Abstract Submitted
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Validity of nonrelativistic-form expression for calculation of Compton scattering doubly differential cross sections. L.A. LAJOHN, R.H. PRATT, University of Pittsburgh — The nonrelativistic impulse approximation expression for Compton scattering doubly differential cross sections (DDCS) is the product of a separate kinematic factor K and the Compton profile J (i.e. DDCS=KJ). This form allows one to easily obtain the Compton profile from measured or predicted DDCS. At high photon energies or for heavy atoms, it becomes necessary to use the relativistic impulse approximation (RIA). However in the full RIA expression, the integral over the initial electron momentum p for J is weighted by a p-dependent K. Over 30 years ago Ribberfors [1](as well as others), argued that this expression can be placed in a DDCS=KJ form by assuming that the initial electron energy $E(p) = (p^2 + m^2)^{1/2} \approx m$. Further, he argued that this relativistic KJ (RKJ) approximation would be good if the scattering angle θ is 180^o, but that small errors would occur away from the Compton peak maximum at other angles. We will show that the assumption $E(p) \approx m$ breaks down for K-shell DDCS for atoms with $Z > 30$, due to broadening of the Compton profile, and that the maximum error of the RKJ approximation occurs when $\theta = 180^o$, where at the Compton peak maximum the values can be over 50% too large. The results of this study provide a useful guide for when one can use the RKJ approximation to obtain accurate DDCS.
[1.] R. Ribberfors, Phys. Rev. B, **12** 2067 (1975)

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