From (e, e') to $(\vec{e}, \vec{e}')$ & $(e, e'\gamma)$

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PWBA :

$$\left(\frac{d\sigma}{d\Omega}\right) = \left(\frac{Ze^2}{E_e}\right)^2 f_{rec} \left[V_L(\theta)\left|F_C^\lambda(q)\right|^2 + V_T(\theta)\left|F_T^\lambda(q)\right|^2\right]$$

Eλ states :

$$F_C^\lambda(q) \propto \int_0^\infty \rho_\lambda(r)\, j_\lambda(qr)\, r^2\, dr$$

$$F_T^\lambda(q) \propto \int_0^\infty \left\{\sqrt{\lambda+1}\, j_{\lambda,\lambda-1}(r)\, j_{\lambda-1}(qr) + \sqrt{\lambda}\, j_{\lambda,\lambda+1}(r)\, j_{\lambda+1}(qr)\right\} r^2\, dr$$

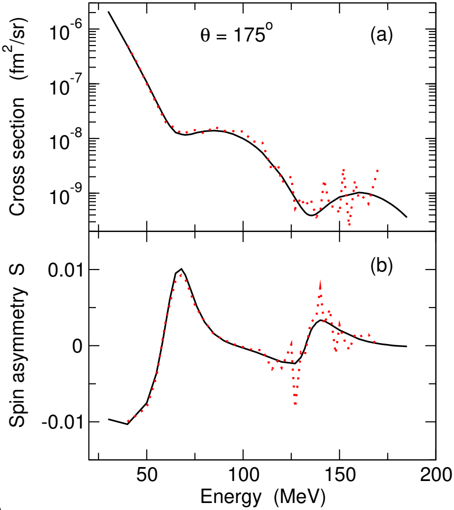
Mλ states :

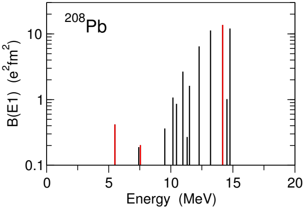
$$F_T^\lambda(q) \propto \int_0^\infty j_{\lambda,\lambda}(r)\, j_\lambda(qr)\, r^2\, dr$$

$$V_L(\theta) = \frac{1+cos\theta}{2(y-cos\theta)^2};\ V_T(\theta) = \frac{2y+1-cos\theta}{4(y-cos\theta)(1-cos\theta)};\ y = 1+\frac{E_x^2}{2E_e(E_e-E_x)}$$

$V_T(\theta) >> V_L(\theta)$ @ $\theta \approx 0^o$ and $\theta \approx 180^o$

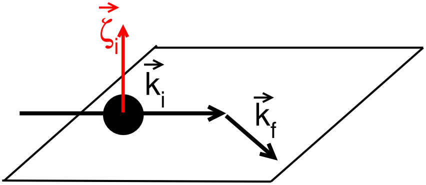
^{208}Pb(e, e') with excitation of 1^- state at 5.5 MeV



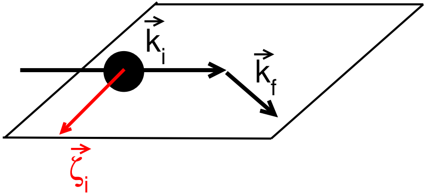


$(\vec{e}, \vec{e}')$ project

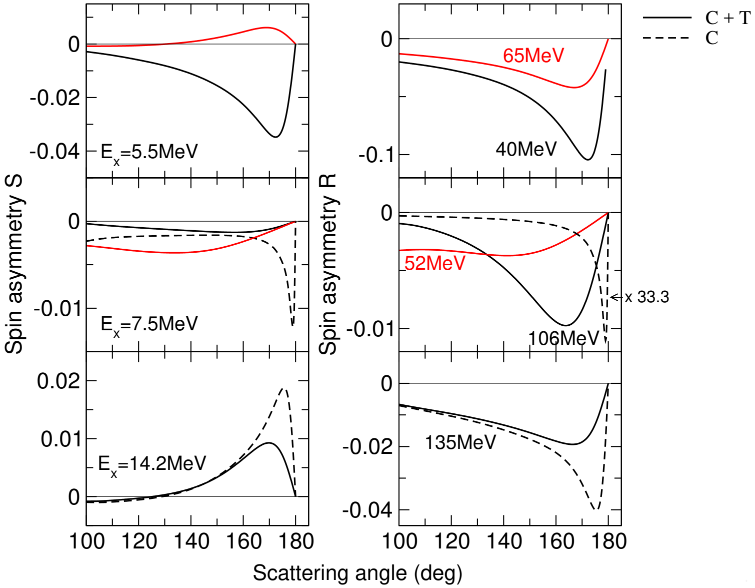
$$P(\zeta_i) = \frac{d\sigma(\zeta_i, \zeta_f) - d\sigma(-\zeta_i, \zeta_f)}{d\sigma(\zeta_i, \zeta_f) + d\sigma(-\zeta_i, \zeta_f)}$$



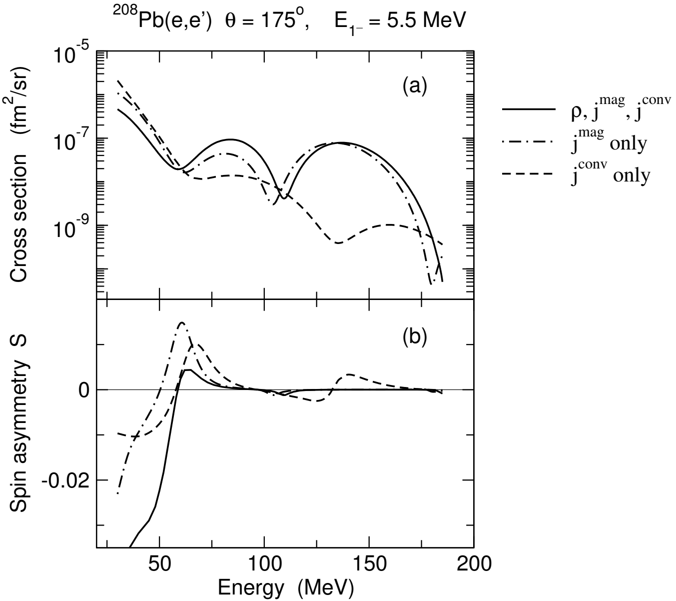
Sherman function $S = P(\boldsymbol{e}_y)$



Polarization correlation $R = P(-\boldsymbol{e}_x)$



C + T
C
Spin asymmetry S
Spin asymmetry R
E_x=5.5MeV
E_x=7.5MeV
E_x=14.2MeV
65MeV
40MeV
52MeV
106MeV
x 33.3
135MeV
0
-0.02
-0.04
-0.01
0.02
0.01
-0.1
100
120
140
160
180
Scattering angle (deg)



208Pb(e,e') θ = 175°, E1− = 5.5 MeV
Cross section (fm2/sr)
10-5
10-7
10-9
(a)
ρ, j.mag, j.conv
j.mag only
j.conv only
Spin asymmetry S
(b)
0
-0.02
50
100
150
200
Energy (MeV)

$(e, e'\gamma)$ project

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Coincident Electron Scattering in Distorted
Wave Born Approximation
I. The $(e, e'\gamma)$ Process[1]

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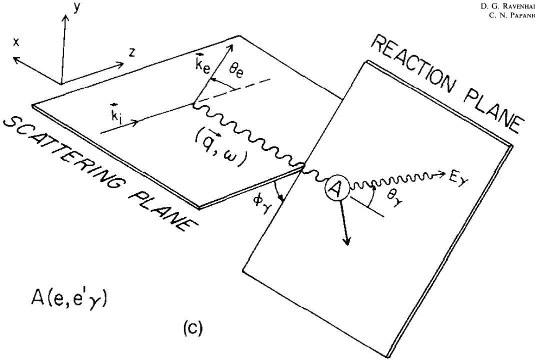

ϑ_f - scattering angle for electrons
θ_k - scattering angle for photons

2_1^+ and 2_2^+ states in ^{92}Zr

$(e,e'\gamma)$ Measurements on the 4.439-MeV State of ^{12}C

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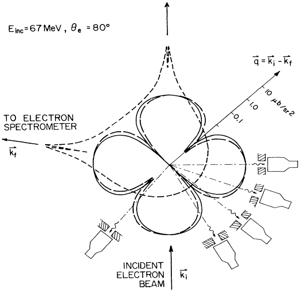
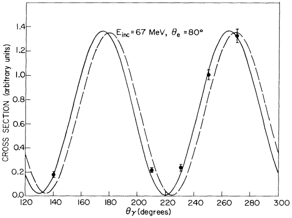
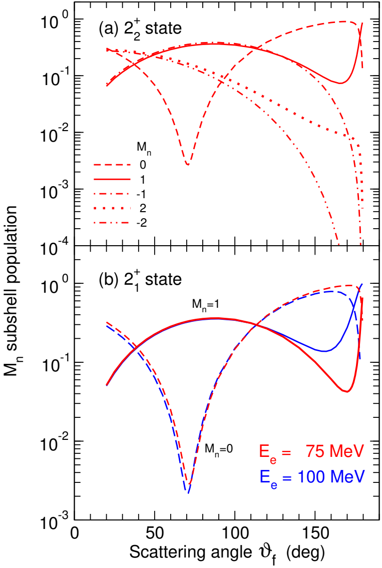
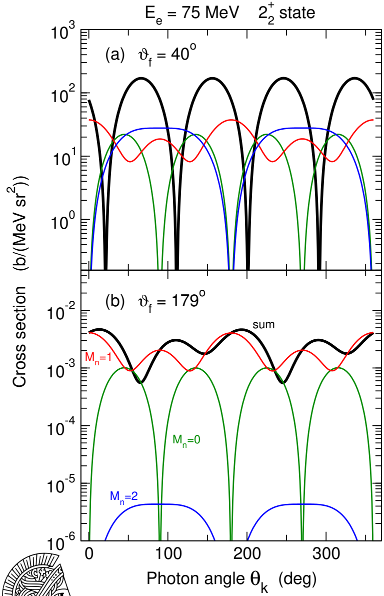




Relative contribution $\frac{\left(\frac{d\sigma_{M_n}}{d\Omega_f}\right)}{\left(\frac{d\sigma_{\text{tot}}}{d\Omega_f}\right)}$ of a given M_n subshell of a 2^+ state in $^{92}\mathrm{Zr}(e,e')$



^{92}Zr$(e, e'\gamma)$

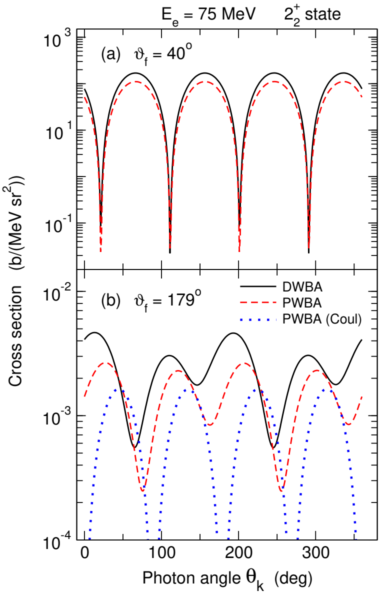


$$\frac{d^3\sigma_{(M_n=0)}}{d\omega d\Omega_k d\Omega_f} \sim B_0 \sin^2 2\theta_k$$

$$\frac{d^3\sigma_{(M_n=\pm1)}}{d\omega d\Omega_k d\Omega_f} \sim A_{\pm1}\cos^2\theta_k + B_{\pm1}\cos^2 2\theta_k$$

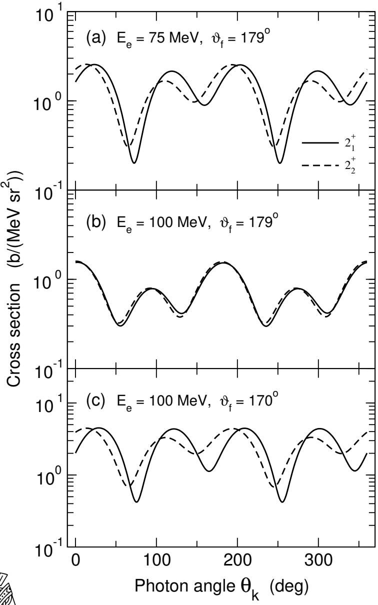
$$\frac{d^3\sigma_{(M_n=\pm2)}}{d\omega d\Omega_k d\Omega_f} \sim A_{\pm2}\sin^2\theta_k + B_{\pm2}\sin^2 2\theta_k$$

$$B_{\pm2} << 1$$

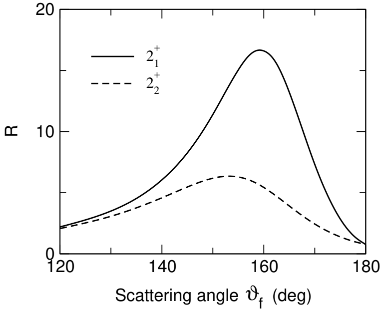


E_e = 75 MeV 2_2^+ state
(a) ϑ_f = 40°
(b) ϑ_f = 179°
DWBA
PWBA
PWBA (Coul)
Cross section (b/(MeV sr^2))
Photon angle θ_k (deg)
10^3
10^1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
0
100
200
300

2_1^+ versus 2_2^+



$$R = \frac{\frac{d^3\sigma}{d\omega d\Omega_k d\Omega_f}(\theta_k{=}110^\circ)}{\frac{d^3\sigma}{d\omega d\Omega_k d\Omega_f}(\theta_k{=}80^\circ)}$$



2_2^+ c.s. is multiplied by F_m factor