Adopted Levels

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. E. Purcell, C. G. Sheu	ENSDF	28-Feb-2019

History

$Q(\beta^-)=2.166\times10^4$ *9*; $S(n)=-2.0\times10^2$ *13* 2017Wa10

As the following theoretical and experimental articles indicate, the ground state of ^{5}H has $J^\pi=1/2^+$ and is located around 2 MeV above the ^{3}H+2n threshold and has a width greater than 1 MeV. Broad and nearly degenerate excited states with $J^\pi=3/2^+$ and $5/2^+$ are predicted a few MeV above the ground state; however, the experimental results are not sufficient to describe the excited states in great detail.

Suggestion of a bound ^{5}H ground state:

In the theoretical work of [Blanchard and Winter, Phys. Rev. 107 (1957) 774] titled *"Is ^{5}H Particle Stable"*, it was suggested that $^5H_{g.s.}$ may be bound and observable with $E_\beta\approx19$ MeV followed by a delayed neutron emission. Subsequent searches for β unstable ^{5}H were carried out utilizing ^{7}Li(γ,2p) (1962Ce03: Berkeley, 1963Ne02: Purdue, 1964Sh18: Orsay, 1965Ar04: Frascati), ^{7}Li(p,3p) reactions (Tautfest, Phys. Rev. 111 (1958) 1162 and 1958Ta03: Berkeley, 1964Sc02: Brookhaven), ^{7}Li(π^-,d) (1968Bo32: Univ. Chicago) and analysis of the ^{235}U(n,*f*) yields (1964An06: USSR).

An erroneous result obtained in the $E_{brem.}(\gamma)=320$ bombardment of ^{nat}Li at Purdue suggested population of a $T_{1/2}=110$ ms *30* β emitter with $E_\beta>15$ MeV that was attributed to ^{5}H (1963Ne02). The experiments following (1963Ne02) mainly searched for a reasonably narrow and bound ^{5}H ground state. However, no evidence of β unstable ^{5}H was found in any subsequent study. The sentiment is well represented in the title *Still another unsuccessful search for ^{5}H*: (1968Bo32).

General theoretical analyses, favoring an unbound $^5H_{g.s.}$ are given in (1960Go36, 1960Ze03, 1963Ar06, 1964Go25, 1968Go36, 1975Be49, 1981Av02, 1981Be10, 1981Ka39, 1989Go24, 2001Fi24, 2002Ti05, 2004Ao05, 2004Gr03, 2004Ti02, 2018Gr02).

See a broad review of the experimental data in (2004Gr17).

It is pointed out in (2017Wu03) that the structure of ^{5}H plays an important role in the hypernucleus $^6_\Lambda$H. See the discussion in the following reaction ^{2}H(^{6}He,^{3}He).

Theory:

J^π	$1/2^+$	$5/2^+$	$3/2^+$	
Ref.[a]	$E;\Gamma$[b]	$E;\Gamma$[b]	$E;\Gamma$[b]	Method
1985Po10	2.7	5.1	7.0	$(0+1)\hbar\omega$ shell model
1985Po10	2.7	6.2	5.5	$(0+2)\hbar\omega$ shell model
2000Sh23	2.5-3.0;3-4	4.6-5.0;5	6.4-6.9;8	hyperspherical harmonics
2001De02, 2002De68	≈3;1-4			generator coordinate
2003Ar18	1.59;2.48	2.9;4.1	3.0;4.8	three body cluster model
2007De18	1.57;1.53	2.82;2.51	3.25;3.89	complex scaled expansion
2007Br18, 2010Ne06	1.39;1.60	2.11;2.87	2.10;3.14	modifed J-matrix
2008Ad16	1.9(2);0.6(2)		4(1);0.6(1)	generator coordinate

[a] Also see 2003Ba99 (R matrix).
[b] $E;\Gamma$ in MeV.

^{5}H Levels

Cross Reference (XREF) Flags

A	^{1}H(^{6}He,^{2}He)	E	^{7}Li(π^-,d)	I	^{9}Be(α,^{8}B)
B	^{2}H(^{6}He,^{3}He)	F	^{7}Li(^{6}Li,^{8}B)	J	^{9}Be(^{11}B,^{15}O)
C	^{3}H(t,p)	G	^{9}Be(π^-,pt)	K	^{11}B(π^-,D4HE),^{10}B(π^-,P4HE)
D	^{6}Li(π^-,p)	H	^{9}Be(π^-,dd)	L	C(^{6}He,^{5}H)

Continued on next page (footnotes at end of table)

Adopted Levels (continued)

^{5}H Levels (continued)

E(level)	J^{π}	$T_{1/2}$	$E_{res}(^{3}H+2n)$(MeV)	XREF	Comments
0	(1/2^{+})	5.3 MeV *4*	2.4 *3*	ABC L	%2n≈100 E(level): From (2017Wu03) see discussion in ^{2}H(^{6}He,^{3}He); other reported values are $E_{res}(^{3}H+2n)$=1.7 MeV *3* (1997Ko07); $E_{res}(^{3}H+2n)$=1.8 MeV *2* (2004St18); $E_{res}(^{3}H+2n)$=2.2 MeV *3* (2005Te05); $E_{res}(^{3}H+2n)$≈1.8 MeV (2005Go46) and $E_{res}(^{3}H+2n)$≈3 MeV (2003Me11,2003Me18). $T_{1/2}$: From (2017Wu03); Other reported values are Γ=1.9 MeV *4* (1997Ko07); Γ=1.3 MeV *5* (2004St18); Γ≈2.5 MeV (2005Te05); Γ≈1.3 MeV (2005Go46) and Γ≈6 MeV (2003Me11,2003Me18).
3.1×10^{3} *6*		5.3 MeV *5*	5.5 *3*	GH K	%2n≈100 E(level): From average of $E_{res}(^{3}H+2n)$=5.2 MeV *3* (2005Gu17), $E_{res}(^{3}H+2n)$=6.1 MeV *4* (2005Gu17) and $E_{res}(^{3}H+2n)$=5.6 MeV *1* (2009Gu03). $T_{1/2}$: From average of Γ=5.5 MeV *5* (2005Gu17), Γ=4.5 MeV *12* (2005Gu17) and Γ=4 MeV 2 (2009Gu03).
8.1×10^{3} *6*		6.8 MeV *6*	10.5 *4*	DE GHI K	%2n≈100 E(level): From average of $E_{res}(^{3}H+2n)$=11.8 MeV *7* (1990Am04) $E_{res}(^{3}H+2n)$=9.1 MeV *7* (1990Am04), $E_{res}(^{3}H+2n)$=10.4 MeV *3* (2005Gu17), $E_{res}(^{3}H+2n)$=11.4 MeV *7* (2005Gu17), $E_{res}(^{3}H+2n)$=9.7 MeV *10* (2009Gu03) and $E_{res}(^{3}H+2n)$=11.5 MeV *10* (2009Gu03). $T_{1/2}$: From average of Γ=5.6 MeV *9* (1990Am04); Γ=7.4 MeV *6* (1990Am04), Γ=7.4 MeV *6* (2005Gu17), Γ=5 MeV *1* (2005Gu17), Γ=7.3 MeV 30 (2009Gu03) and Γ=8.2 MeV 30 (2009Gu03).
16.1×10^{3} *5*		4.8 MeV *17*	18.5 *4*	GH	%2n≈100 E(level): From average of $E_{res}(^{3}H+2n)$=18.7 *5* (2005Gu17) and $E_{res}(^{3}H+2n)$=18.3 MeV *5* (2005Gu17). $T_{1/2}$: From average of Γ=3.9 MeV *20* (2005Gu17) and Γ=5.5 MeV *17* (2005Gu17).
24.4×10^{3} *5*		3.5 MeV *14*	26.8 *4*	GH	%2n≈100 E(level): From average of $E_{res}(^{3}H+2n)$=26.8 MeV *4* (2005Gu17) and $E_{res}(^{3}H+2n)$=26.5 MeV *10* (2005Gu17). $T_{1/2}$: From average of Γ=3.0 MeV *14* (2005Gu17) and Γ=6 MeV *3* (2005Gu17).