

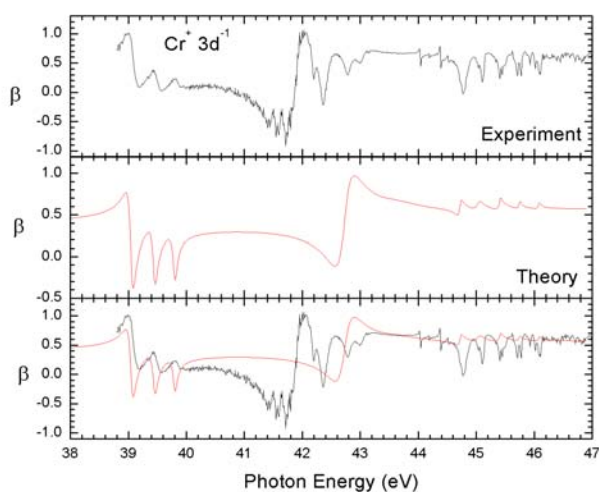
PHOTOELECTRON SPECTROMETRY OF ATOMIC CHROMIUM IN THE REGION OF THE 3P TO 3D GIANT RESONANCE

Scott B. Whitfield¹, Brian Krosschell¹, and Ralf Wehlitz²

¹*Department of Physics and Astronomy, University of Wisconsin, Eau Claire, WI 54701*

²*Synchrotron Radiation Center, University of Wisconsin, Stoughton, WI 53589*

Atomic Cr, by virtue of its half filled $3d$ and $4s$ subshells, $[\text{Ar}]3d^5 4s^1 ({}^7S_3)$, is one of the simplest open-shell atoms to have a partially filled d subshell. This makes detailed studies of atomic Cr particularly attractive both theoretically and experimentally. In fact, atomic Cr has been the object of fairly extensive experimental and theoretical investigations [1]. Nevertheless, there is presently no experimental data of the angular distribution parameters, β , of the Cr mainlines. Only recently has there been any theoretical calculations of β [2] and this for the $3d$ photoelectron only. This lack of experimental data for β prompted us to investigate its photon energy dependence for both the $3d$ and $4s$ mainlines and the strongest photoelectron satellite line in the region of the $3p \rightarrow 3d$ giant resonance. A comparison between our measured β values as a function of photon energy for the $3d$ mainline and theory is shown in the figure below. There is generally good accord between experiment and theory with the exception of certain resonance transitions which were not accounted for by theory.



We have also found strong deviations from $\beta = 2.0$ for the $4s$ mainline on most of the $3p \rightarrow 3d$ resonances, while off resonance they have β values of 2.0 as generally expected. For half-open subshell atoms one generally expects s -subshell photoelectrons to have $\beta = 2.0$ independent of the incident photon energy. Deviations from this behavior are an indication of relativistic effects. We will present a simple qualitative argument for why we observe deviations of $\beta = 2.0$ for the $4s$ mainline on resonance.

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References:

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