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Comment on "Medium-Modified Form Factors, Relativistic Dynamics, and the $(e, e'p)$ Reaction"

Cohen, Van Orden, and Picklesimer¹ have examined the effects of relativistic dynamics and medium-modified form factors on the ratio of transverse to longitudinal response functions in the $(e, e'p)$ reaction. They find (1) that these effects are small and (2) that the observed anomalous T/L ratio^{2,3} can be fully explained by final-state distortions. We agree with (1), but disagree with (2).

The crucial aspect of our analysis has been to use model parameters [i.e., bound-state wave function and optical potential] that yield a good fit to the momentum distribution $\rho_{1p}(\mathbf{p}_m)$ for $1p$ knockout (see Ref. 4 for details). The data and results of our unfactorized nonrelativistic distorted-wave impulse-approximation (DWIA) calculations (Ref. 5) with the McVoy-Van Hove off-shell current operator are shown in Fig. 1 for both $1p$ knockout from ^{12}C and $1s$ knockout from ^6Li in the representation $R_G = (4m^2 W_T / Q^2 W_L)^{1/2}$. The bump at $Q^2 \approx 0.145 \text{ (GeV}/c)^2$ is due to the occurrence of a minimum in $\rho_{1p}(\mathbf{p}_m)$. The distortion effects that are somewhat larger than quoted in Refs. 2 and 3 are because of (i) an improved calculation of Coulomb distortion and (ii) the constraint of the complete $\rho_{1p}(\mathbf{p}_m)$, are nonnegligible, but at the two largest Q^2 points the data show a significant deviation from the DWIA calculation. In view of the discrepancy with the calculations of Cohen, Van Orden, and Picklesimer, we stress the importance of a proper description of $\rho(\mathbf{p}_m)$ for a meaningful interpretation of R_G . In this context it is noted that for $1s$ knockout where the dependence on a proper model description of $\rho(\mathbf{p}_m)$ is reduced, the data show again a clear deviation from the impulse approximation. We note in addition that the current operator for a free (on-shell) Dirac particle has been used by Cohen, Van Orden, and Picklesimer to describe a bound proton, whereas we have used an off-shell operator that satisfies gauge invariance.

In conclusion, we claim that model calculations should first of all reproduce the shape of measured momentum distributions, before meaningful interpretations of T/L -separated data can be made. In addition, the dependence of model calculations on the choice of current operator needs further theoretical attention (see Refs. 6 and 7). We see therefore no reason at present to abandon the conclusion reached in Refs. 2 and 3 that $(e, e'p)$ experiments on both ^6Li and ^{12}C reveal a significant deviation from the impulse approximation.

FIG. 1. The quantity R_G deduced from the ^{12}C $1p$ -knockout and the ^6Li $1s$ -knockout data as a function of momentum transfer squared. Solid (dashed) curve is an unfactorized DWIA calculation for R_G . The dotted curve is the plane-wave impulse-approximation calculation. (FSI denotes final-state interaction.)

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¹T. D. Cohen, J. W. Van Orden, and A. Picklesimer, Phys. Rev. Lett. **59**, 1267 (1987).

²G. van der Steenhoven *et al.*, Phys. Rev. Lett. **57**, 182 (1986).

³G. van der Steenhoven *et al.*, Phys. Rev. Lett. **58**, 1727 (1987).

⁴G. van der Steenhoven *et al.*, Nucl. Phys. **A480**, 547 (1988).

⁵S. Boffi, C. Giusti, and F. D. Pacati, Nucl. Phys. **A386**, 599 (1982).

⁶C. Giusti and F. D. Pacati, Nucl. Phys. **A336**, 42 (1980).

⁷A. Picklesimer, J. W. Van Orden, and S. J. Wallace, Phys. Rev. C **32**, 1312 (1985).