EXFOR News (February 2020)

New experimental data available from Nuclear Reaction Data Centres

EXFOR [1] is a world-wide data library for experimental neutron, charged-particle and photon induced reaction data compiled by the International Network of the Nuclear Reaction Data Centres (NRDC)[a] co-ordinated by the IAEA Nuclear Data Section. Regularly updated web retrieval databases are available at IAEA-NDS as well as NNDC, NEADB, JCPRG and CDFE.

This News lists newly created EXFOR entries as well as revised EXFOR entries where new data subentries are added. Entries from articles pubslished in past 10 years are flagged by asterisks (*). Please send an email to the NRDC Coordinator (n.otsuka@iaea.org) for inclusion in the EXFOR News distribution list as well as any question on EXFOR.

[1] N. Otuka, E. Dupont, V. Semkova, B. Pritychenko et al., Nucl.Data.Sheets **120**(2014)272.

Quantity codes

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

1 Hydrogen 1

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,el	^{1}H	DA	4RUSLEB	2.3+08	2.5+08	Jour	ZET,41,1713	61	P.S.Baranov+	M1011
	γ,el	^{1}H	?	4RUSLEB	2.3+08	2.5+08	Jour	ZET,41,1713	61	P.S.Baranov+	M1011

1 Hydrogen 2

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	n,2n	^{1}H	DAE	1USAROC	1.4+07	1.4+07	Jour	PR/C,100,034001	19	C.J.Forrest+	14575

3 Lithium 6

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,x+n	inclusive	DAP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013

3 Lithium 7

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	n,d	^{6}He	DA	4RUSKUR	1.4+07	1.4+07	Book	NEJTRONFIZ,,249	61	K.M.Mikhailina+	41226

4 Beryllium 9

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,x+n	inclusive	DAP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013

6 Carbon 12

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,tot		CS	4RUSLEB	2.2+07	2.4+07	Jour	ZET,37,1811	59	N.A.Burgov+	M1008
	γ,x+n	inclusive	CSP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013
	γ,x+n	inclusive	DAP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013
	γ,x+p	inclusive	DAE	4RUSFTI	3.5+07	8.5+07	Jour	ZET,38,267	59	E.B.Bazhanov	M1010

7 Nitrogen 14

Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
γ,2α	^{6}Li	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,2p	^{12}B	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,α	^{10}B	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n	^{13}N	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+2p	^{11}B	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+α	^{9}B	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p	^{12}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p+2α	^{4}He	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p+α	^{8}Be	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,p	^{13}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,p+α	^{9}Be	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006

8 Oxygen 16

Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
γ,2n+2p+2α	^{4}He	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,2p	^{14}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,3α	^{4}He	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,α	^{12}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n	^{15}O	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+2p	^{13}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+α	^{11}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p	^{14}N	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p+α	^{10}B	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,p	^{15}N	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,p+α	^{11}B	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006

10 Neon 20

Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
γ,2α	^{12}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,2p	^{18}O	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,α	^{16}O	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n	^{19}Ne	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+2α	^{11}C	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+2p	^{17}O	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+α	^{15}O	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p	^{18}F	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p+3α	^{6}Li	?	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,n+p+α	^{14}N	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,p	^{19}F	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006
γ,p+α	^{15}N	INT	4RUSLEB		1.7+08	Jour	ZET,42,747	62	A.N.Gorbunov+	M1006

13 Aluminium 27

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,x+n	inclusive	DAP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013

18 Argon 40

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	n,tot		CS	1USALAS	1.0+08	9.0+08	Jour	PRL,123,042502	19	B.Bhandari+	14573

22 Titanium

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	n,tot		CS	1USARPI	4.0+05	2.5+07	Jour	NSE,193,903	19	M.J.Rapp+	14576

26 Iron

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	n,inel	$^{\rm nat}$Fe	CSP	4RUSKUR	2.5+06	2.5+06	Rept	INDC(CCP)-105,21	76	V.M.Bezotosnyj+	40521

26 Iron 56

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,x+n	inclusive	DAP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013

29 Copper 63

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,x+n	inclusive	DAP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013

29 Copper 65

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,el	^{65}Cu	CS	4KASKAZ	1.1+06	1.1+06	Jour	ZET,45,443	63	D.K.Kaipov+	M1014

40 Zirconium

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	n,tot		CS	1USARPI	4.0+05	2.5+07	Jour	NSE,193,903	19	M.J.Rapp+	14576

50 Tin 116

Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
γ,el	^{116}Sn	CS	4KASKAZ	1.3+06	1.3+06	Jour	ZET,45,443	63	D.K.Kaipov+	M1014

50 Tin 120

Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
γ,p	^{119}In	CS	4RUSLEB	1.6+07	2.6+07	Jour	ZET,39,1578	60	Kuoch'I-Di+	M1012
γ,p	^{119}In	INT	4RUSLEB		3.0+07	Jour	ZET,39,1578	60	Kuoch'I-Di+	M1012
γ,x	^{118}In	CS	4RUSLEB	2.3+07	2.6+07	Jour	ZET,39,1578	60	Kuoch'I-Di+	M1012
γ,x	^{118}In	INT	4RUSLEB		3.0+07	Jour	ZET,39,1578	60	Kuoch'I-Di+	M1012

58 Cerium 140

Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
γ,el	^{140}Ce	CS	4UZ UZB	1.6+06	1.6+06	Jour	ZET,46,1486	63	R.B.Begzhanov+	M1015

71 Lutetium 173

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	n,γ	^{174}Lu	CS	1USALAS	2.0-03	2.2+02	Jour	PR/C,99,064603	19	A.Ebran+	14410

71 Lutetium 175

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	n,γ	^{176}Lu	CS	1USALAS	2.0-03	2.2+02	Jour	PR/C,99,064603	19	A.Ebran+	14410

73 Tantalum 181

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	n,tot		CS	1USARPI	4.0+05	2.5+07	Jour	NSE,193,903	19	M.J.Rapp+	14576

79 Gold 196

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,x+p	inclusive	CSP	4RUSFTI		2.2+07	Jour	ZET,38,95	59	E.D.Makhnovskii	M1009
	γ,x+p	inclusive	DAP	4RUSFTI		2.2+07	Jour	ZET,38,95	59	E.D.Makhnovskii	M1009

81 Thallium

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,fis		CS	4RUSLEB	8.8+07	2.4+08	Jour	ZET,32,241	57	E.V.Minarik+	M1007

82 Lead 208

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,x+n	inclusive	DAP	4RUSLEB		2.5+08	Jour	ZET,28,746	55	P.S.Baranov+	M1013

83 Bismuth 209

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,fis		CS	4RUSLEB	8.9+07	2.4+08	Jour	ZET,32,241	57	E.V.Minarik+	M1007

90 Thorium 232

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,fis		CS	4RUSLEB	2.4+07	2.3+08	Jour	ZET,32,241	57	E.V.Minarik+	M1007
*	γ,fis		CS	1USATNL	4.7+06	5.8+06	Jour	PR/C,98,054609	18	J.A.Silano+	L0239
*	γ,fis		NU	1USATNL	5.2+06	5.7+06	Jour	PR/C,98,054609	18	J.A.Silano+	L0239

92 Uranium 235

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	γ,fis	^{136}Cs	FY	1USATNL	1.3+07	1.3+07	Jour	PR/C,100,014608	19	Krishichayan+	L0225

92 Uranium 238

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
	γ,fis		CS	4RUSLEB	2.0+07	2.3+08	Jour	ZET,32,241	57	E.V.Minarik+	M1007
*	γ,fis		CS	1USATNL	4.3+06	6.0+06	Jour	PR/C,98,054609	18	J.A.Silano+	L0239
*	γ,fis		NU	1USATNL	5.1+06	5.8+06	Jour	PR/C,98,054609	18	J.A.Silano+	L0239

94 Plutonium 239

	Reaction	Product	Quant.	Lab.	Energy (eV) Min	Energy (eV) Max	Type	Documentation Ref Vol Page	Date	Author	Data #
*	γ,fis	^{136}Cs	FY	1USATNL	1.3+07	1.3+07	Jour	PR/C,100,014608	19	Krishichayan+	L0225