Abstract Submitted
for the DAMOP07 Meeting of
The American Physical Society

Prediction of Compton doubly and tripply differential cross sections and Compton profiles at high energy from modified nonrelativistic theories: Effect of treating the momentum of the ejected electron relativistically L.A. LAJOHN, R.H. PRATT, University of Pittsburgh — With increasing atomic number and incident photon energy (ω_1), the nonrelativistic (nr) matrix element based on the interaction Hamiltonian [$H_{int} = (e^2A^2/2) - e(p \cdot A)$] becomes insufficient for the accurate prediction of Compton cross sections, even in the Compton peak region, except when v/c (v=velocity of the ejected electron) is small, in which case it remains valid. Under such circumstances one could use the more exact relativistic S-matrix (SM) theory. However we find that for doubly and triply differential cross sections in the vicinity of the Compton peak, an A^2 matrix element based on Schrödinger wavefunctions works even for $v/c \to 1$, if the momentum of the ejected electron is treated relativistically. However an entirely nr treatment (including for momentum) of the Compton profiles (CP), as a function of p_z (p_z = z component of the incident electron energy), unlike for the cross sections, is in surprisingly good agreement with relativistic SM (with relativistic p_z) results even when $v/c \to 1$, due to partial cancellation of relativistic factors in CP and p_z.

Larry LaJohn
University of Pittsburgh

Date submitted: 01 Feb 2007 Electronic form version 1.4