scattering doubly differential cross sections within impulse approximation
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Simple analytic expressions for correcting the factorizable formula for Compton L. A. LAJOHN, R. H. PRATT, University of Pittsburgh — The factorizable form of the relativistic impulse approximation (RIA) expression for Compton scattering doubly differential cross sections (DDCS) becomes progressively less accurate as the binding energy of the ejected electron increases. This expression, which we call the RKJ approximation, makes it possible to obtain the Compton profile (CP) from measured DDCS. We have derived three simple analytic expressions, each which can be used to correct the RKJ error for the atomic K-shell CP obtained from DDCS for any atomic number Z. The expression which is the most general is valid over a broad range of energy ω and scattering angle θ, a second expression which is somewhat simpler is valid at very high ω but over most θ, and the third which is the simplest is valid at small θ over a broad range of ω. We demonstrate that such expressions can yield a CP accurate to within a 1% error over 99% of the electron momentum distribution range of the Uranium K-shell CP. Since the K-shell contribution dominates the extremes of the whole atom CP (this is where the error of RKJ can exceed an order of magnitude), this region can be of concern in assessing the bonding properties of molecules as well as semiconducting materials.

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