

Photon Cross Sections on the Web

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INTRODUCTION

Photon interaction cross section data are required for many radiological physics and engineering applications such as radiation measurement or radiation protection. For the applications a program called XCOM, Photon Cross Sections on a Personal Computer, was developed by Berger and Hubbell in 1987. The XCOM is excellent covering a wide range of energies from 1 keV to 100 GeV in any element of atomic number $Z = 1$ to 100, compound or mixture; however, XCOM runs on only IBM-compatible personal computers. Our objective is to extend the usage of the XCOM program accessible from the Internet 24 hours a day anywhere using the Web browser.

METHOD

Our Internet server system is composed of a common hardware and software as follows: machine: "intel pentium" processor (100MHz) PC; operating system: "Linux 2.0.36"; internet domain name server: "bind-4.9.7-REL."; world wide web server: "apache 1.3.6"; compiler: "GNU FORTRAN 77 and GNU c 2.7.23".

All free software were installed on a commercially and easily available, inexpensive, IBM PC/AT compatible machine to make DNS and WWW servers. A new extended program, called eXcom, based on XCOM version 1.2 has been developed by FORTRAN and c compilers on the PC UNIX platform.

RESULTS AND DISCUSSION

The opening menu of our eXcom, Photon Cross Sections on our Web page, shown in Fig. 1 indicates a brief explanation for the function of the program and the instruction manual. To confirm whether the eXcom and the Internet server system is correct, we compared the data obtained from the system using a remote Web client with the data of ICRU Report 46 "Photon, Electron, Proton and Neutron Interaction Data for Body Tissues" (1992). The results of comparison for an adult mandible which contained nine elements appeared to be consistent with interaction data for coherent and incoherent scattering, photoelectric absorption and pair production, and total attenuation at energies from 10 keV to 100 MeV in ICRU Report 44.

CONCLUSION

In applications of medical physics, our system provides photon interaction cross section data available to Internet Web browsers for all substances contained in elements from $Z = 1$ to 100 at any given energy from 1 keV to 100 GeV.

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eXcom: Photon Cross Sections on the Web

Welcome to our *eXcom*, Photon Cross Sections on our Web page! On this page you can calculate data of photon cross sections for coherent and incoherent scattering, photoelectric absorption and pair production, total attenuation with and without coherent scattering in any element of atomic number $Z = 1$ to 100, compound or mixture, at energies from 1 keV to 100 GeV using the same database and interpolation algorithm as the *XCOM* version 1.2 by Berger and Hubbell (1987).

In the following form, please input [A. Substance Name] for your memo, [B. Additional Energy (MeV)] only when you want to calculate at standard energy grid (spaced approximately logarithmically) plus additional energy (if you leave this box blank, the *eXcom* program returns results calculated at standard energy grid as default), and [C. Element] where you can select all that apply or at least one, and set with [D. Weight Fraction], and then click the button [Submit Query]; if you change your mind use [Reset] and try again.

For an example of an input form

```
A.Substance Name: |Water, ICRU Report 44 |
B.Additional Energy (MeV): |0.661660 |^|
                        |1.173238 |:|
                        |1.332502 |:|
                        | |v|
C.Element(s):      D.Weight Fraction: C.Element(s):      D.Weight Fraction:
[x] 1 H Hydrogen  |0.112 | [ ] 51 Sb Antimony | |
[ ] 2 He Helium   | | [ ] 52 Te Tellurium| |
.....
[x] 8 O Oxygen    |0.888 | [ ] 58 Ce Cerium   | |
.....
[Submit Query] [Reset]
```

Form to calculate photon cross section data

A. Substance Name:

B. Additional Energy (MeV):

C. Element(s):	D. Weight Fraction:	C. Element(s):	D. Weight Fraction:
<input type="checkbox"/> 1 H Hydrogen	<input type="text"/>	<input type="checkbox"/> 51 Sb Antimony	<input type="text"/>
<input type="checkbox"/> 2 He Helium	<input type="text"/>	<input type="checkbox"/> 52 Te Tellurium	<input type="text"/>
<input type="checkbox"/> 3 Li Lithium	<input type="text"/>	<input type="checkbox"/> 53 I Iodine	<input type="text"/>
<input type="checkbox"/> 4 Be Beryllium	<input type="text"/>	<input type="checkbox"/> 54 Xe Xenon	<input type="text"/>
<input type="checkbox"/> 5 B Boron	<input type="text"/>	<input type="checkbox"/> 55 Cs Cesium	<input type="text"/>
<input type="checkbox"/> 6 C Carbon	<input type="text"/>	<input type="checkbox"/> 56 Ba Barium	<input type="text"/>
<input type="checkbox"/> 7 N Nitrogen	<input type="text"/>	<input type="checkbox"/> 57 La Lanthanum	<input type="text"/>
<input type="checkbox"/> 8 O Oxygen	<input type="text"/>	<input type="checkbox"/> 58 Ce Cerium	<input type="text"/>
<input type="checkbox"/> 9 F Fluorine	<input type="text"/>	<input type="checkbox"/> 59 Pr Praseodymium	<input type="text"/>
<input type="checkbox"/> 10 Ne Neon	<input type="text"/>	<input type="checkbox"/> 60 Nd Neodymium	<input type="text"/>

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[XCOM Previous Home Page](#)

Fig. 1 The opening menu of our *eXcom*, Photon Cross Sections on our Web page.