

Laszewski and Alarcon Reply: The purpose of our Letter¹ was to present the results of a quantitative, background-free, model-independent measurement of the distribution of $M1$ strength near 9 MeV in ^{90}Zr using highly polarized tagged photons. Previous to this work, six other groups²⁻⁷ had attempted similar measurements using a variety of techniques, all of which have one or more significant experimental limitations which include insufficient multipole selectivity of the probe, large, poorly defined backgrounds, and substantial model dependence in strength determinations. The three unpolarized-proton inelastic-scattering experiments^{3,4,6} share all of these limitations, and differ among themselves by factors of 2 to 3 in the respective reported amounts of $M1$ strength near 9 MeV. The (p,p') spin-flip measurement⁶ was not used to give definite $M1$ assignments (the $\Delta S=1$ cross section is in fact dominated by $M2$ excitations⁸) or to extract $M1$ strengths, so that its relative insensitivity to $\Delta S=0$ excitations is not really to the point in this discussion.

The large $M1$ strength discrepancies among the (p,p') experiments was not mentioned in the paper by Nanda *et al.*⁶; but Crawley *et al.*⁴ suggested that it might be due at least in part to the choice of background lines under the $L=0$ bump. The line in Bertrand *et al.*³ is significantly below the smooth interpolations used by Crawley *et al.*⁴ and later by Nanda *et al.*⁶ This is an important point because the low line of Bertrand *et al.*³ was constrained by fitting the wide Coulomb-excited $E1$ giant dipole resonance (GDR) centered at 17 MeV in the (p,p') spectra with a GDR shape and energy taken from (γ,n) work at Saclay. No such fit of the Coulomb-excited $E1$ was attempted by Crawley *et al.*⁴ or by Nanda *et al.*⁶ and as a result it appears that their more arbitrary background lines tend to be too high, and their respective estimates of $M1$ strength too low. It is an interesting refinement of this observation that because the (γ,n) GDR line shape used by Bertrand *et al.*³ did not extend below neutron threshold (12 MeV), their reported $M1$ strength would tend to be too large by an amount related to the amount of $E1$ strength found in the region in the low-energy tail of the GDR. The subtraction of a cross section corresponding to our measured $E1$ strength¹ from the reported (p,p') $M1$ cross section³

gives a corrected (p,p') $M1$ in good agreement both with our polarized-photon $M1$ measurement and with what would be expected from systematics.¹ The work of Bertrand *et al.*³ also seems to be in better agreement with (p,n) experiments⁹ than the other (p,p') work.

It would seem that a proper consideration of the Coulomb excitation of the large amount of $E1$ strength in the GDR region and below can provide valuable guidance for the placement of the background line in (p,p') $M1$ experiments. A consistent reanalysis of the (p,p') measurements may make it possible to bring these experiments into quantitative agreement with each other and with our polarized-tagged-photon results.

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