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Criteria for using impulse approximation to obtain Compton scattering doubly differential cross sections L.A. LAJOHN, R.H. PRATT, University of Pittsburgh — We find that the criterion often used for predicting when impulse approximation (IA) theory yields accurate doubly differential cross sections (DDCS), namely $< p_i > /q \leq 1$, where $< p_i >$ is the expectation value of the momentum distribution of the bound electron and q is the magnitude of the photon momentum transfer, which is much less restrictive than the assumptions on which IA theory is based ($< p_i > /q << 1$), is not generally dependable. We examine the IA error Δ, where $\Delta = (DDCS_{SM} - DDCS_{RIA})/DDCS_{SM}$ ($DDCS_{SM}$ and $DDCS_{RIA}$ are the peak magnitudes for S-matrix and relativistic IA derived DDCS respectively). One striking feature is that, for a given incident photon energy ω_i and nuclear charge Z, Δ goes from negative to positive as the scattering angle θ increases. Further, when $< p_i > /q$ is held constant at a value less than unity, Δ changes sign at nearly the same θ for all Z. Therefore, when θ is large or small, $< p_i > /q << 1$ is generally required in order for IA derived DDCS to be valid, while at intermediate θ, $< p_i > /q \approx 1$ is typically sufficient, since Δ is small. The θ at which Δ changes sign increases as $< p_i > /q$ increases.

L.A. LaJohn
University of Pittsburgh

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