

EXFOR News (October 2011)

New experimental data available from Nuclear Reaction Data Centres

EXFOR is a world-wide data library for experimental neutron induced, charged-particle induced and photonuclear reaction data compiled by the [International Network of the Nuclear Reaction Data Centres \(NRDC\)](#)^a coordinated by the [IAEA Nuclear Data Section](#). Regularly updated retrieval database is available at [NNDC](#), [NEADB](#), [IAEA-NDS](#), [JAEA](#), [JCPRG](#) and [CDFE](#).

Quantity codes

ALF	α -value ($\sigma_{\text{capt}}/\sigma_{\text{fis}}$)	FY	Fission product yield
AMP	Length or amplitude	INT	Cross section integral over incident energy
CHG	Fragment charge	KE	Kinetic energy
CS	Cross section	KER	Kerma factor
CSN	Differential with respect to number of particles	MLT	Multiplicity
CSP	Partial cross section	NQ	Nuclear quantity
CST	Temperature dependent cross section	NU	Fission neutron multiplicity $\bar{\nu}$
D3A	Triple differential $d\Omega_1/d\Omega_2/dE'$	NUD	Delayed fission neutron multiplicity $\bar{\nu}_d$
D3E	Triple differential $d\Omega/dE'_1/dE'_2$	NUF	Fragment neutrons
D4A	Quadruple diff. $d\Omega_1/d\Omega_2/dE'_1/dE'_2$	POL	Polarization
DA	Differential $d/d\Omega$	POD	Differential polarization
DAA	Double differential $d\Omega_1/d\Omega_2$	PY	Product yield (other than fission)
DAE	Double differential $d\Omega/dE'$	RI	Resonance integral
DAP	Partial differential $d/d\Omega$	RP	Resonance parameter
DAT	Temperature-dependent Legendre coefficient	RR	Reaction rate
DE	Differential d/dE'	SIF	Self indication
DEP	Energy spectrum for specific group	SPC	Gamma spectrum
DP	Diff. by linear momentum of outgoing part.	TSL	Thermal scattering
DT	Diff. by 4-momentum transfer squared	TT	Thick target yield
ETA	η -value $\bar{\nu}\sigma_{\text{fis}}/(\sigma_{\text{capt}} + \sigma_{\text{fis}})$	TTD	Differential thick target yield, $d/d\Omega$
EVL	Evaluation	TTP	Partial thick target yield

Special codes in outgoing particle field

abs	Absorption	fus	Fusion	sct	Scattering	tot	Total
el	Elastic	inel	Inelastic	tcx	Total charge changing		
fis	Fission	non	Nonelastic	ths	Thermal scattering		

Special codes in incident energy field

Fast	Fast reactor spectrum average	Maxw	Maxwellian spectrum average
Fiss	Fission spectrum average	Spont	Spontaneous (for fission)

^a [NNDC](#) (USA), [NEADB](#) (France), [NDS](#) (Austria), [CJD](#) (Russia), [CNDC](#) (China), [ATOMKI](#) (Hungary), [BARC](#) (India), [JAEA](#) (Japan), [JCPRG](#) (Japan), [KAERI](#) (Korea), [CAJaD](#) (Russia), [CDFE](#) (Russia), [CNPD](#) (Russia), [UkrNDC](#) (Ukraine)

				3		Lithium				6
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation	Date	Author	Data #
				Min	Max					
				Ref Vol Page						
n,t	^4He	?	4RUSLEB	9.0+00	2.6+04	Jour	ZET,33,(1),9	Jul 57	A.A.Bergman+	41272

				3		Lithium				7
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation	Date	Author	Data #
				Min	Max					
				Ref Vol Page						
n,tot		CS	4RUSFEI	9.1+06	9.1+06	Conf	77KIEV,2,27	Apr 77	N.S.Biryukov+	40568

				13		Aluminium				27
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation	Date	Author	Data #
				Min	Max					
				Ref Vol Page						
$^3\text{He},\alpha$	^{26}Al	DAP	3CHFTHU	6.5+06	6.5+06	Jour	CHP,10,84	72	C.S.Lin+	O1033

				27		Cobalt				59
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation	Date	Author	Data #
				Min	Max					
				Ref Vol Page						
γ,n	^{58}Co	INT	4RUSRGU		2.5+07	Jour	AE,63,44	87	M.G.Davydov+	M0298

				29		Copper				
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation	Date	Author	Data #
				Min	Max					
				Ref Vol Page						
n,el	^{nat}Cu	DA	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307
n,tot		CS	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307

				39		Yttrium				89
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation	Date	Author	Data #
				Min	Max					
				Ref Vol Page						
γ,fis	Many	CS	4UKRKFT		2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295
e,fis	Many	CS	4UKRKFT	2.8+08	2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295

40 Zirconium

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,fis	Many	CS	4UKRKFT	2.8+08	2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295
e,fis	Many	CS	4UKRKFT	2.8+08	2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295

40 Zirconium 90

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,n	⁸⁹ Zr	?	4RUSFTI		2.2+07	Jour	IZV,33,700	69	G.P.Antropov+	M0814

40 Zirconium 91

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,n	⁹⁰ Zr	?	4RUSFTI		2.2+07	Jour	IZV,33,700	69	G.P.Antropov+	M0814
γ ,x+n	inclusive	CS	4RUSFTI	1.2+07	2.2+07	Jour	IZV,33,700	69	G.P.Antropov+	M0814

41 Niobium 93

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,fis	Many	CS	4UKRKFT		2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295
e,fis	Many	CS	4UKRKFT	2.8+08	2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295

42 Molybdenum

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,fis	Many	CS	4UKRKFT		2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295
e,fis	Many	CS	4UKRKFT	2.8+08	2.8+08	Jour	AE,63,386	87	V.G.Batiy+	M0295

49 Indium

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
n,el	^{nat} In	DA	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307
n,tot		CS	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307

50 Tin

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ,x	Many	CS	4RUSMOS		2.0+07	Jour	IZV,75,594	11	B.S.Ishkhanov+	M0803
n,el	^{nat}Sn	DA	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307
n,tot		CS	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307

50 Tin 112

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
n,α	^{109}Cd	CS	4UKRKHU	1.5+07	1.5+07	Jour	AE,78,(5),329	May 95	P.M.Gopych+	41172

56 Barium 134

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,inel$	^{134}Ba	DAP	4RUSKUR	1.0+06	1.0+06	Jour	YF,58,(12),2115	Dec 95	A.M.Demidov+	41197
$n,inel$	^{134}Ba	POL	4RUSKUR	1.0+06	1.0+06	Jour	YF,58,(12),2115	Dec 95	A.M.Demidov+	41197

56 Barium 138

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma,0$		RP	2GERTHD			Jour	NP/A,779,1	06	S.Volz+	M0821

58 Cerium 140

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma,0$		RP	2GERTHD			Jour	NP/A,779,1	06	S.Volz+	M0821

60 Neodymium 142

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma,0$		RP	2GERTHD			Jour	NP/A,779,1	06	S.Volz+	M0821

60 Neodymium 146

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma,x+n$	inclusive	CS	4RUSSGU	7.8+06	2.2+07	Jour	YF,13,463	71	O.V.Vasilyev+	M0817

$\gamma, x+n$ inclusive INT 4RUSSGU 2.2+07 Jour YF,13,463 71 O.V.Vasilyev+ [M0817](#)

60 Neodymium 148

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma, x+n$	inclusive	CS	4RUSSGU	7.5+06	2.3+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.3+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816
$n, inel$	^{148}Nd	DAP	4RUSKUR	1.0+06	1.0+06	Jour	AE,57,(4),270	Oct 84	L.I.Govor+	41574
$n, inel$	^{148}Nd	POL	4RUSKUR	1.0+06	1.0+06	Jour	AE,57,(4),270	Oct 84	L.I.Govor+	41574

60 Neodymium 150

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma, x+n$	inclusive	CS	4RUSSGU	8.0+06	2.3+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.3+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816

62 Samarium 144

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma, 0$		RP	2GERTHD			Jour	NP/A,779,1	06	S.Volz+	M0821

62 Samarium 148

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma, x+n$	inclusive	CS	4RUSSGU	7.8+06	2.2+07	Jour	YF,13,463	71	O.V.Vasilyev+	M0817
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.2+07	Jour	YF,13,463	71	O.V.Vasilyev+	M0817

62 Samarium 150

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma, x+n$	inclusive	CS	4RUSSGU	8.0+06	2.3+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.3+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816

62 Samarium 152

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$\gamma, x+n$	inclusive	CS	4RUSSGU	8.5+06	2.2+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.3+07	Jour	YF,10,460	69	O.V.Vasilyev+	M0816

62 Samarium 154

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\gamma, x+n$	inclusive	CS	4RUSSGU	8.0+06	2.3+07	Jour	YF,10,460		69	O.V.Vasilyev+	M0816
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.3+07	Jour	YF,10,460		69	O.V.Vasilyev+	M0816

63 Europium 151

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\gamma, x+n$	inclusive	CS	4RUSSGU	7.8+06	2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817

63 Europium 153

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\gamma, x+n$	inclusive	CS	4RUSSGU	8.2+06	2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817

64 Gadolinium 152

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\gamma, x+n$	inclusive	CS	4RUSSGU	7.5+06	2.1+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817

64 Gadolinium 153

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$n, 0$		RP	4UKRIJD		2.1+01	Conf	87KIEV,2,220		Sep 87	V.P.Vertebnyy+	40986

64 Gadolinium 154

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\gamma, x+n$	inclusive	CS	4RUSSGU	7.8+06	2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817

64 Gadolinium 156

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\gamma, x+n$	inclusive	CS	4RUSSGU	7.8+06	2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817

64 Gadolinium 158

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
$\gamma, x+n$	inclusive	CS	4RUSSGU	7.8+06	2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817
$\gamma, x+n$	inclusive	INT	4RUSSGU		2.2+07	Jour	YF,13,463		71	O.V.Vasilyev+	M0817

79 Gold 197

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
γ, el	¹⁹⁷ Au	DA	1USAUI	1.1+07	1.8+07	Jour	PR,126,228		62	J.S.O'Connell+	M0819

80 Mercury 198

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
γ, x	Many	?	4RUSMOS		2.9+07	Jour	IZV,75,603		11	B.S.Ishkhanov+	M0807

82 Lead

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
n, el	^{nat} Pb	DA	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086		Dec 68	G.V.Gorlov+	40307
n, tot		CS	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086		Dec 68	G.V.Gorlov+	40307

83 Bismuth 209

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
γ, x	Many	INT	1USANBS		1.4+08	Jour	PR,159,953		67	J.M.Wyckoff	M0818
n, el	²⁰⁹ Bi	DA	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086		Dec 68	G.V.Gorlov+	40307
n, tot		CS	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086		Dec 68	G.V.Gorlov+	40307

90 Thorium 232

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,fis		NUD	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178
γ ,fis		?	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178

92 Uranium

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
n ,el	^{nat} U	DA	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307
n ,tot		CS	4RUSKUR	4.0+06	4.0+06	Jour	YF,8,(6),1086	Dec 68	G.V.Gorlov+	40307

92 Uranium 235

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,fis		NUD	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178
γ ,fis		?	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178
n ,abs		ALF	4RUSKUR	2.5+01	2.5+01	Conf	80KIEV,2,119	Sep 80	G.V.Muradyan+	40581

92 Uranium 236

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
n ,el	²³⁶ U	AMP	4RUSFEI	6.0+03	4.2+05	Jour	YK,1985,(2),44	85	L.E.Kazakov+	40890

92 Uranium 238

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,el	²³⁸ U	DA	1USAUI	1.1+07	1.1+07	Jour	PRL,28,513	72	H.E.Jackson+	M0820
γ ,fis		NUD	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178
γ ,fis	Many	?	4RUSTIL		1.4+07	Jour	AE,15,308	63	K.A.Petrzhak+	M0172
γ ,fis		?	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178
γ ,inel	²³⁸ U	DAP	1USAUI	1.1+07	1.1+07	Jour	PRL,28,513	72	H.E.Jackson+	M0820

93 Neptunium 237

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,fis	Many	FY	4RUSTIL		1.4+07	Jour	AE,35,211	73	M.Ya.Kondrat'Ko+	M0198

94

Plutonium

239

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
γ ,fis		NUD	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178
γ ,fis		?	4RUSTIL		1.5+07	Jour	AE,20,268	66	O.P.Nikotin+	M0178

98

Californium

252

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
0,fis	^{nat} G	MLT	4RUSMOS	Spont		Jour	IZV,75,(4),580	11	N.V.Eremin+	41551