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EPDL97:
the Evaluated PhotonData Library, '97 Version

by
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Summary documentation (V.G. Pronyaev and P. McLaughlin, ed.)

Abstract: The Evaluated Photon Data Library, 1997 version (EPDL97), is designed for use in photon transport calculations at Lawrence Livermore National Laboratory. This library includes photon interaction data for all elements with atomic number between Z = 1 (hydrogen) and 100 (fermium), including: photoionization, photoexcitation, coherent and incoherent scattering, and pair and triplet production cross sections. For use in applications data is provided for all elements over the energy range 1 eV to 100 GeV. **EPDL97 completely supersedes the earlier 1989 version of EPDL(89) (see IAEA-NDS-158, Summary documentation to the EPDL) and it is highly recommended that users only use the most recent version of this library.** The Evaluated Atomic Data Library (**EADL**), Evaluated Electron Data Library (**EEDL**) an Evaluated Excitation Data Library (**EXDL**) are included to allow consistent coupled photon-electron transport calculations. The data package is available from the IAEA Nuclear Data Section on CD-ROM (12 files, 74.2 MB), or can be downloaded from http://www-nds.iaea.org/epdl97/

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Online: TELNET or FTP: iaeand.iaea.org
username: IAEANDS for interactive Nuclear Data Information System
usernames: ANONYMOUS for FTP file transfer;
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This data library should be cited as follows:
D.E. Cullen, J.H. Hubbell and L. Kissel, "EPDL97: the Evaluated Photon Data Library, '97 Version", report UCRL-50400, Vol.6, Rev.5, 1997
Hyperlink to Red Cullen's page:
http://www.llnl.gov/cullen1/document/epdl97/epdl97.pdf
with a Report UCRL-50400, Vol.6, Rev.5, 1997

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For detailed description of the EPDL97 Library see reference under Citation guideline or Hyperlink above

EPDL97 vs. EPDL(89) Contents

Compared to EPDL(89) (see IAEA-NDS-158, 1994 and references in it), EPDL97 has been updated to include all of the most recently available theoretical and experimental data. In this process EPDL97 has taken advantage of the tremendous increase in computer power and storage capacity since EPDL(89) was released. Data has been calculated to higher precision and includes more data points to allow more accurate interpolation between tabulated data points.
To briefly summarize the similarities and differences between EPDL97 and EPDL(89),

Similarities

1) Both include data for elements Z = 1 (hydrogen) through 100 (fermium).
2) Both include cross sections for photoionization, coherent and incoherent scattering, pair and triplet production, form factors, scattering functions, anomalous scattering functions, and average energy all secondary particles, including the initial scattered photon, as well as any secondary photons, electron and positrons. For photoionization both include cross sections for all subshells.
3) Both include data up to 100 GeV.
4) Both use the same atomic parameters, in particular for consistency with the Livermore Evaluated Electron Data Library (EEDL) [5], both use the same photoionization subshell binding energies.

Differences

5) EPDL97 includes data down to 1 eV, whereas EPDL(89) includes data down to 10 eV. The extension to lower energy was primarily to allow a complete description of photoionization, that is required to accurately calculate anomalous scattering factors.
6) EPDL97 includes photoexcitation data, that was not available at the time that EPDL(89) was released.
7) EPDL97 includes improved anomalous scattering factors and coherent scattering cross sections, based on the photoionization and now available photoexcitation cross sections.
8) EPDL97 is based on more recently available theoretical and experimental data.
For a more detailed description of the differences between EPDL(89) and EPDL97 contact D. E. Cullen for a copy of a much longer report including plots comparing all of the data from the two libraries. This is a very large and limited edition report, so please only request a copy if you really need to know the details of differences.

Related Livermore Data Bases

EPDL97 is one of a set of data bases developed at Lawrence Livermore National Laboratory to allow consistent coupled photon-electron transport calculations. Use of the combination of these data bases is consistent in the sense that both photons and electrons use exactly the same atomic parameters, such as photoionization subshell binding energies.

The Data Bases include

EPDL97 - The Evaluated Photon Data Library, includes data to describe the transport of photons, as well as the initial generation of secondary particles, such as the primary electron emitted due to photoionization or Compton (incoherent) scattering, as well as the electron/positron pair emitted due to pair production.

EEDL - The Evaluated Electron Data Library, includes data to describe the transport of electrons, as well as the initial generation of secondary particles, such as the primary photon due to bremmstrahlung, as well as the primary electron due to inelastic scattering and electroionization.

EADL - The Evaluated Atomic Data Library, includes data to describe the relaxation of ionized atoms back to neutrality, during which photons (fluorescence x-rays) and electrons (Auger and Coster-Kronig) are emitted. It is assumed that the relaxation of an ionized atom is independent of how the atom was ionized, so that this data may be used to describe the relaxation of atoms that were ionized due to either photoionization or electroionization.

EXDL - The Evaluated Excitation Data Library, includes data to describe photoexcitation lines. EXDL is distributed with EPDL97, but maintained as a separate file of data, in order to simplify its use in applications.

Photon Anomalous Scattering Factors - Anomalous scattering factors are those of Cullen computed using the relativistic dispersion relation as detailed in Pratt, et al. (1994) (see main report) in conjunction with the EPDL97 photoionization and photoexcitation data.

One of the constraints on EPDL97 is that it remains consistent with the existing data bases. In particular, EPDL97 has been constrained to use exactly the same atomic parameters as the other data bases.

The EPDL97 package includes the following files, all documents are given in PDF, MS Word, HTML and PostScript types) . The package can be obtained from the Nuclear Data Section on CD-ROM:

The contents of the CD-ROM can be used from the CD-ROM or loaded to the hard drive on the PC. Either way it can then be used interactively to view/retrieve the ENDF/B formatted libraries by clicking on “getdata.htm”

The CD-ROM contains 5 directories of data and documents as described below:

Directory **ANOMLOUS** contains the **Photon Anomalous Scattering Factors** for Z= 1 to 100 over the energy range 1 ev to 10 Mev. A document describing the format is included. Anomalous scattering factors are those of Cullen computed using the relativistic dispersion relation as detailed in Pratt, et al. (1994) in conjunction with the EPDL97 photoionization and photoexcitation data. (See the **DOCUMENTS** directory for more detail)

Directory **Cdlabel** Labels templates for CD-ROM and Jewell case (needs labelling Software)

Directory **DOCUMENT** contains the documents:
"EPDL97: the Evaluated Photon Data Library, '97 Version", report UCRL-50400, Vol.6, Rev.5, 1997 by D.E. Cullen, J.H. Hubbell and L. Kissel.

“UCRL-ID-117796”: ENDL formats for the LLNL libraries.

Directory **ENDFB** contains 3 sub-directories with the data libraries **EPDL97, EADL** and **EEDL** in the ENDF/B-VI format. *(See below for a short description of these libraries). Each subdirectory includes the complete file and 100 files of the individual Z elements.

Directory **ENDL** contains 4 sub-directories with the data libraries **EPDL97, EADL, EEDL and EXDL** in the ENDL format. * (See below for a short description of these libraries). Each subdirectory includes the complete file and 100 files of the individual Z elements.

*

Epdl97	The Evaluated Photon Data Library includes data to describe the transport of photons, as well as the initial generation of secondary particles, such as the primary electron emitted due to photoionization or Compton (incoherent) scattering, as well as the electron/positron pair emitted due to pair production.
Eedl	The Evaluated Electron Data Library includes data to describe the transport of electrons, as well as the initial generation of secondary particles, such as the primary photon due to bremmstrahlung, as well as the primary electron due to inelastic scattering and electroionization
Eadl	The Evaluated Atomic Data Library includes data to describe the relaxation of ionized atoms back to neutrality, during which photons (fluorescence x-rays) and electrons (Auger and Coster-Kronig) are emitted. It is assumed that the relaxation of an ionized atom is independent of how the atom was ionized, so that this data may be used to describe the relaxation of atoms that were ionized due to either photoionization or electroionization
Exdl	The Evaluated Excitation Data Library in Livermore format, includes data to describe photoexcitation lines. EXDL is distributed with EPDL97, but maintained as a separate file of data, in order to simplify its use in applications