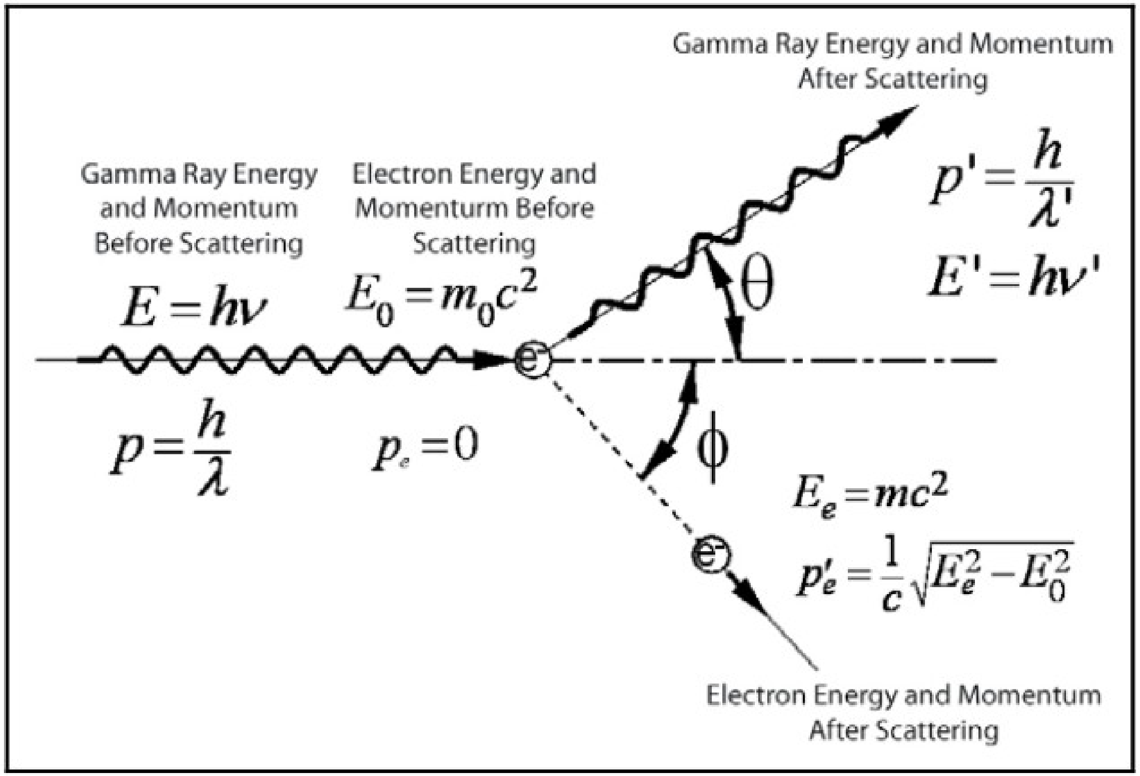
Efecto Compton



$$h\nu' = h\nu \frac{1}{1 + \varepsilon(1 - \cos\theta)} \qquad \varepsilon = h\nu / m_e c^2$$

$$m_e c^2 = 0.511\, MeV$$

Energía transferida al electrón

$$E_K = h\nu - h\nu' = h\nu \frac{\varepsilon(1 - \cos\theta)}{1 + \varepsilon(1 - \cos\theta)}$$

Fórmula de Klein-Nishina

$$\frac{d_e\sigma_c^{KN}}{d\Omega} = \frac{r_e^2}{2}(1+\cos^2\theta)\,F_{KN}$$

$$F_{KN} = \frac{1}{[1+\varepsilon(1-\cos\theta)]^2}\left\{1+\frac{\varepsilon^2(1-\cos\theta)^2}{[1+\varepsilon(1-\cos\theta)](1+\cos^2\theta)}\right\}$$

$$\sigma_c(E) = \pi Z r_e^2 \lambda \left[(1-2\lambda-2\lambda^2)\ln\left(1+\frac{2}{\lambda}\right)+\frac{2(1+9\lambda+8\lambda^2+2\lambda^3)}{(\lambda+2)^2}\right]$$

$$\lambda \equiv m_e c^2/E$$

$$r_e = \frac{e^2}{4\pi\epsilon_o m_e c^2}$$

Radio clásico del electrón

Fotón dispersado

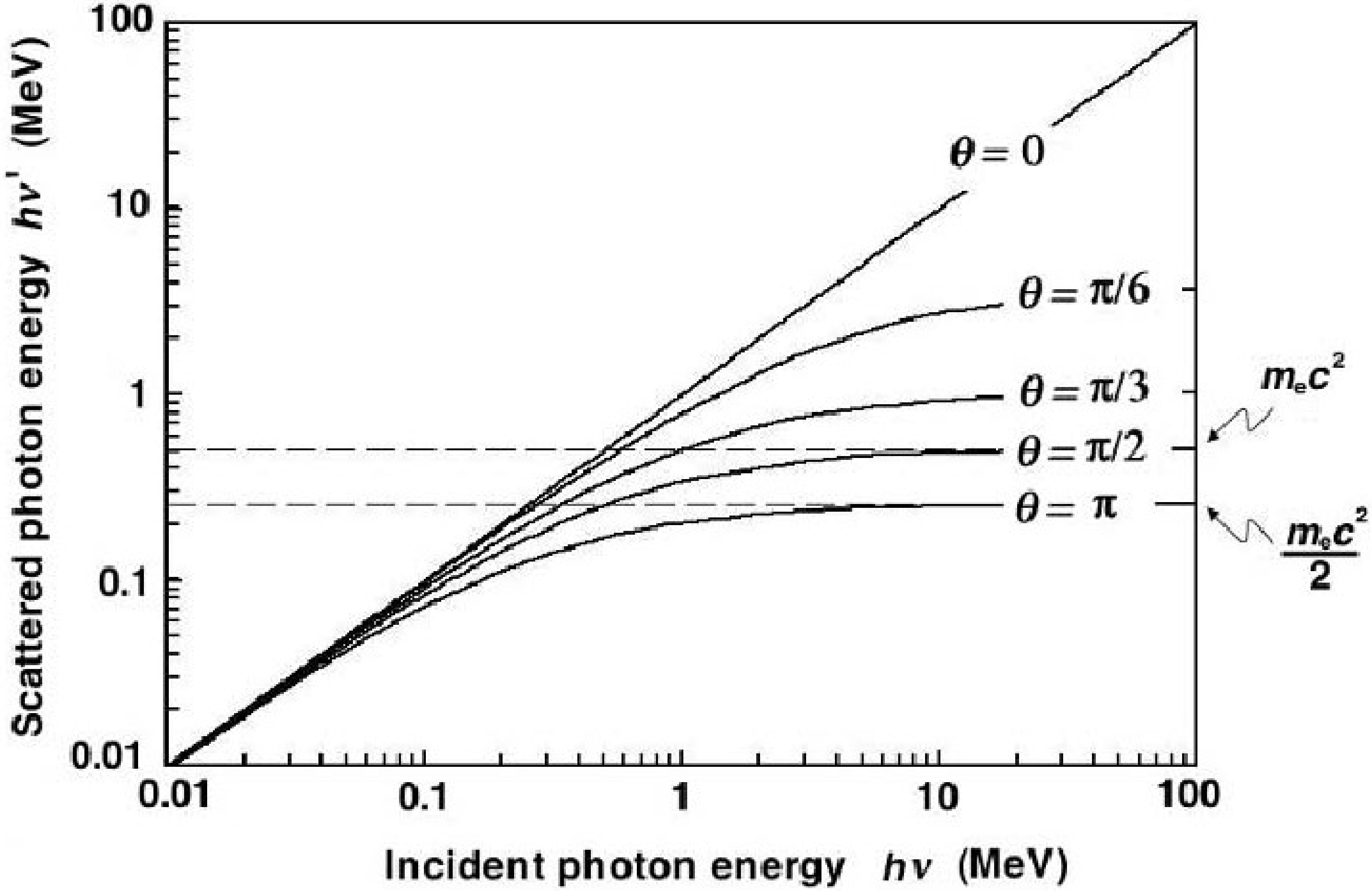


Fig. 7.7. Scattered photon energy $h\nu'$ against the incident photon energy $h\nu$ for various scattering angles θ in the range from 0° to180°

Electrón dispersado

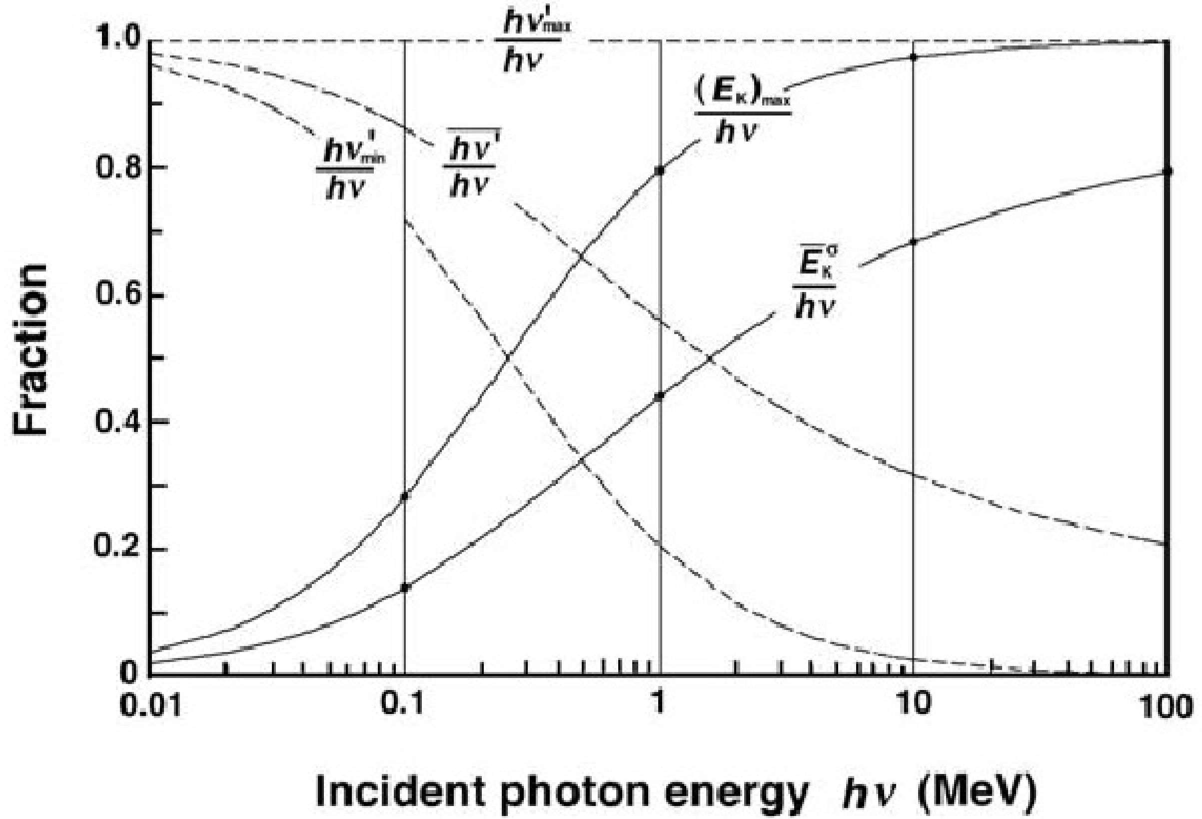


Fig. 7.8. Fraction of incident photon energy $h\nu$ transferred in Compton effect to:

- Maximum energy of recoil electron: $(E_\mathrm{K})_\mathrm{max}/(h\nu)$; $\theta = \pi$ [see (7.30)]
- Mean energy of recoil electron: $\overline{E}_\mathrm{K}^\sigma/(h\nu)$ [see (7.54 below)]
- Maximum energy of scattered photon: $h\nu'_\mathrm{max}/(h\nu)$; $\theta = 0°$ [see (7.33)]
- Mean energy of the scattered photon: $\overline{h\nu'}/(h\nu)$ [see (7.34)]
- Minimum energy of the scattered photon: $h\nu'_\mathrm{min}/(h\nu)$; $\theta = \pi$ [see (7.35)]

Factor de forma

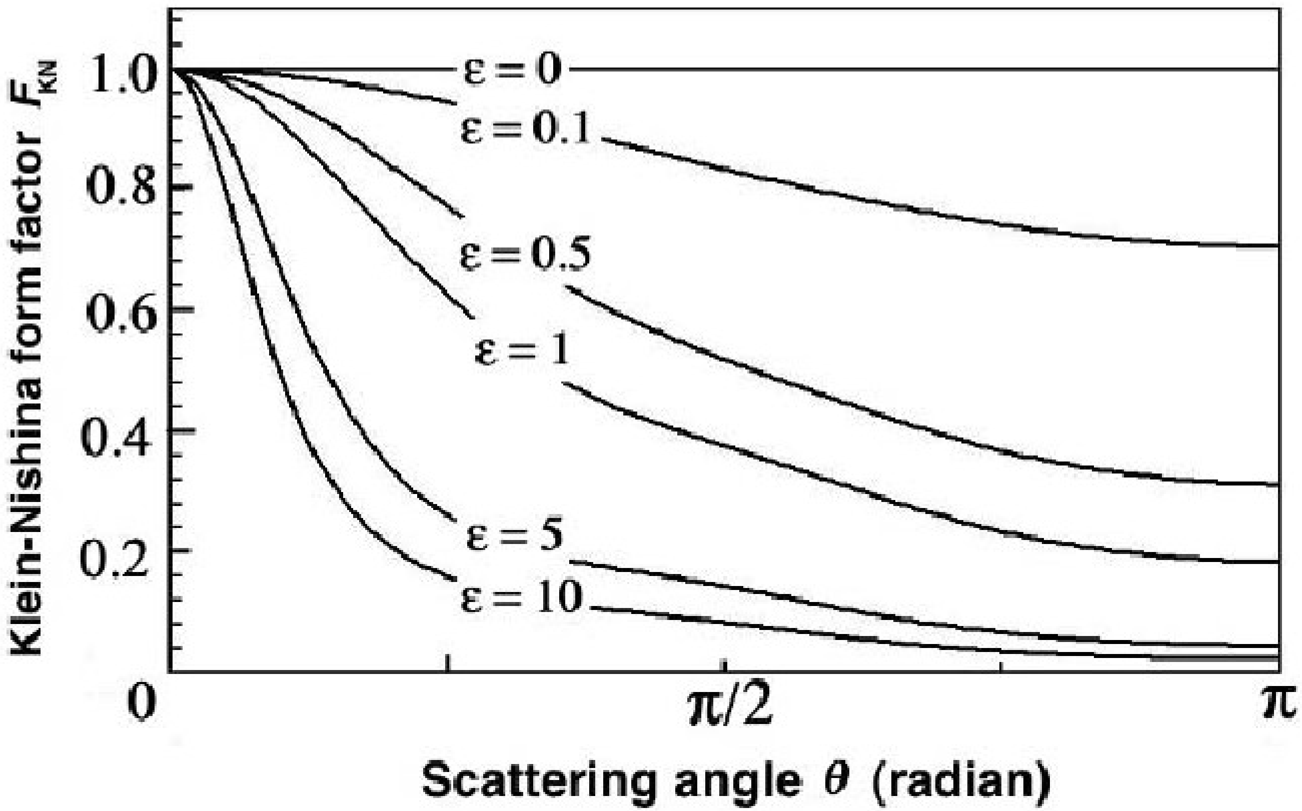


Fig. 7.9. Atomic form factor for Compton effect F_{KN} against scattering angle θ

Fórmula de Klein-Nishina

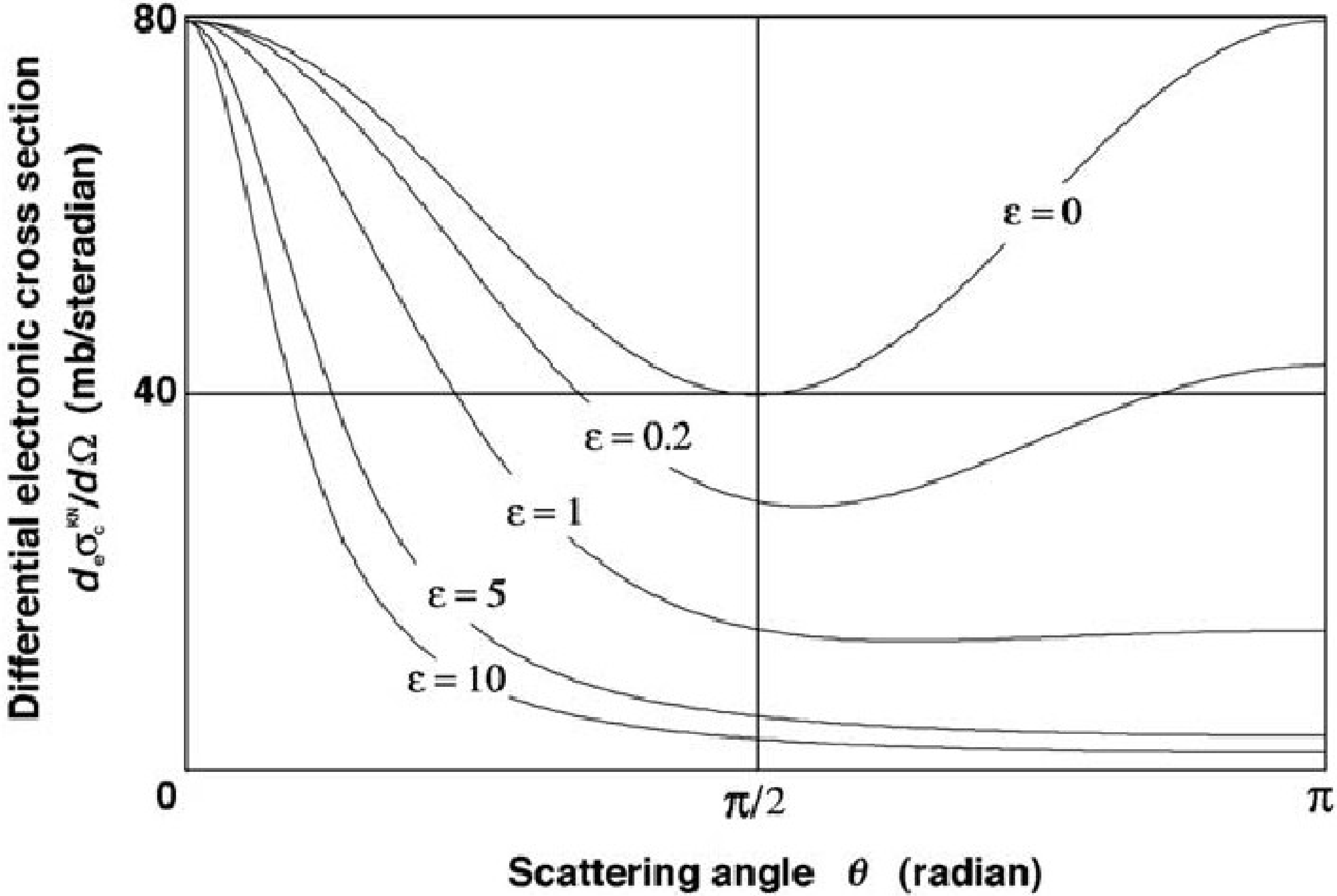


Fig. 7.10. Differential electronic cross section for Compton effect $d_e\sigma_c^{KN}/d\Omega$ against scattering angle θ for various values of $\varepsilon = h\nu/(m_e c^2)$, as given by (7.36). The differential electronic cross section for Compton effect $d_e\sigma_c^{KN}/d\Omega$ for $\varepsilon = 0$ is equal to the differential electronic cross section for Thomson scattering $d_e\sigma_{Th}/d\Omega$ (see Fig. 7.2)

Fórmula de KN en polares

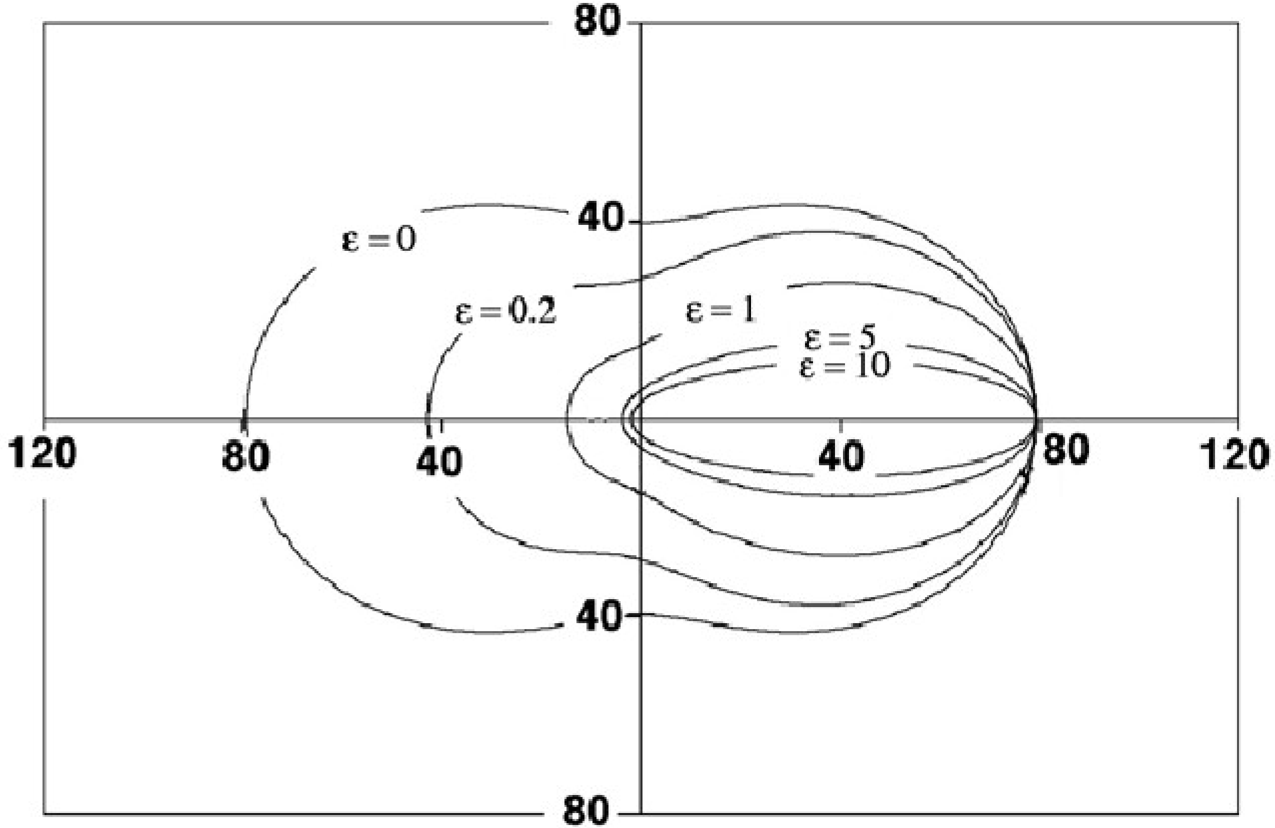


Fig. 7.11. Polar representation of the angular dependence of the differential electronic cross section $d_e\sigma_c^{KN}/d\Omega$ for Compton scattering, as given by (7.36) and plotted for various values of $\varepsilon = h\nu/(m_e c^2)$. The differential electronic cross section for Compton effect $d_e\sigma_c^{KN}/d\Omega$ for $\varepsilon = 0$ is equal to the differential electronic cross section for Thomson scattering $d_e\sigma_{Th}/d\Omega$ (see Fig. 7.3)

Distribución de energías de los electrones Compton

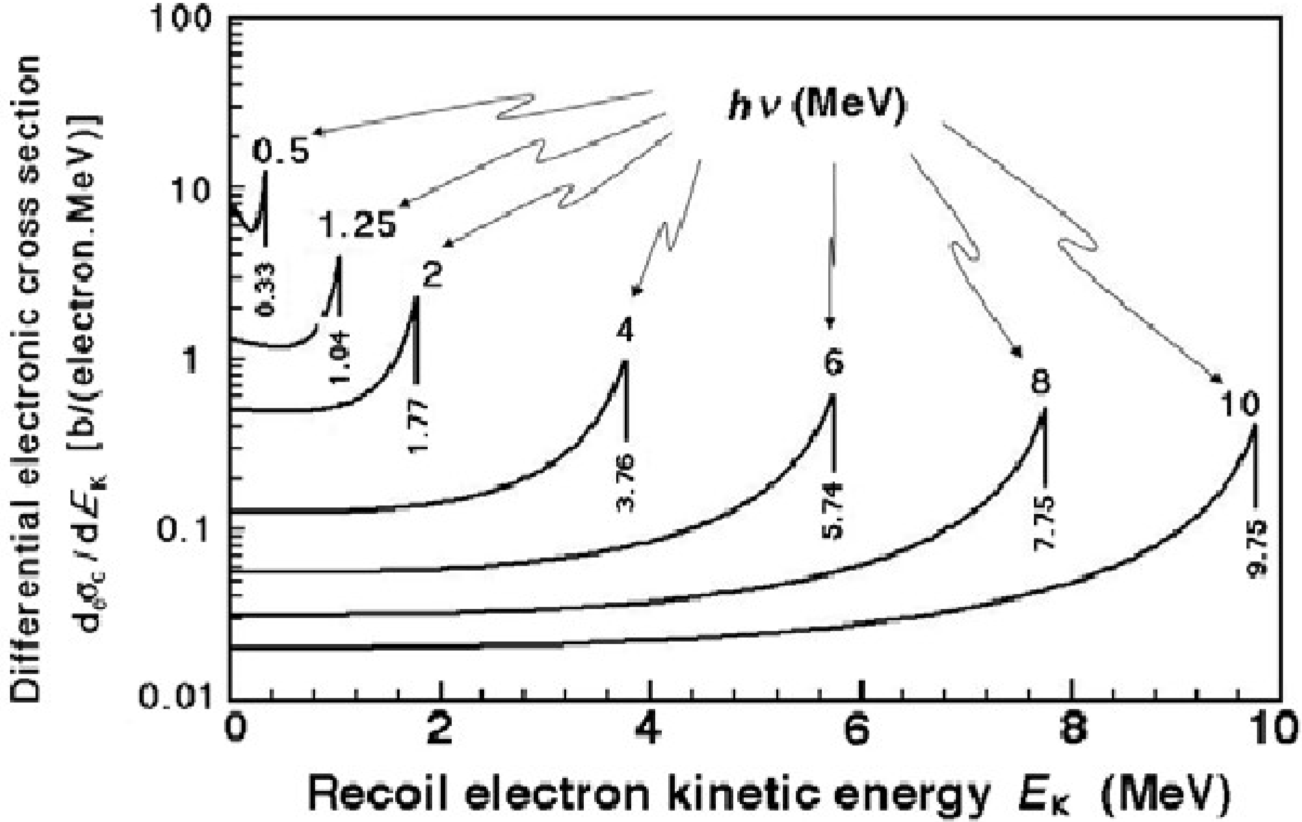


Fig. 7.12. Differential electronic Klein-Nishina cross section per unit kinetic energy $d_e\sigma_c^{KN}/dE_K$ calculated from (7.43) and plotted against the kinetic energy of the Compton recoil electron E_K for various incident photon energies $h\nu$. For a given photon energy the maximum kinetic energy of the recoil electron, calculated from (7.44), is indicated on the graph

Seccion eficaz total KN

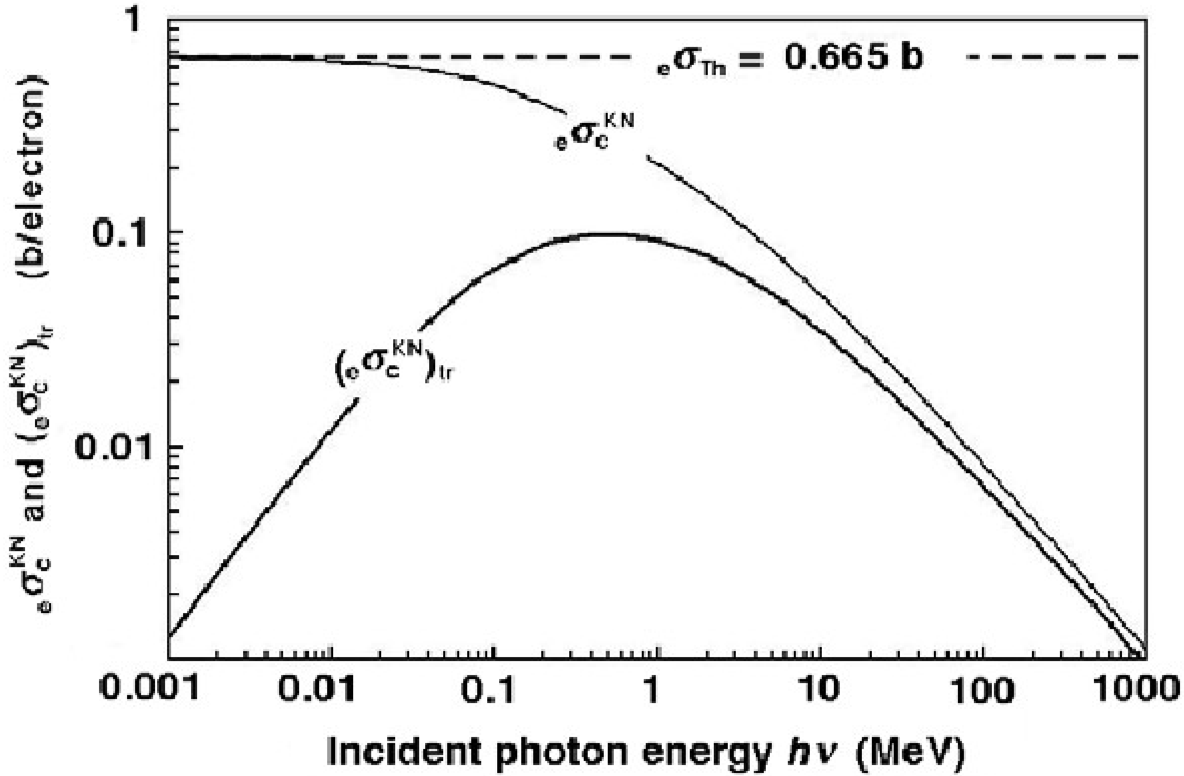


Fig. 7.13. Compton electronic cross section $_e\sigma_c^{KN}$ and electronic energy transfer cross section $(_e\sigma_c^{KN})_{tr}$ for a free electron against incident photon energy $h\nu$ in the energy range from 0.001 MeV to 1000 MeV, determined from Klein-Nishina Eqs. (7.45) and (7.51), respectively. For very low photon energies $_e\sigma_c^{KN} = {_e\sigma_{Th}} = 0.665$ b

Efectos de ligadura

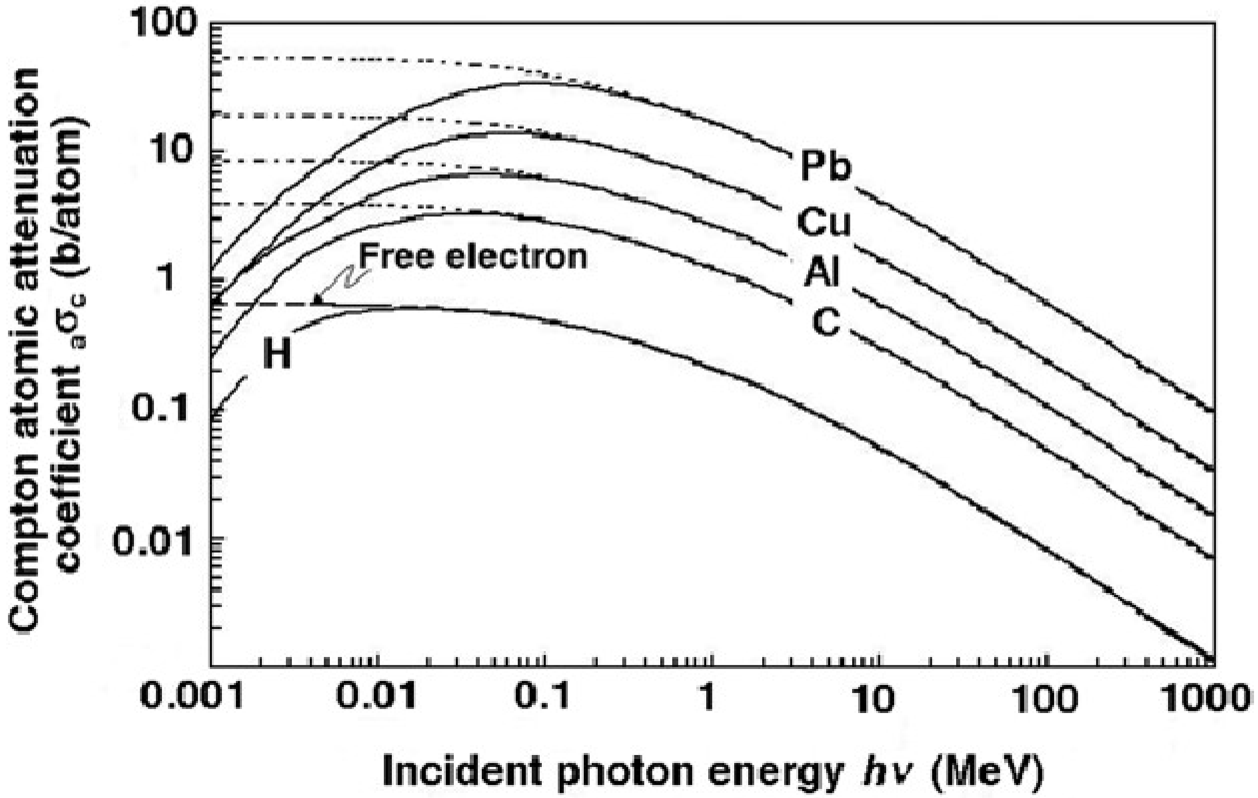


Fig. 7.14. Compton atomic cross sections $_a\sigma_c$ plotted against incident photon energy $h\nu$ for various absorbers, ranging from hydrogen to lead. The *dotted curves* represent $_a\sigma_c^{KN}$ data calculated with Klein-Nishina free-electron relationships; the *solid curves* represent the $_a\sigma_c$ data that incorporate the binding effects of the orbital electrons. The *dashed curve* represents the Klein-Nishina free electron coefficients $_e\sigma_c^{KN}$ for the Compton effect