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Relativistic regimes in which Compton scattering doubly differential cross sections obtained from impulse approximation are accurate due to cancelation of errors. L.A. LAJOHN, R.H. PRATT, University of Pittsburgh — There is no simple parameter that can be used to predict when impulse approximation (IA) can yield accurate Compton scattering doubly differential cross sections (DDCS) in relativistic regimes. When Z is low, a small value of the parameter <p>/q (where <p>is the average initial electron momentum and q is the momentum transfer) suffices. For small Z the photon electron kinematic contribution described in relativistic S-matrix (SM) theory reduces to an expression, X^{rel}, which is present in the relativistic impulse approximation (RIA) formula for Compton DDCS. When Z is high, the S-Matrix photon electron kinematics no longer reduces to X^{rel}, and this along with the error characterized by the magnitude of <p>/q contribute to the RIA error Δ. We demonstrate and illustrate in the form of contour plots that there are regimes of incident photon energy ω_i and scattering angle θ in which the two types of errors at least partially cancel. Our calculations show that when θ is about 65° for Uranium K-shell scattering, Δ is less than 1% over an ω_i range of 300 to 900 keV.

L. A. LaJohn
University of Pittsburgh

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