancement at lower photon energy comes for the gradient in the vector potential  $\vec{A}$ , which normal is assumed to be a constant. Almost 10 years later another student, K-D Tsuei (third paper in the next section) showed that the enhancement was directly related to the *multipole surface plasmon* which is at an energy of  $\sim 0.8 \omega_p$ .

Also see the article by Levinson in PRB **24**, 628 (1981).