^{232}Th(n,γ),(n,n):resonances   2018MuZZ,2012Gu13

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	B. Singh, J. K. Tuli, E. Browne	NDS 170, 499 (2020)	8-Oct-2020

2018MuZZ: evaluation of neutron-resonances.
Experimental data:
2012Gu13: neutron beam at E=1 eV-1 MeV from neutron time-of-flight facility n_TOF at CERN. Target=^{232}Th, 99.5% enriched.
    Measured E(n) by time-of-flight, neutron capture yields by γ-ray measurements using deuterated benzene C_6D_6 γ-ray detectors.
    Deduced neutron resonances, J, π, Γ_γ, gΓ_n. Authors report 386 resonances from 8 eV to 4 keV. R-matrix analysis.
1992Fr14 (also 1992Po13): study of 23 p-wave resonances from 8 eV to 392 eV.
1972Ra41: measured neutron resonances by TOF method, deduced resonance parameters for 302 resonances from 21.78 eV to
    3994.4 eV; 240 s-wave and 62 p-wave resonances.
1964Ga06: 227 resonances from 21.84 eV to 4000 eV. Most values are in agreement with those from 1972Ra41 but are generally
    less precise.
1967Bh05: Study of 21.7, 23.4, 59.4 and 69.1 eV resonances.
1965Ha22: Study of 11 resonances from 20 eV to 222 eV.
Others: 1988Ko15, 1988AlZN, 1982Ol06, 1979Ch30, 1977Ma39, 1971Fo11, 1964Bo04.
All data are from 2018MuZZ evaluation unless otherwise stated. Values of gΓ_n^0 and gΓ_n^1 are also given in this evaluation.

^{233}Th Levels

    J^π=1/2$^+$ for s-wave (L=0) resonances, and 1/2$^-$,3/2$^-$ for p-wave (L=1) resonances, further limited to 1/2$^-$ for some resonances.
    For L=1, statistical factor g=1 for J(level)=1/2$^-$ and 2 for J(level)=3/2$^-$.
    2012Gu13 give Γ_γ=24.40 meV for all the L=1 resonances.

E(level)[†]	J^{π}[&]	L[&]	Comments
S(n)-0.01146?	1/2$^+$	0	Γ_γ=24.85 meV.
			Fictitious level.
S(n)+0.00836	1/2$^-$	1	E(n)=8.360 eV *1*.
			gΓ_n=0.00027 meV *1*, Γ_γ=29.0 meV *87*.
S(n)+0.01314	3/2^{-a}	1	E(n)=13.138 eV *2*.
			gΓ_n=0.00019 meV *1*.
S(n)+0.02182	1/2$^+$	0	E(n)=21.819 eV *3*.
			gΓ_n=2.10 meV *2*, Γ_γ=24.5 meV *5*.
S(n)+0.02345	1/2$^+$	0	E(n)=23.454 eV *3*.
			gΓ_n=3.90 meV *8*, Γ_γ=24.7 meV *5*.
S(n)+0.03698	1/2^{-a}	1	E(n)=36.982 eV *4*.
			gΓ_n=0.00088 meV *1*.
S(n)+0.03823	3/2^{-d}	1	E(n)=38.232 eV *4*.
			gΓ_n=0.00048 meV *1*.
S(n)+0.04107	1/2^{-a}	1	E(n)=41.066 eV *5*.
			gΓ_n=0.00051 meV *1*.
S(n)+0.04707	3/2^{-d}	1	E(n)=47.068 eV *5*.
			gΓ_n=0.00174 meV *3*.
S(n)+0.04994[‡]	1/2$^-$,3/2$^-$	1	E(n)=49.941 eV *6*.
			gΓ_n=0.00043 meV *1*.
S(n)+0.05879	3/2^{-a}	1	E(n)=58.786 eV *9*.
			gΓ_n=0.0090 meV *2*.
S(n)+0.05952	1/2$^+$	0	E(n)=59.523 eV *9*.
			gΓ_n=3.90 meV *8*, Γ_γ=24.4 meV *3*.
S(n)+0.06458[‡] *1*	1/2$^-$	1	E(n)=64.575 eV *10*.
			gΓ_n=0.00079 meV *4*.
S(n)+0.06923 *2*	1/2$^+$	0	E(n)=69.228 eV *15*.

^{232}**Th(n,γ),(n,n):resonances   2018MuZZ,2012Gu13 (continued)**

$\underline{^{233}\text{Th Levels (continued)}}$

E(level)[†]	J$^\pi$[&]	L[&]	Comments
S(n)+0.09014 *1*	1/2^{-a}	1	gΓ_n=43.9 meV *3*, Γ_γ=22.6 meV *4*. E(n)=90.139 eV *10*.
S(n)+0.09806 *1*	1/2$^-$	1	gΓ_n=0.0056 meV *1*. E(n)=98.057 eV *10*.
S(n)+0.10363 *1*	1/2$^-$,3/2$^-$	1	gΓ_n=0.004 meV *1*.
S(n)+0.11300 *1*	1/2$^+$	0	gΓ_n=0.0065 meV *1*.
S(n)+0.12083 *2*	1/2$^+$	0	gΓ_n=13.0 meV *2*, Γ_γ=24.0 meV *5*.
S(n)+0.12817 *2*	3/2^{-d}	1	gΓ_n=22.2 meV *2*, Γ_γ=23.6 meV *6*.
S(n)+0.12916 *2*	1/2$^+$	0	gΓ_n=0.080 meV *4*.
S(n)+0.14583 *2*	1/2^{+b}	0^b	gΓ_n=3.40 meV *7*, Γ_γ=27.4 meV *11*.
S(n)+0.14806 *2*	1/2^{-a}	1	gΓ_n=0.088 meV *3*. gΓ_n=0.09 meV (2012Gu13).
S(n)+0.15429 *2*	1/2$^+$	0	gΓ_n=0.0063 meV *1*.
S(n)+0.16711‡ *2*	1/2$^-$	1	gΓ_n=0.20 meV *4*, Γ_γ=22.5 meV *5*.
S(n)+0.17030 *4*	1/2$^+$	0	gΓ_n=0.024 meV *1*.
S(n)+0.17886 *3*	1/2$^-$,3/2$^-$	1	gΓ_n=60.9 meV *4*, Γ_γ=24.0 meV *6*.
S(n)+0.19260 *3*	1/2$^+$		gΓ_n=0.025 meV *1*.
S(n)+0.19620 *3*	3/2^{-d}	1	gΓ_n=16.5 meV *3*, Γ_γ=24.0 meV *8*.
S(n)+0.19925 *3*	1/2$^+$	0	gΓ_n=0.072 meV *2*.
S(n)+0.20258 *3*	1/2$^-$	1	gΓ_n=9.8 meV *2*, Γ_γ=20.5 meV *4*.
S(n)+0.21091 *3*	3/2^{-a}	1	gΓ_n=0.042 meV *2*.
S(n)+0.2195 *2*	1/2^{+b}	0^b	gΓ_n=0.0180 meV *4*.
S(n)+0.22111 *4*	1/2$^+$	0	gΓ_n=0.052 meV *8*. gΓ_n=0.05 meV (2012Gu13).
S(n)+0.23195‡ *4*	1/2$^-$	1	gΓ_n=29.7 meV *4*, Γ_γ=24 meV *1*.
S(n)+0.23407 *4*	1/2^{-a}	1	gΓ_n=0.010 meV *1*.
S(n)+0.24225 *4*	3/2^{-a}	1	gΓ_n=0.018 meV *1*.
S(n)+0.25147 *5*	1/2$^+$	0	gΓ_n=0.043 meV *1*.
S(n)+0.25810 *3*	1/2^{-a}	1	gΓ_n=31.3 meV *5*, Γ_γ=26.0 meV *9*.
S(n)+0.26304 *5*	1/2$^+$	0	gΓ_n=0.01 meV *1*.
S(n)+0.27276 *3*	3/2^{-a}	1	gΓ_n=21.5 meV *5*, Γ_γ=24.3 meV *7*.
S(n)+0.27645 *3*	3/2^{-a}	1	gΓ_n=0.019 meV.
S(n)+0.28568 *6*	1/2$^+$	0	gΓ_n=0.0086 meV *2*.
S(n)+0.2905 *3*	3/2^{-a}	1	gΓ_n=30.6 meV *6*, Γ_γ=25.4 meV *10*.
S(n)+0.2998‡ *3*	1/2$^-$,3/2$^-$	1	gΓ_n=0.07 meV *2*.
S(n)+0.3027 *3*	3/2^{-a}	1	gΓ_n=0.041 meV *10*.
S(n)+0.3056 *3*	1/2$^+$	0	gΓ_n=0.14 meV *2*.
S(n)+0.3094 *3*	1/2^{+b}	0^b	gΓ_n=28.9 meV *5*, Γ_γ=25.1 meV *20*.
S(n)+0.3218 *3*	3/2^{-a}	1	gΓ_n=0.053 meV *10*. gΓ_n=0.06 meV, Γ_γ=24.43 meV (2012Gu13).
S(n)+0.3290 *3*	1/2$^+$	0	gΓ_n=0.04 meV *1*.
S(n)+0.33523‡ *3*	1/2$^-$,3/2$^-$	1	gΓ_n=74 meV *1*, Γ_γ=26.0 meV *15*.
S(n)+0.3383 *3*	1/2^{-a}	1	gΓ_n=0.035 meV.
S(n)+0.3419 *3*	1/2$^+$	0	gΓ_n=0.051 meV *20*.
S(n)+0.35200 *3*	1/2^{-a}	1	gΓ_n=38.9 meV *10*, Γ_γ=25.3 meV *28*.
S(n)+0.3614 *3*	3/2^{-a}	1	gΓ_n=0.077 meV.
S(n)+0.3654 *3*	1/2$^+$	0	gΓ_n=0.088 meV *20*.
S(n)+0.3695 *3*	1/2$^+$	0	gΓ_n=26.1 meV *10*, Γ_γ=23 meV *3*.
S(n)+0.3806 *3*	3/2^{-a}	1	gΓ_n=25.6 meV *10*, Γ_γ=23.2 meV *0*.
S(n)+0.3915 *3*	1/2^{-a}	1	gΓ_n=0.14 meV *3*.
S(n)+0.4010 *4*	1/2$^+$	0	gΓ_n=0.16 meV *5*.
S(n)+0.4028 *4*	1/2^{+b}	0^b	gΓ_n=11.0 meV *4*, Γ_γ=25 meV *4*.
S(n)+0.4119 *4*	1/2^{-a}	1	gΓ_n=0.10 meV *4*. gΓ_n=0.14 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+0.4209 *4*	1/2$^+$	0	gΓ_n=0.23 meV *3*.
S(n)+0.42734 *4*	1/2$^-$,3/2$^-$	1	gΓ_n=0.52 meV *6*. Γ_γ=24.40 meV (2012Gu13).
			gΓ_n=0.019 meV.

<u>^{232}Th(n,γ),(n,n):resonances　　2018MuZZ,2012Gu13 (continued)</u>

<u>^{233}Th Levels (continued)</u>

E(level)[†]	J$^\pi$[&]	L[&]	Comments
S(n)+0.4543 4	1/2$^+$	0	gΓ_n=1.20 meV 7. Γ_γ=24.40 meV (2012Gu13).
S(n)+0.4590 4	3/2^{-a}	1	gΓ_n=0.065 meV 20.
S(n)+0.4628 4	1/2$^+$	0	gΓ_n=63.4 meV 20, Γ_γ=21.5 meV 10.
S(n)+0.4664 4	1/2^{-a}	1	gΓ_n=0.12 meV 4.
S(n)+0.4706 4	1/2$^-$,3/2$^-$	1	gΓ_n=0.048 meV 30.
S(n)+0.4765 4	3/2^{-a}	1	gΓ_n=0.16 meV 3.
S(n)+0.4890 4	1/2$^+$	0	gΓ_n=59 meV 1, Γ_γ=19.2 meV 5.
S(n)+0.5106 3	1/2$^+$	0	gΓ_n=4.2 meV 4.
S(n)+0.5288 3	1/2$^+$	0	gΓ_n=14.7 meV 6, Γ_γ=19.5 meV 30.
S(n)+0.5336 3	1/2^{-a}	1	gΓ_n=0.26 meV 5.
S(n)+0.5359 3	3/2^{-a}	1	gΓ_n=0.37 meV 7.
S(n)+0.5405 3	1/2^{+b}	0^b	gΓ_n=0.98 meV 5. gΓ_n=1.09 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+0.55033[@]	3/2$^-$	1	gΓ_n=0.04 meV.
S(n)+0.5700 3	1/2$^+$	0	gΓ_n=27.6 meV 9, Γ_γ=19.4 meV 15.
S(n)+0.5739 3	3/2^{-e}	1^e	gΓ_n=0.68 meV 9. gΓ_n=0.31 meV (2012Gu13).
S(n)+0.5784 3	3/2^{-e}	1^e	gΓ_n=2.2 meV 2. gΓ_n=0.99 meV (2012Gu13).
S(n)+0.58401[@]	1/2$^-$	1	gΓ_n=0.03 meV.
S(n)+0.5943 3	1/2^{+b}	0^b	gΓ_n=0.13 meV 4. gΓ_n=0.13 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+0.5986 3	1/2$^+$	0	gΓ_n=10.5 meV 5, Γ_γ=19.5 meV 20.
S(n)+0.6181 3	1/2$^+$	0	gΓ_n=4.8 meV 4. Γ_γ=27.44 meV (2012Gu13).
S(n)+0.6250[‡] 3	1/2$^-$,3/2$^-$	1	gΓ_n=0.053 meV 40.
S(n)+0.6447 4	3/2^{-a}	1	gΓ_n=0.15 meV 5.
S(n)+0.6568 4	1/2$^+$	0	gΓ_n=49 meV 2, Γ_γ=19 meV 2.
S(n)+0.66563 4	1/2$^+$	0	gΓ_n=27.7 meV 10, Γ_γ=18 meV 2.
S(n)+0.6755 4	1/2$^+$	0	gΓ_n=209 meV 3, Γ_γ=19.0 meV 16.
S(n)+0.6879 4	1/2$^+$	0	gΓ_n=52 meV 2, Γ_γ=21.3 meV 15.
S(n)+0.6956 5	1/2^{-a}	1	gΓ_n=0.17 meV 10.
S(n)+0.6970[‡] 5	1/2$^-$,3/2$^-$	1	gΓ_n=0.15 meV 10.
S(n)+0.70000[@]	1/2$^+$	0	gΓ_n=0.50 meV, Γ_γ=24.4 meV.
S(n)+0.7012 5	1/2$^+$	0	gΓ_n=15.6 meV 10, Γ_γ=19.7 meV 40.
S(n)+0.7047 4	1/2^{-a}	1	gΓ_n=0.20 meV 8.
S(n)+0.7133 4	1/2$^+$	0	gΓ_n=30.4 meV 20, Γ_γ=19 meV 3.
S(n)+0.7197 4	1/2^{-a}	1	gΓ_n=0.093 meV 50.
S(n)+0.7240 4	1/2^{+b}	0^b	gΓ_n=0.120 meV 4. gΓ_n=0.12 meV, Γ_γ=24.4 meV (2012Gu13).
S(n)+0.7413 4	1/2$^+$	0	gΓ_n=190 meV 3, Γ_γ=21.5 meV 10.
S(n)+0.7585 4	1/2^{-a}	1	gΓ_n=0.3 meV 1.
S(n)+0.7652 4	3/2^{-d}	1	gΓ_n=0.68 meV 20.
S(n)+0.7740 4	1/2^{-a}	1	gΓ_n=0.05 meV 5.
S(n)+0.7790 4	1/2$^+$	0	gΓ_n=12 meV 1, Γ_γ=25.5 meV 25.
S(n)+0.7840[‡] 4	1/2$^-$,3/2$^-$	1	gΓ_n=0.077 meV 60.
S(n)+0.7878[‡] 5	1/2$^-$,3/2$^-$	1	gΓ_n=0.078 meV 60.
S(n)+0.7923 5	3/2^{-a}	1	gΓ_n=0.083 meV 70.
S(n)+0.8045 5	1/2$^+$	0	gΓ_n=180 meV 3, Γ_γ=24.0 meV 12.
S(n)+0.8083 5	3/2^{-a}	1	gΓ_n=0.14 meV 6.
S(n)+0.8149[‡] 5	1/2$^-$,3/2$^-$	1	gΓ_n=0.14 meV 7.
S(n)+0.8210 5	3/2^{-e}	1^e	gΓ_n=1.2 meV 2. gΓ_n=0.61 meV (2012Gu13).
S(n)+0.8289 5	1/2^{+b}	0^b	gΓ_n=0.24 meV 8. gΓ_n=0.23 meV, Γ_γ=24.4 meV (2012Gu13).
S(n)+0.8370 5	1/2$^+$	0	gΓ_n=1.6 meV 2. Γ_γ=24.4 meV (2012Gu13).
S(n)+0.8427 5	1/2$^+$	0	gΓ_n=29 meV 2, Γ_γ=19 meV 2.
S(n)+0.8510 5	3/2^{-d}	1	gΓ_n=0.95 meV 10. gΓ_n=0.17 meV (2012Gu13).
S(n)+0.8667 5	1/2$^+$	0	gΓ_n=14.7 meV 10, Γ_γ=24 meV 3.
S(n)+0.8690 5	3/2^{-a}	1	gΓ_n=0.67 meV 20.

^{232}**Th(n,γ),(n,n):resonances　　2018MuZZ,2012Gu13 (continued)**

$\underline{^{233}\text{Th Levels (continued)}}$

E(level)[†]	J$^{\pi}$[&]	L[&]	Comments
S(n)+0.87927[@]	3/2$^-$	1	gΓ_n=0.05 meV.
S(n)+0.8846 *5*	3/2^{-a}	1	gΓ_n=0.35 meV *8*.
S(n)+0.8906 *5*	1/2$^+$	0	gΓ_n=39 meV *2*, Γ_{γ}=22 meV *2*.
S(n)+0.8988 *5*	3/2^{-a}	1	gΓ_n=0.082 meV *70*.
S(n)+0.9070 *5*	1/2$^+$	0	gΓ_n=2.1 meV *3*. Γ_{γ}=24.4 meV (2012Gu13).
S(n)+0.9194 *5*	3/2^{-a}	1	gΓ_n=0.47 meV *10*.
S(n)+0.9270 *5*	1/2^{+b}	0^b	gΓ_n=0.50 meV *5*. gΓ_n=0.28 meV, Γ_{γ}=24.4 meV (2012Gu13).
S(n)+0.9345 *5*	3/2^{-a}	1	gΓ_n=0.39 meV *9*.
S(n)+0.9437 *5*	1/2$^+$	0	gΓ_n=45.5 meV *20*, Γ_{γ}=24 meV *2*.
S(n)+0.9560 *5*	1/2^{-a}	1	gΓ_n=0.18 meV *20*.
S(n)+0.9630 *5*	1/2$^+$	0	gΓ_n=7.7 meV *7*. Γ_{γ}=22.25 meV (2012Gu13).
S(n)+0.9748 *5*	3/2^{-a}	1	gΓ_n=0.26 meV *10*.
S(n)+0.9835 *5*	1/2$^+$	0	gΓ_n=37.6 meV *20*, Γ_{γ}=20.9 meV *20*.
S(n)+0.9910 *5*	1/2$^+$	0	gΓ_n=90.5 meV *30*, Γ_{γ}=21.7 meV *24*.
S(n)+0.9968 *6*	3/2^{-a}	1	gΓ_n=0.41 meV *20*.
S(n)+1.0001[‡] *6*	1/2$^-$,3/2$^-$	1	gΓ_n=0.25 meV *10*.
S(n)+1.0111 *6*	1/2$^+$	0	gΓ_n=123 meV *3*, Γ_{γ}=20.1 meV *22*.
S(n)+1.0230 *6*	3/2^{-a}	1	gΓ_n=0.42 meV *70*. gΓ_n=0.22 meV (2012Gu13).
S(n)+1.0293 *6*	1/2^{-a}	1	gΓ_n=0.21 meV *7*.
S(n)+1.0395 *6*	1/2$^+$	0	gΓ_n=11.2 meV *10*. Γ_{γ}=25.94 meV (2012Gu13).
S(n)+1.0435 *6*	1/2^{-a}	1	gΓ_n=0.59 meV *8*.
S(n)+1.046 *1*	3/2^{-a}	1	gΓ_n=0.26 meV *8*.
S(n)+1.051 *1*	3/2^{-a}	1	gΓ_n=0.34 meV *8*.
S(n)+1.06096[@]	3/2$^-$	1	gΓ_n=0.09 meV.
S(n)+1.0650 *6*	1/2$^+$	0	gΓ_n=6.1 meV *6*. Γ_{γ}=25.19 meV (2012Gu13).
S(n)+1.07412[@]	3/2$^-$	1	gΓ_n=0.04 meV.
S(n)+1.0776 *6*	1/2$^+$	0	gΓ_n=11 meV *1*. Γ_{γ}=25.27 meV (2012Gu13).
S(n)+1.0933 *6*	1/2$^+$	0	gΓ_n=2.2 meV *3*. Γ_{γ}=24.40 meV (2012Gu13).
S(n)+1.1103 *6*	1/2$^+$	0	gΓ_n=27.8 meV *20*, Γ_{γ}=18.3 meV *40*.
S(n)+1.1150 *6*	1/2^{-e}	1^e	gΓ_n=1.7 meV *3*. gΓ_n=2.16 meV.
S(n)+1.1162 *6*	3/2^{-a}	1	gΓ_n=1.0 meV *3*.
S(n)+1.1211 *6*	1/2$^+$	0	gΓ_n=3.7 meV *4*. Γ_{γ}=24.40 meV (2012Gu13).
S(n)+1.1275[‡] *6*	1/2$^-$,3/2$^-$	1	gΓ_n=0.21 meV *8*.
S(n)+1.1332 *6*	3/2^{-a}	1	gΓ_n=0.42 meV *10*.
S(n)+1.1395 *6*	1/2$^+$	0	gΓ_n=18 meV *2*, Γ_{γ}=9.6 meV *30*.
S(n)+1.1510 *6*	1/2$^+$	0	gΓ_n=20.9 meV *20*, Γ_{γ}=22 meV *2*.
S(n)+1.1769 *6*	3/2^{-a}	1	gΓ_n=0.41 meV *10*.
S(n)+1.18677[@]	3/2$^-$	1	gΓ_n=0.06 meV.
S(n)+1.1953 *6*	1/2$^+$	0	gΓ_n=9.5 meV *9*. Γ_{γ}=24.44 meV (2012Gu13).
S(n)+1.2052 *6*	3/2^{-a}	1	gΓ_n=2.0 meV *3*.
S(n)+1.2141 *6*	1/2$^-$,3/2$^-$	1	gΓ_n=0.3 meV *3*.
S(n)+1.2183 *6*	1/2^{+e}	0^e	gΓ_n=0.5 meV *1*. gΓ_n=0.34 meV, Γ_{γ}=24.42 meV (2012Gu13).
S(n)+1.2249 *6*	1/2^{-a}	1	gΓ_n=0.42 meV *20*.
S(n)+1.2287 *6*	1/2$^+$	0	gΓ_n=39 meV *3*. Γ_{γ}=24.76 meV (2012Gu13).
S(n)+1.2347 *6*	1/2^{-a}	1	gΓ_n=1.1 meV *2*.
S(n)+1.2435 *6*	1/2$^+$	0	gΓ_n=23.4 meV *20*, Γ_{γ}=20 meV *3*.
S(n)+1.2493 *6*	1/2$^+$	0	gΓ_n=127 meV *4*. Γ_{γ}=23.18 meV (2012Gu13).
S(n)+1.2617 *6*	3/2^{-a}	1	gΓ_n=1.0 meV *2*.
S(n)+1.2664 *5*	3/2^{-a}	1	gΓ_n=0.28 meV *20*.
S(n)+1.2700 *6*	1/2$^+$	0	gΓ_n=24.2 meV *20*, Γ_{γ}=20 meV *3*.
S(n)+1.2885 *6*	3/2^{-a}	1	gΓ_n=0.5 meV *2*.
S(n)+1.2927 *6*	1/2$^+$	0	gΓ_n=104 meV *4*, Γ_{γ}=25 meV *2*.
S(n)+1.3024 *6*	1/2$^+$	0	gΓ_n=52 meV *3*, Γ_{γ}=20 meV *2*.
S(n)+1.30801[@]	1/2$^-$	1	gΓ_n=0.69 meV.

Continued on next page (footnotes at end of table)

^{232}**Th(n,γ),(n,n):resonances   2018MuZZ,2012Gu13 (continued)**

<u>^{233}Th Levels (continued)</u>

E(level)[†]	J$^{\pi}$[&]	L[&]	Comments
S(n)+1.3353 6	1/2$^+$	0	gΓ_n=3.3 meV 6. Γ_γ=24.40 meV (2012Gu13).
S(n)+1.3464 6	3/2^{-a}	1	gΓ_n=1.1 meV 2.
S(n)+1.3555 6	1/2$^+$	0	gΓ_n=84 meV 4, Γ_γ=24 meV 3.
S(n)+1.3605 6	1/2$^+$	0	gΓ_n=6.4 meV 8. Γ_γ=24.12 meV (2012Gu13).
S(n)+1.3732 6	3/2^{-d}	1	gΓ_n=1.5 meV 4.
S(n)+1.3789 6	1/2$^+$	0	gΓ_n=53 meV 3, Γ_γ=22 meV 2.
S(n)+1.38523[@]	3/2$^-$	1	gΓ_n=0.09 meV.
S(n)+1.3884 6	3/2^{-a}	1	gΓ_n=2.4 meV 4.
S(n)+1.3987 6	1/2$^+$	0	gΓ_n=141 meV 4, Γ_γ=19.2 meV 20.
S(n)+1.40945[@]	3/2$^-$	1	gΓ_n=0.14 meV.
S(n)+1.4184 6	1/2^{-a}	1	gΓ_n=0.54 meV 20.
S(n)+1.4273 6	1/2$^+$	0	gΓ_n=111 meV 4, Γ_γ=21.0 meV 23.
S(n)+1.4346 6	1/2$^+$	0	gΓ_n=38 meV 3, Γ_γ=21 meV 3.
S(n)+1.4424 6	1/2^{+b}	0^b	gΓ_n=1.2 meV 3. gΓ_n=0.94 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+1.45069[@]	3/2$^-$	1	gΓ_n=0.13 meV.
S(n)+1.4615 6	1/2^{+e}	0^e	gΓ_n=1.4 meV 4. gΓ_n=1.43 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+1.46597[@]	3/2$^-$	1	gΓ_n=0.09 meV.
S(n)+1.4790 6	1/2^{+e}	0^e	gΓ_n=2.3 meV 4. gΓ_n=1.95 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+1.48547[@]	3/2$^-$	1	gΓ_n=0.19 meV.
S(n)+1.5016 6	1/2^{-a}	1	gΓ_n=0.67 meV 30.
S(n)+1.5100 7	1/2$^+$	0	gΓ_n=7.9 meV 10. Γ_γ=24.40 meV (2012Gu13).
S(n)+1.5165 7	1/2^{-a}	1	gΓ_n=1.7 meV 3.
S(n)+1.5196 7	1/2$^+$	0	gΓ_n=197 meV 5, Γ_γ=21.9 meV 21.
S(n)+1.5252 7	1/2$^+$	0	gΓ_n=202 meV 6, Γ_γ=21.9 meV 25.
S(n)+1.5564 7	1/2$^+$	0	gΓ_n=8.1 meV 10. Γ_γ=23.75 meV (2012Gu13).
S(n)+1.5820 7	1/2$^+$	0	gΓ_n=24.6 meV 20. Γ_γ=22.83 meV (2012Gu13).
S(n)+1.5906 7	1/2$^+$	0	gΓ_n=365 meV 7, Γ_γ=23.8 meV 17.
S(n)+1.6030 7	1/2$^+$	0	gΓ_n=60 meV 4, Γ_γ=24.3 meV 20.
S(n)+1.6110 7	1/2^{-a}	1	gΓ_n=0.95 meV 20.
S(n)+1.6240 7	1/2$^-$,3/2$^-$	1	gΓ_n=1.3 meV 4.
S(n)+1.6310 7	1/2$^+$	0	gΓ_n=540 meV 1, Γ_γ=19.1 meV 29.
S(n)+1.6410 7	1/2$^+$	0	gΓ_n=43.7 meV 40, Γ_γ=23.9 meV 20.
S(n)+1.6620 7	1/2$^+$	0	gΓ_n=130 meV 5, Γ_γ=24.7 meV 28.
S(n)+1.6784 7	1/2$^+$	0	gΓ_n=29 meV 3, Γ_γ=18.4 meV 70.
S(n)+1.6896 7	3/2^{-a}	1	gΓ_n=1.2 meV 3.
S(n)+1.6980 7	1/2$^+$	0	gΓ_n=2.3 meV 8. Γ_γ=24.40 meV (2012Gu13).
S(n)+1.7060 7	1/2$^+$	0	gΓ_n=2.4 meV 4. Γ_γ=24.40 meV (2012Gu13).
S(n)+1.7197 4	1/2$^+$	0	gΓ_n=41 meV 3, Γ_γ=17 meV 3.
S(n)+1.7268 7	3/2^{-a}	1	gΓ_n=1.3 meV 2.
S(n)+1.7319 7	3/2^{-a}	1	gΓ_n=1.6 meV 4.
S(n)+1.7407 7	1/2$^+$	0	gΓ_n=8 meV 2. Γ_γ=24.22 meV (2012Gu13).
S(n)+1.7470 7	1/2$^+$	0	gΓ_n=37 meV 4, Γ_γ=21.2 meV 27.
S(n)+1.7634 7	1/2$^+$	0	gΓ_n=120 meV 6, Γ_γ=26 meV 3.
S(n)+1.76660[@]	3/2$^-$	1	gΓ_n=0.67 meV.
S(n)+1.7866 7	3/2^{-d}	1	gΓ_n=2.1 meV 5.
S(n)+1.79393[@]	1/2$^-$	1	gΓ_n=0.00 meV.
S(n)+1.8040 7	1/2$^+$	0	gΓ_n=102 meV 5, Γ_γ=19.5 meV 21.
S(n)+1.8132 7	1/2$^+$	0	gΓ_n=42 meV 4, Γ_γ=21.6 meV 32.
S(n)+1.8250 7	1/2$^+$	0	gΓ_n=98 meV 5, Γ_γ=19.0 meV 25.
S(n)+1.8370 7	3/2^{-a}	1	gΓ_n=1.3 meV 3.
S(n)+1.8497 7	1/2$^+$	0	gΓ_n=5.4 meV 9.
S(n)+1.85043[@]	3/2$^-$	1	gΓ_n=2.41 meV.
S(n)+1.8556 7	1/2$^+$	0	gΓ_n=46 meV 4, Γ_γ=25 meV 3.

Continued on next page (footnotes at end of table)

<center>^{232}Th(n,γ),(n,n):resonances   2018MuZZ,2012Gu13 (continued)</center>

<center><u>^{233}Th Levels (continued)</u></center>

E(level)[†]	J$^\pi$[&]	L[&]	Comments
S(n)+1.8624 7	1/2$^+$	0	gΓ$_n$=39 meV 3, Γ$_\gamma$=23.0 meV 28.
S(n)+1.89046[@]	1/2$^+$	0	gΓ$_n$=0.25 meV, Γ$_\gamma$=24.40 meV.
S(n)+1.8990 7	3/2^{-a}	1	gΓ$_n$=1.1 meV 4.
S(n)+1.8984[‡] 7	1/2$^+$	0	gΓ$_n$=5.9 meV 9.
S(n)+1.9015 7	1/2$^+$	0	gΓ$_n$=125 meV 7, Γ$_\gamma$=29 meV 5.
S(n)+1.9294 7	3/2^{-e}	1^e	gΓ$_n$=7.6 meV 10. gΓ$_n$=2.83 meV (2012Gu13).
S(n)+1.9320 7	1/2$^+$	0	gΓ$_n$=16.9 meV 30. Γ$_\gamma$=24.40 meV (2012Gu13).
S(n)+1.9400 7	3/2^{-a}	1	gΓ$_n$=0.32 meV 20.
S(n)+1.9517 7	1/2$^+$	0	gΓ$_n$=123 meV 6, Γ$_\gamma$=24 meV 4.
S(n)+1.9723 7	1/2$^+$	0	gΓ$_n$=235 meV 8, Γ$_\gamma$=22.4 meV 30.
S(n)+1.9882 7	1/2$^+$	0	gΓ$_n$=49 meV 5, Γ$_\gamma$=18 meV 3.
S(n)+2.0060 4	1/2$^+$	0	gΓ$_n$=27.7 meV 30, Γ$_\gamma$=22.9 meV 40.
S(n)+2.0154 4	1/2^{+b}	0^b	gΓ$_n$=1.0 meV 4. gΓ$_n$=0.92 meV, Γ$_\gamma$=24.40 meV (2012Gu13).
S(n)+2.0350 5	1/2^{-a}	1	gΓ$_n$=1.3 meV 7. Γ$_\gamma$=24.40 meV (2012Gu13).
S(n)+2.0516 5	1/2$^+$	0	gΓ$_n$=19 meV 3. Γ$_\gamma$=22.59 meV (2012Gu13).
S(n)+2.0620 5	1/2$^+$	0	gΓ$_n$=60 meV 8, Γ$_\gamma$=17 meV 3.
S(n)+2.0737 5	1/2$^+$	0	gΓ$_n$=6.9 meV 10. Γ$_\gamma$=21.98 meV (2012Gu13).
S(n)+2.0789 5	1/2$^+$	0	gΓ$_n$=11 meV 2. Γ$_\gamma$=23.31 meV (2012Gu13).
S(n)+2.0973 5	1/2^{+b}	0^b	gΓ$_n$=1.0 meV 4. gΓ$_n$=0.83 meV, Γ$_\gamma$=24.40 meV (2012Gu13).
S(n)+2.1169 5	1/2$^+$	0	gΓ$_n$=75 meV 6, Γ$_\gamma$=20 meV 3.
S(n)+2.14001[@]	1/2$^-$	1	gΓ$_n$=0.80 meV.
S(n)+2.1476 5	1/2$^+$	0	gΓ$_n$=95 meV 13. Γ$_\gamma$=23.68 meV (2012Gu13).
S(n)+2.1581 5	1/2^{-a}	1	gΓ$_n$=2 meV 1.
S(n)+2.1625 5	1/2$^+$	0	gΓ$_n$=114 meV 16. Γ$_\gamma$=22.62 meV (2012Gu13).
S(n)+2.1704 5	1/2^{-a}	1	gΓ$_n$=2.7 meV 7.
S(n)+2.1779 5	1/2$^+$	0	gΓ$_n$=84 meV 11, Γ$_\gamma$=17 meV 3.
S(n)+2.1968 5	1/2$^+$	0	gΓ$_n$=54 meV 5, Γ$_\gamma$=17 meV 3.
S(n)+2.2073 5	3/2^{-a}	1	gΓ$_n$=2.2 meV 6.
S(n)+2.2162 5	1/2$^+$	0	gΓ$_n$=27 meV 4. Γ$_\gamma$=20.22 meV (2012Gu13).
S(n)+2.2219 5	1/2$^+$	0	gΓ$_n$=97 meV 8, Γ$_\gamma$=27 meV 5.
S(n)+2.2337 5	1/2^{+c}	0^c	gΓ$_n$=2.1 meV 7. gΓ$_n$=2.25 meV, Γ$_\gamma$=24.40 meV (2012Gu13).
S(n)+2.24809[@]	3/2$^-$	1	gΓ$_n$=0.00 meV.
S(n)+2.26200[@]	3/2$^-$	1	gΓ$_n$=0.08 meV.
S(n)+2.2709 5	1/2$^+$	0	gΓ$_n$=28.3 meV 50. Γ$_\gamma$=21.67 meV (2012Gu13).
S(n)+2.2763 6	1/2$^+$	0	gΓ$_n$=58 meV 5, Γ$_\gamma$=24 meV 3.
S(n)+2.2865 6	1/2$^+$	0	gΓ$_n$=280 meV 20, Γ$_\gamma$=19 meV 5.
S(n)+2.3069 6	3/2^{-a}	1	gΓ$_n$=3.2 meV 9.
S(n)+2.31368[@]	3/2$^-$	1	gΓ$_n$=0.04 meV.
S(n)+2.3211 6	1/2^{+c}	0^c	gΓ$_n$=4.2 meV 10. gΓ$_n$=2.50 meV, Γ$_\gamma$=24.40 meV (2012Gu13).
S(n)+2.3297 6	3/2^{-a}	1	gΓ$_n$=2.2 meV 6.
S(n)+2.3358 6	1/2$^+$	0	gΓ$_n$=124 meV 11, Γ$_\gamma$=20 meV 4.
S(n)+2.3444 6	1/2$^-$	1	gΓ$_n$=6.6 meV 10.
S(n)+2.3526 6	1/2$^+$	0	gΓ$_n$=19 meV 3. Γ$_\gamma$=24.68 meV (2012Gu13).
S(n)+2.3537[‡] 6	1/2$^+$	0	gΓ$_n$=16 meV 3.
S(n)+2.36460[@]	1/2$^-$	1	gΓ$_n$=0.01 meV.
S(n)+2.3752 6	1/2$^+$	0	gΓ$_n$=119 meV 16, Γ$_\gamma$=18 meV 3.
S(n)+2.3827 6	3/2^{-c}	1^c	gΓ$_n$=4.5 meV 20.
S(n)+2.3911 6	1/2^{+c}	0^c	gΓ$_n$=3.6 meV 8. gΓ$_n$=1.63 meV, Γ$_\gamma$=24.40 meV (2012Gu13).
S(n)+2.40936[@]	1/2$^-$	1	gΓ$_n$=0.62 meV.
S(n)+2.41435[@]	3/2$^-$	1	gΓ$_n$=0.05 meV.
S(n)+2.4185 6	1/2$^+$	0	gΓ$_n$=89.8 meV 80. Γ$_\gamma$=21.38 meV (2012Gu13).
S(n)+2.4274 6	3/2^{-a}	1	gΓ$_n$=2.7 meV 7.

<center>Continued on next page (footnotes at end of table)</center>

^{232}Th(n,γ),(n,n):resonances   2018MuZZ,2012Gu13 (continued)

^{233}Th Levels (continued)

E(level)[†]	J$^{\pi}$[&]	L[&]	Comments
S(n)+2.42984[@]	1/2$^+$	0	gΓ_n=2.44 meV, Γ_γ=24.40 meV.
S(n)+2.4348 6	3/2^{-a}	1	gΓ_n=2.2 meV 7.
S(n)+2.4398 6	3/2^{-e}	1^e	gΓ_n=10.5 meV 10. gΓ_n=8.55 meV (2012Gu13).
S(n)+2.45362[@]	1/2$^-$	1	gΓ_n=1.66 meV.
S(n)+2.4558 6	1/2$^+$	0	gΓ_n=170 meV 12. Γ_γ=26.01 meV (2012Gu13).
S(n)+2.4625 6	1/2^{+b}	0^b	gΓ_n=3.8 meV 9. gΓ_n=3.30 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+2.4749 6	1/2^{+b}	0^b	gΓ_n=1.2 meV 5. gΓ_n=0.70 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+2.48451[@]	3/2$^-$	1	gΓ_n=0.02 meV.
S(n)+2.4918 6	1/2^{+c}	0^c	gΓ_n=7.2 meV 10. gΓ_n=8.66 meV, Γ_γ=24.07 meV (2012Gu13).
S(n)+2.5093 7	1/2$^+$	0	gΓ_n=336 meV 25. Γ_γ=18.40 meV (2012Gu13).
S(n)+2.5273 7	1/2$^+$	0	gΓ_n=51 meV 4. Γ_γ=21.70 meV (2012Gu13).
S(n)+2.53751[@]	1/2$^-$	1	gΓ_n=2.42 meV.
S(n)+2.5571 7	1/2^{+c}	0^c	gΓ_n=3.7 meV 9. gΓ_n=4.78 meV, Γ_γ=24.23 meV (2012Gu13).
S(n)+2.5632 7	1/2$^+$	0	gΓ_n=312 meV 20. Γ_γ=21.78 meV (2012Gu13).
S(n)+2.5696 7	1/2$^+$	0	gΓ_n=64 meV 6. Γ_γ=21.78 meV (2012Gu13).
S(n)+2.58319[@]	3/2$^-$	1	gΓ_n=0.00 meV.
S(n)+2.59244[@]	3/2$^-$	1	gΓ_n=0.72 meV.
S(n)+2.6040 7	3/2^{-a}	1	gΓ_n=2.6 meV 3.
S(n)+2.6120 7	1/2$^+$	0	gΓ_n=93 meV 7, Γ_γ=32 meV 1.
S(n)+2.6244 7	1/2$^+$	0	gΓ_n=12 meV 2. Γ_γ=23.35 meV (2012Gu13).
S(n)+2.6353 7	1/2$^+$	0	gΓ_n=176 meV 18, Γ_γ=28.5 meV 10.
S(n)+2.6555 7	1/2^{-e}	1^e	gΓ_n=9 meV 1. gΓ_n=2.29 meV (2012Gu13).
S(n)+2.6634 7	1/2$^+$	0	gΓ_n=209 meV 20, Γ_γ=26.9 meV 10.
S(n)+2.6730 7	3/2^{-a}	1	gΓ_n=1.4 meV 5.
S(n)+2.6772 7	1/2$^+$	0	gΓ_n=13 meV 3. Γ_γ=23.73 meV (2012Gu13).
S(n)+2.6884 7	1/2$^+$	0	gΓ_n=207 meV 21, Γ_γ=27.1 meV 10.
S(n)+2.6994 7	3/2^{-a}	1	gΓ_n=2.8 meV 4.
S(n)+2.7133 7	1/2$^+$	0	gΓ_n=102 meV 13, Γ_γ=29.1 meV 10.
S(n)+2.7228 7	1/2$^+$	0	gΓ_n=16 meV 2. Γ_γ=24.12 meV (2012Gu13).
S(n)+2.7337 7	1/2$^+$	0	gΓ_n=410 meV 41, Γ_γ=26.9 meV 10.
S(n)+2.7493 7	1/2$^+$	0	gΓ_n=22 meV 2, Γ_γ=26 meV.
S(n)+2.7650 7	3/2^{-a}	1	gΓ_n=2.8 meV 13, Γ_γ=26 meV.
S(n)+2.7736 8	1/2$^+$	0	gΓ_n=76 meV 10, Γ_γ=25.5 meV 10.
S(n)+2.7833 8	1/2^{-a}	1	gΓ_n=3.8 meV 3.
S(n)+2.7932 8	1/2$^+$	0	gΓ_n=176 meV 14, Γ_γ=28.3 meV 10.
S(n)+2.8032 8	1/2^{+b}	0^b	gΓ_n=6.7 meV 5. gΓ_n=3.33 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+2.8158 8	1/2$^+$	0	gΓ_n=35.8 meV 20. Γ_γ=23.42 meV (2012Gu13).
S(n)+2.8330 8	1/2$^+$	0	gΓ_n=46 meV 5, Γ_γ=29 meV 1.
S(n)+2.8400 8			gΓ_n=4.9 meV 5.
S(n)+2.8449 8	1/2^{-a}	1	gΓ_n=0.2 meV 2.
S(n)+2.8527 8	1/2$^+$	0	gΓ_n=228 meV 15, Γ_γ=26.1 meV 10.
S(n)+2.8616 8	1/2$^+$	0	gΓ_n=10 meV 1. Γ_γ=24.34 meV (2012Gu13).
S(n)+2.8706 8	3/2^{-a}	1	gΓ_n=2.2 meV 3.
S(n)+2.8842 8	1/2$^+$	0	gΓ_n=11 meV 3. Γ_γ=24.85 meV (2012Gu13).
S(n)+2.8959 8	1/2^{+c}	0^c	gΓ_n=7 meV 1. gΓ_n=3.89 meV, Γ_γ=24.07 meV (2012Gu13).
S(n)+2.9100 8	3/2^{-a}	1	gΓ_n=3.5 meV 4.
S(n)+2.9150 8	1/2$^+$	0	gΓ_n=9.7 meV 7. Γ_γ=24.33 meV (2012Gu13).
S(n)+2.9323 8	1/2^{-a}	1	gΓ_n=3.1 meV 3.
S(n)+2.9415 8	3/2^{-a}	1	gΓ_n=2.0 meV 3.
S(n)+2.9487 8	1/2$^+$	0	gΓ_n=107 meV 11, Γ_γ=32.6 meV 7.
S(n)+2.9566 8	1/2$^+$	0	gΓ_n=49 meV 4, Γ_γ=23 meV 1.
S(n)+2.9666 8	1/2$^+$	0	gΓ_n=17 meV 1. Γ_γ=24.76 meV (2012Gu13).
S(n)+2.9723 8	3/2^{-f}	1^f	gΓ_n=3.7 meV 4.

^{232}Th(n,γ),(n,n):resonances   **2018MuZZ,2012Gu13** (continued)

^{233}Th Levels (continued)

E(level)[†]	J$^{\pi}$[&]	L[&]	Comments
S(n)+2.9800 *8*	3/2^{-e}	1^e	gΓ_n=11.9 meV *8*. gΓ_n=0.05 meV (2012Gu13).
S(n)+2.9888 *9*	1/2$^+$	0	gΓ_n=35.5 meV *40*, Γ_γ=31.0 meV *15*.
S(n)+2.99721[@]	3/2$^-$	1	gΓ_n=0.12 meV.
S(n)+3.0068 *9*	1/2^{+c}	0^c	gΓ_n=2.9 meV *7*. gΓ_n=2.16 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.0172 *9*	1/2$^+$	0	gΓ_n=27.1 meV *10*. Γ_γ=23.42 meV (2012Gu13).
S(n)+3.0278 *9*	1/2$^+$	0	gΓ_n=247 meV *26*, Γ_γ=23.9 meV *10*.
S(n)+3.0397 *9*	1/2$^+$	0	gΓ_n=68 meV *6*, Γ_γ=31.9 meV *10*.
S(n)+3.0501[‡] *9*	1/2$^-$	1	gΓ_n=6.4 meV *20*.
S(n)+3.0619 *9*	1/2$^+$	0	gΓ_n=34 meV *3*. Γ_γ=26.32 meV (2012Gu13).
S(n)+3.0777 *9*	3/2^{-f}	1^f	gΓ_n=5.5 meV *8*.
S(n)+3.0830 *9*	1/2$^+$	0	gΓ_n=64 meV *7*, Γ_γ=30.2 meV *20*.
S(n)+3.1040 *9*	1/2$^+$	0	gΓ_n=19.9 meV *20*, Γ_γ=26 meV.
S(n)+3.1093 *9*	1/2$^+$	0	gΓ_n=33.8 meV *40*. Γ_γ=22.39 meV (2012Gu13).
S(n)+3.1209 *9*	1/2$^-$	1	gΓ_n=8.6 meV *9*, Γ_γ=26 meV.
S(n)+3.1485 *9*	1/2$^+$	0	gΓ_n=214 meV *25*, Γ_γ=27.0 meV *15*.
S(n)+3.1535 *9*	1/2$^+$	0	gΓ_n=226 meV *23*, Γ_γ=23.7 meV *15*.
S(n)+3.1680 *9*	1/2^{+b}	0^b	gΓ_n=3.3 meV *7*, Γ_γ=26 meV. gΓ_n=2.16 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.1862[‡] *9*			gΓ_n=9.1 meV *20*.
S(n)+3.1890 *9*	1/2$^+$	0	gΓ_n=87 meV *8*, Γ_γ=22.1 meV *15*.
S(n)+3.2074 *9*	1/2$^+$	0	gΓ_n=104 meV *12*, Γ_γ=22.6 meV *9*.
S(n)+3.2165 *9*	3/2^{-f}	1^f	gΓ_n=7.9 meV *9*.
S(n)+3.2297 *10*	1/2$^+$	0	gΓ_n=19.3 meV *20*. Γ_γ=24.05 meV (2012Gu13).
S(n)+3.2379 *10*	1/2^{+f}	0^f	gΓ_n=4.6 meV *7*, Γ_γ=26 meV.
S(n)+3.2425 *10*	3/2^{-e}	1^e	gΓ_n=17.5 meV *20*. gΓ_n=0.57 meV (2012Gu13).
S(n)+3.2527 *10*	1/2$^+$	0	gΓ_n=97 meV *10*, Γ_γ=25.7 meV *10*.
S(n)+3.2706 *10*	1/2$^+$	0	gΓ_n=51 meV *5*. Γ_γ=22.89 meV (2012Gu13).
S(n)+3.296 *1*	1/2$^+$	0	gΓ_n=475 meV *52*, Γ_γ=34.6 meV *8*.
S(n)+3.306 *1*	1/2^{+c}	0^c	gΓ_n=1.5 meV *5*. gΓ_n=0.31 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.3176 *10*	1/2$^+$	0	gΓ_n=5.9 meV *10*. Γ_γ=23.98 meV (2012Gu13).
S(n)+3.3323 *10*	1/2$^+$	0	gΓ_n=48 meV *6*, Γ_γ=33.2 meV *17*.
S(n)+3.3429 *10*	1/2$^+$	0	gΓ_n=198 meV *22*, Γ_γ=27.5 meV *90*.
S(n)+3.3531 *10*	1/2^{+f}	0^f	gΓ_n=8.8 meV *9*. Γ_γ=24.40 meV (2012Gu13).
S(n)+3.3623 *10*	3/2$^-$	1	gΓ_n=5.9 meV *7*.
S(n)+3.3845 *10*	1/2$^+$	0	gΓ_n=90 meV *10*, Γ_γ=36 meV *3*.
S(n)+3.4119 *10*	1/2$^+$	0	gΓ_n=18.9 meV *20*, Γ_γ=26 meV.
S(n)+3.4337 *11*	1/2^{+c}	0^c	gΓ_n=10.8 meV *7*, Γ_γ=26 meV. gΓ_n=6.14 meV, Γ_γ=23.71 meV (2012Gu13).
S(n)+3.4430 *11*	1/2$^+$	0	gΓ_n=34 meV *2*. Γ_γ=24.44 meV (2012Gu13).
S(n)+3.4586 *11*	1/2^{+b}	0^b	gΓ_n=2.9 meV *4*. gΓ_n=2.46 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.4720 *11*	1/2$^+$	0	gΓ_n=24 meV *2*. Γ_γ=25.11 meV (2012Gu13).
S(n)+3.5023 *11*	1/2^{+b}	0^b	gΓ_n=4.4 meV *4*, Γ_γ=26 meV. gΓ_n=2.40 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.5110 *11*	1/2$^+$	0	gΓ_n=5.8 meV *5*. Γ_γ=24.40 meV (2012Gu13).
S(n)+3.5218 *11*	1/2$^+$	0	gΓ_n=110 meV *15*, Γ_γ=29.4 meV *10*.
S(n)+3.5448 *11*	1/2^{+c}	0^c	gΓ_n=8.4 meV *10*. gΓ_n=2.01 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.5522 *11*	3/2^{-a}	1	gΓ_n=4.4 meV *5*.
S(n)+3.5684 *11*	1/2^{+f}	0^f	gΓ_n=6.8 meV *7*, Γ_γ=26 meV. gΓ_n=0.89 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.5761 *11*	1/2$^+$	0	gΓ_n=49 meV *4*, Γ_γ=26 meV.
S(n)+3.5950 *11*	1/2$^+$	0	gΓ_n=24 meV *4*. Γ_γ=26.77 meV (2012Gu13).
S(n)+3.6116 *11*	1/2$^+$	0	gΓ_n=130 meV *15*, Γ_γ=27.2 meV *10*.
S(n)+3.6181 *11*	1/2^{-f}	1^f	gΓ_n=8.5 meV *10*, Γ_γ=26 meV.
S(n)+3.6240 *11*	1/2^{+c}	0^c	gΓ_n=9.2 meV *10*. gΓ_n=7.84 meV, Γ_γ=24.06 meV (2012Gu13).
S(n)+3.6375 *12*	1/2^{+c}	0^c	gΓ_n=10 meV *1*. gΓ_n=4.64 meV, Γ_γ=24.12 meV (2012Gu13).
S(n)+3.6517 *12*	1/2$^+$	0	gΓ_n=53 meV *8*, Γ_γ=29.7 meV *14*.
S(n)+3.6665 *12*	1/2^{-a}	1	gΓ_n=4.5 meV *8*.

Continued on next page (footnotes at end of table)

^{232}Th(n,γ),(n,n):resonances   **2018MuZZ,2012Gu13** (continued)

^{233}Th Levels (continued)

E(level)[†]	J$^\pi$[&]	L[&]	g$\Gamma_n\Gamma_\gamma$/Γ (meV)[g]	Comments
S(n)+3.6742 *12*	1/2$^+$	0		gΓ_n=19.1 meV *30*. Γ_γ=24.71 meV (2012Gu13).
S(n)+3.6930 *12*	1/2^{+c}	0^c		gΓ_n=3.8 meV *6*. gΓ_n=0.06 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.7084 *12*	1/2^{+c}	0^c		gΓ_n=7 meV *1*. gΓ_n=4.81 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.7160 *12*	1/2$^+$	0		gΓ_n=31 meV *4*. Γ_γ=27.13 meV (2012Gu13).
S(n)+3.7230 *12*	1/2$^+$	0		gΓ_n=113 meV *20*, Γ_γ=27.9 meV *12*.
S(n)+3.7328 *12*	1/2$^+$	0		gΓ_n=50 meV *7*, Γ_γ=25.7 meV *17*.
S(n)+3.74976[@]	3/2$^-$	1		gΓ_n=0.14 meV.
S(n)+3.7598 *12*	1/2$^+$	0		gΓ_n=17 meV *2*. Γ_γ=23.50 meV (2012Gu13).
S(n)+3.7790 *12*	3/2^{-a}	1		gΓ_n=2.0 meV *6*.
S(n)+3.7871 *12*	1/2$^+$	0		gΓ_n=33.4 meV *40*. Γ_γ=25.29 meV (2012Gu13).
S(n)+3.79813[@]	3/2$^-$	1		gΓ_n=0.03 meV.
S(n)+3.8124 *12*	1/2^{+f}	0^f		gΓ_n=5.5 meV *9*. Γ_γ=24.40 meV (2012Gu13).
S(n)+3.8205 *12*	1/2$^+$	0		gΓ_n=43 meV *6*, Γ_γ=26.2 meV *26*.
S(n)+3.8270 *13*	1/2$^+$	0		gΓ_n=130 meV *15*, Γ_γ=25.3 meV *13*.
S(n)+3.8360 *12*	3/2^{-a}	1		gΓ_n=3.6 meV *7*.
S(n)+3.8490 *13*	1/2$^+$	0		gΓ_n=29 meV *3*. Γ_γ=26.17 meV (2012Gu13).
S(n)+3.8610 *13*	3/2^{-a}	1		gΓ_n=4.3 meV *6*.
S(n)+3.8688 *13*	1/2$^+$	0		gΓ_n=70 meV *4*, Γ_γ=26.9 meV *11*.
S(n)+3.8843 *13*	1/2$^+$	0		gΓ_n=19 meV *3*. Γ_γ=24.23 meV (2012Gu13).
S(n)+3.9065 *13*	1/2$^+$	0		gΓ_n=240 meV *15*. Γ_γ=26.37 meV (2012Gu13).
S(n)+3.9170 *13*	1/2^{-a}	1		gΓ_n=5.2 meV *7*.
S(n)+3.9240 *13*	1/2$^+$	0		gΓ_n=13.5 meV *10*. Γ_γ=24.41 meV (2012Gu13).
S(n)+3.9320 *13*	1/2$^+$	0		gΓ_n=42 meV *6*, Γ_γ=29.7 meV *17*.
S(n)+3.9520 *13*	1/2^{+c}	0^c		gΓ_n=8.9 meV *10*. gΓ_n=3.62 meV, Γ_γ=24.40 meV (2012Gu13).
S(n)+3.9618 *13*	1/2$^+$	0		gΓ_n=42 meV *5*, Γ_γ=31.3 meV *18*.
S(n)+3.9710 *13*	1/2$^+$	0		gΓ_n=78 meV *8*, Γ_γ=27.6 meV *15*.
S(n)+3.9765 *13*	1/2$^+$	0		gΓ_n=130 meV *14*, Γ_γ=33.7 meV *12*.
S(n)+3.9950 *13*	1/2$^+$	0		gΓ_n=23.7 meV *20*, Γ_γ=26 meV.
S(n)+4.012			1.7 *4*	
S(n)+4.023			5.8 *5*	
S(n)+4.030			1.9 *6*	
S(n)+4.045			27.8 *5*	
S(n)+4.061			1.3 *3*	
S(n)+4.073			16.5 *5*	
S(n)+4.080			16.3 *6*	
S(n)+4.086			4.5 *5*	
S(n)+4.102			3.5 *4*	
S(n)+4.113			13.7 *6*	
S(n)+4.122			37.2 *6*	
S(n)+4.134			13.1 *4*	
S(n)+4.143			2.5 *10*	
S(n)+4.152			14.6 *5*	
S(n)+4.170			28.3 *7*	
S(n)+4.175			4.3 *6*	
S(n)+4.185			0.7 *4*	
S(n)+4.197			0.8 *4*	
S(n)+4.204			7.7 *5*	
S(n)+4.208			3.5 *6*	
S(n)+4.221			5.8 *4*	
S(n)+4.234			8.8 *4*	
S(n)+4.245			14.1 *5*	
S(n)+4.260			8.1 *5*	
S(n)+4.266			16.8 *5*	
S(n)+4.288			17.8 *5*	
S(n)+4.296			7.1 *6*	

^{232}Th(n,γ),(n,n):resonances   **2018MuZZ,2012Gu13** (continued)

^{233}Th Levels (continued)

E(level)[†]	g$\Gamma_n\Gamma_\gamma$/Γ (meV)[g]
S(n)+4.308	2.9 4
S(n)+4.318	3.2 4
S(n)+4.329	24.4 6
S(n)+4.339	15.8 5
S(n)+4.347	4.7 4
S(n)+4.360	27.1 6
S(n)+4.374	4.0 5
S(n)+4.385	22.0 5
S(n)+4.396	5.6 6
S(n)+4.403	16.2 6
S(n)+4.411	3.7 5
S(n)+4.428	14.3 6
S(n)+4.442	6.6 5
S(n)+4.461	20.7 6
S(n)+4.470	16.6 6
S(n)+4.481	14.0 8
S(n)+4.494[#]	72.4 17
S(n)+4.505	16.8 9
S(n)+4.522	1.0 4
S(n)+4.537	16.1 7
S(n)+4.546	14.7 6
S(n)+4.558	21.6 6
S(n)+4.573	9.1 5
S(n)+4.584	12.5 6
S(n)+4.607	12.9 8
S(n)+4.613	21.8 8
S(n)+4.635	14.5 5
S(n)+4.649	23.4 7
S(n)+4.663[#]	55.5 11
S(n)+4.685	27.0 11
S(n)+4.702	10.9 6
S(n)+4.716	0.3 5
S(n)+4.731	26.7 11
S(n)+4.740	13.8 80
S(n)+4.747	6.0 9
S(n)+4.753	10.2 8
S(n)+4.761	5.5 7
S(n)+4.771	4.2 4
S(n)+4.800	34.1 10
S(n)+4.815[#]	39.3 10
S(n)+4.825	1.4 7
S(n)+4.834[#]	68.9 14
S(n)+4.846	11.2 9
S(n)+4.852	1.5 70
S(n)+4.862	21.8 7
S(n)+4.878[#]	47.5 11
S(n)+4.897	3.5 60
S(n)+4.914[#]	60.9 12
S(n)+4.933	26.6 20
S(n)+4.938	8.1 11
S(n)+4.946	5.2 50
S(n)+4.959	13.3 60
S(n)+4.981	35.4 12
S(n)+5.003	16.1 6
S(n)+5.014	6.0 6

Continued on next page (footnotes at end of table)

^{232}Th(n,γ),(n,n):resonances   2018MuZZ,2012Gu13 (continued)

^{233}Th Levels (continued)

E(level)†	g$\Gamma_n\Gamma_\gamma$/Γ (meV)^g	Comments
S(n)+5.021	10.6 6	
S(n)+5.028	6.8 6	
S(n)+5.036$^{\#}$	25.4 7	
S(n)+5.055	38.2 10	
S(n)+5.064	5.6 6	
S(n)+5.075	33.5 7	
S(n)+5.088	8.0 5	
S(n)+5.103	14.2 5	
S(n)+5.117	23.4 5	
S(n)+5.130	7.6 5	
S(n)+5.141	14.8 60	
S(n)+5.149	4.9 60	
S(n)+5.161	7.4 16	
S(n)+5.165	4.9 16	
S(n)+5.177	15.8 5	
S(n)+5.188	20.1 5	
S(n)+5.199	11.6 5	
S(n)+5.216	21.0 4	
S(n)+5.231$^{\#}$	23.7 8	
S(n)+5.250$^{\#}$	32.4 8	
S(n)+5.271	29.3 7	
S(n)+5.289$^{\#}$	28.8 8	
S(n)+5.300	50.0 11	
S(n)+5.328	16.0 7	
S(n)+5.341	4.2 5	
S(n)+5.377	24.8 6	
S(n)+5.391	17.5 6	
S(n)+5.400	14.0 7	
S(n)+5.413	4.3 8	
S(n)+5.423	12.4 10	
S(n)+5.432	25.6 8	
S(n)+5.462	26.3 7	
S(n)+5.477	39.4 9	
S(n)+5.500	38.0 12	
S(n)+5.517	31.0 15	
S(n)+5.544$^{\#}$	92.2 15	
S(n)+5.562	28.1 8	
S(n)+5.583	9.7 6	
S(n)+5.594	10.9 72	
S(n)+5.607	5.6 9	
S(n)+5.615	20.0 7	
S(n)+5.622	9.5 10	
S(n)+5.629	19.9 7	
S(n)+5.643	10.5 6	
S(n)+5.660	37.4 9	
S(n)+5.671	17.1 7	
S(n)+5.691	14.4 11	
S(n)+5.697	14.9 9	Additional information 1.
S(n)+5.702	19.2 10	
S(n)+5.714	14.7 7	
S(n)+5.729	6.8 7	
S(n)+5.740	19.5 6	
S(n)+5.752	24.4 5	
S(n)+5.759	12.4 10	
S(n)+5.770	2.3 10	

$\underline{^{233}\text{Th Levels (continued)}}$

E(level)†	g$\Gamma_n\Gamma_\gamma$/Γ (meV)^g	E(level)†	g$\Gamma_n\Gamma_\gamma$/Γ (meV)^g	E(level)†	g$\Gamma_n\Gamma_\gamma$/Γ (meV)^g
S(n)+5.789	5.6 4	S(n)+6.735	14.2 16	S(n)+8.103	34.8 23
S(n)+5.798	9.5 5	S(n)+6.748	42.5 18	S(n)+8.118	25.3 20
S(n)+5.810	6.0 5	S(n)+6.760	6.8 15	S(n)+8.143	24.9 9
S(n)+5.819	8.3 5	S(n)+6.780	47.8 33	S(n)+8.162	33.9 20
S(n)+5.828	17.0 5	S(n)+6.792	24.9 22	S(n)+8.187	38.8 24
S(n)+5.842	5.6 4	S(n)+6.804	12.3 19	S(n)+8.215$^{\#}$	75.0 36
S(n)+5.859	19.6 9	S(n)+6.828	67.1 28	S(n)+8.248	15.2 12
S(n)+5.863	2.8 9	S(n)+6.850	7.6 20	S(n)+8.266	43.9 16
S(n)+5.875	11.7 7	S(n)+6.863	69.5 30	S(n)+8.282	17.8 14
S(n)+5.891$^{\#}$	51 1	S(n)+6.880	5.1 15	S(n)+8.306$^{\#}$	98.3 25
S(n)+5.913$^{\#}$	58.5 10	S(n)+6.891	17.0 15	S(n)+8.338	14.9 16
S(n)+5.934	12.8 19	S(n)+6.909	44.6 18	S(n)+8.359$^{\#}$	55.8 23
S(n)+5.947	31.9 17	S(n)+6.948	46.5 19	S(n)+8.385	13.7 14
S(n)+5.961	1.1 15	S(n)+6.986	78.7 36	S(n)+8.404	43.9 22
S(n)+5.975	36.4 22	S(n)+7.007	19.9 16	S(n)+8.427$^{\#}$	48.6 22
S(n)+5.985	43.9 19	S(n)+7.038	21.7 19	S(n)+8.448	8.1 16
S(n)+5.996	14.4 17	S(n)+7.058	72.2 24	S(n)+8.458	13.9 17
S(n)+6.008	17.6 19	S(n)+7.084	18.0 15	S(n)+8.471	28.4 17
S(n)+6.019	44.1 22	S(n)+7.106	8.0 12	S(n)+8.496$^{\#}$	108.6 35
S(n)+6.027	49.3 20	S(n)+7.129	72.1 24	S(n)+8.512	10.6 17
S(n)+6.051	27.2 14	S(n)+7.163	31.5 22	S(n)+8.525	23.7 15
S(n)+6.069	19.5 12	S(n)+7.177	90.6 28	S(n)+8.554	31.4 24
S(n)+6.095	34.0 19	S(n)+7.205	23.0 14	S(n)+8.574	24.7 26
S(n)+6.105	27.8 24	S(n)+7.220	14.5 13	S(n)+8.592	3.2 29
S(n)+6.120	7.5 15	S(n)+7.244	25.2 3	S(n)+8.612$^{\#}$	147 15
S(n)+6.131	37.2 16	S(n)+7.272	10.3 36	S(n)+8.627	29.4 37
S(n)+6.143	34.3 15	S(n)+7.306	45.0 23	S(n)+8.667$^{\#}$	65.0 26
S(n)+6.166	9.0 8	S(n)+7.326	53.5 20	S(n)+8.692	44.6 21
S(n)+6.187	13.1 9	S(n)+7.358	47.7 23	S(n)+8.722	29.4 18
S(n)+6.213	26.8 11	S(n)+7.396	54.6 26	S(n)+8.764$^{\#}$	57.6 29
S(n)+6.228	7.6 12	S(n)+7.417	21.4 16	S(n)+8.800$^{\#}$	72.2 29
S(n)+6.257$^{\#}$	56.2 48	S(n)+7.436	15.5 14	S(n)+8.835	35.5 35
S(n)+6.269	10.9 16	S(n)+7.450	42.2 18	S(n)+8.849	24.8 25
S(n)+6.289	12.4 12	S(n)+7.474	14.1 13	S(n)+8.878$^{\#}$	117.5 35
S(n)+6.302	27.1 11	S(n)+7.515$^{\#}$	163.9 38	S(n)+8.902	8.1 20
S(n)+6.333$^{\#}$	64.1 23	S(n)+7.550	23.0 14	S(n)+8.939$^{\#}$	163.7 52
S(n)+6.354	21.1 12	S(n)+7.576	51.0 18	S(n)+8.998$^{\#}$	151.5 45
S(n)+6.368	8.0 9	S(n)+7.593	28.1 15	S(n)+9.053$^{\#}$	104.4 35
S(n)+6.389	7.9 12	S(n)+7.612	56.7 19	S(n)+9.124$^{\#}$	63.5 30
S(n)+6.398	11.9 10	S(n)+7.644	3.6 25	S(n)+9.168$^{\#}$	93.0 37
S(n)+6.427	56.4 17	S(n)+7.655	54.3 33	S(n)+9.191	17.6 19
S(n)+6.456	34.8 17	S(n)+7.695	47.7 47	S(n)+9.219	46.0 25
S(n)+6.464	21.3 14	S(n)+7.719	33.7 24	S(n)+9.241	34.6 24
S(n)+6.475	37.4 16	S(n)+7.763$^{\#}$	112.3 50	S(n)+9.268	30.9 24
S(n)+6.492	40.9 15	S(n)+7.797	92.8 38	S(n)+9.296$^{\#}$	59.1 34
S(n)+6.512	30.9 16	S(n)+7.834	35.6 19	S(n)+9.326	53.0 35
S(n)+6.538	11.7 12	S(n)+7.855	39.6 20	S(n)+9.350	48.4 28
S(n)+6.561	75.3 26	S(n)+7.878	50.6 21	S(n)+9.370	60.2 26
S(n)+6.590	9.5 11	S(n)+7.896	42.3 23	S(n)+9.402	38.7 24
S(n)+6.611	18 12	S(n)+7.929$^{\#}$	130.1 46	S(n)+9.424	36.2 24
S(n)+6.626	20.0 13	S(n)+7.960	22.2 19	S(n)+9.453	30.5 16
S(n)+6.640	15.2 12	S(n)+8.000	7.9 15	S(n)+9.489	95 3
S(n)+6.664$^{\#}$	74.1 24	S(n)+8.024	39.8 20	S(n)+9.518$^{\#}$	61.1 25

^{232}**Th(n,γ),(n,n):resonances**   **2018MuZZ,2012Gu13 (continued)**

$\underline{^{233}\text{Th Levels (continued)}}$

E(level)[†]	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)[g]	E(level)[†]	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)[g]	E(level)[†]	$g\Gamma_n\Gamma_\gamma/\Gamma$ (meV)[g]
S(n)+6.697	23.2 *9*	S(n)+8.053	12.6 *16*	S(n)+9.537	76.5 *21*
S(n)+6.717	30.7 *20*	S(n)+8.080[#]	153.9 *39*	S(n)+9.556	41.5 *16*

^{232}**Th(n,γ),(n,n):resonances**   **2018MuZZ,2012Gu13 (continued)**

^{232}Th(n,γ),(n,n):resonances   **2018MuZZ,2012Gu13** (continued)

^{233}Th Levels (continued)

E(level)[†]	gΓ$_n$Γ$_γ$/Γ (meV)[g]	E(level)[†]	gΓ$_n$Γ$_γ$/Γ (meV)[g]	E(level)[†]	gΓ$_n$Γ$_γ$/Γ (meV)[g]
S(n)+9.590	34.7 *19*	S(n)+9.856	43.4 *29*	S(n)+10.138[#]	107.3 *37*
S(n)+9.607	34.8 *20*	S(n)+9.878	45.7 *21*	S(n)+10.202[#]	109.1 *62*
S(n)+9.645[#]	59.5 *25*	S(n)+9.910[#]	105.9 *30*	S(n)+10.241	49.8 *27*
S(n)+9.665	33.7 *19*	S(n)+9.947	32.4 *22*	S(n)+10.268	37.2 *24*
S(n)+9.710[#]	106.7 *49*	S(n)+9.978[#]	86.9 *43*	S(n)+10.301[#]	49.6 *43*
S(n)+9.751[#]	111.1 *45*	S(n)+10.026[#]	117.6 *40*	S(n)+10.339[#]	52.8 *30*
S(n)+9.779	35.6 *22*	S(n)+10.051	31.2 *26*	S(n)+10.373	71.3 *30*
S(n)+9.807	70.3 *32*	S(n)+10.074	38.5 *21*	S(n)+10.392	41.6 *23*
S(n)+9.835	75.8 *34*	S(n)+10.111[#]	21.2 *18*		

[†] S(n)(^{233}Th)=4786.39 *9* (2017Wa10).
[‡] Resonance not given in 2012Gu13.
[#] Apparent multiplet (2018MuZZ).
[@] Resonance from 2012Gu13, not given in 2018MuZZ.
[&] Values from 2018MuZZ and 2012Gu13 are in general agreement. When different, values are adopted by evaluators from 2012Gu13.
[a] From 2012Gu13. J^π=1/2$^-$,3/2$^-$ implied from L=1 in 2018MuZZ.
[b] From 2012Gu13. 2018MuZZ give L=1 implying 1/2$^-$,3/2$^-$.
[c] From 2012Gu13. 2018MuZZ give L=1, 1/2$^-$.
[d] From 2012Gu13. 2018MuZZ give 1/2$^-$.
[e] From 2012Gu13. 2018MuZZ give L=0 implying 1/2$^+$.
[f] From 2012Gu13. No L and J values given in 2018MuZZ.
[g] Resonance strength.