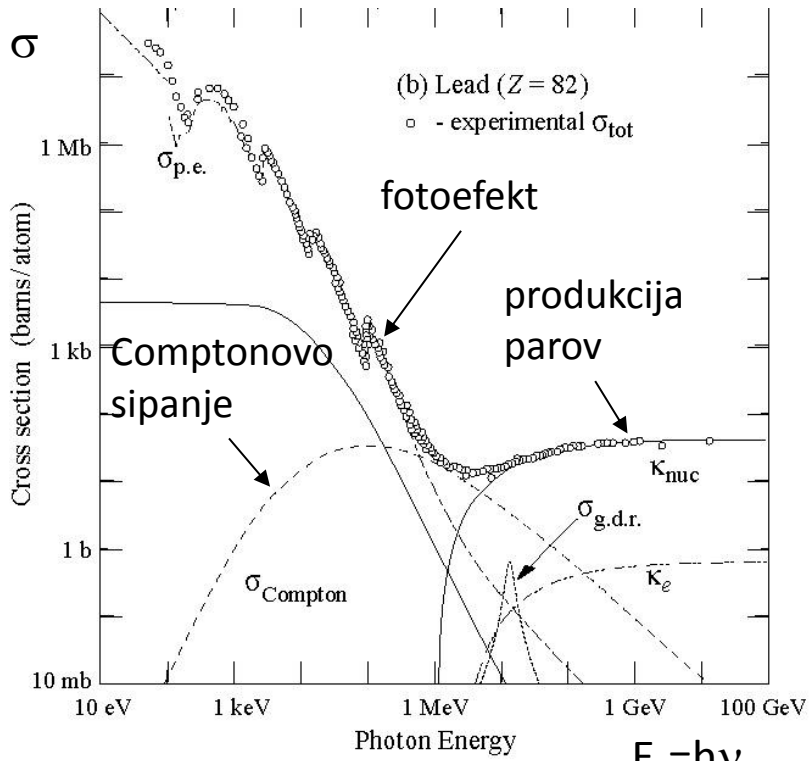
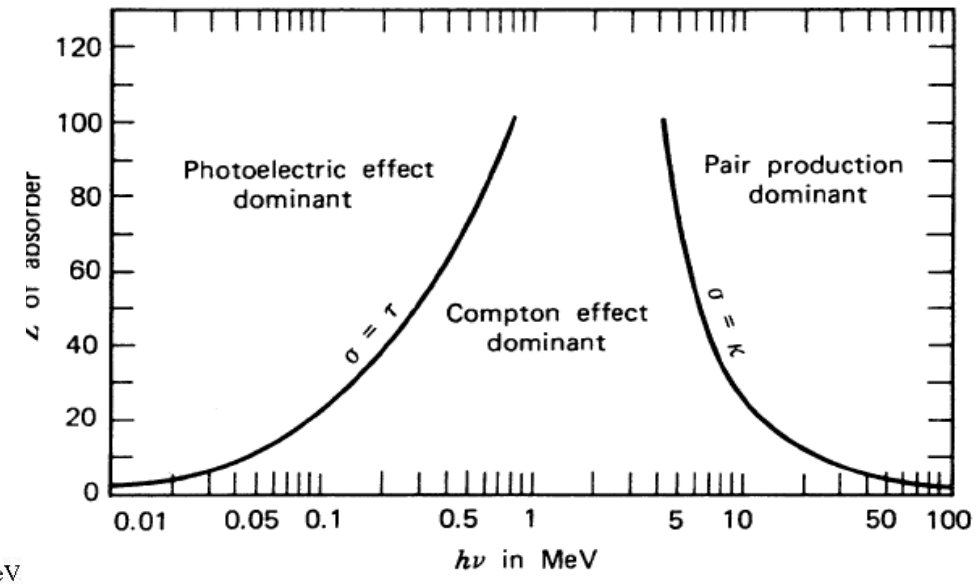
Interkacija fotonov s snovjo

$w = \sigma \, dN_e/dS$

posamezni procesi prevladujoči v določenem energijskem intervalu

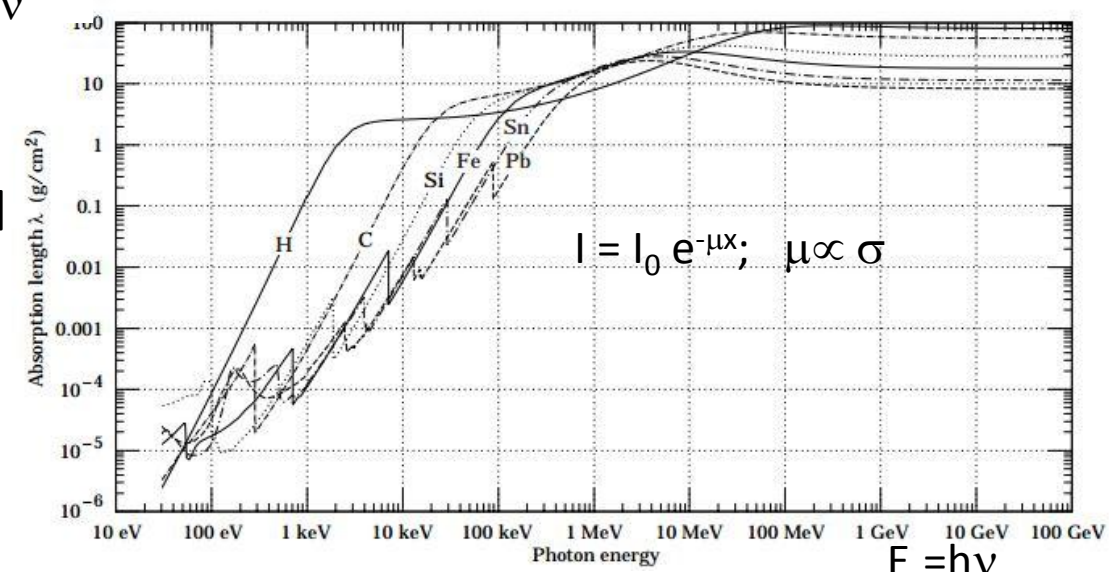


$E_\gamma = h\nu$



(from Knoll)

μ/ρ [g/cm²]



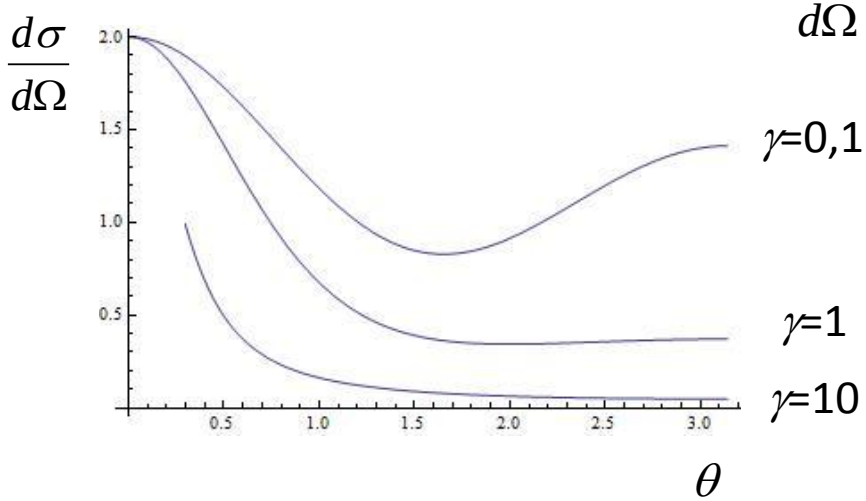
$I = I_0 \, e^{-\mu x}; \quad \mu \propto \sigma$

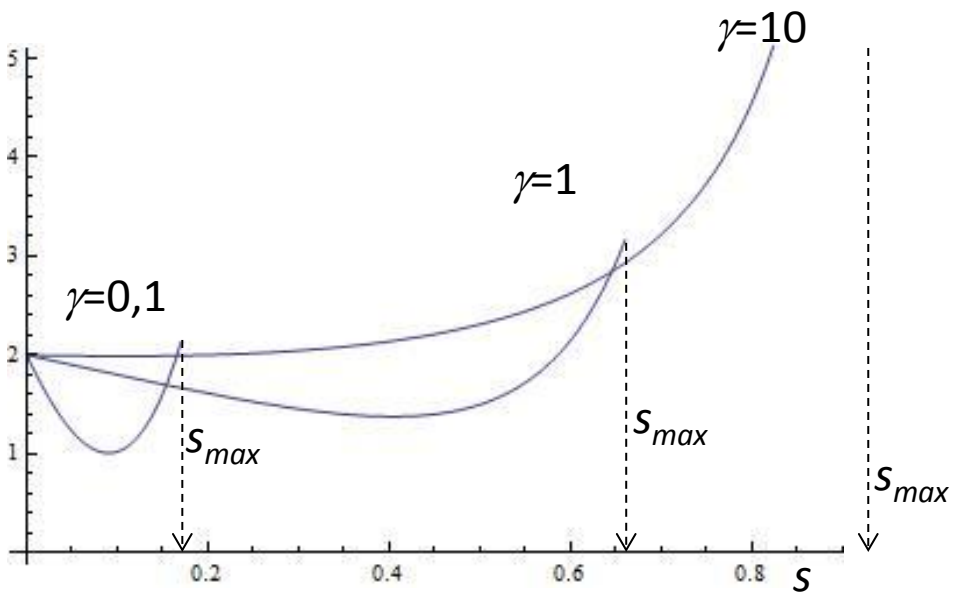
$E_\gamma = h\nu$

Comptonovo sipanje

$$\frac{d\sigma}{d\Omega} = \frac{r_e^2}{2}\frac{1}{\left[1+\gamma(1-\cos\theta)\right]^2}\cdot\left[1+\cos^2\theta+\frac{\gamma^2(1-\cos\theta)^2}{1+\gamma(1-\cos\theta)}\right]$$

$$\gamma = \frac{h\nu}{mc^2}$$

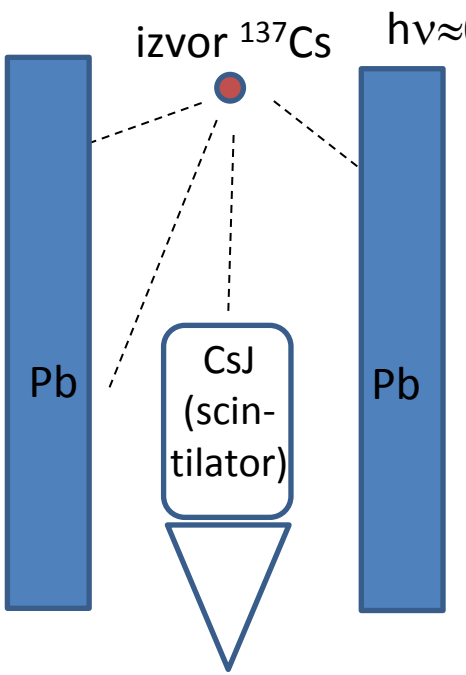


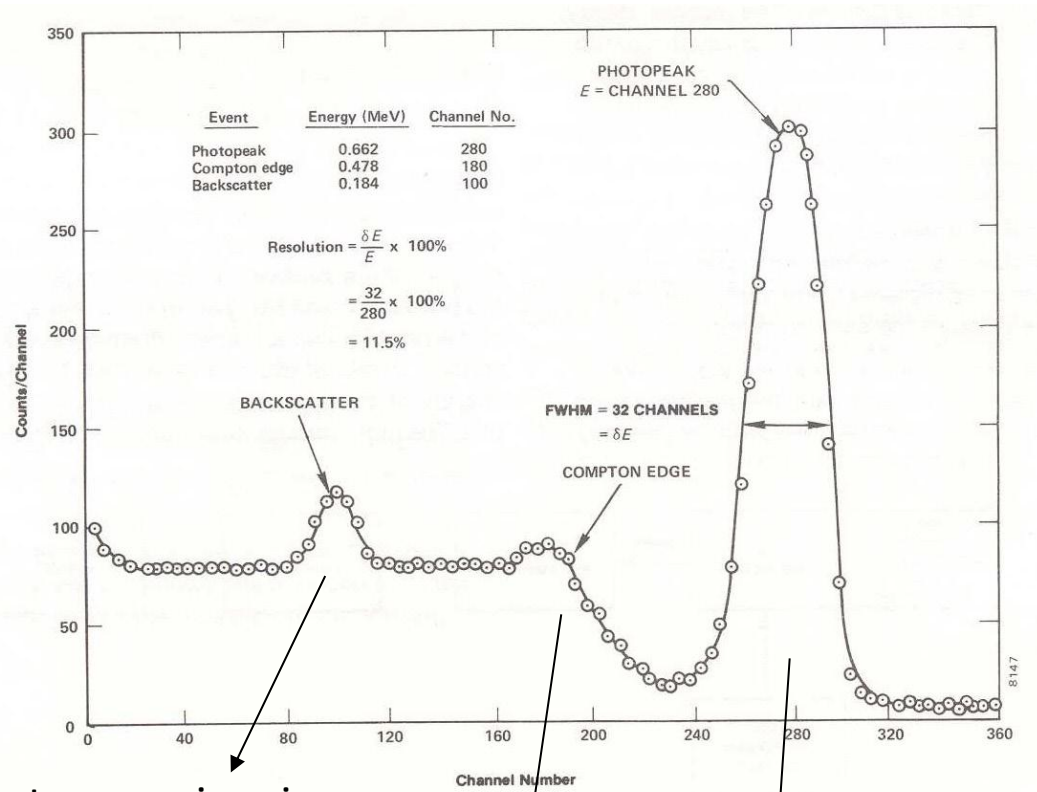


$$\frac{d\sigma}{ds} = \frac{\pi r_e^2}{mc^2\gamma^2}\cdot\left[2+\frac{s^2}{\gamma^2(1-s)^2}+\frac{s}{1-s}\left(s-\frac{2}{\gamma}\right)\right]$$

$$s = \frac{T}{h\nu}, \quad s_{\max} = \frac{2\gamma}{1+2\gamma}$$

Comptonovo sipanje





detektiramo energijo nabitih delcev, ki jih povzročijo fotoni

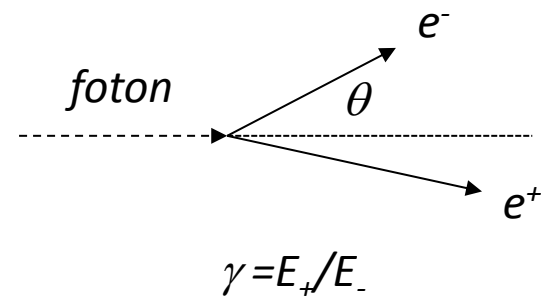
Comptonovo sipanje
(povratno sipanje)
$h\nu' = h\nu/(1+\gamma(1-\cos\theta))$
$\theta = 180^o$
$h\nu' = 0.18$ MeV

Comptonovo sipanje
(Comptonski rob)
$T_{max} = h\nu\ 2\gamma/(1+2\gamma)$; $\gamma = h\nu/m_e c^2$
$T_{max} = 0{,}48$ MeV

fotoefekt
$T_e = h\nu - W_{vez} \approx 0.66$ MeV

produkcija parov

$$\frac{d\sigma}{d\theta} = \ln\left[\frac{2h\nu}{m_e c^2}\right] f_1(\theta) + f_2(\theta)$$



$$f_1(\theta) = \frac{\cos^2(\theta/2)}{\sin^4(\theta/2)}$$

$$f_2(\theta) = (1+\gamma^2)\ln\left[\frac{\gamma}{(1+\gamma)^2}\right]\frac{\cos^2(\theta/2)}{\sin^4(\theta/2)} + \frac{\gamma(5-2\gamma)}{4\sin^4(\theta/2)} +$$

$$+\frac{\gamma^2 - 2\ln(1+\gamma)}{\sin^2(\theta/2)} + \frac{\gamma^2}{8\sin^6(\theta/2)}\left[\frac{\gamma}{\gamma^2 + 4(1+\gamma)\sin^2(\theta/2)}\left(2\sin^2(\theta/2)+\gamma\right) - 1\right] +$$

$$+\ln\left[\frac{\sqrt{\gamma^2 + 4(1+\gamma)\sin^2(\theta/2)} + \gamma}{\sqrt{\gamma^2 + 4(1+\gamma)\sin^2(\theta/2)} - \gamma}\right]\frac{(1+\gamma)\left(3\left(\gamma^2 + 4(1+\gamma)\sin^2(\theta/2)\right) - \gamma(2+\gamma)\right)}{2\left(\gamma^2 + 4(1+\gamma)\sin^2(\theta/2)\right)^{3/2}\sin^2(\theta/2)}$$