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NEANDC-97"U"
INDC(ENE)-5/L

NUCLEAR ENERGY AGENCY NUCLEAR DATA COMMITTEE

A LIST OF COMPUTER PROGRAMS FOR NEUTRON CROSS SECTION CALCULATIONS AND ANALYSIS

(Revised: January 1974)

Organisation for Economic Co-operation and Development
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ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

NUCLEAR ENERGY AGENCY

5th August 1974

MEMORANDUM

To: NEANDC "U" Distribution List
INDC "L" Distribution List (via Dr. J.J. Schmidt, IAEA/NDS)

c.c. Mr. L. Garcia de Viedma, NEA/CPL
Mr. Z. Turkov, IAEA/INIS
Mrs. M. Butler, USCC
Mrs. B. Maskewitz, RSIC

From: Jacques Royen (NEANDC Secretariat)

Object: Availability of some Nuclear Model Codes at the OECD/NEA Computer Program Library

Our Ref: EN/S/4882

1. Since 1970, the Nuclear Energy Agency Nuclear Data Committee (called at that time the European-American Nuclear Data Committee) has examined the difficulties of getting nuclear model codes to run satisfactorily. Considerable re-writing effort is required when changing to another computer and the results are frequently quite different; for example, it was said a conversion of ABACUS-NEARREX from a CDC-3600 to an IBM-360 gave about 15% difference. It is believed that a large fraction of the codes being used are giving incorrect answers for purely computational reasons having nothing to do with physical applicability.

2. "A great deal of money has been expended in the use of these large model programs with results that have not always proved reliable. The matter is not so critical in the context of basic research as often a very qualitative result will provide the desired physical information, e.g. the angular momentum transferred in a stripping reaction. However, applied calculations can be demanding of accuracy in those instances where interpolation and extrapolation of measured data provide important and quantitative microscopic data. Many of the calculations are simply not accurate to the necessary degree. The uncertainties, or errors, are of two types :

(i) An inappropriate specification of the physical process providing an incorrect definition of the problem for solution. Such problem dependent errors generally occur as the result of applying the wrong code to the problem, e.g. use of power series solutions rather than spherical harmonics expansions in deformed-well calculations.

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(ii) Program-dependent errors including errors in the numerical analysis or the computational algorithms employed in the program specification and "bugs" attributable to the writing of the program, software design, or a lack of understanding of the computer system (hardware and software) utilized by the applications program. These calculational uncertainties stem from a number of sources. Some of the numerical methods are simply inadequate. The "answers" appear incorrect and the errors are very difficult to detect as documentation is often incomplete, or even non-existent, and many of the programs have a long and uncertain history of modification passing through a number of laboratories and/or personnel. The matter is further complicated by their transfer from one computer system to another differing in basic mode of operation, compiler characteristics, number representation, etc. The net result is too often discrepancies in the range 1 - 10% in calculational results for such important quantities as the fast neutron cross sections of plutonium-239."

3. Clearly, there is a need and room for considerable improvement. In other nuclear fields, such as reactor physics, radiation shielding, etc., efforts are under way on checking codes and getting them to run properly; the availability of selected programs, well-documented and with pertinent test cases, at the major code centers, can indeed be a significant help. Each user can assist by conveying to the centre his experience with the library codes so that "bugs" can be eliminated and "incorrect answers" resolved. It is basically up to the need group, or professional user community, to do this. They develop the library programs, use them, test them, and benefit from the co-operative exchange and central information services provided by the centre. The centres contribute standardization, information, and documentation efforts essential to effective computer program interchange. Some testing of nuclear model codes is now in progress; it does not, however, get at the root of the problem. Nuclear physicists are expected, so far, to take care of themselves, and this is proving to be very expensive in time and money. Yet, the co-operation and utilization of code centres for the storage, dissemination, testing, maintenance and annotation of complex nuclear model codes can result in considerable savings in computational costs and lead to appreciable improvements in important evaluated data.

4. The OECD/NEA Computer Program Library, which is a clearinghouse for computer programs for reactor calculations, was established in 1964 at the Ispra Joint Research Centre of the Commission of the European Communities. Thirteen European countries and Japan contribute to the financing of the CPL, which operates in close collaboration with centres providing similar services in North America, notably the United States Code Center (USCC) at Argonne National Laboratory and the Radiation Shielding Information Center (RSIC) at Oak Ridge National Laboratory, and exchanges with them computer program packages pertinent to nuclear science and

technology. In addition to the fourteen supporting countries, a number of others maintain links with the CPL through the International Atomic Energy Agency, which has stationed a senior programmer at the Library to deal with non-OECD countries.

5. The basic objective of the CPL (and of the American code centres mentioned above) is to achieve, through the collection, testing and redistribution of computer programs for nuclear calculations, an improved use of these programs and an accelerated development of new and more advanced ones based on the exchange of users' experience and propositions for improvement. Most of these programs are donated by scientific organisations in the countries supporting the Library : after receipt they are tested for operation on various computers besides those for which they were written, after which they are made available to other organisations on request. Over the years, CPL has encountered a variety of problems in testing, adapting and running programs of many types, and has accumulated a substantial fund of specialised knowledge for the solution of such problems.

6. The Committee of the Computer Program Library (CPL's directing body) has agreed that nuclear model programs be held and disseminated by the Library, subject to subsequent supporting action by the NEANDC and on the understanding that only a limited number of programs could be accepted. Because of the high costs involved in checking out a "finished" program obtained from another establishment (typically, between one and two thousand U.S. dollars), CPL must be very selective in collecting programs for subsequent distribution; also, it is probably important to emphasize the quality of a few well-selected and properly-tested programs rather than a large quantity of material of more dubious merit.

7. To assist the selection of nuclear model codes which are found particularly useful and have potential wide interest, comments on the status, use and availability of such codes which could usefully be exchanged through the CPL were obtained through the members of the NEANDC; this effort was complemented by a similar activity regarding the USCC. Attention was focused on model codes used for the calculation of microscopic data for applied nuclear energy programs, in order to avoid the large number of codes largely employed in basic research studies or in the compilation of macroscopic data libraries such as multigroup cross sections. Based on the answers received, published material, personal knowledge and discussion, a "List of Computer Programs for Neutron Cross Section Calculations and Analysis" was drawn up by Professor V. Benzi, Director of the Computer Centre of the Italian Comitato Nazionale per l'Energia Nucleare, in Bologna. This list (document NEANDC-97"U"), which is attached to this memorandum, also includes information obtained from the IAEA.

8. Some nuclear model computer programs have already been introduced into the CPL collection. Should you be interested in a program listed in NEANDC-97"U", or in another one which could also be of wide interest, it is proposed that you get in touch with:

Mr. Luis Garcia de Viedma
Head, OECD/NEA Computer Program Library
Casella Postale No. 15
I-21027 Ispra (Va)
Italy

Telephone: 780-224
Telex : 38045 NEA CPL
Cable : NEA-ISPRA

(in the United States and Canada:

Mrs. Margaret Butler
Director, United States Code Center
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Telephone: 312-739-7711, Ext. 4366
TWX 910-258-3285
WUX LB, Argonne, Illinois).

The feasibility of exchanging the program through the Library will then be examined with utmost care. Your remarks and suggestions will also be most welcome.

GENERAL REMARKS

1) The list is ordered by country of origin (in alphabetical order) and then by field of application of the code. The name of the code, author, author establishment and reference are given in the first, second, third and fifth column, respectively. The fourth column contains a synthetic description of the most important performances of the code.

2) The following definitions of the field of application are adopted:

i) Thermal scattering. Calculation of thermal neutron scattering laws, $S(\alpha,\beta)$, and/or neutron scattering cross sections and kernels.

ii) Resolved resonances. Class A: Analysis of experimental data using a given approximation like single-level, multi--level, Reich-Moore etc.. Class B: Calculation of resonance cross sections in a given approximation.

iii) Unresolved resonances. Calculation of average cross sections in the region of unmeasured but resolved resonances.

iv) Statistical model. Calculation of average (mainly compound-nucleus) cross sections in the region of strongly overlapping resonances and/or in the continuum.

v) Optical model. Calculation of total, shape-elastic, collective, direct and reaction cross sections in the continuum on the basis of the "cloudy cristal ball" model.

vi) Miscellanea. All those codes pertinent to neutron cross section calculations which cannot be classified under def. i) to v).

Far to be complete, it is felt that the list contains more than 80% of the codes in use to-day. Important contributions from F.R. Germany, UK (Oxford University) and other European countries are very likely missing. In addition, some of the listed codes might be obsolete.

4) Codes adjusted for computers or languages other than those for which they were originally developed are not mentioned in the list.

ABBREVIATIONS

AA	=	Adler-Adler Method
ACCC	=	Adiabatic Coupled Channel Calculations
ADXS	=	Angular Differential Cross Section
AGD	=	Angular -ray Distribution
AM	=	Area Method
ASP	=	Automatic Search of Parameters
BBM	=	Blatt-Biedenharn Method
CCBA	=	Coupled Channel Born Approximation
CCC	=	Coupled Channel Calculation
CCXS	=	Collective Capture Cross Section
CEXS	=	Compound Elastic Cross Section
CF	=	Coulomb Functions
CHP	=	Charged Particle
CHXS	=	Charged Particle Cross Section
CIXS	=	Compound Inelastic Cross Section
CNXS	=	Compound Nucleus Cross Section
COXS	=	Coherent Scattering Cross Section
CXS	=	Radiative Capture Cross Section
DB	=	Doppler Broadening
DDXS	=	Double Differential Cross Section
DIXS	=	Direct Interaction Cross Section
DM	=	Diffraction Model
DOP	=	Deformed Optical Potential
DWBA	=	Distorted Wave Born Approximation
ELC	=	Energy Level Calculation
ETXS	=	Energy Transfer Cross Section
EVM	=	Evaporation Model
EXS	=	Elastic Scattering Cross Section
FL	=	Fluctuation Factor
FXS	=	Fission Cross Section
GRP	=	Statistical Generation of Resonance Parameters
GRSC	=	Gamma-ray Spectra Calculation
GXS	=	Group-averaged Cross Sections
GWC	=	Gamma Width Calculation

ABBREVIATIONS (continued)

HS	=	Heterogeneous System
ICOXS	=	Incoherent Scattering Cross Section
IXS	=	Inelastic Scattering Cross Section
LL	=	Lane-Lynn Method
LM	=	Legendre Moments
LSOP	=	Local Spherical Optical Potential
MA	=	Maxwellian Average
MF	=	Moldauer Formalism
MIC	=	Microscopic Model
MLDA	=	Multi-level Data Analysis
MLXS	=	Multi-level Cross Section
MM	=	Margolis Model
MPXS	=	Multiple Particle Emission Cross Section
NLOP	=	Non-Local Optical Potential
OT	=	Optical Model Transmission Coefficients
PEF	=	Penetration Factors
PHS	=	Phase-Shift
PHXS	=	Photo-reaction Cross Section
POL	=	Polarization
RESP	=	Resonance Parameters
RFF	=	Radial Form Factor
RI	=	Resonance Integral
RM	=	Reich-Moore Approximation
RR	=	Reduced R-matrix Approximation
RXS	=	Resonance Cross Section
SAF	=	Satchler Formalism
SAXS	=	Shielded Average Cross Sections
SDRC	=	Semi-Direct Radiative Capture
SHF	=	Shift-Factors
SI	=	Self-Indication Method
SL	=	Scattering Law
SLDA	=	Single Level Data Analysis
SLXS	=	Single Level Cross Sections

ABBREVIATIONS (continued)

SO	=	S_o Strength Function
STM	=	Secondary Energy Transfer Moment
TNSK	=	Thermal Scattering Kernel
TR	=	Transmission Method
TXS	=	Total Cross Section
UAXS	=	Unshielded Average Cross Sections
WF	=	Wave-functions Calculation

AUSTRALIA

Resolved resonances

(Class A)

MULFT	?	?	MLDA,AA	(1)

(Class B)

GUNIA	?	?	SLXS,GRP	(1)

Optical model

COMPOST	?	?	NLOP?	(1)

BELGIUM

Resolved resonances

(Class A)

SHAPTRA	?	?	SLDA,TXS	(1)

EURATOM

Resolved resonances

(Class A)

GACAFI	SCHMID	CBNM-GEEL	FXS	(2)
BLATT 4 (ERRFIT)	CAO	CBNM-GEEL	BBM	(2)

Statistical model

FIROH	SCHMID	CBNM-GEEL	EVM	(2)
GJROH	SCHMID	CBNM-GEEL	MPXS	(2)

FRANCE

Thermal scattering

GRAND MOTHER	PILLARD+	SACLAY	ICOXS,LM	(3)
LITTLE MOTHER	PILLARD+	SACLAY	ICOXS,LM	(3)

Resolved resonances

(Class A)

BW1-501	SANCHE	SACLAY	SLDA,TXS,FXS	(4)
MULTI-RMMC	DERRIN	SACLAY	RM,TXS,FXS	(4)
VAL-PA-RESØ	ALIX	SACLAY	SO,RESP	(5)

(Class B)

MR-MS	DECHARGE+	LIMEIL	MLXS,EXS	(6)
R-MAT	LE RIGOLEUR	CADARACHE	MLXS,SLXS,EXS	(7)

Statistical model

FISINGA	KREBS+	SACLAY	FL,FXS,CXS,IXS	(8)

Optical model

MAGALI	RAYNAL	SACLAY	LSOP,ASP	(9)
ECIS 70	RAYNAL	SACLAY	DOP,CCC	(4)
(ECIS 71)			(ASP)	

GERMANY (F. R.)

Optical model

?	?	?	NLOP ?	(1)

Miscellanea

PHASESHIFT	KANKOWSKY	ERLANGEN U.	PHS,POL	(10)

ITALY

Resolved resonances

(Class B)

SETER	MARTINELLI+	CNEN-BOL	SLXS,RI	(11)
PIUME	MARTINELLI+	CNEN-BOL	MLBW,GRP	(12)

Unresolved resonances

UNPEC	LESCA+	CNEN-BOL	RI,DB,GXS,HS	(13)

Statistical model

SAUD	BENZI+	CNEN-BOL	CXS,LL	(14)
FISPRØ II	BENZI+	CNEN-BOL	CXS,MM	(15)
MARE	REFFO+	CNEN-BOL	EVM,CHXS,MPXS	(16)
PRODE	MENAPACE+	CNEN-BOL	DIXS,IXS,CHXS	(17)
PACO	MENAPACE+	CNEN-BOL	EVM,IXS,CHXS	(17)
FISPRONE	PANINI+	CNEN-BOL	CXS,MM,OT,FL	(17)

Optical model

SASSI	BENZI+	CNEN-BOL	LSOP,CNXS	(18)
SMOG	BENZI+	CNEN-BOL	LSOP,POL	(19)
ADAPE	FABBRI+	CNEN-BOL	DOP,ACCC	(20)
DANGFASI	FABBRI+	CNEN-BOL	DOP,CCC,POL	(21)
(DUMBO)			PHS	
CERBERO	FABBRI+	CNEN-BOL	LSOP,CNXS,CHXS	
			EXS,MF,PEF	(17)
DIRCO	FABBRI+	CNEN-BOL	SDRC,CCXS	(22)
KISS	FABBRI+	CNEN-BOL	SDRC	(23)
SURF	FABBRI+	CNEN-BOL	PHXS,CCC	(24)
MIDI	FABBRI+	CNEN-BOL	CXS,CCC	(17)
MIMOC	FABBRI+	CNEN-BOL	MIC,CCC,PHS	(25)
RES	FABBRI+	CNEN-BOL	RESP,MIC,CCC	(17)

ITALY (continued)

Miscellanea

SPEC	FABBRI+	CNEN-BOL	GRSC	(26)
LILABNER	BENZI+	CNEN-BOL	Level density par.	(17)
FGETA	FABBRI+	CNEN-BOL	CF	(27)
BOSTAW	FABBRI+	CNEN-BOL	ELC,WF	(28)
RAFF	FABBRI+	CNEN-BOL	RFF	(29)
EXODUS	BENZI+	CNEN-BOL	IXS Analysis	(17)
NILSSON	FABBRI+	CNEN-BOL	ELC,WF,DOP	(17)
LARA	REFFO+	CNEN-BOL	GWC	(17)

JAPAN

Thermal scattering

FREE	ISHGURO	JAERI	SL,ETXS	(30)
NELKER	SHIMADA	MAPI	SL,ETXS	(30)
E.S.4.	MATSUOKA+	HITACHI	SL,TNSK,LM	(31)
UNCLE	TOKIZAWA+	NAIG	DDXS,ETXS, IXS,SL,EXS	(32)
FREDAM	NAKAHARA	JAERI	COXS	(30)
ONE PHONON	TAKAHASHI	JAERI	COXS,ETXS	(30)
UNCLETOM	IIJIMA+	NAIG	COXS,EXS	(30)
THRUSH	KADOTANI	CRC	TNSK	(33)
HIKER	NAKAHARA	JAERI	TNSK	(34)

Resolved resonances

(Class A)

MAH-AREA	TACHIBANA+	JAPC	AM	(35)

Statistical model

STAF	NAKAMURA	FUJI	FXS	(36)
RACY-S,RACY-D	NAKAMURA+	FUJI	CXS	(37)
STEVE-1	HATCHYA	MITSUI	CHXS,EVM	(30)

JAPAN (continued)

Optical model

TOTAL	IGARASI	JAERI	TXS,SO	(36)
ELIESE	IGARASI	JAERI	LSOP,CNXS	(38)
ELIESE-2	IGARASI	JAERI	LSOP,CNXS CHXS,ASP	(39)
ELIESE-3	IGARASI	JAERI	LSOP,NLOP, CNXS,CHXS,EXS, EVM,MF,POL,ASP, PHS,PEF	(40)
STAX-2	TOMITA	JAERI	LSOP,CNXS, MF,ASP	(41)
INS-ELASTIC	KAWAI	TOKIOTECH.	LSOP,POL,EXS	(42)
N-TRANCE	KIMURA+	JAERI	TXS	(43)

Miscellanea

WAFFI	IGARASI	JAERI	WF	(36)
TRANCE	IGARASI	JAERI	PEF,SO	(36)

SWEDEN

Optical model

SUM-CC	ERIKSSON	AE-STUDSVIK	SDRC	(44)

SWITZERLAND

Miscellanea

SIPLEV	?	?	DOP,ELC,WF	(45)
ABOLLA	?	?	DOP,ELC	(45)

UK

Thermal scattering

ADDELT	McLATCHIE	HARWELL	SL	(46)
LEAP	McLATCHIE+	HARWELL	SL	(47)
SCAT	HUTCHINSON+	HARWELL	LM,ICOXS,ETXS	(48)
PIXSE	McDOUGALL	WINFRITH	ETXS,GXS	(49)
SLAB	HUTCHINSON	HARWELL	SL	(48)
SOLON	BUTLAND	WINFRITH	ETXS,GXS	(50)
HEXCOH	BUTLAND	WINFRITH	COXS	(51)
CY-LEAP	BUTLAND	WINFRITH	SL	(46)
TRAP	McLATCHIE	HARWELL	ETXS	(50)

Resolved resonances

(Class A)				
CAPM	MOXON	HARWELL	SLDA ?	(50)
(Class B)				
REMO	JAMES	WINFRITH	RM,TXS, EXS,CXS,FXS	(30)
GENEX	BRISSENDEN	WINFRITH	CXS,FXS,TXS, IXS,DB	(52)
SIGAR	POPE+	WINFRITH	MLXS,TXS, IXS,DB	(50)
MLCSC	MOXON	HARWELL	MLXS,TXS,EXS, CXS,DB	(1)
(UN-NAMED)	LYNN+	HARWELL	like MLCSC + FXS	(1)
MCLA	HARVEY+	HARWELL	MLXS,TXS,EXS FXS,CXS,DB	(30)
SLP	DOHERTY	WINFRITH	SLXS	(53)

UK (continued)

Unresolved resonances

RESP	BRISSENDEN+	WINFRITH	GRP	(54)
RESINT	POPE	WINFRITH	RI,UAXS	(54)
SIGAV	JAMES	WINFRITH	TXS,FXS,CXS, UAX	(1)
ERIC-II (ERIC-I)	SUMNER	WINFRITH	RI,DB,HS SAXS	(55)
RIP	DOHERTY	WINFRITH	RI	(30)
REGA	?	?	SAXS	(50)

Statistical model

HFW	WILMORE	HARWELL	HF,FL	(56)

Optical model

OMW	WILMORE	HARWELL	LSOP,ASP	(50)
OMPS	HILL	OXFORD UN.	LSOP,CNXS, ASP	(42)

Miscellanea

CWF-TABLE	NORTON+	WINFRITH	SHF,PEF,CHP	(30)
EVAP	MOXON	HARWELL	GRSC	(50)

UNITED STATES

Thermal scattering

FLANGE-1	HONECK+	GGA	DDXS,ETXS	(57)
GASKET	KOPPEL+	GGA	DDXS,ADXS LM,STM,MA	(58)
GAKER	HOUSTON	GGA	DDXS,LM,IXS	(59)
SUMMIT	BELL	GGA	DDXS,ETXS	(60)
TOR	CLENDENIN	LASL	SL	(61)
COHBE/PREP	BORGONOVI	GGA	SL	(62)
FLANGE-II	HONECK+	GGA	EXS,FXS,IXS CXS,GXS,LM	(63)
GLEN	CLENDENIN	LASL.	SL	(64)

Resolved resonances

(Class A)

CODILLI	ADLER+	ILLINOIS UN.	MLDA,AA	(65)
TACASI	FRIESENHAN	GGA	SLDA,AM TR,SI,CXS	(66)

(Class B)

ZUT	KUNCIR	GGA	RI,DB,HS	(67)
PSEUDO	MATHEWS	GGA	GRP	(68)
SUMOR (MO 271)	HARRIS+	BAPI	SLXS,RR,RM DB	(69)
RAMP 1	BHAT	BNL	MLXS,CXS, EXS,FXS,TXS RM	(70)
GRAMP	GOLDSMITH	WAPD	GRP,MLXS,RM	(71)
MUFFLE	PRESKITT	ORNL	MLXS,FXS,RI	(72)
SIGPLOT (SIGMA 2)	BHAT	BNL	SLXS,DB, CXS,EXS,FXS	(70)
COMBCO	MARSHALL	PHILIPPS	SLXS,RM,DB	(73)
ADLER	BHAT	BNL	AA,TXS,FXS,CXS	(70)
TRIX 1	OTTER	AI	RI,HS,DB,GXS	(74)
FASDOP	STEVENS	GGA	SLXS,DB	(75)
EXT/XO	GIBSON+	WANL	SLXS,DB	(76)
STRIP	HELHOLTZ+	BAW	RI,HS	(77)

UNITED STATES (continued)

Unresolved resonances

TUZ	KUNCIR	GGA	RI,HS,DB	(78)
GANDY	COHEN+	GGA	CXS,EXS,FXS, DB	(79)
RAPTURE	FERZIGER+	GE-APED	RI,DB,CXS,FXS	(80)

Statistical model

COMNUC (CASCADE)	DUNFORD	AI	MF,FXS,CXS. CEXS,CIXS	(81)
NCAP	SCHMITTROTH?	HANFORD EDL	MM,FL,CXS	(82)
(HF-XS)	GRENCH	LOCKHEED	HF,CXS,CLXS, CIXS	(42)
LIANA	SMITH	TRINITY UN.	HF,FL,OT, CEXS,CIXS,CHXS	(83)
HELENE (HELGA)	PENNY	ORNL	HF,OT,CEXS CIXS,CHXS	(84)
TRNRX	MATHUR+	TEXAS NC	HF,OT,FL,AGD	(85)
TRANSEC	MATHUR+	TEXAS NC	SAF,OT,AGD	(86)
JANE	FERGUSON	NRDL	MF,CXS,CIXS, CHXS,AGD	(87)
GROGI 2	GILAT	BNL	EVM,CIXS, CXS,CHXS	(88)
HAFEVER	FRIEDMAN+	APDA	HF,OT,CEXS, CIXS	(89)
NEARREX	MOLDAUER	ANL	HF,OT,MM,FL, CXS,FXS,CEXS, CIXS,CHXS	(90)
AVERAGE (AVERAGE IV)	BHAT	BNL	LL,FXS CXS,CEXS	(70)
MANDY/BARBARA (MANDYF/BARBARAF)	SHELDON+	VIRGINIA UNIVERSITY	HF,FL	(91)
(RES.AV-IXS)	TUCKER	STANFORD UNIVERSITY	HF,FL	(92)
HFS	WILLIS	LASL	HF	(93)
FASCRO(THRESH)	PEARLSTEIN	BNL	EVM,MPXS	(94)

UNITED STATES (continued)

Optical model

ABACUS-NEARREX	ZAWADZKI+	ANL	LSOP,CNXS	(95)
2-PLUS	DUNFORD	AI	DOP,CCC	(96)
JUPITOR-1	TAMURA	ORNL	DOP,CCC,ACCC	(97)
JUPITOR-2 (ZEUS-II)	TAMURA	TEXAS UNIVERSITY	DOP,CCC,ACCC	(92)
OPTIC (OPTIC-II)	GOLDMAN+	KAPL	LSOP,RXS	(98)
SCAT	MELKANOFF+	UCLA	LSOP,POL	(99)
OPTIXI	THOMPSON	FLORIDA UN.	LSOP	(100)
4-PLUS	DUNFORD	AI	DOP,CCC	(92)
ABACUS-II	AUERBACH	BNL	LSOP,CNXS POL,ASP	(101)
GENOA	PEREY	ORNL	LSOP,ASP	(92)
JIB3,DWUCK SNOOPY,FTAU	PEREY	ORNL	LSOP,CNXS ASP	(92)
DWBA-VENUS	TAMURA+	TEXAS	DWBA,DIXS	(102)
MARS	TAMURA	TEXAS UN.	CCBA,DOP	(92)
JULIE/SALLY	BASSEL+	ORNL	DWBA,DIXS	(103)
OPTICAL MODEL CODE	BARTELS+	MIT	?	(104)
RAROMP	PYLE	MINNESOTA UN.	ASP	(93)
PHASER	SLAVIK	KAPL	LSOP,CNXS,POL	(105)

Miscellanea

LYNNE	JOHNSON	ORNL	MIL	(106)
PEGGY	OWEN	ORNL	PHS	(107)
RAMES	OWEN	ORNL	RFF	(108)
ATHENA 4	CHWIEROT+	ORNL	RFF	(109)
COULOM	TAMURA+	TEXAS UN.	CF	(110)
DUCAL	YOST	ORNL	GRSC	(111)
NEPTUNE	TAMURA	TEXAS UN.	ELC	(92)
SPECTIO	YOUNG+	LASL	GRSC	(112)
BOUND	SMITH	TRINITY UN.	ELC,WF	(93)
WAVES	CASWELL	NBS	WF	(113)
(UN-NAMED)	CHI	S.NEWYORK UN.	ELC,WF	(93)

UNITED STATES (continued)

LEGCOEF3/ GEORGE	SMITH+	GGA	EXS,LM	(114)
BESFIT	PEARLSTEIN	BNL	EXS,DM	(115)
CLEM	SLAVIK+	KAPL	EXS,LM	(116)
CHAD	BERLAND	AI	EXS,LM	(117)

TABLE I: Number of Programmes by Country

Country	Th.Scatt.	Res.Res.(A)	Res.Res.(B)	Unres.Res.	Stat.Model	Opt.Model.	Misc.	Total
AUSTRALIA	-	1	1	-	-	1	-	3
BELGIUM	-	1	-	-	-	-	-	1
EURATOM	-	2	-	-	2	-	-	4
FRANCE	2	3	2	-	1	2	-	10
GERMANY	-	-	-	-	-	1	1	2
ITALY	-	-	2	1	6	11	8	28
JAPAN	9	1	-	-	3	7	2	22
SWEDEN	-	-	-	-	-	1	-	1
SWITZ.	-	-	-	-	-	-	2	2
UK	9	1	7	6	1	2	2	28
USA	8	2	13	3	16	17	15	74
TOTAL	28	11	25	10	29	42	30	175

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