

## Nuclear Reaction Data Center (JCPRG)

### EXFOR : Recent Compilation (Added in December 2007)

EXFOR is a world-wide database for experimental neutron induced, charged-particle induced and photonuclear reaction compiled by Nuclear Reaction Data Centres Network coordinated by IAEA Nuclear Data Section. This list gives newly compiled data to EXFOR. *This list consists of tables titled by target nuclide.*

Retrieval service is available at:

<http://www.jcprg.org/exfor/>

#### Quantity code

ALF	Alpha	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	Nu
D3A	Triple differential $d\Omega_1/d\Omega_2/dE'$	NUD	Nu delayed
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	Eta	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)

				1		Hydrogen				1	
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #	
				Min	Max						
$^{12}\text{N},p$	$^{12}\text{N}$	DAP	1USANOT	4.6+07	4.6+07	Jour	PR/C,75,024607	07	B.B.Skorodumov+	C1571	
$^{18}\text{F},\alpha$	$^{15}\text{O}$	DA	1USAORL	6.6+05	8.8+05	Conf	2006CERN,,273	06	K.Y.Chae+	C1569	

				4		Beryllium				9	
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #	
				Min	Max						
$^8\text{Li},^7\text{Li}$	$^{10}\text{Be}$	DA	1USANOT	2.7+07	2.7+07	Jour	PR/C,75,054602	07	V.Guimaraes+	C1570	
$^8\text{Li},^9\text{Li}$	$^8\text{Be}$	DA	1USANOT	2.7+07	2.7+07	Jour	PR/C,75,054602	07	V.Guimaraes+	C1570	
$^8\text{Li},el$	$^9\text{Be}$	DA	1USANOT	2.7+07	2.7+07	Jour	PR/C,75,054602	07	V.Guimaraes+	C1570	

				6		Carbon					
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #	
				Min	Max						
$n,non$		CS	2JPNJAE	4.2+07	7.8+07	Jour	NSTS,2,405	Aug 02	M.Ibaraki+	23019	

				6		Carbon				12	
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #	
				Min	Max						
$n,\alpha$	$^9\text{Be}$	CSP	2JPNTOH	1.4+07	1.4+07	Jour	NIM/A,440,(2),403	Feb 00	T.Sanami+	23005	
$n,el$	$^{12}\text{C}$	DA	2JPNTOH	1.4+07	1.4+07	Jour	NIM/A,366,(2-3),354	Dec 95	M.Baba+	23004	
$n,\gamma$	$^{13}\text{C}$	CS	2JPNTIT	Maxwl	2.0+05	Jour	AJ,422,(2),912	Feb 94	T.Ohsaki+	23002	
$n,\gamma$	$^{13}\text{C}$	CSP	2JPNTIT	2.1+04	2.0+05	Jour	AJ,422,(2),912	Feb 94	T.Ohsaki+	23002	
$n,inel$	$^{12}\text{C}$	DAP	2JPNTOH	1.4+07	1.4+07	Jour	NIM/A,366,(2-3),354	Dec 95	M.Baba+	23004	
$n,n+2\alpha$	$^4\text{He}$	?	2JPNTOH	1.4+07	1.4+07	Jour	NIM/A,366,(2-3),354	Dec 95	M.Baba+	23004	
$n,x+d$	inclusive	DAE	2JPNJAE	7.5+07	7.5+07	Jour	NST,36,(2),143	Feb 99	Y.Nauchi+	23015	
$n,x+p$	inclusive	DAE	2JPNJAE	6.4+07	7.5+07	Jour	NST,36,(2),143	Feb 99	Y.Nauchi+	23015	

				8		Oxygen				17	
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #	
				Min	Max						
$n,\alpha$	$^{14}\text{C}$	CS	2JPNJAE	1.5+07	1.5+07	Jour	NSE,129,(1),81	May 98	Y.M.Verzilov+	23001	
$n,t$	$^{15}\text{N}$	CS	2JPNJAE	1.5+07	1.5+07	Jour	NSE,129,(1),81	May 98	Y.M.Verzilov+	23001	



$n,x+\gamma$	inclusive	DAE	2JPNTOH	6.0+06	3.3+07	Jour	NST,31,(11),1133	Nov 94	E.Tanabe+	23010
$n,x+\alpha$	inclusive	CS	2JPNOSA	1.4+07	1.4+07	Jour	NST,34,(1),1	Jan 97	Y.Takao+	23013

**28                      Nickel                      58**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$p,inel$	$^{58}\text{Ni}$	DAP	1USAINU	1.6+08	1.6+08	Jour	PR/C,75,034310	07	H.Fujita+	C1573
$^3\text{He},t$	$^{58}\text{Cu}$	DAP	2JPNOSA	4.2+08	4.2+08	Jour	PR/C,75,034310	07	H.Fujita+	C1573

**28                      Nickel                      64**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$^{132}\text{Sn},fus$		CS	1USAORL	1.5+08	2.0+08	Jour	PR/C,75,054607	07	J.F.Liang+	C1572

**40                      Zirconium**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,non$		CS	2JPNJAE	4.2+07	7.8+07	Jour	NSTS,2,405	Aug 02	M.Ibaraki+	23019

**40                      Zirconium                      90**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,2n$	$^{89}\text{Zr}$	CS	2JPNETL	1.4+07	1.5+07	Jour	NST,24,(12),1076	Dec 87	T.Iguchi+	23008

**41                      Niobium                      93**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,2n$	$^{92}\text{Nb}$	CS	2JPNETL	1.4+07	1.5+07	Jour	NST,24,(12),1076	Dec 87	T.Iguchi+	23008
$n,inel$	$^{93}\text{Nb}$	CS	2JPNJAE	1.4+07	1.5+07	Jour	NST,30,(10),967	Oct 93	Y.Ikeda+	23009

**50                      Tin                      122**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
0,0		NQ	2JPNJAE	Spont		Jour	ANE,17,(2),95	90	Y.Nakajima+	23003
$n,0$		RP	2JPNJAE		3.0+04	Jour	ANE,17,(2),95	90	Y.Nakajima+	23003
$n,tot$		CS	2JPNJAE	6.7+03	2.9+04	Jour	ANE,17,(2),95	90	Y.Nakajima+	23003

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## Cesium

133

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,\gamma$	$^{134}\text{Cs}$	CS	2JPNKTO	3.2+03	2.7+05	Jour	NST,20,(10),797	Oct 83	N.Yamamuro+	23007
$n,\gamma$	$^{134}\text{Cs}$	?	2JPNKTO	1.5+03	7.5+04	Jour	NST,20,(10),797	Oct 83	N.Yamamuro+	23007

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## Cerium

140

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,\gamma$	$^{141}\text{Ce}$	CS	2JPNTIT		5.5+08	Jour	NST,37,(9),740	Sep 00	S.Harnood+	23016
$n,\gamma$	$^{141}\text{Ce}$	MLT	2JPNTIT		5.5+05	Jour	NST,37,(9),740	Sep 00	S.Harnood+	23016
$n,\gamma$	$^{141}\text{Ce}$	?	2JPNTIT	1.5+04	5.5+05	Jour	NST,37,(9),740	Sep 00	S.Harnood+	23016

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## Praesodymium

141

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,\gamma$	$^{142}\text{Pr}$	CS	2JPNTIT		5.5+08	Jour	NST,37,(9),740	Sep 00	S.Harnood+	23016
$n,\gamma$	$^{142}\text{Pr}$	MLT	2JPNTIT		5.5+05	Jour	NST,37,(9),740	Sep 00	S.Harnood+	23016
$n,\gamma$	$^{142}\text{Pr}$	?	2JPNTIT	1.5+04	1.0+05	Jour	NST,37,(9),740	Sep 00	S.Harnood+	23016
$n,\gamma$	$^{142}\text{Pr}$	?	2JPNTIT	5.4+05	5.4+05	Jour	NP/A,457,(2),301	Sep 86	M.Igashira+	23006
$n,\gamma$	$^{142}\text{Pr}$	?	2JPNTIT	5.5+05	5.5+05	Jour	NST,37,(9),740	Sep 00	S.Harnood+	23016

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## Terbium

159

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,\gamma$	$^{160}\text{Tb}$	?	2JPNTIT	1.0+04	8.0+05	Jour	NP/A,457,(2),301	Sep 86	M.Igashira+	23006

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## Holmium

165

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,\gamma$	$^{166}\text{Ho}$	?	2JPNTIT	4.2+05	4.2+05	Jour	NP/A,457,(2),301	Sep 86	M.Igashira+	23006

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## Lutetium

175

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
$n,\gamma$	$^{176}\text{Lu}$	?	2JPNTIT	5.7+05	5.7+05	Jour	NP/A,457,(2),301	Sep 86	M.Igashira+	23006

**73 Tantalum 181**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n,γ</i>	<sup>182</sup> Ta	DE	2JPN TIT	4.0+05	4.0+05	Jour	NP/A,457,(2),301	Sep 86	M.Igashira+	23006
<i>n,γ</i>	<sup>182</sup> Ta	?	2JPN KTO	1.5+03	7.5+04	Jour	NST,20,(10),797	Oct 83	N.Yamamuro+	23007
<i>n,γ</i>	<sup>182</sup> Ta	?	2JPN TIT	4.2+05	4.2+05	Jour	NP/A,457,(2),301	Sep 86	M.Igashira+	23006
<i>n,p</i>	<sup>181</sup> Hf	CS	2JPNOSA	1.3+07	1.5+07	Jour	NST,31,(12),1248	Dec 94	Y.Kasugai+	23011
<i>n,x</i>	<sup>180</sup> Hf	CS	2JPNOSA	1.3+07	1.5+07	Jour	NST,31,(12),1248	Dec 94	Y.Kasugai+	23011

**74 Tungsten 184**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n,α</i>	<sup>181</sup> Hf	CS	2JPNOSA	1.3+07	1.5+07	Jour	NST,31,(12),1248	Dec 94	Y.Kasugai+	23011

**74 Tungsten 186**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n,α</i>	<sup>183</sup> Hf	CS	2JPNOSA	1.3+07	1.5+07	Jour	NST,31,(12),1248	Dec 94	Y.Kasugai+	23011
<i>n,x</i>	<sup>185</sup> Ta	CS	2JPNOSA	1.4+07	1.5+07	Jour	NST,31,(12),1248	Dec 94	Y.Kasugai+	23011

**79 Gold 197**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n,γ</i>	<sup>198</sup> Au	CS	2JPN KTO	3.2+03	2.7+05	Jour	NST,20,(10),797	Oct 83	N.Yamamuro+	23007
<i>n,γ</i>	<sup>198</sup> Au	?	2JPN KTO	1.5+03	7.5+04	Jour	NST,20,(10),797	Oct 83	N.Yamamuro+	23007
<i>n,γ</i>	<sup>198</sup> Au	?	2JPN TIT	4.2+05	4.2+05	Jour	NP/A,457,(2),301	Sep 86	M.Igashira+	23006

**80 Mercury 196**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n,2n</i>	<sup>195</sup> Hg	CS	2JPNJAE	1.3+07	1.5+07	Jour	NST,38,(12),1048	Dec 01	Y.Kasugai+	23018

**80 Mercury 198**

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n,2n</i>	<sup>197</sup> Hg	CS	2JPNJAE	1.3+07	1.5+07	Jour	NST,38,(12),1048	Dec 01	Y.Kasugai+	23018
<i>n,p</i>	<sup>198</sup> Au	CS	2JPNJAE	1.3+07	1.5+07	Jour	NST,38,(12),1048	Dec 01	Y.Kasugai+	23018

80 Mercury 199											
Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation		Date	Author	Data #
				Min	Max		Ref	Vol Page			
<i>n,p</i>	<sup>199</sup> Au	CS	2JPNJAE	1.3+07	1.5+07	Jour	NST,38,(12),1048		Dec 01	Y.Kasugai+	23018
80 Mercury 200											
<i>n,p</i>	<sup>200</sup> Au	CS	2JPNJAE	1.5+07	1.5+07	Jour	NST,38,(12),1048		Dec 01	Y.Kasugai+	23018
80 Mercury 201											
<i>n,p</i>	<sup>201</sup> Au	CS	2JPNJAE	1.5+07	1.5+07	Jour	NST,38,(12),1048		Dec 01	Y.Kasugai+	23018
80 Mercury 202											
<i>n,p</i>	<sup>202</sup> Au	CS	2JPNJAE	1.5+07	1.5+07	Jour	NST,38,(12),1048		Dec 01	Y.Kasugai+	23018
80 Mercury 204											
<i>n,2n</i>	<sup>203</sup> Hg	CS	2JPNJAE	1.3+07	1.5+07	Jour	NST,38,(12),1048		Dec 01	Y.Kasugai+	23018
<i>n,p</i>	<sup>204</sup> Au	CS	2JPNJAE	1.5+07	1.5+07	Jour	NST,38,(12),1048		Dec 01	Y.Kasugai+	23018
82 Lead											
<i>n,non</i>		CS	2JPNJAE	4.2+07	7.8+07	Jour	NSTS,2,405		Aug 02	M.Ibaraki+	23019
92 Uranium 233											
<i>n,fis</i>	Many	FY	2JPNKTO	Maxwl		Jour	NST,34,(9),871		Sep 97	H.Baba+	23014
<i>n,fis</i>	Many	KE	2JPNKTO	Maxwl		Jour	NST,34,(9),871		Sep 97	H.Baba+	23014

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## Uranium

235

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n</i> ,fis	Many	FY	2JPNKTO	Maxwl		Jour	NST,34,(9),871	Sep 97	H.Baba+	23014
<i>n</i> ,fis	Many	KE	2JPNKTO	Maxwl		Jour	NST,34,(9),871	Sep 97	H.Baba+	23014

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## Plutonium

239

Reaction	Product	Quant.	Lab.	Energy (eV)		Type	Documentation Ref Vol Page	Date	Author	Data #
				Min	Max					
<i>n</i> ,fis		FY	2JPNKTO	2.5-02	2.5-02	Jour	NST,32,(5),404	May 95	K.Nishio+	23012
<i>n</i> ,fis	Many	KE	2JPNKTO	Maxwl		Jour	NST,32,(5),404	May 95	K.Nishio+	23012
<i>n</i> ,fis		NU	2JPNKTO	2.5-02	2.5-02	Jour	NST,32,(5),404	May 95	K.Nishio+	23012
<i>n</i> ,fis	Many	NU	2JPNKTO	Maxwl		Jour	NST,32,(5),404	May 95	K.Nishio+	23012
<i>n</i> ,fis	Many	NUF	2JPNKTO	Maxwl		Jour	NST,32,(5),404	May 95	K.Nishio+	23012
<i>n</i> ,fis		?	2JPNKTO	Maxwl		Jour	NST,32,(5),404	May 95	K.Nishio+	23012