Reply to "Parity violating asymmetries in the scattering of transversely polarized protons"

E. G. Adelberger, P. Hoodbhoy, and B. A. Brown
Nuclear Physics Laboratory, University of Washington, Seattle, Washington 98195
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Experimental considerations usually favor measurements of the longitudinal rather than the irregular transverse analyzing power. This is particularly true for the case of the parity mixing in ^{14}N. Some typographical errors in our published expressions are corrected.

We agree that an irregular transverse analyzing power can be used to probe the parity mixing of elastic scattering resonances. As pointed out by Professor Bizzeti, it is usually easier to measure the longitudinal analyzing power we considered[1] rather than the irregular transverse analyzing power he discusses. In general, one cannot find conditions where K_T vanishes while K_T' is maximum. In addition, for the particular application we discussed—the parity mixing of two $J=0$ levels, resonance-resonance interference (which is isotropic) does not contribute to K_T' but does contribute to K_L. Hence at back angles, where resonance-resonance interference is dominant, the irregular transverse analyzing power will not show the enhancement that occurs in the longitudinal analyzing power (see Fig. 1).

We take this occasion to point out that our expression[1] for the cross section for transversely polarized protons K_T contained a sign error. In addition, several typographical errors were present in the text, but not in the computer programs used to generate Fig. 3 of Ref. 1. The corrected expressions are

$$K_T'^{CR}(\theta,E) = -\mathrm{Re}\left[\sum_{l_1 l_2 j} \Gamma(\theta,E,j,l_1,l_2) \begin{pmatrix} j & \frac{1}{2} & l_1 \\ -\frac{1}{2} & -\frac{1}{2} & 1 \end{pmatrix} \begin{pmatrix} j & \frac{1}{2} & l_2 \\ -\frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix} [1+(-1)^{l_1+l_2}][l_1(l_1+1)]^{-1/2} P_{l_1}^{(1)}(\cos\theta)\right], \quad (26)$$

$$K_T'^{RR}(\theta,E) = (1/\sqrt{3})\mathrm{Re}\left[i \sum_{LJ} \Delta(E,L,1,J) \begin{pmatrix} L & 1 & J \\ 1 & -1 & 0 \end{pmatrix} [L(L+1)]^{-1/2} P_L^{(1)}(\cos\theta)\right], \quad (27)$$

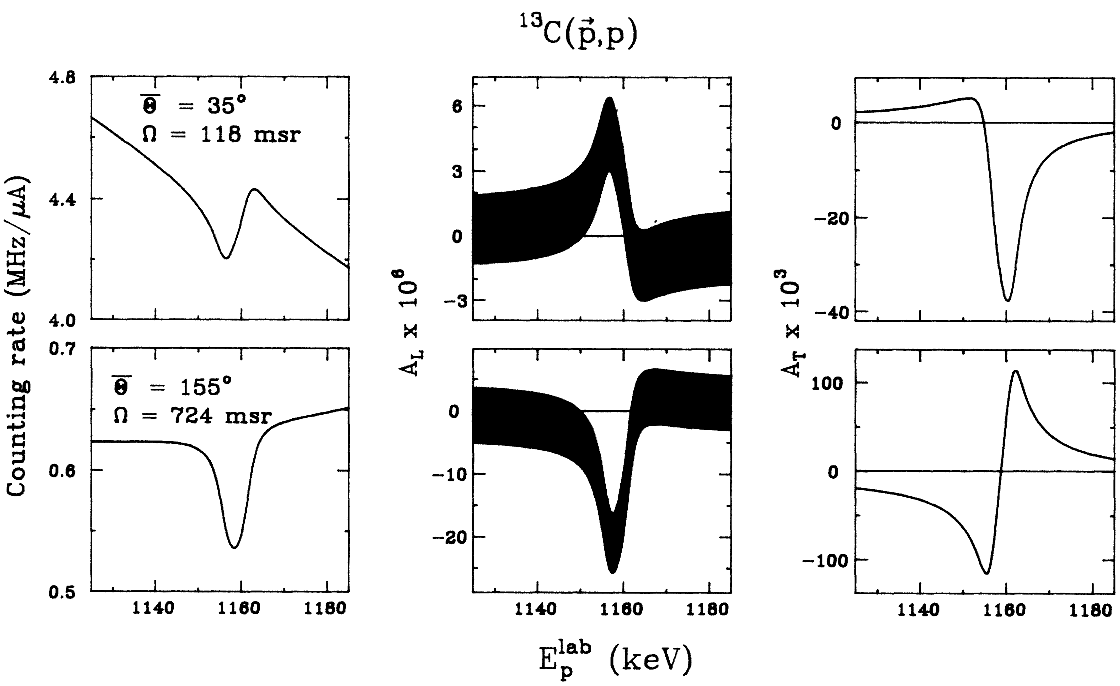

FIG. 1. Predicted counting rates and analyzing powers for an experiment (see text) to study parity mixing of the 0^+ and 0^- $T=1$ levels of ^{14}N. The shaded areas on the A_L plot indicate a $\pm 1\sigma$ band centered on the predicted A_L, where σ is the statistical standard deviation expected after an integrated beam charge of 1 μA d. Counting rates are based on a 30 μg/cm^2 ^{13}C target.

$$\Delta(E,L,S,j)=\frac{1}{8k^2}\sum_{\substack{ll'l_1l_2\\ ss_1s_2JJ'}}(-1)^{s+s_2+l_2+j+J+L}[l]^{1/2}[l']^{1/2}[l_1]^{1/2}[l_2]^{1/2}[s_1]^{1/2}[s_2]^{1/2}[J][J'][L][S][j]$$

$$\times\begin{pmatrix} l_1 & l_2 & j\\ 0 & 0 & 0\end{pmatrix}\begin{pmatrix} l & l' & L\\ 0 & 0 & 0\end{pmatrix} W(JlJ'l';sL)\, W(\tfrac{1}{2}\tfrac{1}{2}s_1s_2;S\tfrac{1}{2})\begin{Bmatrix} l_1 & l_2 & j\\ s_1 & s_2 & S\\ J & J' & L\end{Bmatrix} T^{J}_{ls,l_1s_1} T^{J'*}_{l's,l_2s_2} \;, \tag{30}$$

$$K_U^{J=0}(\theta,E)=\frac{1}{k^2}|C(\theta)|^2+\frac{1}{4k^2}\mathrm{Re}[iC(\theta)(T^*_{0,0}+\cos\theta\, T^*_{1,1})]+\frac{1}{16k^2}(|T_{0,0}|^2+|T_{1,1}|^2) \;, \tag{33}$$

$$K_L^{J=0}(\theta,E)=-\frac{1}{4k^2}(1+\cos\theta)\mathrm{Re}[iC(\theta)T^*_{0,1}]-\frac{1}{8k^2}\mathrm{Re}[T_{0,1}(T^*_{0,0}+T^*_{1,1})] \;. \tag{34}$$

Since our paper[1] was published, new measurements of the energy and widths of the 0^+ and 0^- resonances in ^{14}N have become available.[2] These new values,

$$E_p=1154\pm2\text{ keV},\quad \Gamma_{\mathrm{c.m.}}(0^+)=3.8\pm0.3\text{ keV},\quad E_p=1320\pm7\text{ keV},\quad \Gamma_{\mathrm{c.m.}}(0^-)=410\pm20\text{ keV} \;,$$

particuarly the smaller width of the 0^+ state, make A_L an even more sensitive probe of $\langle 0^+|H_{\mathrm{PNC}}|0^-\rangle$. An updated version of Fig. 3 from Ref. 1, correcting the sign error and incorporating the new resonance parameters, is given in Fig. 1.

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[1] E. G. Adelberger, P. Hoodbhoy, and B. A. Brown, Phys. Rev. C **30**, 456 (1984).

[2] P. B. Fernandez, C. A. Gossett, J. L. Osborne, V. J. Zeps, and E. G. Adelberger, Bull. Am. Phys. Soc. **30**, 1161 (1985).