Preparatory theoretical work for $(e, e'\gamma)$-coincidence spectroscopy

- “*Electric dipole excitation of ^{208}Pb by polarized electron impact*",
D.H. Jakubassa-Amundsen and V.Yu. Ponomarev,
Eur. Phys. Jour. A 52 (2016) 48

- “*Coincident excitation and radiative decay in electron-nucleus collisions*",
D.H. Jakubassa-Amundsen and V.Yu. Ponomarev,
Phys. Rev. C 95 (2017) 024310

- “*Bremsstrahlung background in inelastic electron-nucleus collisions*",
D.H. Jakubassa-Amundsen and A. Krugmann,
J. Phys. G: Nucl. Part. Phys. 44 (2017) 045103

$(e, e'\gamma)$ project

ANNALS OF PHYSICS 178, 187–226 (1987)

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

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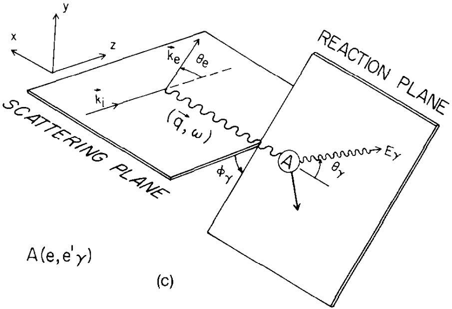


(c)

$$J_{g.s.} \to J_{ex} \to J_{g.s.}$$

$$W_{fi}^{(1)} = i \frac{Z_T c^2}{4\pi\sqrt{\omega}} \frac{\delta(E_f - E_i + \omega)}{\omega - E_x + i\Gamma_n/2}$$

$$\times \sum_{M_n} A_{ni}^{\text{exc}}(M_i, M_n) \cdot A_{fn}^{\text{dec}}(M_n, M_f)$$

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

PWBA:

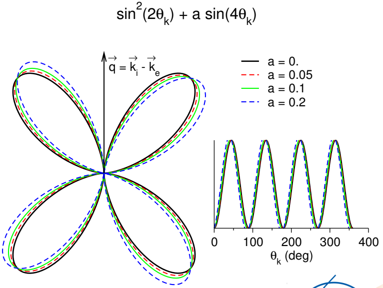
$$\frac{d^3\sigma}{d\omega d\Omega_e d\Omega_\gamma} \sim V_L(\vartheta_f)\,|F_L(q)|^2\, V_L^{J_{ex}}(\theta_k,\phi_k) + V_T(\vartheta_f)\,|F_T(q)|^2\, V_T^{J_{ex}}(\theta_k,\phi_k)$$

$$+V_{LT}(\vartheta_f)\, F_L(q)F_T(q)\, V_{LT}^{J_{ex}}(\theta_k,\phi_k)$$

$$J_f = 0: \quad V_L^{J_{ex}}(\theta_k,\phi_k) = 4\pi|Y_{J_{ex}1}(\theta_k)|^2$$

$$J_{ex} = 2^+: \quad V_L^{J_{ex}}(\theta_k,\phi_k) = sin^2(2\theta_k)$$

$$V_{LT}^{J_{ex}}(\theta_k,\phi_k) = sin(4\theta_k)cos(\phi_k)$$



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

C. N. Papanicolas, S. E. Williamson, H. Rothhaas,[(a)] G. O. Bolme, L. J. Koester, Jr.,
B. L. Miller, R. A. Miskimen, P. E. Mueller, and L. S. Cardman
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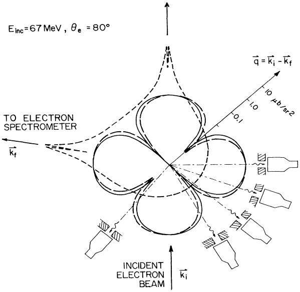
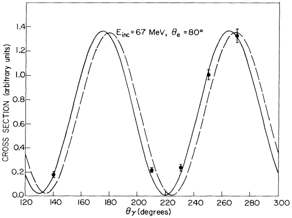
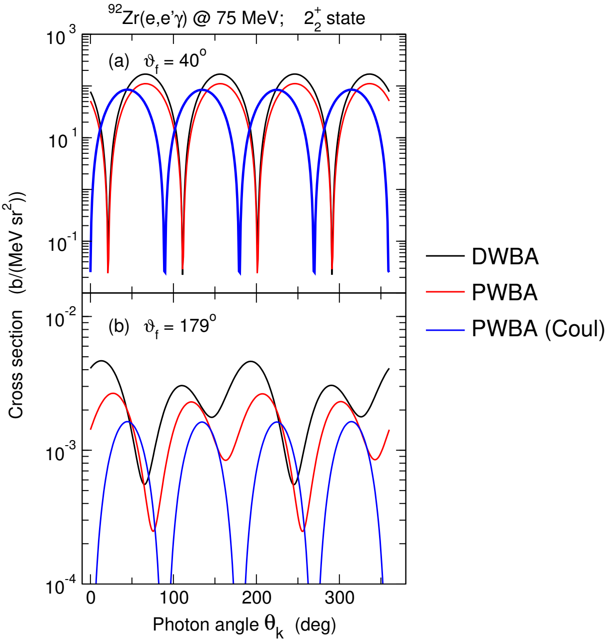
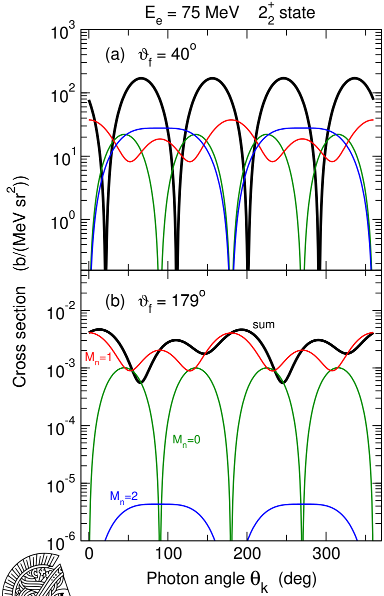
(Received 21 August 1984)






^{92}Zr(e,e'γ) @ 75 MeV; 2_2^+ state
(a) ϑ_f = 40°
(b) ϑ_f = 179°
Cross section (b/(MeV sr^2))
Photon angle θ_k (deg)
DWBA
PWBA
PWBA (Coul)

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



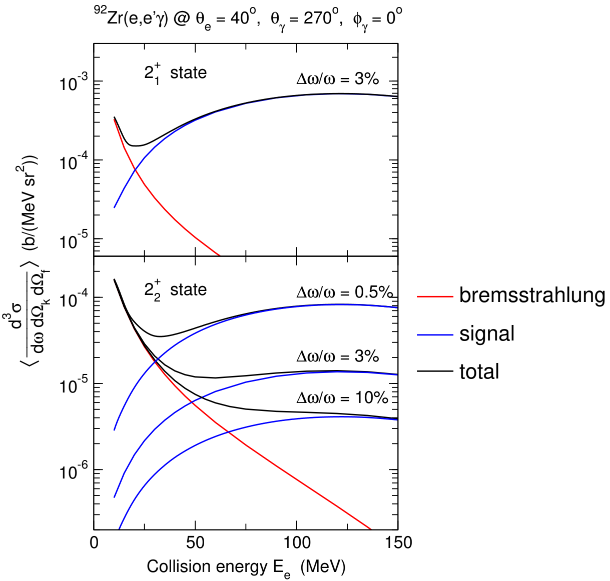
$$\frac{d^3\sigma_{(M_n=0)}}{d\omega d\Omega_k d\Omega_f} \sim B_0 \sin^2 2\theta_k$$

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

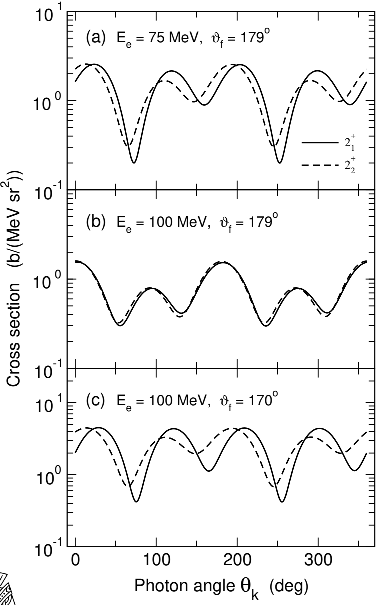
$$\frac{d^3\sigma_{(M_n=\pm2)}}{d\omega d\Omega_k d\Omega_f} \sim A_{\pm2} \sin^2 \theta_k + B_{\pm2} \sin^2 2\theta_k$$

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

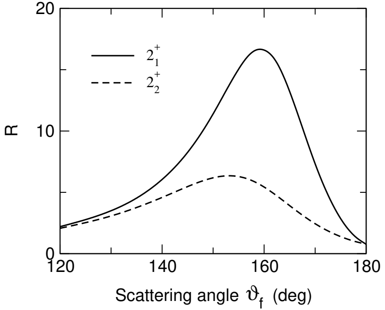
Cross section averaged over the detector resolution $\Delta\omega/\omega$



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