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PROGRAM EPICSHOW

A Computer Code to Allow
Interactive Viewing of the EPIC
Data Libraries
(Version 98-1)

by
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Abstract

EPICSHOW (**E**lectron **P**hoton **I**nteractive **C**ode - **Show** **Data**) is an interactive graphics code that allows users to view and interact with neutron, photon, electron and light charged particle data. Besides on screen graphics the code provides hard copy in the form of tabulated listings and Postscript output files. The code has been implemented on UNIX, IBM-PC, Power MAC, and even Laptop computers. It should be relatively easy to use it on almost any computer.

All of the data included in this system is based on the Lawrence Livermore National Laboratory Databases and the neutron and photon data is used in the TART97 Monte Carlo transport code system.

Summary Documentation (V.G. Pronyaev and P.K. McLaughlin, ed.)

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Citation guidelines:

This code should be cited as follows:

D. E. Cullen, "Program EPICSHOW, a computer code to allow Interactive Viewing of the EPIC Data Libraries. (Version 98-1)", report UCRL-ID-126455, Rev. 1, 1998.

Data References

All of the data included in this system is based on the Lawrence Livermore National Laboratory Databases. If you use any of this data in your applications, see pages 3 and 4 of the report (UCRL-ID-126455, Rev.1, 1998) for the references. The report is included on the CD-ROM.

1998 Update

The document **UCRL-ID-126455,Rev.1** has been updated (October 13, 1998) to describe the 1998 EPICSHOW update to calculate mixtures of material, e.g., water. For details, see the description of this option and how to define mixtures of materials in the document.

Introduction to EPICSHOW

EPICSHOW is a mouse driven interactive graphics codes. There is no keyboard or any other type of input - ONLY the mouse is used and ALL mouse keys (left, center, or right) are treated the same. There are no commands to remember - every option is on the screen and to use any option all you need do is click your mouse in an option box.

You will find that EPICSHOW is so user friendly that you do not even need the report to efficiently use the code. The easiest way to learn how to use EPICSHOW is to just start using it. Feel free to click away with your mouse to select as many options as you want, and see what happens. You will find that in no time at all you will be an EPICSHOW expert.

Computer Requirements

1 Megabyte of Memory
7 Megabytes of Disk Space
a Mouse
a Color screen is highly recommended, but not an absolute necessity

The code is written in standard FORTRAN that can run on any computer. It is distributed with a very simple graphics interface for use on UNIX, IBM-PC, Power MAC, and even Laptops. The code is so standard and the graphics interface so simple, that it should be relatively easy to use it on almost any computer.

Data Contents

EPICSHOW includes data for neutrons, photons, electrons and light charged particles. For neutrons data is included for all materials included in the Livermore ENDL database; it is included in the form of 175 group (energy) averaged TART97 data over the energy range 0.0013 eV to 20 MeV. For all other types of projectiles, data is included for each element, Z = 1 through 100, over the energy range 10 eV to 1 GeV; in the case of photons high energy analytical extensions are provided to extend the data to 100 TeV.

Upon Request, the **EPICSHOW** code is available free of charge, on CD-ROM, from the IAEA Nuclear Data Section.

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1998 Update

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Abstract

EPICSHOW is an interactive graphics code that allows users to view and interact with neutron, photon, electron and light charged particle data. Besides on screen graphics the code provides hard copy in the form of tabulated listings and Postscript output files. The code has been implemented on UNIX, IBM-PC, Power MAC, and even Laptop computers. It should be relatively easy to use it on almost any computer.

All of the data included in this system is based on the Lawrence Livermore National Laboratory Data Bases and the neutron and photon data is used in the TART98 Monte Carlo transport code system.

Overview

For many years the data used at Lawrence Livermore National Laboratory has been documented in the UCRL-50400 report series. Anyone who has subscribed to this series now has an entire bookshelf of reports.

The problem with publishing data in book form is: 1) by the time the books are actually published the data can be out-of-date, 2) books allow users to see the data, but they do not have the data on-line for use in their applications, 3) publishing books is expensive.

As an alternative to the traditional UCRL-50400 series, EPICSHOW is offered as an interactive computer graphics code. Compared to books, a code offers the following advantages: 1) the data files can be maintained up-to-date and periodically distributed, 2) users can not only see the data, they can interact with it and obtain it on their computer in a form that can be easily used in applications, 3) compared to the cost of publishing books, maintaining and distributing this code is relatively inexpensive.

Introduction to EPICSHOW

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You will find that EPICSHOW is so user friendly that you do not even need this report to efficiently use the code. The easiest way to learn how to use EPICSHOW is to just start using it. Feel free to click away with your mouse to select as many options as you want, and see what happens. You will find that in no time at all you will be an EPICSHOW expert.

The remainder of this report defines computer requirements, documents the sources of the data used in this system, and then briefly describes ALL current options. That's it - that's all you need to use this system and understand where the data came from.

Bottom line: HAVE FUN!!!

Computer Requirements

1 Megabyte of Memory
7 Megabytes of Disk Space
a Mouse
a Color screen is highly recommended, but not an absolute necessity

The code is written in standard FORTRAN that can run on any computer. It is distributed with a very simple graphics interfaces for use on UNIX, IBM-PC, Power MAC, and even Laptops. The code is so standard and the graphics interface so simple, that it should be relatively easy to use it on almost any computer.

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EPICSHOW includes data for neutrons, photons, electrons and light charged particles. For neutrons data is included for all materials included in the Livermore ENDL data base; it is included in the form of 175 group (energy) averaged TART98 data over the energy range 0.0013 eV to 20 MeV. For all other types of projectiles, data is included for each element, Z = 1 through 100, over the energy range 10 eV to 1 GeV; in the case of photons high energy analytical extensions are provided to extend the data to 100 TeV.

Data References

All of the data included in this system is based on the Lawrence Livermore National Laboratory Data Bases. Below is a list of the primary references for each type of data. If you use any of our data in your applications these are the references you should quote to document the sources of the data.

Neutrons

The neutron data is based on the Evaluated Nuclear Data Library (ENDL). In this system it is presented in the form of TART98 175 group (energy) averaged data; this is the data used by the Monte Carlo code TART98. The primary references to ENDL include,

"The LLL Evaluated Nuclear Data Library (ENDL): Evaluation Techniques Index, and Descriptions of Individual Evaluations," by R.J. Howerton, et al, (Sept. 1975), UCRL-50400, Vol. 15, Part A, Lawrence Livermore National Laboratory.

"The LLL Evaluated Nuclear Data Library (ENDL): Graphs of Cross Sections from the Library," by R.J. Howerton, et al, (Oct. 1978), UCRL-50400, Vol. 15, Part B, Rev. 1, Lawrence Livermore National Laboratory.

"Tabular and Graphical Presentation of 175 Neutron-Group Constants Derived from the LLL Evaluated Nuclear Data Library (ENDL)," by E.F. Plechaty, et al, (Oct. 1978), UCRL-50400, Vol. 16, Rev. 2, Lawrence Livermore National Laboratory.

Photons

The photon data is based on the Evaluated Photon Data Library (EPDL). Atomic relaxation data to define fluorescence is from the Evaluated Atomic Data Library (EADL). The primary references to EPDL and EADL include,

"The 1989 Livermore Evaluated Photon Data Library (EPDL)," by D.E. Cullen, et al., (March 1990), UCRL-ID-103424, Lawrence Livermore National Laboratory

"Tables and Graphs of Photon-Interaction Cross Sections from 10 eV to 100 GeV Derived from the LLNL Evaluated Photon Data Library (EPDL), Part A: Z=1 to 50, Part B: Z=51 to 100," by D.E. Cullen, et al., (October 1989), UCRL-50400, Vol. 6, Rev. 4, Lawrence Livermore National Laboratory

"Tables and Graphs of Atomic Subshell and Relaxation Data Derived from the LLNL Evaluated Atomic Data Library (EADL)," by S.T. Perkins, et al, (October 1991), UCRL-50400, Vol. 30, Lawrence Livermore National Laboratory

Soon to be added is the latest Livermore photon interaction data, “EPDL97: the Evaluated Photon Data Library, '97 Version, by Dermott E. Cullen, John H. Hubbell , Lynn Kissel, (September 1997), UCRL--50400, Vol. 6, Rev. 5, Lawrence Livermore National

Laboratory

It should also be noted that EPDL is the International Standard adopted for the ENDF/B-VI data library as well as the data used by the Monte Carlo code TART98.

Electrons

The electron data is based on the Evaluated Electron Data Library (EEDL). Atomic relaxation data to define electron emission is from the Evaluated Atomic Data Library (EADL); see, above. The primary references to EEDL include,

"Tables and Graphs of Electron-Interaction Cross Sections from 10 eV to 100 GeV Derived from the LLNL Evaluated Electron Data Library (EEDL), Z=1-100," by S.T. Perkins, et al, (November 1991), UCRL-50400, Vol. 31, Lawrence Livermore National Laboratory.

Charged Particle Data

This data is from the TRIM code.

Screen Layout

The screen is divided into two parts: 1) the lower part is used to display data, 2) the upper part is used to identify the version of the code you are using and to display options. Currently forty (40) option boxes are displayed at the top of the screen, although as yet not all are used.

Code Option Summary

Here's a brief description of the options in the order that they appear on your screen - details on using these options are included later in this report.

==========

Lin/Log X - Switch between linear or log scaling for the X Axis.
Lin/Log Y - Switch between linear or log scaling for the Y Axis.
Points - Switch between showing and not showing data points.

Freeze!!! - Switch between freezing/not freezing the screen.

==========

Zoom X - Use mouse to define lower/upper X limits for next plot.
Show All - Reverse the effect of zoom and show the entire X range.
Ratio - Display data AND ratio of all curves to the first curve.
+Energy - For photons increase upper energy limit by a decade.
-Energy - For photons decrease upper energy limit by a decade.

==========

Grid + 1 - Include more details in the grid.
Grid - 1 - Include less details in the grid.

Mixture - Read mixture from the file EPICSHOW.INP (1998 Update)

barns-1/c - switch between units of barns and 1/cm.

==========

Legend - Switch between showing and not showing the legend.
Bigger - Make characters bigger.
Smaller - Make characters smaller

ColorDump - Create color Postscript copy of current screen

==========

Photons - Display Photon Data
Electrons - Display Electron Data
Positrons - Display Positron Data - Not yet implemented
Charged - Display Light Charged Particle Data
Neutrons - Display Neutron Data

==========

Major - Display Major Cross Sections
Minor - Display Minor Cross Sections
Deposit - Display Energy Deposition Data
Range - Display Range Data - Only Electrons and Charged
Straggle - Display Straggling Data - Not yet implemented

==========

Z + 1 - Position 1 Evaluation UP in the Periodic Table
Z + 10 - Position 10 Evaluations UP in the Periodic Table
Z - 1 - Position 1 Evaluation DOWN in the Periodic Table
Z - 10 - Position 10 Evaluations DOWN in the Periodic Table
Same Z - Display the same data again

==========

2 X 2 - Switch between displaying 1 or 4 plots per screen
Listing - List the data currently being displayed
Pstscript - Switch between creating/not creating Postscript output
Same Plot - Display the same data gain
Stop - Terminate execution

==========

Getting Started

When the code starts it identifies itself; press ANY mouse key to continue. The code next displays Photon, Major cross sections for hydrogen.

Selecting Exactly the Data you Want

From this point on you can select any options that you want, in any order that you want. For example you can select,

Projectile by selecting: Photons, Electrons, Charged or Neutrons - Positrons are not yet

implemented.

Target by selecting Z+1, Z+10, Z-1,Z-10, to quickly position to anyplace in the periodic table.

Data Type by selecting Major, Minor, Deposit and Range - Straggling is not yet implemented.

Once you have the data that you want on the screen you can interact with it to display it in exactly the form you want - you can set,

Scaling using Lin/Log X/Y
Points to decide whether or not you want to display points
Energy Range using Zoom X
Ratio to decide whether or not to display ratios
Grid to include more or less details
Units use barn-1/cm to select microscopic or macroscopic units
Character size using Bigger and Smaller

With these options you can customize each plot to exactly meet your needs.

Once you have the data you want you can obtain hard copy output,

Listing will list ALL of the data for the **Projectile/Target** that you are **presently** displaying. You can output data for as many projectile/target combinations that you wish. When the code finishes all listing output will be in a file named **EPICSHOW.LST**. Note, the listing includes ALL of the data over the entire energy range, not just the energy range you may have selected Zoom X; experience has shown that it is easier to edit the output listing of the data than to restrict output to a Zoomed energy range.

ColorDump will produce a color Postscript file of the entire screen that you are **presently** displaying. See below for details on implementing this option.

Pstscript will produce black and white Postscript files of the data that you display **in the future** - not what is on the screen when you select this option - everything that you display in the future, until you again select this option to turn it off. See below for details on using this option.

EPICSHOW.INP Format for Mixtures

The 1998 and later versions of EPICSHOW can calculate mixtures of materials, e.g., WATER. Mixtures are defined in a file named **EPICSHOW.INP**, which is a simple text file that you can edit to define your materials. The format of this file is,

Line	Columns	Format	Description
1	1-10	A10	Name of Mixture (displayed on plots)
2	12-22	E11.4	Density of Mixture (grams/cc)

3	1-11	I11	ZA of Constituent (ZA = 1000*Z + A)
	12-22	E11.4	Grams/cc of Constituent
	23-33	E11.4	Atoms/cc of Constituent

Line 3 can be repeated any number of times to define all of the constituents of a mixture. The definition of the mixture is terminated by a blank (not zero, blank) line; see the below example input.

For each material as input you can define grams **OR** atoms for **ALL** constituents, but you cannot use **BOTH** grams **AND** atoms in the same material definition. For example, for Water it is convenient to define it as 2 atoms of Hydrogen for each atom of Oxygen, i.e., define the Atoms of each constituent. In contrast for Steel you may wish to define the grams of each constituent. In all cases the Grams or Atoms of all constituents as input are relative and the sum will be normalized to the input Density of Mixture (grams/cc).

EPICSHOW.INP may contain definitions for any number of materials, one after the other. Each time you select the "Mixture" option the next mixture will be read from EPICSHOW.INP.

If any errors are encountered while reading EPICSHOW.INP, the current and all subsequent requests to use the Mixture option will be ignored. In this case, see the file EPICSHOW.LST for details of the error(s).

Below is an example EPICSHOW.INP file defining mixtures. In this case we define Water at a density of 1.0 grams/cc, composed of 2 atoms of hydrogen (1001) for each 1 atom of oxygen (8016) = H2O. This is followed by definitions of Hydrogen and Oxygen at the density that each is a constituent of Water at 1.0 grams/cc. This input can be used to first see the composite data for Water, and to then see how each constituent contributes to the composite data.

```
Water                                   Title - 10A1
            1.0000E+00                  Overall grams/cc  - 11X,E11.4
       1001             2.0000E+00     ZA,grams/cc,atoms - I11,2E11.4
       8016             1.0000E+00
                                       (BLANK LINE TERMINATED MIXTURE)
Hydrogen
            0.11191
       1001             2.0000E+00
                                       (BLANK LINE TERMINATED MIXTURE)
Oxygen
            0.88809
       8016             2.0000E+00
                                       (BLANK LINE TERMINATED MIXTURE)
```

Available Combinations

Not all possible combinations of projectile and type of data are included in this system. For example, ranges are only included for electrons and light charged particles; not for neutrons and photons. Only deposition and range data, no cross sections, are included for

light charged particles.

You will find that other combinations are also not included. If you try to select a combination that is not included the code will not respond. There is no warning - it simply doesn't respond - and you will quickly get used to this and move on to examine other data.

Atomic and Nuclear Data

This system includes atomic data for everything except neutrons. Atomic data is all elemental and is identified by the atomic number (Z) of the element, e.g., 1-H- Nat, means hydrogen (Z=1) with its natural elemental abundance (Nat). The Nuclear data for neutrons is for either a naturally occurring elemental mixture of isotopes, or for a specific isotope. Neutron data is identified by both atomic number (Z) and atomic weight (A), e.g., 92-U-238, means uranium (Z=92), isotope 238.

Microscopic vs. Macroscopic Units

All of the basic data in this system is in microscopic units per atom. Be aware that in defining macroscopic units the atomic weight and the density shown on the plot are used. STP elemental conditions are used in ALL cases. For gases the density of an element that you are using in your applications can be VERY DIFFERENT from STP elemental conditions.

Detailed Instructions

As stated above, the easiest way to learn how to you this code is to just start using it, i.e., click on any options and see what happens. Only a few of the options needs more detailed instructions; these include,

Postscript

Output starts when you select this option AND continues until you again select it to turn it off. If you do not use the option carefully you can end up with an ENORMOUS number of Postscript output files that you don't really want = a Postscript file for every single display that appears on your screen.

To avoid this problem I STRONGLY RECOMMEND: 1) Get the plot on the screen that you want to make a Postscript output of, 2) select Pstscript to turn the option ON, 2) select Same Plot - immediately below Pstscript - this will make another plot of what is currently on the screen - including Postscript output, 3) select Pstscript again to turn the option OFF. If you follow this recommendation Postscript output will only be turned on while you are producing the plots you want and you will end up with ONLY the Postscript output that you want.

When you finish running EPICSHOW you will find a series of Postscript files,

PLOT0001.ps
PLOT0002.ps

etc., one file for each plot. You can print these files on any Postscript printer and view them using any Postscript viewer, such as Ghostview. These files contain only plots of the data; not the options from the top of the screen.

Warning - Every time that you run EPICSHOW and generate Postscript output the code uses the same names for the files. So if you want to save any files from a previous run be sure that you rename then before running the code again.

ColorDump

The above applies to black and white output. For color Postscript output you can use the ColorDump option - only if you get on the Web - search for ImageMagik - and download a copy of the code import for your computer - and put import in the directory where you run EPICSHOW. If you do not have import EPICSHOW will run fine, but this option will be ignored.

Unlike the Pstscript option, ColorDump only applies to the screen currently being displayed - it only produces one screen dump and you need not worry about it staying on and producing more screen dumps.

When you finish running EPICSHOW you will find a series of Postscript files,

SCRN0001.ps
SCRN0002.ps

etc., one file for each plot. You can print these files on any color Postscript printer and view them using any Postscript viewer, such as Ghostview. These files contain a screen dump of the entire screen, including both options at the top of the screen and the data in the lower part of the screen.

Warning - Every time that you run EPICSHOW and generate Postscript output the code uses the same names for the files. So if you want to save any files from a previous run be sure that you rename then before running the code again.

Same Z and Same Plot

Both of these options do exactly the same thing = refresh the screen by repeating the last plot. Be aware that in 2 X 2 mode this will produce another sub-plot - not a plot of everything on the screen.

2 X 2

The code can display either one full screen plot, or four half size plots. The 2 X 2 option is used to switch back and forth between one and four plots per screen. The 2 X 2 option is convenient when you want to compare data all on the same plot. For example, if you want to compare similar data for four different targets, or all of the data for the same

target, e.g., electrons major, minor, energy deposition and range. The possibilities are limited only by your imagination.

If you have a small screen and you use the 2 X 2 option you may have difficulty clearly seeing all of the data. However, on any system Postscript output using the 2 X 2 option will be clear and easy to read.

Warning - If you want a 2 X 2 Postscript output be sure the Pstscript option is ON before you display the first sub-plot on the screen.- remember that the Pstscript option will only produce Postscript output for data that you display in the future, after you have selected the Pstscript option. So if you are using the 2 X 2 option and select the Pstscript option after already plotting a few sub-plots on the screen, the Postscript output **WILL NOT** include the sub-plots that were on the screen before you selected the Pstscript option.

Freeze!!!

Normally as you select each option the screen will immediately respond. If you select Freeze!!! you lock the screen and it will not change until you again select Freeze!!! Once you have unlocked the screen the code will again respond to each command as you select it. For example, if you are at Z=1 and quickly want to go to the other end of periodic table: 1) select Freeze!!!, 2) select Z+10 a number of times - note, your position in Z is always defined on the top line of the screen next to the code identification, so you always know where you are - but nothing else on the screen will change, 3) select Freeze!!! This will release the screen and you can start displaying data.

Freeze!!! and 2 X 2 can be used in combination to get four sets of data from anyplace in the periodic table all on the screen at the same time. For example, try to get the photon major cross sections on the screen for Z = 3, 26, 82 and 94, all at the same time, and you'll see what I mean - using Freeze!!! and 2 X 2 it can be done.

WARNING - Freeze!!! cannot be used to queue a number of plots to display. It can only be used a change as many options as you want for the next plot that you request after you again select Freeze!!! to release the screen.

Points

All of the data included in this system are in tabulated form - no models are used to define data. If you want to see where the data points are tabulated use this option.

Ratio

When this option is used the first curve is considered to be a standard, and the ratio of all other curves to this standard is displayed. This is helpful if you want a quantitative estimate of the ratio of individual cross sections to the total.

Energy

This option only applies to photon data. Above it was stated that all data in this system is tabulated and models are not used. This is true up to 1 GeV. Above this energy analytical expressions are used to define all photon data.

Grid

If you want to try to read values off the plots it helps to add more details to plots. For example, even the first plot displayed is over 12 log decades in cross sections and it is hard a see specific cross section ranges. This is much easier if you add grid detail.

barn-1/cm

This option can be used to display data in either the original data units of barn (microscopic) units or 1/cm (macroscopic) units.

Be aware that in defining macroscopic units the atomic weight and the density shown on the plot are used. STP elemental conditions are used in ALL cases. For gases the density of an element that you are using in your applications can be VERY DIFFERENT from STP elemental conditions.

Character Size

Depending on the size of your screen you may want to make the characters larger or smaller. Also for 2 X 2 output you may want to make the characters larger.

Listing

The output listing for each combination of data is generally in three parts: 1) major data, 2) minor (detailed) data, and 3) macroscopic data. A portion of an example is shown below.

Warning - be aware that this output includes macroscopic derived data. Some users of this system have not checked their output listings in detail and have ended up wasting their time deriving macroscopic data that is already available to them in the output listing.

```
================================================================================================
Atomic Weight 207.190                        82-Pb-Nat                          1.1350+01 grams/cc
                                    Electron Interaction Data
Energy    Cross Sections (barns)----------------------------------Energy Loss per Collision (MeV)
(MeV)     Total     Ionize    Brems.    Excite    Elastic   Transport Ionize    Brems.    Excite
================================================================================================
1.0000-05 2.6290+09 1.3106+08 4.8698+03 8.7576+06 2.4892+09 2.4892+09 6.6445-06 2.1615-06 6.2969-06
1.2500-05 2.4483+09 1.7847+08 5.0513+03 2.6756+07 2.2431+09 2.1032+09 7.2252-06 2.5863-06 6.7137-06
1.2589-05 2.4419+09 1.8016+08 5.0578+03 2.7452+07 2.2343+09 2.0895+09 7.2472-06 2.6018-06 6.7300-06


7.9433+02 5.0670+06 1.3190+06 1.6125+03 1.6149+06 2.1315+06 3.2035-02 3.8557-04 2.5925+01 1.0952-05
8.0000+02 5.0669+06 1.3190+06 1.6131+03 1.6148+06 2.1315+06 3.1720-02 3.8569-04 2.6105+01 1.0952-05
1.0000+03 5.0655+06 1.3189+06 1.6265+03 1.6145+06 2.1305+06 2.0621-02 3.8987-04 3.2463+01 1.0953-05
================================================================================================
Atomic Weight 207.190                        82-Pb-Nat                          1.1350+01 grams/cc
                                    Electron Interaction Data
Energy    Ionization Shell Cross Sections (barns)------------------------------------------------
(MeV)     K         L1        L2        L3        M         N         O         P         Q
================================================================================================
1.0000-05                                                                       1.3106+08
1.2500-05                                                                       1.7847+08
1.2589-05                                                                       1.8016+08


7.9433+02 3.2770+01 1.5391+02 2.0094+02 4.3601+02 1.1170+04 1.8337+05 7.6211+05 3.6151+05
8.0000+02 3.2787+01 1.5391+02 2.0094+02 4.3601+02 1.1170+04 1.8337+05 7.6211+05 3.6151+05
```

```
1.0000+03 3.3373+01 1.5392+02 2.0098+02 4.3608+02 1.1172+04 1.8337+05 7.6202+05 3.6148+05
=============================================================================================
Atomic Weight 207.190                        82-Pb-Nat                        1.1350+01 grams/cc
                                    Electron - Derived Quantities
Energy    Total Cross Section-Mean Free Path------Range-----Energy Loss (Mev/cm)------------------
MeV       barns     1/cm      cm        cm*cm/gr  cm        Total     Ionize    Brems.    Excite
=============================================================================================
1.0000-05 2.6290+09 8.6729+07 1.1530-08 7.6413+06           3.0547+01 2.8728+01 3.4724-04 1.8192+00
1.2500-05 2.4483+09 8.0768+07 1.2381-08 7.1161+06           4.8465+01 4.2539+01 4.3097-04 5.9259+00
1.2589-05 2.4419+09 8.0556+07 1.2414-08 7.0975+06           4.9167+01 4.3072+01 4.3411-04 6.0948+00


7.9433+02 5.0670+06 1.6715+05 5.9825-06 1.4727+04 2.8605+00 1.3964+03 1.6777+01 1.3791+03 5.8345-01
8.0000+02 5.0669+06 1.6715+05 5.9826-06 1.4727+04 2.8645+00 1.4065+03 1.6782+01 1.3892+03 5.8342-01
1.0000+03 5.0655+06 1.6711+05 5.9843-06 1.4723+04 2.9914+00 1.7594+03 1.6962+01 1.7418+03 5.8336-01
```

Using the Data in Your Applications

For neutron and photon applications it is rec ommended that you use the TART98 Monte Carlo transport code. This is a 3-D, Combinatorial geometry, time dependent, general purpose, Monte Carlo code that runs on any computer and is designed to satisfy the needs of a wide variety of applications. It uses the EPICSHOW neutrons and photon data and is now available Worldwide through local computer code centers. It is strongly recommended that if you have applications that only involve neutrons and/ or photons you should use TART98 to solve your problems, rather than trying to re-invent the wheel by writing your own code.

If you prefer to do it yourself you can,

1) If you only need a few materials use EPICSHOW to retrieve the data you need to EPICSHOW.LST and edit it to meet your needs. The format (shown above), is simple tabulated fixed field data with each field ten (10) columns wide in FORMAT E format - WARNING - each field is defined by each 10 columns - not by tabs, blanks or anything else.

2) If you have more general needs use the original tabulated data distributed with the UNIX version of the code. There are a series of files named ???.TAB, where ??? defines the contents of the file, e.g., PHOTON.TAB, ELECTRON.TAB, etc. Each file contains all of the data of a given type for the entire periodic table. As with the EPICSHOW.LST output, these tables have headings describing each type of data, and the tables are in fixed field data in exactly the same 10 characters per field format as found in EPICSHOW.LST.

What Computers will EPICSHOW Run on?

This code has been implemented and used on UNIX, IBM-PC, Power MAC, and even Laptop computers. It is written in such standard FORTRAN and uses such a simple graphics interface that it should be relatively easy to use on any computer.

If you interface this code to a different type of computer it is recommended that you send copies of everything to the author for inclusion in future distributions of this code. This will save you time in the future.

Customizing the Code

All of the names for the options that appear at the top of the screen are in a file named PAGE.DAT. If you do not like the names I've defined, feel free to edit PAGE.DAT to include the names that you prefer. Be VERY CAREFUL not to change the format of this file; if you do, the results obtained running EPICSHOW can be unreliable.

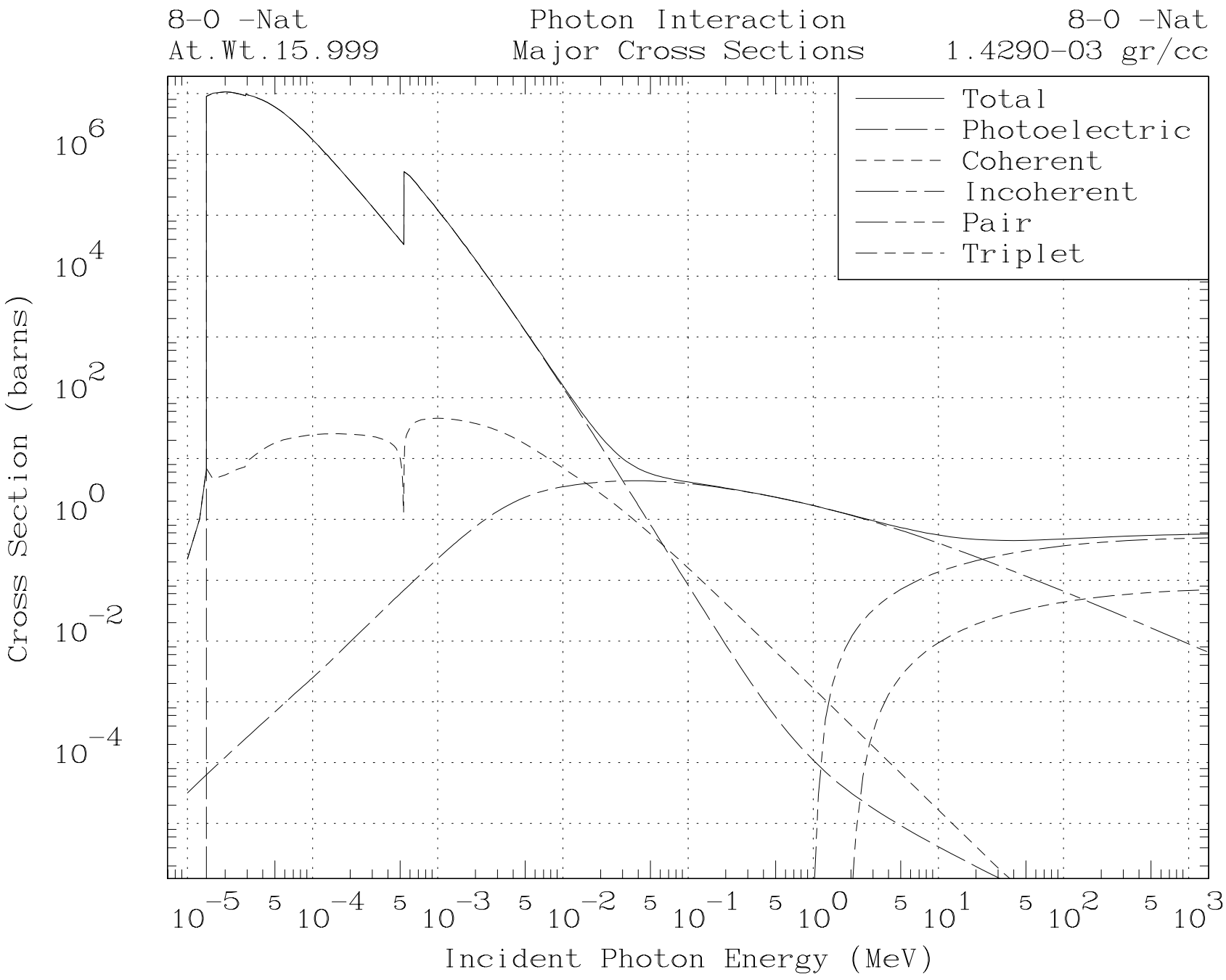
Code Installation

The code is distributed with detailed instructions concerning installation and testing of the code. These instructions are periodically updated for distribution with the code, to insure that the instructions are as up-to-date as possible, and exactly correspond to the version of the code that you will be implementing and using.

When you receive this code you will find a file named **README** - be sure that you read this file as you proceed with installation.

Example EPICSHOW Output

When you first run EPICSHOW take a look at the oxygen photon cross sections. This data is related to the results shown in the **TARTCHEK** update documentation (TARTCHEK.DOC) where energy deposition in a water phantom is discussed. There the question was asked: what's the difference in the energy deposition due to 1 versus 10 MeV photons. From a plot of the oxygen cross sections we can see that the total cross section at 1 MeV is considerably larger than at 10 MeV, so we expect more of the photons to collide and deposit their energy at 1 MeV compared to 10 MeV. That's part of the picture; the rest is that the lower energy photons will scatter through larger angles and spread out more from the incident photon beam.


8-O -Nat
At.Wt.15.999
Photon Interaction
Major Cross Sections
8-O -Nat
1.4290-03 gr/cc
Total
Photoelectric
Coherent
Incoherent
Pair
Triplet
Cross Section (barns)
10^{6}
10^{4}
10^{2}
10^{0}
10^{-2}
10^{-4}
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2} 10^{3}
Incident Photon Energy (MeV)