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Characterization of the relativistic contributions to Compton doubly differential cross sections L.A. LAJOHN, R.H. PRATT, University of Pittsburgh — Illustrations and a detailed analysis will be provoded on how relativistic factors enter into the predictions of Compton doubly differential cross sections (DDCS), using the impulse approximation (IA) theory as a model. Within IA theory it was found that one can analyze the relativistic contributions to DDCS in terms of two components, a kinematic factor $K(p_z)$ and the Compton profile $J(p_z, \rho_{rel})$, both functions of p_z, the z component of the ejected electron. $J(p_z, \rho_{rel})$ is also a function of the relativistic charge density ρ_{rel}. It will be shown by taking the nonrelativistic limit of p_{min} (the relativistic version of p_z), which accounts for most of the relativistic effects on DDCS, that the relativistic shift of the Compton peak in DDCS to higher energy, determined by $J(p_z, \rho_{rel})$, as well as most of the relativistic increase in the peak amplitude determined by $K^{rel}(p_{min})$, is due to the only term in p_{min} that differs from p_z, that is $\omega_1\omega_2$ in the former and $\frac{\omega_1^2+\omega_2^2}{2}$ in the latter, the two terms becoming equal as $\omega_2 \to \omega_1$, (ω_1 and ω_2 are the incident and scattered photon energies). However the true nonrelativistic limit of $K(p_{min})$ is not obtained unless $\omega_2(1 - cos\theta)$ is neglected, which is valid if $\omega_2 << mc^2$, also if θ is small even at high energies. Finally the much smaller relativistic contribution due to ρ_{rel}, which decreases the Compton peak height with increasing nuclear charge Z will be examined.

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