Adopted Levels, Gammas

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia	NDS 195,368 (2024)	1-Dec-2023

Q(β^-)=2045 *10*; S(n)=6839 *11*; S(p)=7279 *40*; Q(α)=120 *60* 2021Wa16
Production: Be(^{197}Au, x) (1999Be63); Be(^{208}Pb, x) E=1 GeV/nucleon (2005Ca02).

^{191}Re Levels

Cross Reference (XREF) Flags

A ^{9}Be(^{208}Pb,Xγ)
B ^{187}Re(^{136}Xe,Xγ)
C ^{192}Os(t,α),(pol t,α)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0[#]	(3/2$^+$,1/2$^+$)	9.8 min *5*	A C	%β^-=100 Eβ^-=1800 keV *200* (1953At24 – absorption measurement). Probable doublet comprised of J=1/2 and J=3/2 members of the 1/2[411] rotational band. $T_{1/2}$: from 1953At24. Assignment to ^{191}Re was based on chemical separation and production of the isotope by (n,p). Measured β^- (1953At24). Other value: 9.70 min (1970HaZI).
27 *3*			C	
97[@] *3*	(5/2$^+$)		C	This state (5/2$^+$) is the g.s. in odd-mass Re isotopes with A≥179.
145[&] *3*	(9/2$^-$)		BC	$T_{1/2}$: 20 μs from systematics (2021Ko07 – NUBASE).
227[#] *3*	(5/2$^+$,7/2$^+$)		C	Doublet comprised of J=5/2 and 7/2 members of the 1/2[411] band.
254 *3*			C	
264 *3*			C	
285[&] *3*	(11/2$^-$)		BC	E(level): From (t,α),(pol t,α). Least squares fit of Eγ yields 285.1, ΔEγ(140.0) not available. J$^\pi$: M1+E2 140.0γ to (9/2$^-$), band member.
299 *3*			C	
413.6[c]	(11/2$^-$)		B	J$^\pi$: 268.7γ to (9/2$^-$). Assigned as a bandhead.
449 *3*	(1/2$^+$)		C	
509.9[&]	(13/2$^-$)		B	J$^\pi$: 224.9γ M1+E2 to (11/2$^-$), band member.
521 *3*	(5/2$^+$)		C	
550 *3*			C	
553.2[c]	(13/2$^-$)		B	J$^\pi$: γ to (11/2$^-$), band member.
555 *3*			C	
606 *3*			C	
621.1[d]	(13/2$^-$)		BC	J$^\pi$: γ to (11/2$^-$) and (9/2$^-$). Assigned as a bandhead in comparison with that in ^{187}Re and ^{189}Re (^{136}Xe,xγ – 2016Re02).
627 *3*			C	
644.8[&]	(15/2$^-$)		B	J$^\pi$: M1+E2 134.8γ to (13/2$^-$), E2 359.9γ to (11/2$^-$), band member.
741 *3*			C	
758 *3*			C	
799[a] *3*	(7/2$^+$)		C	
832 *3*			C	
858 *3*	(5/2$^+$)		C	
876 *3*			C	
883.1[d]	(15/2$^-$)		B	J$^\pi$: γ to (13/2$^-$), band member.
889.5[c]	(15/2$^-$)		B	J$^\pi$: γ to (13/2$^-$) and (11/2$^-$), band member.
952.8[&]	(17/2$^-$)		B	J$^\pi$: 307.9γ M1+E2 to (15/2$^-$), band member.

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Adopted Levels, Gammas (continued)

^{191}Re Levels (continued)

E(level)[†]	Jπ[‡]	$T_{1/2}$	XREF	Comments
977.1[c]	(17/2⁻)		B	Jπ: γ to (15/2⁻) and (13/2⁻), band member.
1004 *3*			C	
1015 *3*			C	
1064 *3*	(3/2⁺)		C	
1088.6[&]	(19/2⁻)		B	Jπ: γ to (17/2⁻) and (15/2⁻), band member.
1112 *3*			C	
1128 *3*			C	
1145 *3*	(5/2⁺)		C	Observed in other odd-mass Re isotopes also.
1229[b] *3*	(11/2⁻)		C	Jπ: by analogy with the second J=11/2 in ^{187}Re and ^{189}Re, where state with a larger transition strength (charge exchange) was observed.
1243 *3*			C	
1349.8[c]	(19/2⁻)		B	Jπ: γ to (17/2⁻) and (15/2⁻), band member.
1367 *6*	(11/2⁻)		C	
1408 *6*			C	
1468 *6*			C	
1485.8[&]	(21/2⁻)		B	Jπ: γ to (19/2⁻) and (17/2⁻), band member.
1507.6	(21/2⁺)	70 ns *40*	B	Jπ: From 157.9γ (E1) and 418.9γ (E1) to (19/2⁻). $T_{1/2}$: from γγ(t) (^{136}Xe,Xγ).
1524 *6*			C	
1560 *6*			C	
1601.6	(25/2⁻)	50.6 μs *35*	B	E(level): 0+x level in (^{208}Pb,xγ) probably is the same level in consideration of the level lifetime. Jπ: 93.8γ (M2) (21/2⁺), 115.9γ (E2) to (21/2⁻), band member. $T_{1/2}$: From τ=73 μs *5* (^{136}Xe,Xγ) − γ(t). Other: 77 μs *33* (^{208}Pb,xγ).
1663 *6*			C	
1678.7	(23/2⁺)	33.3 ns *28*	B	Jπ: 192.8γ (E1) to (21/2⁻). $T_{1/2}$: from τ=48 ns *4* (^{136}Xe,Xγ) − γ(t).
1715 *6*			C	
1835 *6*			C	
1904 *6*			C	
1937 *6*	(5/2⁺)		C	Possible vibrational state.

[†] From least-squares fit to Eγ, for levels with depopulating gammas. Level energies, if without depopulating gammas, are from (t,α),(pol t,α).

[‡] From a comparison between experimental and theoretical angular distributions of (t,α) cross sections, and from analyzing powers measured in the (pol t,α) reaction, except where otherwise noted. Nilsson orbitals were assigned mainly on the basis of systematics of the same orbitals in other odd-mass Re isotopes.

[#] Band(A): 1/2(411).

[@] Band(B): 5/2(402).

[&] Band(C): 9/2(514).

[a] Band(D): 7/2(404).

[b] Band(E): 7/2(523).

[c] Band(F): π11/2[505].

[d] Band(G): π9/2[514]⊗2+$_γ$.

Adopted Levels, Gammas (continued)

$\gamma(^{191}Re)$

E_i(level)	J_i^π	E_γ[†]	I_γ	E_f	J_f^π	Mult.[†]	δ[†]	α[‡]	Comments
285	(11/2$^-$)	140.0	100	145	(9/2$^-$)	M1+E2	0.28 *+14−12*	1.92 *7*	α(K)=1.55 *10*; α(L)=0.282 *21*; α(M)=0.065 *6* α(N)=0.0158 *14*; α(O)=0.00260 *17*; α(P)=0.000168 *11*
413.6	(11/2$^-$)	268.7	100	145	(9/2$^-$)				
509.9	(13/2$^-$)	224.9		285	(11/2$^-$)	M1+E2	0.20 *10*	0.512 *15*	α(K)=0.423 *15*; α(L)=0.0691 *10*; α(M)=0.01585 *24* α(N)=0.00384 *6*; α(O)=0.000642 *9*; α(P)=4.57×10^{-5} *17* E_γ: Other: A comparable 224.6 keV *5* gamma is unplaced in (^{208}Pb,xγ).
		364.9		145	(9/2$^-$)				
553.2	(13/2$^-$)	139.7		413.6	(11/2$^-$)				E_γ: Other: A comparable 139.9 keV *5* gamma is unplaced in (^{208}Pb,xγ).
		267.6		285	(11/2$^-$)				
621.1	(13/2$^-$)	336.0		285	(11/2$^-$)				
		476[#]		145	(9/2$^-$)				
644.8	(15/2$^-$)	134.8		509.9	(13/2$^-$)	M1+E2	0.17 *9*	2.18 *4*	α(K)=1.79 *5*; α(L)=0.302 *13*; α(M)=0.0695 *34* α(N)=0.0168 *8*; α(O)=0.00280 *10*; α(P)=0.000194 *6* E_γ: Other: A comparable 134.5 keV *5* gamma is unplaced in (^{208}Pb,xγ).
		359.9		285	(11/2$^-$)	E2		0.0520 *7*	α(K)=0.0365 *5*; α(L)=0.01186 *17*; α(M)=0.00289 *4* α(N)=0.000691 *10*; α(O)=0.0001056 *15*; α(P)=3.50×10^{-6} *5* E_γ: Other: A comparable 360γ is unplaced in (^{208}Pb,xγ).
883.1	(15/2$^-$)	262.0	100	621.1	(13/2$^-$)				
889.5	(15/2$^-$)	336.0		553.2	(13/2$^-$)				
		379.7		509.9	(13/2$^-$)				
		476.0		413.6	(11/2$^-$)				
952.8	(17/2$^-$)	307.9		644.8	(15/2$^-$)	M1+E2	0.32 *+20−15*	0.209 *17*	α(K)=0.172 *16*; α(L)=0.0283 *11*; α(M)=0.00650 *21* α(N)=0.00157 *5*; α(O)=0.000263 *11*; α(P)=1.85×10^{-5} *18* E_γ: Other: A comparable 308γ is unplaced in (^{208}Pb,xγ).
		442.9		509.9	(13/2$^-$)				
977.1	(17/2$^-$)	87.6		889.5	(15/2$^-$)				
		423[#]		553.2	(13/2$^-$)				
1088.6	(19/2$^-$)	136.0		952.8	(17/2$^-$)				
		443.9		644.8	(15/2$^-$)				E_γ: Other: A comparable 443.7 keV *5* gamma is unplaced in (^{208}Pb,xγ).
1349.8	(19/2$^-$)	261.7		1088.6	(19/2$^-$)				
		372.8		977.1	(17/2$^-$)				
		396.8		952.8	(17/2$^-$)				
		460.1		889.5	(15/2$^-$)				
		466.8		883.1	(15/2$^-$)				
1485.8	(21/2$^-$)	397.0		1088.6	(19/2$^-$)				
		533.2		952.8	(17/2$^-$)				

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Adopted Levels, Gammas (continued)

$\gamma(^{191}Re)$ (continued)

E_i(level)	J_i^π	E_γ[†]	E_f	J_f^π	Mult.[†]	α[‡]	Comments
1507.6	$(21/2^+)$	157.9	1349.8	$(19/2^-)$	(E1)	0.1179 *17*	α(K)=0.0971 *14*; α(L)=0.01608 *23*; α(M)=0.00367 *5* α(N)=0.000878 *12*; α(O)=0.0001404 *20*; α(P)=7.93×10^{-6} *11* E_γ: Other: A comparable 158.3 keV *5* gamma is unplaced in (^{208}Pb,xγ).
		418.9	1088.6	$(19/2^-)$	(E1)	0.01089 *15*	α(K)=0.00911 *13*; α(L)=0.001381 *19*; α(M)=0.000313 *4* α(N)=7.54×10^{-5} *11*; α(O)=1.243×10^{-5} *17*; α(P)=8.28×10^{-7} *12* E_γ: Other: A comparable 418.5 keV *5* gamma is unplaced in (^{208}Pb,xγ).
1601.6	$(25/2^-)$	93.8	1507.6	$(21/2^+)$	(M2)	58.9 *8*	α(K)=40.1 *6*; α(L)=14.27 *20*; α(M)=3.57 *5* α(N)=0.874 *12*; α(O)=0.1425 *20*; α(P)=0.00871 *12*
		115.9	1485.8	$(21/2^-)$	(E2)	2.301 *32*	α(K)=0.642 *9*; α(L)=1.254 *18*; α(M)=0.318 *4* α(N)=0.0757 *11*; α(O)=0.01082 *15*; α(P)=5.47×10^{-5} *8*
1678.7	$(23/2^+)$	171.1	1507.6	$(21/2^+)$			
		192.8	1485.8	$(21/2^-)$	(E1)	0.0707 *10*	α(K)=0.0585 *8*; α(L)=0.00947 *13*; α(M)=0.002161 *30* α(N)=0.000518 *7*; α(O)=8.34×10^{-5} *12*; α(P)=4.91×10^{-6} *7*

† From (^{136}Xe,xγ). Multipolarity and mixing ratio are based on $\gamma\gamma(\theta)$ data.
‡ Additional information 1.
# Placement of transition in the level scheme is uncertain.

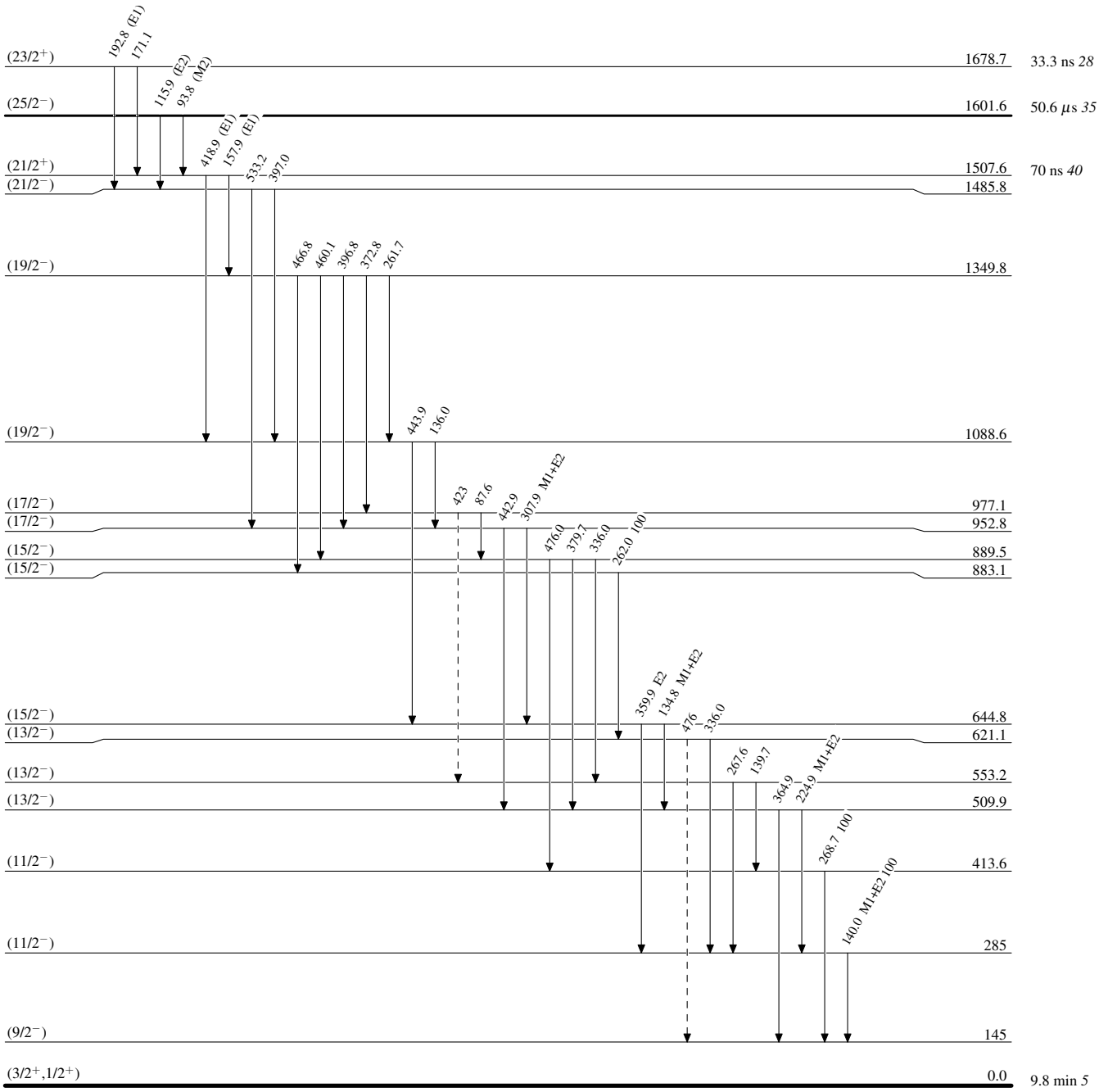
Adopted Levels, Gammas

Legend

Level Scheme

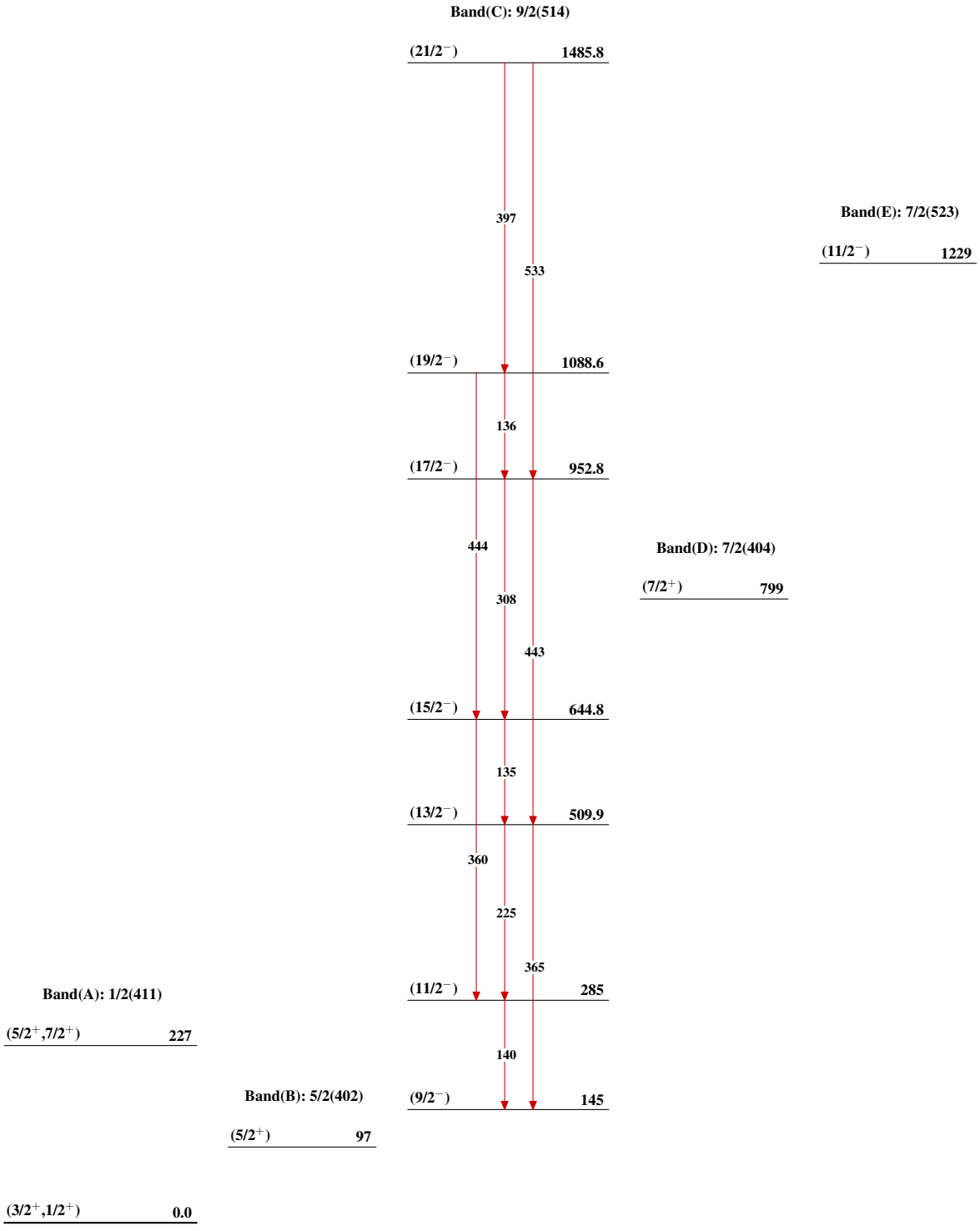
Intensities: Relative photon branching from each level

γ Decay (Uncertain)



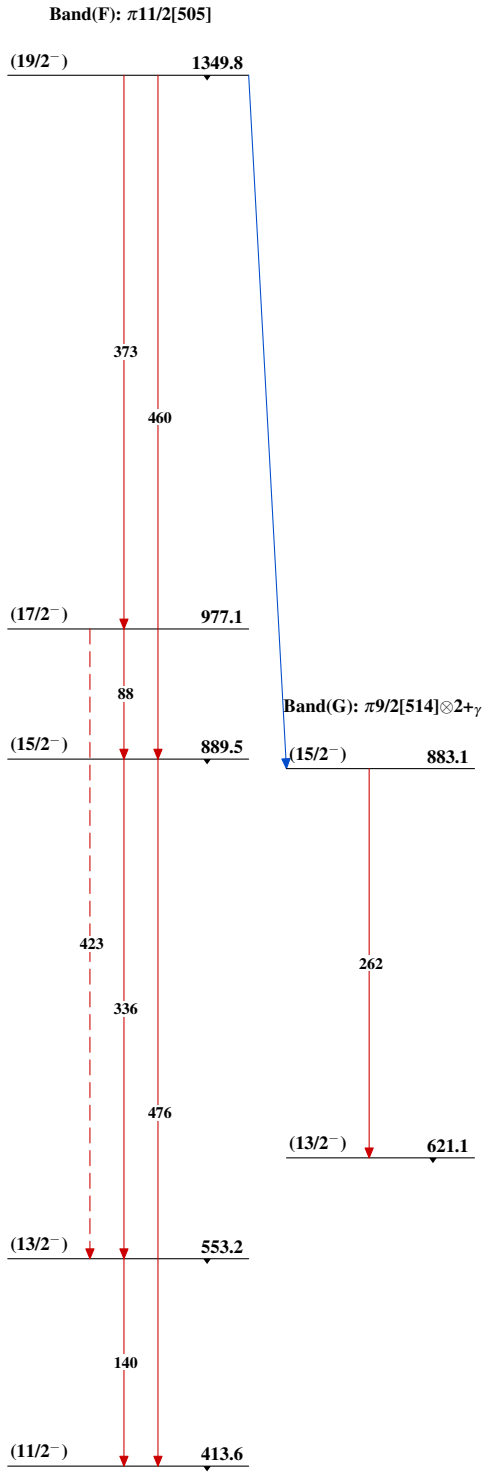
$^{191}_{75}Re_{116}$

Adopted Levels, Gammas



$^{191}_{75}Re_{116}$

Adopted Levels, Gammas (continued)



$^{191}_{75}Re_{116}$