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Comment on "Well-established Nucleon Resonances Revisited by Double-Polarization Measurements"

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The Letter of Thiel *et al.* [1] compares precise measurements of the double-polarization observable G to three independent predictions from the Bonn-Gatchina (BnGa) [2], Mainz (MAID) [3], and the George Washington University (SAID) [4] groups. The authors note that the SAID and MAID predictions are poor, over significant energy and angular ranges, while the BnGa result provides a good description. We show that, in fact, the BnGa and SAID predictions are qualitatively similar. The much older MAID fit does have a problem. The major source of this problem was outlined in our previous publication [4].

The most signifcant deviations between predictions were illustrated in Fig. 4 of Ref. [1], which plotted G as a function of the photon lab energy for center-of-mass π^0 production angles (θ_π) of 90° and 130°. We re-draw this plot in Fig. (1), using predictions from our new CM12 solution [4]. The BnGa and CM12 curves both give a good representation of the data. Therefore, the inclusion of our CM12 solution in the analysis of Ref. [1] alters some conclusions of that work. The original figure in Ref. [1] used the former solution SN11 of 2011 [5]. Above 1.2 GeV, the solutions CM12 and SN11 fit existing $\pi^0 p$ G data with χ^2-per-datum of 2.14 and 2.79, respectively.

Reference [4] demonstrated that the imposition of two-body unitarity in a Chew-Mandelstam form constituted a significant refinement over previous SAID parametrizations. This required the consistent and unified incorporation of hadronic-sector amplitudes. An immediate consequence of this improvement, over earlier SAID parametrization forms, was an improved χ^2-per-datum for a smaller number of parameters, as noted in [4]. The finding of the authors, that differences in the BnGa and SAID are "surprising", are thereby obviated – both approaches incorporate two-body unitarity at the hadronic level. It is encouraging, in fact, that two groups working completely independently but using two-body unitarity approaches are in agreement – at least in this particular observable, even though the BnGa analysis utilizes a larger combined fit to many connected reactions.

The authors also note that the discrepancies between the different groups' solutions, for the G observable, are partly due to differences in the $E_{0+}^{1/2}$ proton multipole, connected to the $N(1535)$ resonance. This issue was also discussed extensively in Ref. [4]. Values for the $E_{0+}^{1/2}$ multipole, and its phase, were compared in Figs. 6 and 7 of that publication for the BnGa solution, the MAID solution, and for the two most recent SAID solutions SN11 and CM12.

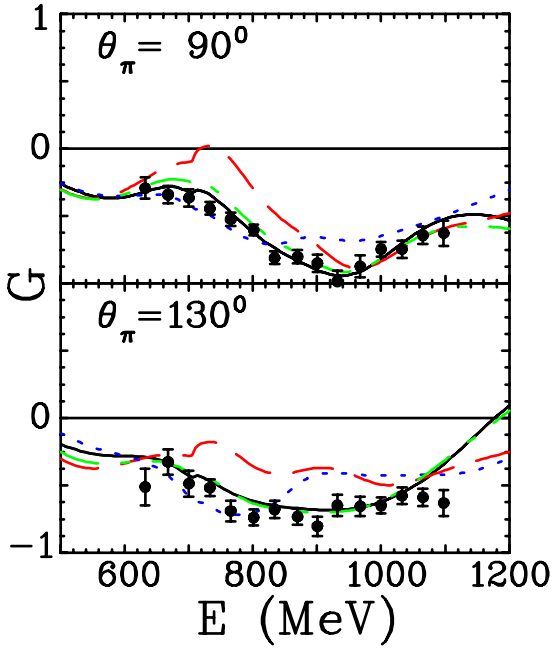

FIG. 1. (Color online) Double-polarization observable G for $\gamma p \to \pi^0 p$ as a function of energy for two selected bins in θ_π. Curves: solid (black): BG2011-02 of BnGa [2]; dashed (red): SN11 of SAID [5]; dash-dotted (green): CM12 of SAID [4], and dotted (blue): MAID07 [3]. Black dots show CB-ELSA/TAPS Collaboration data [1]. Plotted uncertainties are statistical.

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[1] A. Thiel, *et al.* (CB-ELSA/TAPS Collaboration), Phys. Rev. Lett. **109**, 102001 (2012).

[2] The Bonn-Gatchina analyses are available through the

Bonn website: http://pwa.hiskp.uni-bonn.de/. See also A. V. Anisovich, *et al.*, Eur. Phys. J. A **48**, 15 (2012).

[3] The MAID analyses are available through the Mainz website: http://wwwkph.kph.uni-mainz.de/MAID/. See also D. Drechsel, S. S. Kamalov, and L. Tiator, Eur. Phys. J. A **34**, 69 (2007).

[4] R.L. Workman, M.W. Paris, W.J. Briscoe, and I.I. Strakovsky, Phys. Rev. C **86**, 015202 (2012).

[5] R.L. Workman, W.J. Briscoe, M.W. Paris, and I.I. Strakovsky, Phys. Rev. C **85**, 025201 (2012).