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NUCLEAR ENERGY AGENCY NUCLEAR DATA COMMITTEE

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

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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 crystal 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 γ -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
PNS	= 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_0 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 CAO CBNM-GEEL BBM (2)

(ERRFIT)

Statistical model

FIRON SCHMID CBNM-GEEL EVM (2)

GJRON 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)
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Optical model

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

GERMANY (F. R.)

Optical model

?	?	?	NLOP ?	(1)
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Miscellanea

PHASESHIFT	KANKOWSKY	ERLANGEN U.	PHS, POL	(10)
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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)
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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	SDFC	(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	CRG	TNSK	(33)
HIKER	NAKAHARA	JAERI	TNSK	(34)

Resolved resonances

(Class A)

MAH-AREA	TACHIBANA+	JAPC	AM	(35)
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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)
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SWITZERLAND

Miscellanea

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

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)
SOLOD	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)
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(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)

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

HFV	WILMORE	HARWELL	HF, FL	(56)
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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	BORGONOV	GGA	SL	(62)
FLANGE-II	HONECK+	GGA	EXS,FXS,IXS	
			CXS,CXS,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	HARRIS+	BAP	SLXS,RR,RM	(69)
(MO 271)			DB	
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	BHAT	BNL	SLXS,DB,	(70)
(SIGMA 2)			CXS,EXS,FXS	
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 (HF-XS)	SCHMITTROTH? GRENCH	HANFORD EDL LOCKHEED	MM,FL,CXS HF,CXS,CLXS, CIXS	(82) (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) (RES.AV-IXS)	SHELDON+ TUCKER	VIRGINIA UNIVERSITY STANFORD UNIVERSITY	HF,FL HF,FL	(91) (92)
HFS	WILLIS	LASL	HF	(93)
FASCRO (THRESH)	PEARLSTEIN	BNL	EVM,MPXS	(94)

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	TAMURA	TEXAS	DOP, CCC, ACCC	(92)
(ZEUS-II)		UNIVERSITY		
OPTIC	GOLDMAN+	KAPL	LSOP, RXS	(98)
(OPTIC-II)				
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	PEREY	ORNL	LSOP, CNXS	(92)
SNOOPY, FTAU			ASP	
DWBA-VENUS	TAMURA+	TEXAS	DWBA, DIXS	(102)
MARS	TAMURA	TEXAS UN.	CCBA, DOP	(92)
JULIE/SALLY	BASSEL+	ORNL	DWBA, DIXS	(103)
OPTICAL MODEL	BARTELS+	MIT	?	(104)
CODE				
RAROMP	PYLE	MINNESOTA UN.	ASP	(93)
PHASER	SLAVIK	KAPL	LSOP, CNXS, POL	(105)

Miscellaneous

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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