Isotopes Project

LAWRENCE BERKELEY NATIONAL LABORATORY

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NUCLEAR DATA DISSEMINATION ACTIVITIES
April 1999 - April 2000

Report prepared for the Nuclear Structure and Decay Working Group, USNDP Annual Meeting, April 26-28, 2000 at Lawrence Berkeley National Laboratory.

This report refers exclusively to the data dissemination component of the Isotopes Project's activities; for the group's Data Evaluation activities, please see the Isotopes Project's report to the Nuclear Structure and Decay Data Working Group.

DISSEMINATION RESPONSIBILITY, STATUS

The Isotopes Project collaborates with Lund University (Sweden) and Evitech (Finland) to develop Isotope Explorer 2 (C++, Windows), Isotope Explorer 3 (Java, HTML), and the WWW Table of Radioactive Isotopes. The group also supports WWW dissemination home pages for Nuclear Astrophysics, Neutron Capture, Spontaneous Fission, Radioactive Decay, Nuclear Structure, Atomic Masses, Education, and other topics. The demand for these services has approximately doubled each year and the usage, derived from the server log, is summarized in Table 1.

Table 1. Usage Summary from the LBNL Isotopes Project Server

	1996	1997	1998	1999
Total Requests	240,035	509,920	902,024	1,934,757
ENSDF Isotopes	68,264	162,468	246,525	395,727
XUNDL Isotopes	0	0	0	3,738
Isotope Explorer 3	0	0	1,266	44,127
WWW TORI Search	0	0	50,217	189,979
NSR Searches	0	12,253	32,212	44,586
Education	0	0	6,701	21,727
Astrophysics	3,956	8,322	7,254	9,782
Atomic Masses	3,124	5,935	8,070	12,334
Radioactive Decay	3,152	5,563	7,319	8,794
Nuclear Structure	1,729	2,920	4,394	5,547
Neutron Capture	0	0	3,013	7,540
Fission	0	0	2,476	5,589
Isotope Explorer 2	4,989	9,008	16,612	17,390
Isotopes Project	3,665	6,166	11,323	22,892

PERSONNEL

Isotopes Project personnel involved in data dissemination are as follows:

R. Firestone	0.5 FTE
S.Y.F. Chu	0.3 FTE (0 FTE after 5/1/2000)
L. Nguyen	0.1 FTE (student)

In addition, two students of Peter Ekström from Lund, Magnus Odmo and Frederik Gusting, and one student of Kari Vierinen from the Espoo- Vantaa Institute of Technology (Evitech), Nikla Ratinen, spent extended training periods with the Isotopes Project.

ISOTOPE EXPLORER 2 (C++, Windows)

Isotope Explorer 2 and its predecessor VuENSDF were first developed in 1996 by the LBNL/Lund collaboration. Recently Evitech, Finland has joined the effort. The Windows C++ program is a helper application for displaying *Nuclear Data Sheets* style tables, level scheme and rotational band drawings, plots, and nuclear charts. There are currently about 3200 registered users of the program. Isotope Explorer 2 can interactively retrieve and display ENSDF data from the WWW, *Table of Isotopes* CD-ROM, or from local files. Data can be restricted to a range of property values, tables can be sorted by column, and level scheme drawings can be restricted by coincidence relationships. The nuclear charts can be colored by property and used to search and display data from the ENSDF file or from a ground state/isomer property database. Reference keyword abstracts can be displayed for each dataset, and the references can be searched by author name.

Isotope Explorer 2 was originally compiled with the Borland C++ compiler that is no longer well supported and is less compatible with Windows programming than the Microsoft Foundation Class compiler. We have begun porting the program to the MFC compiler in collaboration with Evitech. The modules for displaying level schemes and nuclear charts were ported in 1999, and additional work will continue in 2000.

ISOTOPE EXPLORER 3 (Java, HTML)

Isotope Explorer 3 is being developed by the LBNL/Lund collaboration. The program provides Internet access to ENSDF, XUNDL, SDBAND, and TORI databases. The data can be selected by dataset, decay or reaction type, or by isotope. Information is displayed both as *Nuclear Data Sheet* style tables, and as level scheme or rotational band drawings. The data can be selected by level and gamma properties. References are linked to the NSR file. Java language is still limited for displaying Greek characters, slanted text, and other desired capabilities. Files cannot be saved and the output is often too slow. This has limited acceptance of Isotope Explorer 3 which is used by less than 10% of all Isotope Explorer users.

In 1999 two students from Lund developed an Isotope Explorer 3 chart module and a version of the table module with sorting capability. The chart module still requires server support to become fully functional, but a standalone version will be released soon. Due to Java limitations the table module is too slow, even with fast computers, to replace the existing version and will await further development.

ISOTOPE EXPLORER REFERENCE SERVER

The Isotope Explorer reference server was developed by the LBNL/Lund collaboration. It supports rapid searches of the NSR file by author(s), nuclide, publication year, keynumber, keyword, reaction, and other criteria. References to recent AIP journal articles are linked directly to the papers. Plans to add links to additional references and enhancements of the search criteria have been delayed due to available manpower considerations.

WWW Table of Radioactive Isotopes

The WWW Table of Radioactive Isotopes was developed by the LBNL/Lund collaboration. Alpha-, beta- and gamma-ray decay data from ENSDF has been installed into a database that is searchable on the Internet. We have added calculated x-ray and Auger electron energies and intensities for vacancies in the K, L1, L2, and L3 atomic shells. Beta spectra have been calculated and are displayed with a Java plotting applet. These data can be searched by energy, intensity, and by parent mass, atomic number, neutron number, and/or half-life. The data are also linked to decay scheme drawings generated with Isotope Explorer 3. Work is in progress to calculate bremsstrahlung and conversion electron spectra and to generate genetic feedings.

WWW HOME PAGES

The Isotopes Project supports WWW home for a variety of topics of nuclear interest. The Nuclear Astrophysics home page provides astrophysical rates and other related information necessary for nucleosynthesis calculations. The Nuclear Structure home page offers access to the Table of Superdeformed Nuclear Bands and Fission Isomers and other information for the high-spin community. The Neutron Capture home page gives access to capture gamma-ray data from Lone and ENSDF, and thermal neutron cross sections. The Fission home page was developed for users of the Gammasphere spontaneous fission data. The Educational home page provides a periodic table linked to information about the isotopes of any element, and animated Gifs displaying various nuclear and astrophysics phenomena. Experimental and theoretical atomic masses are on the Atomic Mass home page.

A updated version of the Table of SuperDeformed Nuclear Bands and Fission Isomers is being developed for display on the WWW and publication in *Nuclear Data Sheets*. The Neutron Capture home page is being revised to represent the IAEA Coordinated Research Project on the Development of a Database for Prompt γ-ray Neutron Activation Analysis (PGAA). Also, a WWW PGAA Database, analogous to the WWW Table of Radioactive Isotopes, is being developed as part of the CRP. Several proposals have been submitted for a project to update and expand the nuclear astrophysics data effort.

INTERNET ADDRESSES

LBNL/Lund Nuclear Data Dissemination home page - http://ie.lbl.gov/toi.html
Isotope Explorer 2 - http://ie.lbl.gov/isoexpl/isoexpl.htm
Isotope Explorer 3 - http://ie.lbl.gov/ensdf/
WWW Table of Radioactive Isotopes - http://nucleardata.nuclear.lu.se/nucleardata/toi/
Nuclear Science References(LBNL) - http://128.3.5.61:6023/welcome.htm
Nuclear Science References (Lund) - http://130.235.93.31:6023/welcome.htm
Educational Website - http://ie.lbl.gov/education/isotopes.htm
Nuclear Astrophysics home page - http://ie.lbl.gov/astro.html
Nuclear Structure home page - http://ie.lbl.gov/hspin.html
Neutron Capture home page - http://ie.lbl.gov/ng.html
Fission home page - http://ie.lbl.gov/fission.html
Atomic Mass data home page - http://ie.lbl.gov/toimass.html
Isotopes Project home page - http://ie.lbl.gov/ip.html
Lund Nuclear Data WWW Service home page –
http://nucleardata.nuclear.lu.se/nucleardata/index.asp?page=Links_database
Evitech home page - http://www.evitech.fi/en/index.html

REFERENCES

1999 Update to the 8th Edition of the Table of Isotopes CD-ROM, R.B. Firestone, C.M. Baglin, and S.Y.F. Chu, John Wiley & Sons, Inc. (1999).

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The New Prompt Gamma-ray Catalog for PGAA, G.L. Molnar, Zs. Revay, T. Belgya, and R.B. Firestone, proceedings of 4th Topical meeting on Industrial Radiation and Radioisotope Measurement Applications (IRRMA'99), 3-7 October 1999, Raleigh, NC, invited paper to be published in Applied Radiaction and Isotopes.

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Application of Prompt Gamma Activation Analysis (PGAA) to Ocean Floor Geothermal- Vent-Produced Metal Sulfides, D.L. Perry, R. Gatti, R.B. Firestone, P. Wilde, G.L. Molnar, Z. Revay, and Z. Kasztovszky, American Chemical Society National Meeting, 26-30 March 2000, San Francisco, paper GEOC83.

The Nuclear Science Database: 60 Years of Community Experience, keynote address to the HUGO Mutation Database Initiative Meeting, 9 April 2000, Vancouver Canada.