

$^{208}\text{Pb}(^{16}\text{O},4n\gamma)$ 1988HaZJ,1985Bo32

Type	Author	History	Literature Cutoff Date
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 ^{220}Th Levels

1988HaZJ, 1988ScZN, 1985Bo32: E=94 MeV. Measured: γ , ce, $\gamma\gamma$ recoil, ce γ recoil coincidences.

E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]	E(level) [†]	J ^π [‡]
0 [#]	0 ⁺	1328.8 [@] 5	7 ⁻	2434.3?	(12 ⁺)	3004.4 [@] 7	15 ⁻
386.5 [#] 3	2 ⁺	1597.9 [#] 6	8 ⁺	2441.4 [#] 6	12 ⁺	3466.6 [@] 8	17 ⁻
759.8 [#] 5	4 ⁺	1718.7 [@] 6	9 ⁻	2554.8 [@] 7	13 ⁻	3952.8 [@] 8	19 ⁻
993.7 [@] 5	5 ⁻	2012.4 [#] 6	10 ⁺	2884.4? [#] 7	(14 ⁺)		
1165.8 [#] 5	6 ⁺	2158.7 [@] 6	11 ⁻	2900?	(14 ⁺)		

[†] From least-squares fit to the γ -ray energies.

[‡] From Adopted Levels based on band assignments and γ -ray multiplicities in this data set.

[#] Band(A): g.s. $K^\pi=0^+$ band.

[@] Band(B): $K^\pi=0^-$ band.

 $\gamma(^{220}\text{Th})$

E_γ [‡]	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [@]	α [†]	$I_{(\gamma+ce)}$ [#]	Comments
113.3 3	2554.8	13 ⁻	2441.4	12 ⁺	[E1]	0.363 6	8	ce(K)/($\gamma+ce$)=0.2040 25; ce(L)/($\gamma+ce$)=0.0469 8; ce(M)/($\gamma+ce$)=0.01137 19; ce(N+)/($\gamma+ce$)=0.00380 7 ce(N)/($\gamma+ce$)=0.00299 5; ce(O)/($\gamma+ce$)=0.000682 11; ce(P)/($\gamma+ce$)=0.0001213 20; ce(Q)/($\gamma+ce$)=7.28×10 ⁻⁶ 12
120.4 ^{&}	3004.4	15 ⁻	2884.4? (14 ⁺)	[E1]		0.316	1	ce(K)/($\gamma+ce$)=0.1851 22; ce(L)/($\gamma+ce$)=0.0415 6; ce(M)/($\gamma+ce$)=0.01004 15; ce(N+)/($\gamma+ce$)=0.00336 5 ce(N)/($\gamma+ce$)=0.00264 4; ce(O)/($\gamma+ce$)=0.000604 9; ce(P)/($\gamma+ce$)=0.0001078 16; ce(Q)/($\gamma+ce$)=6.59×10 ⁻⁶ 10
120.7 3	1718.7	9 ⁻	1597.9 8 ⁺	[E1]		0.314	28	ce(K)/($\gamma+ce$)=0.1843 24; ce(L)/($\gamma+ce$)=0.0412 7; ce(M)/($\gamma+ce$)=0.00999 16; ce(N+)/($\gamma+ce$)=0.00335 6 ce(N)/($\gamma+ce$)=0.00263 5; ce(O)/($\gamma+ce$)=0.000601 10; ce(P)/($\gamma+ce$)=0.0001073 17; ce(Q)/($\gamma+ce$)=6.56×10 ⁻⁶ 11
120.7 ^{&} 3	2554.8	13 ⁻	2434.3? (12 ⁺)	[E1]		0.314	5	ce(K)/($\gamma+ce$)=0.1843 24; ce(L)/($\gamma+ce$)=0.0412 7; ce(M)/($\gamma+ce$)=0.00999 16; ce(N+)/($\gamma+ce$)=0.00335 6 ce(N)/($\gamma+ce$)=0.00263 5; ce(O)/($\gamma+ce$)=0.000601 10; ce(P)/($\gamma+ce$)=0.0001073 17; ce(Q)/($\gamma+ce$)=6.56×10 ⁻⁶ 11
146.3 3	2158.7	11 ⁻	2012.4 10 ⁺	E1		0.199	20	ce(K)/($\gamma+ce$)=0.1293 17; ce(L)/($\gamma+ce$)=0.0275 4; ce(M)/($\gamma+ce$)=0.00664 10; ce(N+)/($\gamma+ce$)=0.00223 4 ce(N)/($\gamma+ce$)=0.00175 3; ce(O)/($\gamma+ce$)=0.000402

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$^{208}\text{Pb}(^{16}\text{O},4n\gamma)$ 1988HaZJ,1985Bo32 (continued) $\gamma(^{220}\text{Th})$ (continued)

E_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. @	$\alpha^\dagger$	$I_{(\gamma+ce)}^\#$	Comments
162.9 3	1328.8	7 ⁻	1165.8 6 ⁺	E1		0.1536	62	6; ce(P)/(γ+ce)=7.25×10 ⁻⁵ 11; ce(Q)/(γ+ce)=4.69×10 ⁻⁶ 7 Mult.: α(L)exp<0.064; theory: α(L)(E1)=0.0329, α(L)(E2)=1.44, α(L)(M1)=0.959. ce(K)/(γ+ce)=0.1045 14; ce(L)/(γ+ce)=0.0217 4; ce(M)/(γ+ce)=0.00523 8; ce(N+)/(γ+ce)=0.00176 3 ce(N)/(γ+ce)=0.001381 21; ce(O)/(γ+ce)=0.000317 5; ce(P)/(γ+ce)=5.77×10 ⁻⁵ 9; ce(Q)/(γ+ce)=3.84×10 ⁻⁶ 6
172.2 3	1165.8	6 ⁺	993.7 5 ⁻	E1		0.1345	55	Mult.: α(L)exp=0.029 9; theory: α(L)=0.0250. ce(K)/(γ+ce)=0.0933 13; ce(L)/(γ+ce)=0.0191 3; ce(M)/(γ+ce)=0.00462 7; ce(N+)/(γ+ce)=0.001554 23 ce(N)/(γ+ce)=0.001219 18; ce(O)/(γ+ce)=0.000281 5; ce(P)/(γ+ce)=5.11×10 ⁻⁵ 8; ce(Q)/(γ+ce)=3.45×10 ⁻⁶ 5
233.8 3	993.7	5 ⁻	759.8 4 ⁺	E1		0.0655	69	Mult.: α(L)exp=0.020 6; theory: α(L)=0.0220. ce(K)/(γ+ce)=0.0489 7; ce(L)/(γ+ce)=0.00952 14; ce(M)/(γ+ce)=0.00229 4; ce(N+)/(γ+ce)=0.000773 12 ce(N)/(γ+ce)=0.000605 9; ce(O)/(γ+ce)=0.0001401 21; ce(P)/(γ+ce)=2.59×10 ⁻⁵ 4; ce(Q)/(γ+ce)=1.88×10 ⁻⁶ 3
268.9 3	1597.9	8 ⁺	1328.8 7 ⁻	E1		0.0475	45	Mult.: α(K)exp=0.07 2; theory: α(K)=0.0521. ce(K)/(γ+ce)=0.0363 5; ce(L)/(γ+ce)=0.00691 10; ce(M)/(γ+ce)=0.001659 24; ce(N+)/(γ+ce)=0.000561 8 ce(N)/(γ+ce)=0.000439 7; ce(O)/(γ+ce)=0.0001019 15; ce(P)/(γ+ce)=1.89×10 ⁻⁵ 3; ce(Q)/(γ+ce)=1.421×10 ⁻⁶ 21
275.6 & 3	2434.3?	(12 ⁺)	2158.7 11 ⁻				6	Mult.: α(K)exp=0.05 2; theory: α(K)=0.0380.
282.6 3	2441.4	12 ⁺	2158.7 11 ⁻	E1		0.0425	17	Mult.: α(K)exp=0.4 1; theory: α(K)(E1)=0.0359, α(K)(E2)=0.0862, α(K)(M1)=0.852. ce(K)/(γ+ce)=0.0326 5; ce(L)/(γ+ce)=0.00617 9; ce(M)/(γ+ce)=0.001481 21; ce(N+)/(γ+ce)=0.000501 8 ce(N)/(γ+ce)=0.000392 6; ce(O)/(γ+ce)=9.10×10 ⁻⁵ 13; ce(P)/(γ+ce)=1.694×10 ⁻⁵ 25; ce(Q)/(γ+ce)=1.285×10 ⁻⁶ 19
293.5 3	2012.4	10 ⁺	1718.7 9 ⁻	E1		0.0390	27	Mult.: α(K)exp<0.034; theory: α(K)=0.0340. ce(K)/(γ+ce)=0.0301 5; ce(L)/(γ+ce)=0.00567 8; ce(M)/(γ+ce)=0.001359 20; ce(N+)/(γ+ce)=0.000460 7 ce(N)/(γ+ce)=0.000360 6; ce(O)/(γ+ce)=8.36×10 ⁻⁵ 12; ce(P)/(γ+ce)=1.558×10 ⁻⁵ 23; ce(Q)/(γ+ce)=1.191×10 ⁻⁶ 17
329.6 & 3	2884.4?	(14 ⁺)	2554.8 13 ⁻	[E1]		0.0302	5	Mult.: α(K)exp=0.04 1; theory: α(K)=0.0313. ce(K)/(γ+ce)=0.0236 4; ce(L)/(γ+ce)=0.00437 7; ce(M)/(γ+ce)=0.001045 15; ce(N+)/(γ+ce)=0.000354 5 ce(N)/(γ+ce)=0.000277 4; ce(O)/(γ+ce)=6.44×10 ⁻⁵ 10; ce(P)/(γ+ce)=1.206×10 ⁻⁵ 17; ce(Q)/(γ+ce)=9.44×10 ⁻⁷ 14

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$^{208}\text{Pb}(^{16}\text{O},4n\gamma)$ **1988HaZJ,1985Bo32 (continued)** $\gamma(^{220}\text{Th})$ (continued)

E_γ ‡	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. @	$\alpha^\dagger$	$I_{(\gamma+ce)}^\#$	Comments
335.1 3	1328.8	7 ⁻	993.7	5 ⁻	E2	0.1215	16	Mult.: $\alpha(K)\text{exp}=0.08$ 3; theory: $\alpha(K)(E1)=0.0243$, $\alpha(K)(E2)=0.0605$. ce(K)/($\gamma+ce$)=0.0522 7; ce(L)/($\gamma+ce$)=0.0413 6; ce(M)/($\gamma+ce$)=0.01102 16; ce(N+)/($\gamma+ce$)=0.00374 6 ce(N)/($\gamma+ce$)=0.00295 5; ce(O)/($\gamma+ce$)=0.000668 10; ce(P)/($\gamma+ce$)=0.0001160 17; ce(Q)/($\gamma+ce$)=3.15×10 ⁻⁶ 5
^x 341.6								Mult.: $\alpha(K)\text{exp}=0.08$ 3; theory: $\alpha(K)=0.0586$. E _γ : from 1985Bo32 . Mult.: $\alpha(K)\text{exp}=0.08$ 3; theory: $\alpha(K)(E1)=0.0225$, $\alpha(K)(E2)=0.0564$.
373.3 3	759.8	4 ⁺	386.5	2 ⁺	E2	0.0897	100	ce(K)/($\gamma+ce$)=0.0434 6; ce(L)/($\gamma+ce$)=0.0287 4; ce(M)/($\gamma+ce$)=0.00760 11; ce(N+)/($\gamma+ce$)=0.00258 4 ce(N)/($\gamma+ce$)=0.00204 3; ce(O)/($\gamma+ce$)=0.000462 7; ce(P)/($\gamma+ce$)=8.08×10 ⁻⁵ 12; ce(Q)/($\gamma+ce$)=2.55×10 ⁻⁶ 4
386.5 3	386.5	2 ⁺	0	0 ⁺	E2	0.0817	97	Mult.: from K/L, data not given. $\alpha(K)\text{exp}=0.05$ 1; theory: $\alpha(K)=0.0473$. ce(K)/($\gamma+ce$)=0.0409 6; ce(L)/($\gamma+ce$)=0.0256 4; ce(M)/($\gamma+ce$)=0.00676 10; ce(N+)/($\gamma+ce$)=0.00229 4 ce(N)/($\gamma+ce$)=0.00181 3; ce(O)/($\gamma+ce$)=0.000411 6; ce(P)/($\gamma+ce$)=7.20×10 ⁻⁵ 11; ce(Q)/($\gamma+ce$)=2.38×10 ⁻⁶ 4
389.8 3	1718.7	9 ⁻	1328.8	7 ⁻	E2	0.0798	28	Mult.: $\alpha(K)\text{exp}=0.04$ 1; theory: $\alpha(K)=0.0442$. ce(K)/($\gamma+ce$)=0.0403 6; ce(L)/($\gamma+ce$)=0.0248 4; ce(M)/($\gamma+ce$)=0.00656 10; ce(N+)/($\gamma+ce$)=0.00223 4 ce(N)/($\gamma+ce$)=0.00176 3; ce(O)/($\gamma+ce$)=0.000399 6; ce(P)/($\gamma+ce$)=7.00×10 ⁻⁵ 10; ce(Q)/($\gamma+ce$)=2.34×10 ⁻⁶ 4
396.3 3	2554.8	13 ⁻	2158.7	11 ⁻	[E2]	0.0764	3	Mult.: $\alpha(K)\text{exp}=0.04$ 1; theory: $\alpha(K)=0.0435$. ce(K)/($\gamma+ce$)=0.0391 6; ce(L)/($\gamma+ce$)=0.0235 4; ce(M)/($\gamma+ce$)=0.00621 9; ce(N+)/($\gamma+ce$)=0.00211 3 ce(N)/($\gamma+ce$)=0.001661 24; ce(O)/($\gamma+ce$)=0.000378 6; ce(P)/($\gamma+ce$)=6.63×10 ⁻⁵ 10; ce(Q)/($\gamma+ce$)=2.26×10 ⁻⁶ 4
406.1 3	1165.8	6 ⁺	759.8	4 ⁺	(E2)	0.0716	29	ce(K)/($\gamma+ce$)=0.0375 5; ce(L)/($\gamma+ce$)=0.0217 3; ce(M)/($\gamma+ce$)=0.00572 9; ce(N+)/($\gamma+ce$)=0.00194 3 ce(N)/($\gamma+ce$)=0.001530 22; ce(O)/($\gamma+ce$)=0.000348 5; ce(P)/($\gamma+ce$)=6.12×10 ⁻⁵ 9; ce(Q)/($\gamma+ce$)=2.15×10 ⁻⁶ 3
414.7 3	2012.4	10 ⁺	1597.9	8 ⁺	(E2)	0.0678	5	Mult.: $\alpha(K)\text{exp}=0.022$ 7; theory: $\alpha(K)(E1)=0.0156$, $\alpha(K)(E2)=0.0402$. ce(K)/($\gamma+ce$)=0.0361 5; ce(L)/($\gamma+ce$)=0.0203 3; ce(M)/($\gamma+ce$)=0.00533 8; ce(N+)/($\gamma+ce$)=0.00181 3 ce(N)/($\gamma+ce$)=0.001426 21; ce(O)/($\gamma+ce$)=0.000325 5; ce(P)/($\gamma+ce$)=5.72×10 ⁻⁵ 9; ce(Q)/($\gamma+ce$)=2.07×10 ⁻⁶ 3
429.1 3	2441.4	12 ⁺	2012.4	10 ⁺	[E2]	0.0621	2	Mult.: 0.01< $\alpha(K)\text{exp}$ <0.06; theory: $\alpha(K)(E1)=0.0149$, $\alpha(K)(E2)=0.0386$. ce(K)/($\gamma+ce$)=0.0340 5; ce(L)/($\gamma+ce$)=0.0181 3; ce(M)/($\gamma+ce$)=0.00476 7; ce(N+)/($\gamma+ce$)=0.001617 23 ce(N)/($\gamma+ce$)=0.001273 18; ce(O)/($\gamma+ce$)=0.000290 5; ce(P)/($\gamma+ce$)=5.13×10 ⁻⁵ 8; ce(Q)/($\gamma+ce$)=1.93×10 ⁻⁶ 3
432.2 3	1597.9	8 ⁺	1165.8	6 ⁺	E2	0.0610	7	ce(K)/($\gamma+ce$)=0.0336 5; ce(L)/($\gamma+ce$)=0.01772 25;

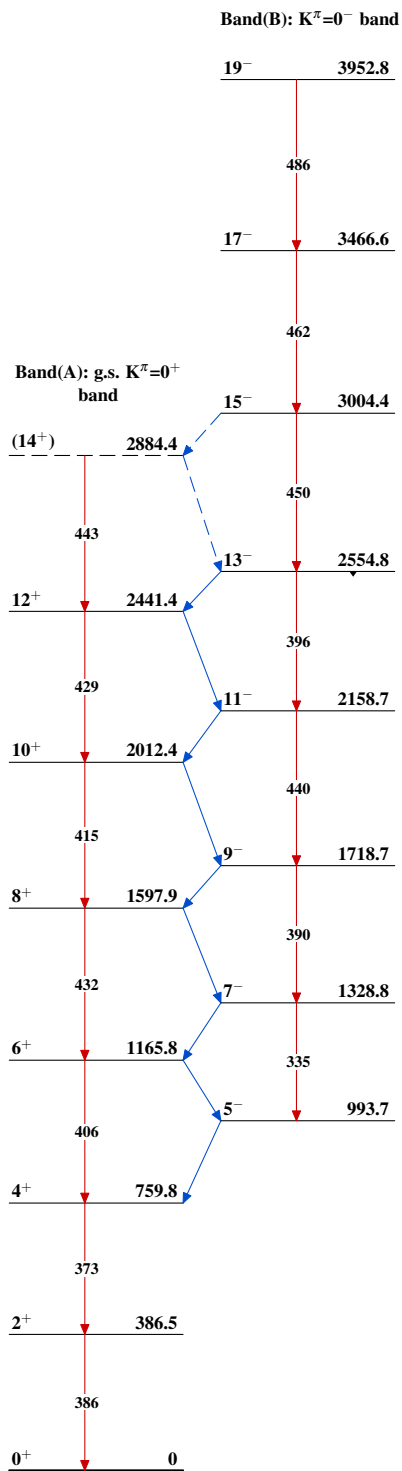
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$^{208}\text{Pb}(^{16}\text{O},4n\gamma)$ **1988HaZJ,1985Bo32** (continued) $\gamma(^{220}\text{Th})$ (continued)

$E_\gamma^{\ddagger}$	$E_i(\text{level})$	J_i^π	E_f	J_f^π	Mult. [@]	$\alpha^\dagger$	$I_{(\gamma+ce)}^\#$	Comments
439.9 3	2158.7	11 ⁻	1718.7	9 ⁻	E2	0.0583	27	ce(M)/($\gamma+ce$)=0.00465 7; ce(N+)/($\gamma+ce$)=0.001579 23 ce(N)/($\gamma+ce$)=0.001243 18; ce(O)/($\gamma+ce$)=0.000283 4; ce(P)/($\gamma+ce$)=5.01 $\times 10^{-5}$ 8; ce(Q)/($\gamma+ce$)=1.90 $\times 10^{-6}$ 3 Mult.: $\alpha(K)\text{exp}=0.04$ 1; theory: $\alpha(K)=0.0356$. ce(K)/($\gamma+ce$)=0.0325 5; ce(L)/($\gamma+ce$)=0.01674 24; ce(M)/($\gamma+ce$)=0.00439 7; ce(N+)/($\gamma+ce$)=0.001490 22 ce(N)/($\gamma+ce$)=0.001173 17; ce(O)/($\gamma+ce$)=0.000268 4; ce(P)/($\gamma+ce$)=4.73 $\times 10^{-5}$ 7; ce(Q)/($\gamma+ce$)=1.84 $\times 10^{-6}$ 3 Mult.: $\alpha(K)\text{exp}=0.027$ 9; theory: $\alpha(K)=0.0348$. ce(K)/($\gamma+ce$)=0.0321 5; ce(L)/($\gamma+ce$)=0.01637 23; ce(M)/($\gamma+ce$)=0.00429 6; ce(N+)/($\gamma+ce$)=0.001456 21 ce(N)/($\gamma+ce$)=0.001146 17; ce(O)/($\gamma+ce$)=0.000262 4; ce(P)/($\gamma+ce$)=4.63 $\times 10^{-5}$ 7; ce(Q)/($\gamma+ce$)=1.81 $\times 10^{-6}$ 3 ce(K)/($\gamma+ce$)=0.0313 5; ce(L)/($\gamma+ce$)=0.01561 22; ce(M)/($\gamma+ce$)=0.00408 6; ce(N+)/($\gamma+ce$)=0.001388 20 ce(N)/($\gamma+ce$)=0.001092 16; ce(O)/($\gamma+ce$)=0.000249 4; ce(P)/($\gamma+ce$)=4.42 $\times 10^{-5}$ 7; ce(Q)/($\gamma+ce$)=1.759 $\times 10^{-6}$ 25 Mult.: $0.01 < \alpha(K)\text{exp} < 0.07$; theory: $\alpha(K)(E1)=0.0127$, $\alpha(K)(E2)=0.0330$. ce(K)/($\gamma+ce$)=0.0298 4; ce(L)/($\gamma+ce$)=0.01430 20; ce(M)/($\gamma+ce$)=0.00373 6; ce(N+)/($\gamma+ce$)=0.001269 18 ce(N)/($\gamma+ce$)=0.000998 15; ce(O)/($\gamma+ce$)=0.000228 4; ce(P)/($\gamma+ce$)=4.05 $\times 10^{-5}$ 6; ce(Q)/($\gamma+ce$)=1.665 $\times 10^{-6}$ 24 Mult.: $\alpha(L)\text{exp}=0.025$ 8; theory: $\alpha(K)(E1)=0.0120$, $\alpha(K)(E2)=0.0313$. $\alpha(K)=0.0308$ 5; $\alpha(L)=0.01464$ 21; $\alpha(M)=0.00382$ 6; $\alpha(N+)=0.001298$ 19 $\alpha(N)=0.001022$ 15; $\alpha(O)=0.000233$ 4; $\alpha(P)=4.15 \times 10^{-5}$ 6; $\alpha(Q)=1.721 \times 10^{-6}$ 24 ce(K)/($\gamma+ce$)=0.0272 4; ce(L)/($\gamma+ce$)=0.01220 17; ce(M)/($\gamma+ce$)=0.00317 5; ce(N+)/($\gamma+ce$)=0.001079 16 ce(N)/($\gamma+ce$)=0.000849 12; ce(O)/($\gamma+ce$)=0.000194 3; ce(P)/($\gamma+ce$)=3.46 $\times 10^{-5}$ 5; ce(Q)/($\gamma+ce$)=1.505 $\times 10^{-6}$ 22
443.0 3	2884.4?	(14 ⁺)	2441.4	12 ⁺	[E2]	0.0573	1	
449.6 3	3004.4	15 ⁻	2554.8	13 ⁻	(E2)	0.0552	12	
462.2 3	3466.6	17 ⁻	3004.4	15 ⁻	(E2)	0.0516	9	
466 ^{&}	2900?	(14 ⁺)	2434.3?	(12 ⁺)	[E2]	0.0506		
486.2 3	3952.8	19 ⁻	3466.6	17 ⁻	[E2]	0.0456	3	

[†] Additional information 1.[‡] From 1988HaZJ, unless otherwise noted; uncertainties not given by authors. $\Delta E=0.3$ keV assigned by evaluators.[#] From 1988HaZJ; the evaluators have assumed that the intensities given on the level scheme (fig. 3) are $I(\gamma+ce)$ as in 1985Bo32.[@] From $\alpha(K)\text{exp}$ based on $ce(K)$ and I_γ from ce -recoil and γ -ray-recoil coincidences normalized to $\alpha(K)\text{exp}(373.3\gamma)=0.048$ (E2 theory). All conversion coefficient data are from 1985Bo32.[&] Placement of transition in the level scheme is uncertain.^x γ ray not placed in level scheme.

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$^{220}_{90}\text{Th}_{130}$