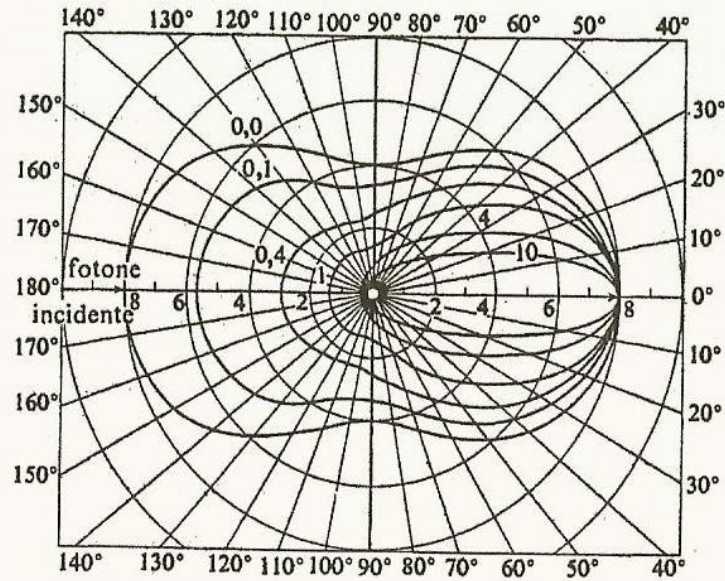# Photon interaction with matter

Fig 13.3 distribuzione angolare nell'effetto Compton

$$\alpha = \frac{E_\gamma}{m_e c^2}$$

$\alpha = 0$

(Thomson)
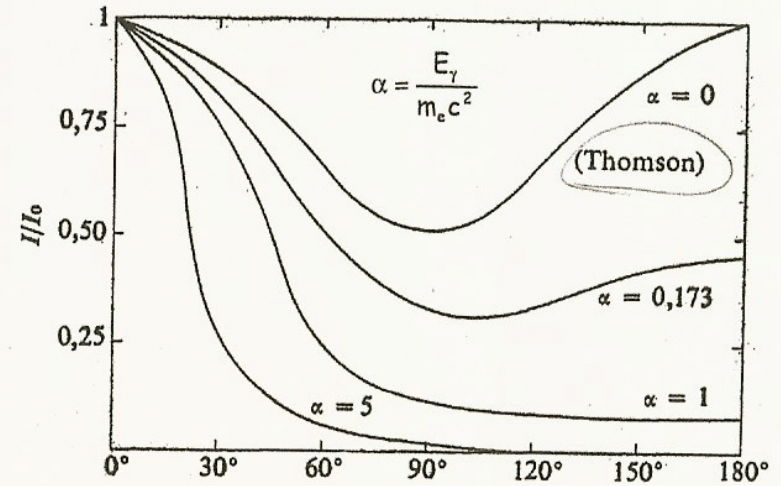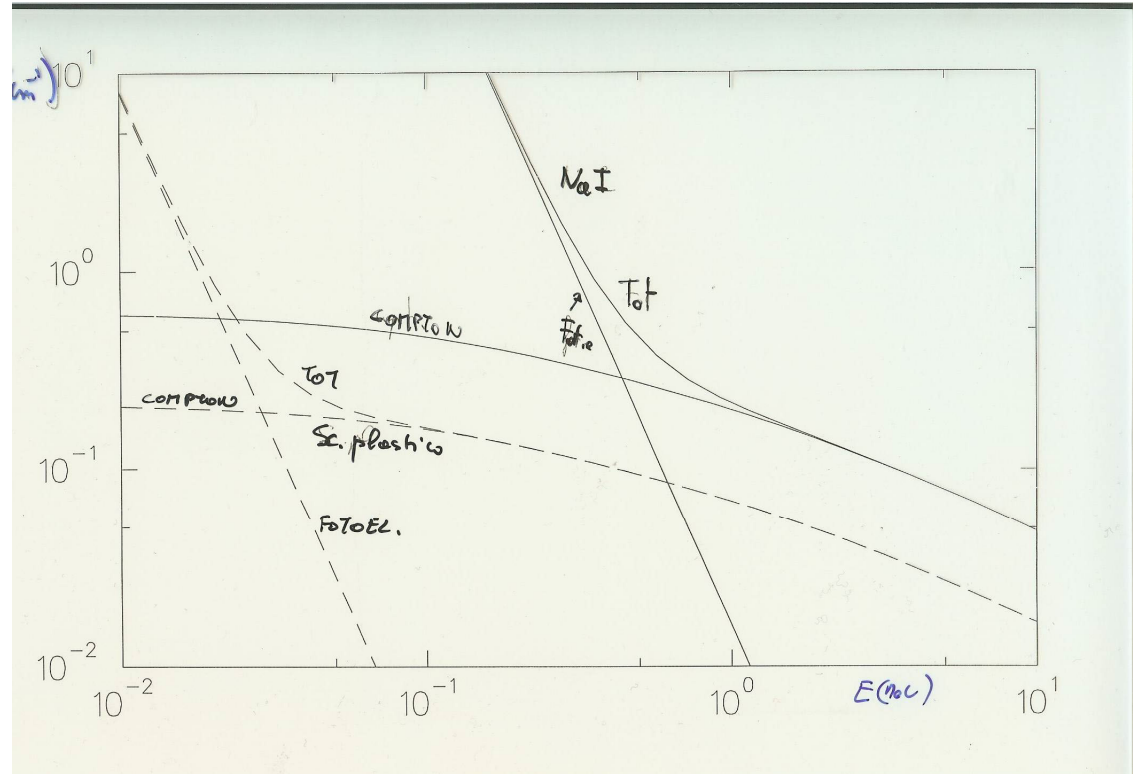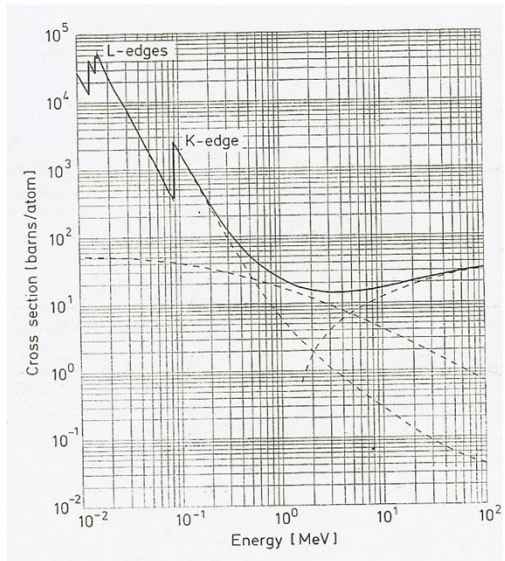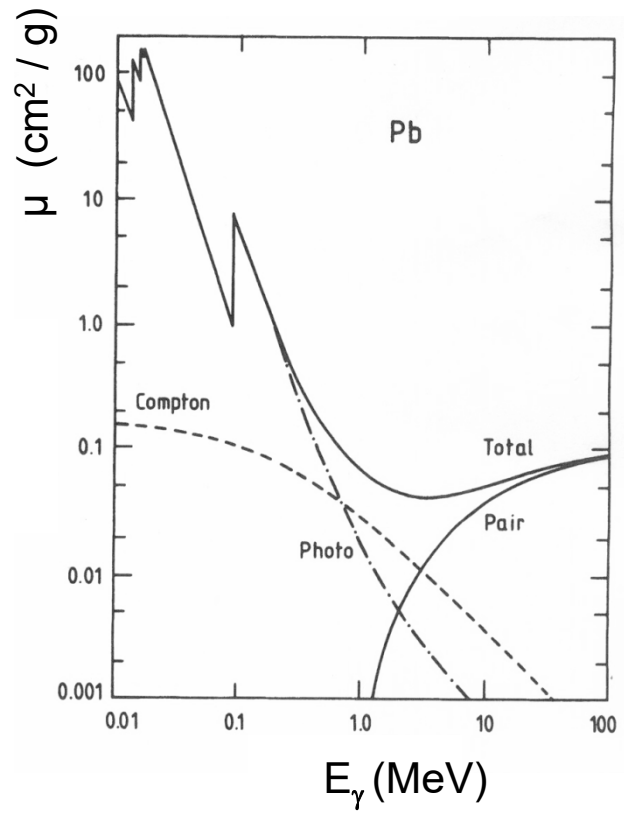
$\alpha = 0,173$

$\alpha = 5$

$\alpha = 1$

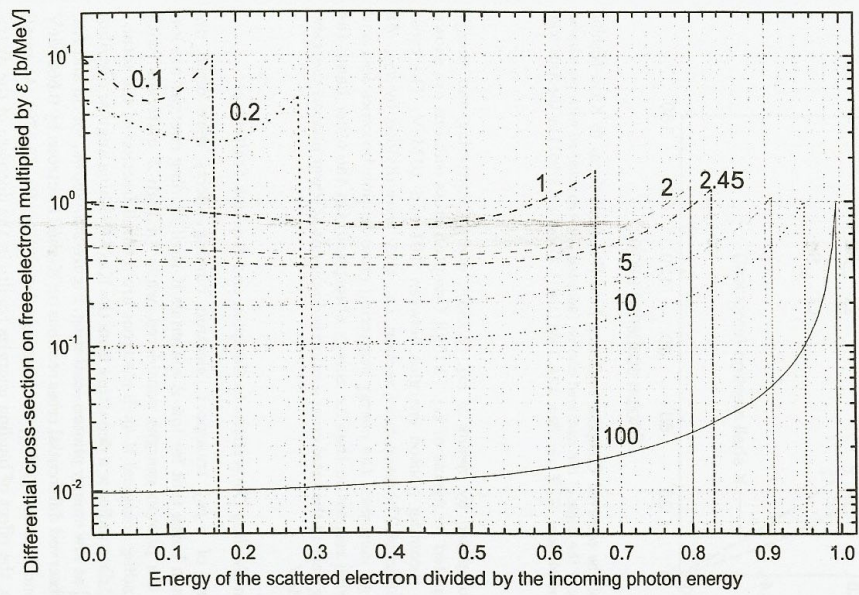Fig 13.4 sezione d'urto Compton in funzione di energia ed angolo di diffusione

Top-left figure (Pb attenuation):

μ (cm² / g)

Pb

100

10

1.0

0.1

0.01

0.001

Compton

Total

Photo

Pair

0.01   0.1   1.0   10   100

E_γ (MeV)

Bottom-left figure:

10^5

10^4

10^3

10^2

10^1

10^0

10^{-1}

10^{-2}

L-edges

K-edge

Cross section [barns/atom]

10^{-2} 10^{-1} 10^0 10^1 10^2

Energy [MeV]

Right figure:

10^1

10^0

10^{-1}

10^{-2}

NaI

Tot

Compton

Fotoe.

Tot

Compton

Sc. plastico

FOTOEL.

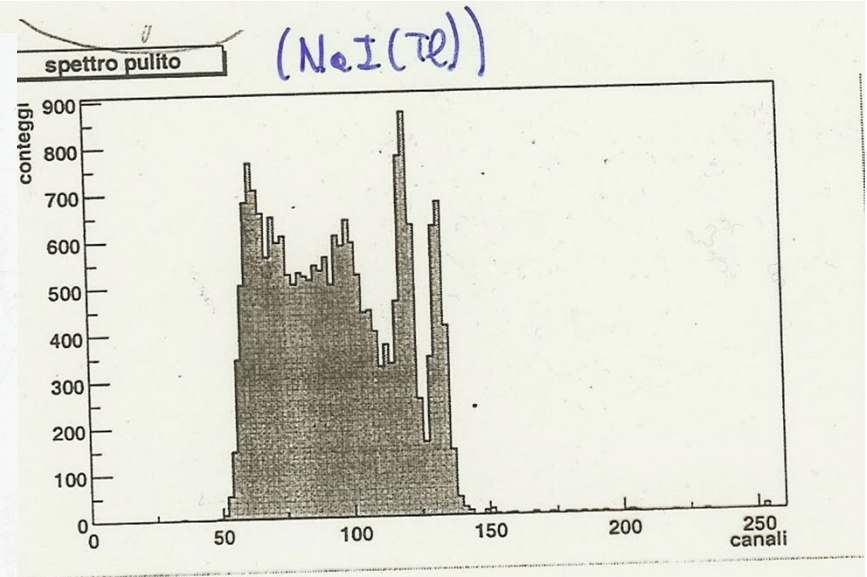10^{-2} 10^{-1} 10^0 10^1

E(MeV)

Fig. 2.55 Compton differential cross-sections on a free electron [Eq. (2.185)] multiplied by $\mathcal{E}$ as a function of the kinetic energy divided by the incoming photon energy [η_e, see Eq. (2.184)]. The curves are for $\mathcal{E} = 0.1, 0.2, 1, 2, 2.45$ (i.e., it corresponds to the average energy of photons from a ^{60}Co source), 5.10 and 100.

spettro pulito

(NaI(Tl))

adc plastico
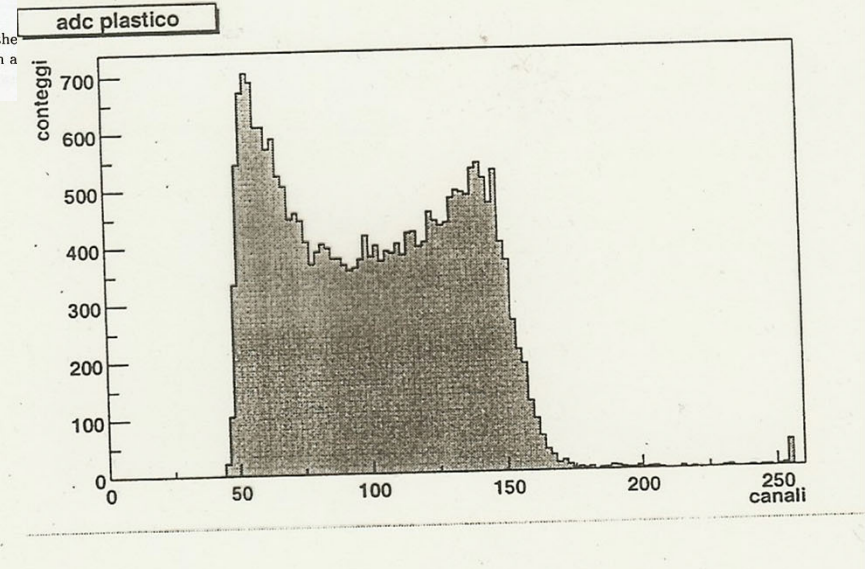
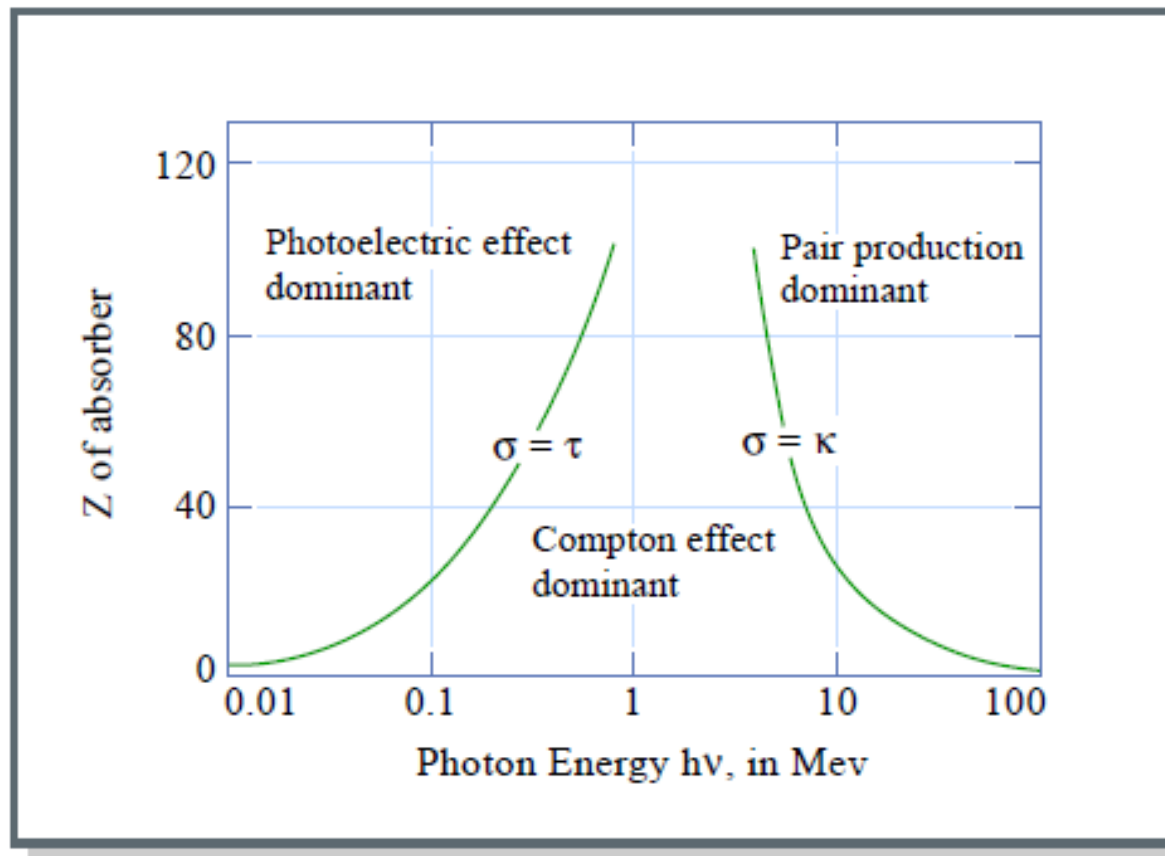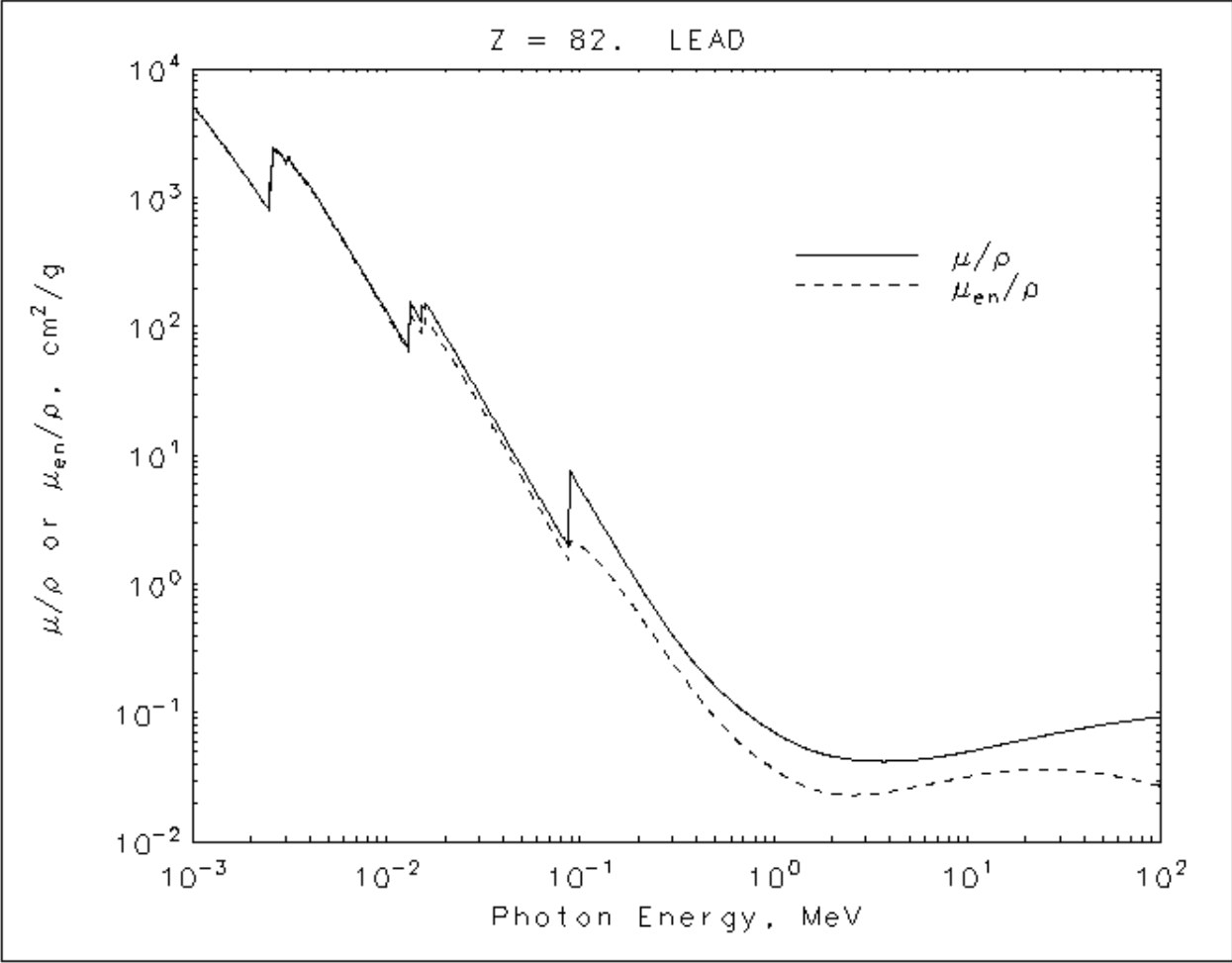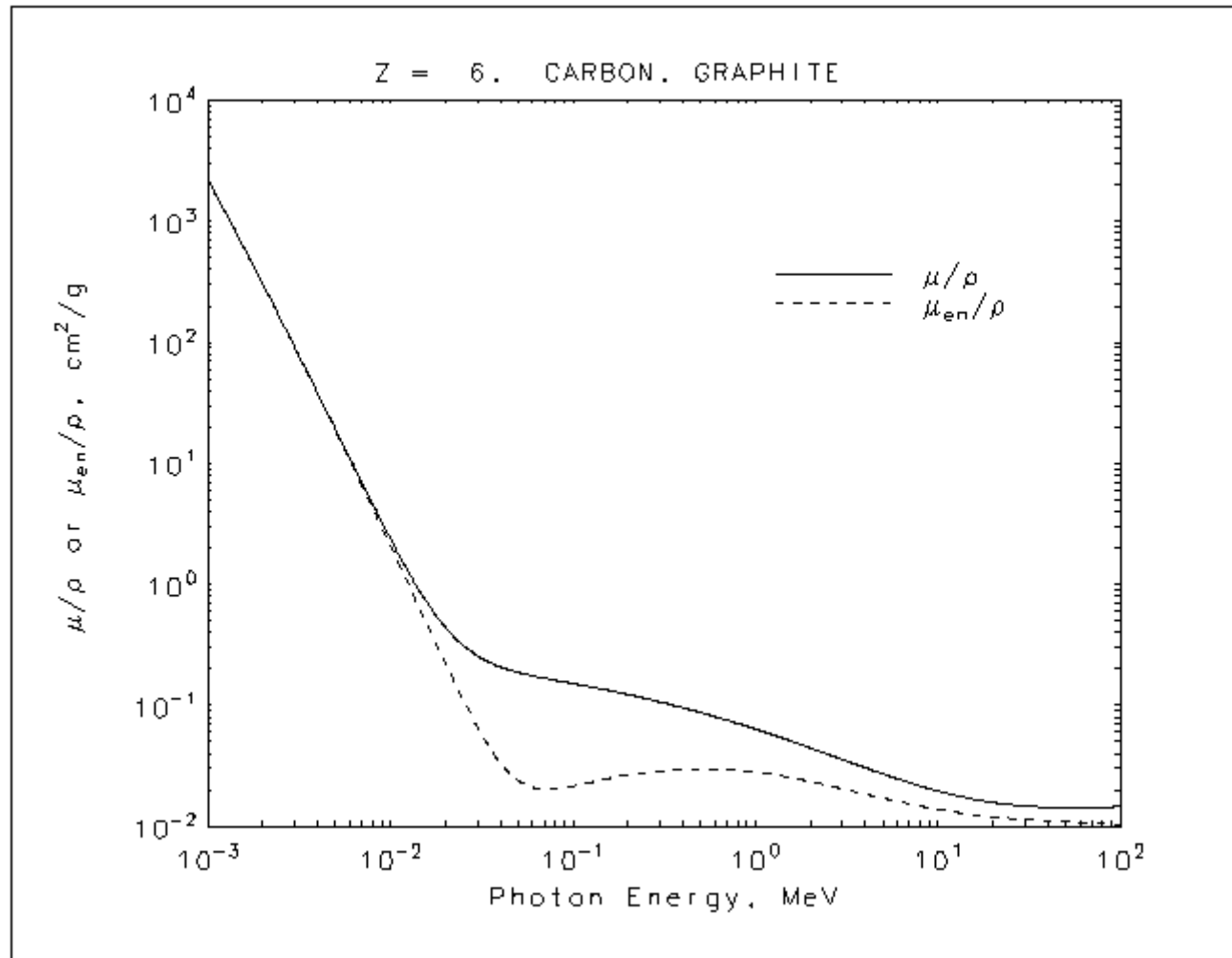| Photon Energy, 5.11 keV	Photon Energy, 5.11 MeV
$\alpha = \dfrac{5.11 \text{ keV}}{0.511 \text{ MeV}} = 0.010$	$\alpha = \dfrac{5.11 \text{ MeV}}{0.511 \text{ MeV}} = 10$
$E_{e(max)} = 5.11 \text{ keV} * \left(2 * \dfrac{0.01}{1.02} \right)$ $= 0.10 \text{ keV}$	$E_{e(max)} = 5.11 \text{ MeV} * \left(2 * \dfrac{10}{21} \right)$ $= 4.87 \text{ MeV}$
$hv' \text{ (min)} = 5.11 \text{ keV} * \dfrac{1}{1.02}$ $= 5.01 \text{ keV}$	$hv' \text{ (min)} = 5.11 \text{ MeV} * \dfrac{1}{21}$ $= 0.24 \text{ MeV}$
Energy transferred: 2%	Energy transferred: 95%

Figure by MIT OCW.

Figure by MIT OCW.

Photon linear absorption coefficent

Photon linear attenuation coefficent