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**AN INDEX TO THE LITERATURE ON
MICROSCOPIC NEUTRON DATA**

**PUBLISHED ON BEHALF OF
USA NATIONAL NEUTRON CROSS-SECTION CENTER
USSR NUCLEAR DATA CENTRE
NEA NEUTRON DATA COMPILATION CENTRE
IAEA NUCLEAR DATA SECTION**

**BY THE
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1975**

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FOREWORD

CINDA, the Computer Index of Neutron Data, contains bibliographical references to measurements, calculations, reviews and evaluations of neutron cross-sections and other microscopic neutron data; it includes also index references to computer libraries of numerical neutron data exchanged between four regional neutron data centres.

CINDA 75 is a cumulative issue in two volumes, which supersedes all earlier issues. It contains the complete CINDA file as at 1 April 1975. A supplement is envisaged to be published in December 1975; it will include CINDA entries compiled between April and October 1975.

The compilation and publication of CINDA are the result of world-wide co-operation involving the following four information centres. Each centre is responsible for compiling the CINDA entries from the literature published in a defined geographical area given in brackets below:

- * The USA National Neutron Cross-Section Center at Brookhaven National Laboratory, USA (United States and Canada)
- * The USSR Nuclear Data Centre at the Fiziko-Energeticheskij Institut Obninsk, Soviet Union (USSR).
- * The NEA Neutron Data Compilation Centre at Saclay, France (OECD member countries in Western Europe and Japan).
- * The IAEA Nuclear Data Section at Vienna, Austria (all other countries in Eastern Europe, Asia, Australia, Africa, Central and South America; also IAEA publications and translation journals).

Besides the published CINDA books, up-to-date computer retrievals for specified CINDA information are currently available on request. For CINDA computer retrievals, as well as for suggestions and corrections, scientists are invited to contact their responsible Centre:

For USA and Canada:

Dr. Sol Pearlstein
National Neutron Cross-Section Center
Brookhaven National Laboratory
Upton, N.Y. 11973
USA

For USSR:

Д-ру В. Н. Манохину
Центр по ядерным данным
Физико-энергетический
Институт
Обнинск, Калужской Обл.
СССР

For other OECD countries:

Dr. L. Lesca
Centre AEN de Compilation
de Données Neutroniques
(NEA Neutron Data
Compilation Centre)
B.P.9
F-91 Gif-sur-Yvette
France

For all other countries:

Dr. J.J. Schmidt
IAEA Nuclear Data Section
Kärntner Ring 11
A-1010 Vienna
Austria

AVANT-PROPOS

CINDA – Computer Index of Neutron Data (Index automatique de données neutroniques) – contient des références aux mesures, calculs et évaluations des sections efficaces et autres données neutroniques microscopiques; il comprend également des références aux index de bibliothèques automatiques de données neutroniques numériques échangées entre quatre centres régionaux de données neutroniques.

CINDA 75 est une édition cumulative en deux volumes remplaçant toutes les éditions précédentes. Il contient le fichier complet CINDA à la date du 1er avril 1975. La publication d'un supplément est envisagée pour décembre 1975; il contiendra les entrées CINDA compilées d'avril à octobre 1975.

La compilation et la publication de CINDA sont le fruit de la collaboration sur le plan mondial des quatre centres de documentation ci-après. Chacun de ces centres est responsable de la compilation des entrées CINDA extraites des revues et ouvrages publiés dans la région géographique indiquée entre parenthèses ci dessous:

- * USA National Neutron Cross-Section Center, Brookhaven, National Laboratory, E.U. (d'Amérique et Canada).
- * Centre des constantes nucléaires de l'URSS, Institut de physique énergétique d'Obninsk, Union soviétique (URSS).
- * Centre NEA de compilation de données neutroniques, Saclay, France (pays de l'Europe occidentale membres de l'OCDE et Japon).
- * Section des constantes nucléaires de l'AIEA, Vienne, Autriche (tous autres pays de l'Europe orientale, d'Asie, d'Australie, d'Afrique, de l'Amérique centrale et de l'Amérique du Sud; également les publications et périodiques de l'AIEA).

Outre les volumes publiés de CINDA, on peut se procurer sur demande des restitutions automatiques d'une partie spécifique de CINDA mise à jour depuis la parution de ce volume. Pour ce service spécialisé, ainsi que pour les suggestions et les rectifications, les intéressés sont priés de se mettre en rapport avec leur centre responsable. (Les adresses sont indiquées à la page précédente.)

ПРЕДИСЛОВИЕ

СИНДА – компьютерный указатель нейтронных данных, содержащий библиографические ссылки на измерения, расчеты, обзоры и оценки нейтронных сечений и на другие микроскопические нейтронные данные. Он включает также ссылки на компьютерные библиотеки цифровых нейтронных данных, которыми обмениваются между собой четыре региональных нейтронных центра.

СИНДА 75 – кумулятивное издание в 2-х томах, заменяющее все предыдущие издания. Оно содержит полный файл СИНДА на 1 апрель 1975 года. Дополнение, как ожидается, будет опубликовано в декабре 1975 г. и включит в себя информацию, собранную для СИНДА между апрелем и октябрем 1975 года. Сбор и публикация СИНДА являются результатом широкого международного сотрудничества с участием следующих четырех информационных центров:

- * Национальный центр по нейтронным сечениям при Брукхейвенской национальной лаборатории, США (Соединенные Штаты Америки и Канада).
- * Центр по ядерным данным СССР при Физико-Энергетическом Институте, Обнинск, СССР (Союз Советских Социалистических Республик).
- * Центр по сбору нейтронных данных АЯЭ в Сакле, Франция, (страны Западной Европы – члены ОЭСР и Япония).
- * Секция по ядерным данным МАГАТЭ в Вене, Австрия, (все страны Восточной Европы, Азия, Австралия, Африка, Центральная и Южная Америка; также публикации МАГАТЭ и переводные журналы).

Каждый центр несет ответственность за сбор входных данных СИНДА из литературы, опубликованной в определенном географическом районе, указанном в скобках выше.

Помимо опубликованных сборников СИНДА, в настоящее время имеется возможность получать по запросу распечатки с ЭВМ по специфической информации, содержащейся в СИНДА. По вопросам получения этих распечаток, а также с различными предложениями и поправками ученым предлагается обращаться в свои соответствующие центры (см. адреса на странице IX).

PREFACIO

CINDA, Computer Index of Neutron Data, contiene referencias bibliográficas sobre medidas, cálculos, revisiones y evaluaciones de secciones eficaces neutrónicas y sobre otros datos neutrónicos microscópicos; incluye también referencias sobre colecciones de programas sobre datos numéricos nucleares intercambiados entre cuatro centros regionales de datos nucleares.

CINDA 75, es una colección completa en dos volúmenes, que sustituye a todas las ediciones anteriores. Contiene la colección completa de CINDA archivada hasta el 1 de abril de 1975. Se espera publicar un suplemento en diciembre de 1975, que incluirá la información compilada entre abril y octubre de 1975.

La compilación y publicación de CINDA es fruto de una colaboración a escala mundial, en la que participan los cuatro centros de información enumerados a continuación. Cada uno de estos centros se encarga de compilar las reseñas correspondientes a la literatura publicada en la región geográfica que se indica entre paréntesis:

- * El Centro Nacional de Secciones Eficaces Neutrónicas de los Estados Unidos, Laboratorio Nacional de Brookhaven, E.U. (Estados Unidos y Canadá).
- * El Centro de Datos Nucleares de la Unión Soviética, Instituto de Físico-energética de Obninsk, Unión Soviética (URSS).
- * El Centro de Compilación de Datos Neutrónicos de la AEN, Saclay, Francia (países de Europa occidental miembros de la OCDE y el Japón).
- * La sección de Datos Nucleares del OIEA en Viena, Austria (todos los restantes países de Europa oriental, Asia, Australia, Africa, América Central y América del Sur; también las publicaciones del OIEA y las revistas de traducciones).

Además de los volúmenes CINDA publicados, se pueden facilitar, previa petición, todas las reseñas almacenadas hasta la fecha en la computadora, correspondientes a informaciones específicas de CINDA. Para obtener esta información, así como para cualquier sugerencia o corrección, se invita a los científicos a dirigirse al Centro que les corresponda (véanse las direcciones en la página IX).

COMPUTER RETRIEVALS AVAILABLE FROM THE CINDA FILE

Requests for computer retrievals (which are free of charge!) should be addressed to one of the Centres given on page IX.

Special reasons which may decide you to ask for a retrieval are:

1. If you particularly need the most recent information available (i.e. information which is not yet contained in the last CINDA publication)
2. If you wish to check a part of the file which cannot easily be selected from the CINDA book.
3. If you are requesting numeric experimental or evaluated data and wish at the same time to know of other data which may not yet be in the centres' numerical data files.

Specification of retrievals:

Possible search parameters are:

Element or Range of Z	or list of isotopes (ZA)

Quantity (for existing quantities see p. XXIII), or list of reactions (ZA Quality)

Energy range or alphabetic abbreviation (e.g. fission-spectrum average data)

Data type (experimental, evaluated, theoretical, etc.)

Laboratory

Country

Reference(s)

Publication date

Date of entry into the CINDA file

(a few more retrieval parameters exist that are mostly for usage of CINDA indexers).

The search parameters may be specified singly or in any reasonable combination. In order to avoid unwanted references on the output listing please specify your requirements as exactly as you can!

Examples

1. Please send me a listing of all references on the Pu-239 neutron capture and absorption cross-sections.
2. Please send me all information entered in the CINDA file since the last CINDA book: but I am interested only in experimental data.
3. What has been published on capture cross-sections of fissile elements since 1970? (The search will specify quantity, Z-range and publication date). I am interested only in point data $\sigma(E)$ and not in data averaged over a neutron spectrum.
4. Please send me all entries for (n,2n) reactions between 14 and 15 MeV and $A \leq 100$.

Output:

The requestor will receive a listing in either of three sorts:

"lab-sort": this sort is firstly by the 3-character laboratory code in alphabetic order, then by nuclide and quantity.

“ZAQ-sort”: entries are sorted by element Z and mass-number A, then by Quantity (sorted as on page XXIII).

“Quantity-sort”: entries are sorted by Quantity (as on page XXIII), then by nuclide ZA

The requestor should specify which sort(s) he prefers. The usual format of computer listings is close to that of the book. (CINDA indexers may obtain retrievals in an "internal" format, which is needed for making corrections and grouping associated CINDA entries.)

A BRIEF INTRODUCTION TO CINDA

The CINDA bibliography allows its users to find the references to specific types of cross-section information or other microscopic data from neutron-induced reactions, for any given target nucleus.

CINDA entries are ordered in this publication first by element and mass number, then by cross-section or other quantity. Within these isotopes and quantity groups, the references are ordered by date of publication; users will notice, however, that experimental, theoretical and evaluation articles are mixed in the listing, and should check from the entry itself whether the reference is of the type they want.

Entries relating to preliminary publications of measurements (i.e. progress reports, abstracts, etc.) are inserted in the CINDA listing as they appear. When the final or archival publication appears it is the policy of CINDA to list the previous references relative to the experiment in blocked form.

The Centres would appreciate notice of any errors of omission or commission users may find, so that the entries concerned can be corrected before the next cumulation.

To obtain the maximum amount of information from CINDA, it is suggested users read the detailed description given in the annex. However, the format of CINDA is rather simple and most of the conventions can easily be guessed. For the majority of uses to which CINDA can be put, the brief description on pages XVI and XVII is all one needs.

NUMERICAL CROSS-SECTION DATA

This issue of CINDA indexes, for a given work, not only its bibliographic references but also in many cases, its numerical data stored in computer libraries, which are available from the data centres. Since July 1970 the exchange of experimental neutron data between the U.S. National Neutron Cross-Section Center, the NEA Neutron Data Compilation Centre, the USSR Central Neutron Data Center and the IAEA Nuclear Data Section has been structured in the EXFOR exchange system, so that data entered at one centre are made available to the other three. Similarly, evaluated neutron data libraries or parts of them are generally available from the same four centres.

Whereas in earlier issues of CINDA the availability of data sets from the data centres was publicized by a simple tag (+) at the right-hand margin under the heading "Data", it was decided to include more information about this data by adding a "data-index line" below the bibliographic reference(s) of a given work. Users of CINDA 75 will find such data-index lines for the experimental neutron data exchanged under the EXFOR agreement, as well as index lines referring to evaluated neutron data libraries which are generally available.

More information about data-index lines and the availability of data can be found in Section 8 of the Annex.

Quantity	Energy (eV)		Lab	Type	Documentation			Date
	Min	Max			Ref	Vol	Page	
(n, γ)	3.0+4	6.5+4	ORL	Expt	Jour Rept Conf	PR 129 BNL-653 61 Vienna	2695 5 73	Mar 63 Feb 62 Aug 61
(n, γ)	1.0-4	5.0-2	WIN	Eval	Rept	AEEW-R 351		Feb 64
(n, γ)	3.0+1	5.0+4	CCP	Expt	Jour	AE 16	256	Mar 64
(n, γ)	8.5+3 8.1+3	9.4+4 9.4+4	SCT	Expt Expt	Jour Data	NP/A 121 EXFOR 30114.	655	Dec 68 Mar 71
Spect (n, γ)	Maxwl		ISP	Expt	Conf	67 Juelich 64		Apr 67

Type of reference. The categories used are JOURNAL, REPORT, CONFERENCE, PREPRINT, PROGRESS report, ABSTRACT, BOOK, DISSERTATION, PRIVATE communication, DATA in computer library.

Type of work. EXPT experimental, EXTH experiment with substantial theory, THEORETICAL, COMPILATION, EVALUATION, REVIEW. See section 5 of the Annex.

Laboratory. The laboratory given on the paper for the first author.
The laboratories for these entries are:
ORL Oak Ridge National Laboratory
WIN AEE Winfrith
CCP Soviet Union, Laboratory unspecified
SCT Cape Town, South Africa
ISP Euratom, Ispra

Table 4 explains all the abbreviations used.

Energy range of incident neutrons in floating decimal point notation, explained more fully in section 3 of the Annex. The energy ranges covered by the references on this page are:

From 30 keV to 65 keV
From 0.1 meV to 50 meV
From 30 eV to 50 keV
From 8.5 keV to 94 keV
From 8.1 keV to 94 keV
Thermal Maxwellian energy spectrum

Cross-section or class of data. The list on page XX shows the order in which quantities are listed, while full definitions are given in Table 2 at the end of this issue.

Author, Comments

Data

Macklin + LIQ SCINT, 10+ - 3, 3.5+ - 1MB
 SUPERSEDED*
 SUPERSEDED*

LOW E PART UK DATA FILE. REFS HIGH E

Kapchigashev + CURVE PB SLOWING DOWN +
 ENGLISH SJA 16 306 FRANCAIS EAF 16 3 104
 Spitz + VDG, M-R, TOF, REL TO IN, GRAPHS +
 SIGMA AT 35 ES, THICK + THIN TARGET

Forte + CIRCULAR POLRZ (POLRZD NS) NDG

Reference Citations

The notation is explained fully in section 6 of the Annex, while abbreviations are expanded in Table 3. The examples are

Physical Review 129, page 2695, March 1963. This article supersedes report BNL-653 and paper 73 of the IAEA conference on the Physics of Fast and Intermediate Reactors, Vienna, August 1961.

Report AEEW-R351, issued February 1964.

Atomnaja Energija 16, page 256, March 1964. Translations into English and French can be found in Soviet Atomic Energy and in Energie Atomique.

Nuclear Physics, Part A, vol.121, page 655, December 1968. A computer retrieval of the numerical data is available under the accession-number EXFOR 30114.

Symposium "Neutronenphysik an Forschungsreaktoren", Juelich, April 1967, page 64.

Numerical Data

A cross under the heading "Data" indicates that the numerical data corresponding to this reference have been entered in the data files of one or more of the co-operating regional or national data centres. More information on the availability of numerical neutron data is given in section 8 of the Annex

Comments

No fixed form, but the type of information given is discussed on page A.4, while common abbreviations are explained in Table 5.

Reading down these six entries we have:

Authors Macklin et al., experimental method liquid scintillator, two experimental values and a list of two previous publications on the same subject.

A section of the UK Nuclear Data File.

Authors Kapchigashev et al., a curve shows results from a neutron slowing down time experiment in lead.

Author Spitz et al., an experiment using a Van-de-Graaff accelerator, Moxon-Rae detector, time-of-flight method; data relative to indium are given as graphs.

Authors Forte et al., circular polarization of gamma rays following capture of polarized neutrons. No data are given (NDG) in this paper.

Element and mass number see the explanation on page A.1 at the end of this issue

24 Chromium means natural Cr

24 Chromium 052 means Cr⁵²

Many refers to a whole range of nuclides

Fprod covers a mixture of fission products

1 Hydrogen CXX and similar codes refer to organic compounds and other molecules and mixtures, the abbreviations used are explained in Table 1 at the end of this issue

SELECTED LITERATURE SCANNED FOR THE PRESENT EDITION

A complete list of periodicals and conference proceedings that have been indexed in CINDA can be found in Table 3 of the Annex. For several important periodicals, the date of the last issue scanned for this edition of CINDA is given in the following (incomplete!) table:

AAFC	Australian reports	Nov 1974
AE	Atomnaja Energija, USSR	Oct 1974
AECL	Chalk River reports, Canada	Sept 1974
AIRE-	Harwell reports, UK	May 1974
ANL-	Argonne reports, USA	Jan 1975
AP	Annals of Physics, USA	Jan 1975
APPB	Acta Physical Polonica B	Dec 1974
AUJ	Australian Journal of Physics	Oct 1974
BAP	Bulletin of the American Physical Society	Feb 1975
BARC-	Trombay reports, India	Aug 1974
BAS	Bull. Acad. Sci. USSR (Engl. transl. of IZV)	Oct 1974
BNL-	Brookhaven reports, USA	Dec 1974
CJP	Canadian Journal of Physics	Dec 1974
CZJB	Czechoslovak Journal of Physics B	Jan 1975
DA/B	Dissertation Abstracts B, USA	Feb 1975
INDC-	Int. Nucl. Data Comm. reports	Jan 1975
INIS-MF-	INIS Microfiches, IAEA	Aug 1974
IZV	Izvestia Ak. Nauk SSSR	Oct 1974
JCP	Journal of Chemical Physics, USA	Feb 1975
JIN	Journal of Inorg. and Nucl. Chem., UK	Dec 1974
JINR-	Dubna reports	Dec 1974
JPA	Journal of Physics A, UK	Dec 1974
JPI	Journal of the Physical Society of Japan	Jan 1975
JPR	Journal de Physique, France	Dec 1974
JUEL-	Jülich reports, Germany, to nr. 998	July 1973
KI	Kernenergie, DDR	Nov 1974
KIK-	Karlsruhe reports, Germany	Oct 1974
KIKI	Budapest reports, Hungary	Jan 1975
LA	Los Alamos reports, USA	Jan 1975
NE ANDC(F)	NEA Nucl. Data Comm. reports	Jan 1975
NE ANDC(UK)	NEA Nucl. Data Comm. reports	July 1974
NIM	Nuclear Instruments & Methods, Netherlands	Dec 1974
NPA	Nuclear Physics A, Netherlands	Jan 1975
NSI	Nuclear Science and Engineering, USA	Feb 1975
ORNL-	Oak Ridge reports, USA	Feb 1975
PL B	Physics Letters B, Netherlands	July 1974
PR A,B,C	Physical Review, parts A,B,C, USA	Feb 1975
PR D	Physical Review, part D, USA	Dec 1974
PRL	Physical Review Letters, USA	Feb 1975
REA	Atomic Energy Review, IAEA	Mar 1974
ScF	Studii si Cercetari de Fizica, Romania	Dec 1974
SJA	Soviet Atomic Energy (Engl. transl. of AE)	Dec 1974

SNP	Soviet J. of Nucl. Phys. (Engl. transl. of YF)	Oct 1974
UCRL-	Livermore reports, USA	Dec 1974
USNDC-	US Nuclear Data Committee reports	Aug 1974
WAPD-	Westinghouse reports, USA	Sept 1974
YF	Jadernaja Fizika, USSR	Oct 1974
YFI-	USSR progress-reports	Aug 1974
ZFK-	Rosendorf reports, DDR	Aug 1974
ZP	Zeitschrift für Physik, Germany	Dec 1974

The following conferences were newly indexed in this issue:

IAEA Panel on Neutron Standard Reference Data, Vienna, 20-24 Nov 1972.

Int. Conference on Nuclear Physics, Munich, 27 Aug - 1 Sep 1973.

Furthermore, data-index lines have been added for the experimental neutron data exchanged in the EXFOR system before April 1975. Both the Bologna and the Australian library of evaluated fission-product neutron cross-sections are indexed in this issue, as well as those parts of the United Kingdom evaluated neutron data library which are generally available.

NEUTRON DATA HANDBOOKS

Although CINDA aims at completeness, it seems of little use to index in CINDA comprehensive neutron data handbooks which would appear in CINDA under almost every nuclide. Instead, a (necessarily incomplete) list of such handbooks which are not indexed in CINDA is given here:

BNL-325, graphical plots of experimental neutron cross-sections, and tabulations of thermal cross-sections and resonance-parameters. National Neutron Cross-Section Center, Brookhaven National Laboratory, USA.

Second edition, July 1958, with a first supplement, Jan 1960, and a second supplement in 5 volumes:

vol. 1, $Z = 1-20$, May 1964

vol. 2A, $Z = 21-40$, Feb 1966

vol. 2B, $Z = 41-60$, May 1966

vol. 2C, $Z = 61-87$, Aug 1966

vol. 3, $Z = 88-98$, Feb 1965

Third edition:

vol. 1 containing tabulated 0.0253 eV cross-sections, resonance properties, resonance parameters and related bibliography, Dec 1973.

vol. 2 containing cross-section curves and bibliography, in preparation.

BNL-400, graphical plots of experimental data on angular distributions in neutron-induced reactions. National Neutron Cross-Section Center, Brookhaven National Laboratory, USA. Third edition.

vol. 1, $Z = 1-20$, Jan 1970

vol. 2, $Z = 21-94$, June 1970.

UCRL-50400 vol. 10: Tabulated experimental data for neutron-induced reactions, on six reels of microfilm, with a seventh reel containing indexes. S.T. Perkins, R.J. Howerton, Lawrence Livermore Laboratory, USA, June 1971. A new version is in preparation.

UK Nuclear Data Library. Those parts of the UK Nuclear Data Library which are generally available on magnetic tape, are indexed in CINDA. For further reference the following reports can be consulted:

The current edition of the main tape NDL-1 of the UK Nuclear Data Library, A. L. Pope, AEEW-M-1208, (March 1973).

Minimal output from UK Nuclear Data Library NDL-1: Thermal Cross-sections, resonance integrals and fission spectrum averages, A. L. Pope, J. S. Story, AEEW-M-1191, (April 1973).

Minimal output from the fission-products data files of the UK Nuclear Data Library: Thermal cross-sections, resonance integrals and fission spectrum averages, A. L. Pope, AEEW-M-1266 (April 1974).

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