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Why criteria for impulse approximation in Compton scattering fail in relativistic regimes L.A. LAJOHN, R.H. PRATT, Unversity of Pittsburgh — The assumption behind impulse approximation (IA) for Compton scattering is that the momentum transfer q is much greater than the average $< p >$ of the initial bound state momentum distribution p. Comparing with S-matrix results, we find that at relativistic incident photon energies (ω_i) and for high Z elements, one requires information beyond $< p > /q$ to predict the accuracy of relativistic IA (RIA) diferential cross sections. The IA expression is proportional to the product of a kinematic factor X^{nr} and the symmetrical Compton profile J, where $X^{nr} = 1+cos^2\theta$ (θ is the photon scattering angle). In the RIA case, X^{nr}, independent of p, is replaced by $X^{rel}(\omega, \theta, p)$ in the integrand which determines J. At nr energies there is virtually no RIA error in the position of the Compton peak maximum (ω_f^{pk}) in the scattered photon energy (ω_f), while RIA error in the peak magnitude can be characterized by $< p > /q$. This is because at low ω_i, the kinematic effects described by S-matrix (also RIA) expressions behave like X^{nr}, while in relativistic regimes (high ω_i and Z), kinematic factors treated accurately by S-matrix but not RIA expressions become significant and do not factor out.

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