Adopted Levels

Q(β^-)=24.28×10^3 *25*; S(n)=−9.1×10^2 *27*; 2017Wa10

In the NUBASE2016 evaluation of nuclear properties (2017Au03), the ground state of ^{6}H is listed as having a mass defect of 41880 keV *250*, a half-life of 2.90×10^{-22} s *70* and an estimated J$^\pi$ of 2$^-$. This corresponds to a resonance energy in the ^{3}H+3n system of 2.72 MeV *25* and a resonance width of 1.57 MeV *38*.

Calculations reported in (1985Po10,1989Go24) obtained the ^{6}H ground state to have J$^\pi$=2$^-$. However, a calculation reported in (1986Be02) gives J$^\pi$=1$^+$ for the ground state.

Three particle transfer experiments, cited in the articles (1984Al08,1986Be35,2008Ca22), produced ^{6}H in the final state and observed a resonance reasonably consistent with the NUBASE2016 evaluation. However, a pion double charge exchange reaction on ^{6}Li, reported in (1990Pa25), which led to ^{6}H in the final state, showed no sign of a ^{6}H resonance. Also, experiments with stopped pions reported in (2003Gu17,2009Gu17) observed ^{6}H resonances at higher excitation energies than the one given in the NUBASE2016 evaluation. Earlier experiments with stopped pions by the same group (1987Go25,1990Am04) saw no evidence of ^{6}H states, but, as stated in (2003Gu17), that might have been due to poor statistics and energy resolution.

Theory:

A shell model calculation with (0+1)$\hbar\omega$ model space for ^{6}H is reported in (1985Po10). From Fig. 1 in that article, the ground state energy of the p+5n system is about −3 MeV. From Table 1, the four lowest calculated states (using the ground state as E=0.0) are 0.0(2$^-$),1.78(1$^-$),2.80(0$^-$),4.79(1$^+$) MeV. These would correspond to resonant states in the ^{3}H+3n system at approximately E(^{3}H+3n)=5.5(2$^-$),7.3(1$^-$),8.3(0$^-$),10.3(1$^+$) MeV, taking into account the ^{3}H binding energy of 8.5 MeV. In the same article, a shell model calculation with (0+2)$\hbar\omega$ model space is also reported.

A shell model calculation for A=6 nuclei is reported in (1986Be02). For ^{6}H, the calculated ground state has J$^\pi$=1$^+$ and the binding energy is calculated to be 7.144 MeV in p+5n system which corresponds to a resonance at E=1.34 MeV in the ^{3}H+3n system.

A calculation of H and He isotopes using the method of angular potential functions is reported in (1989Go24). For the ^{6}H ground state, an energy of 6.3 MeV in ^{3}H+3n system and J$^\pi$=2$^-$ were obtained.

A study of H and He isotopes using the anti-symmetrized molecular dynamics method is reported in (2004Ao05).

Positive experimental results: (See reaction data sets).

Negative experimental results:

^{9}Be(π^-,pd)X,^{7}Li(π^-,p)X:

1987Go25,1990Am04: Studies of the reactions ^{9}Be(π^-,pd)X and ^{7}Li(π^-,p)X with stopped pions were reported in (1987Go25,1990Am04). An analysis of the outgoing particle spectra showed no evidence of ^{6}H states.

Note: The comment was made in (2003Gu17) that the failure to observe ^{6}H states in either of the reactions reported in (1987Go25,1990Am04) may have been due to poor statistics and energy resolution.

^{6}Li(π^-,π^+)X:

1990Pa25: E(π^-)=220 MeV beam from the Los Alamos meson physics facility was incident on a ^{6}LiH target and a missing mass π^+ spectrum obtained. No evidence for ^{6}H was found in the energy range −10 MeV to +30 MeV in the ^{3}H+3n scale, thus casting doubt on the existence of ^{6}H.

Also see (2007Fo05).

^{6}H Levels

Cross Reference (XREF) Flags

A	^{7}Li(^{7}Li,^{8}B)	D	^{11}B(π^-,p^{4}He)
B	^{9}Be(π^-,pd)	E	^{12}C(^{8}He,^{6}H)
C	^{9}Be(^{11}B,^{14}O)		

E(level)	Γ	E$_{res}$(^{3}H+3n)(MeV)	XREF	Comments
0	1.55 MeV *44*	2.72 *25*	ABCDE	E(level): E(^{3}H+3n)=2.72 MeV *25* from (2017Wa17). The weighted average of reported values is E(^{3}H+3n)=2.72 MeV *+31-23* from E(^{3}H+3n)=2.70 MeV *40* (1984Al08), 2.60 MeV *50* (1986Be35), 2.91 MeV *+77-35* (2008Ca22). Γ=1.55 MeV *+44-18*, from the weighted average of 1.80 MeV *50* (1984Al08), 1.30 MeV *50* (1986Be35), and 1.5 MeV *+18-4*

				(2008Ca22). Γ: Γ=1.57 MeV *38*, from (2017Au03). J^{π}: $J^{\pi}=2^{-}$ is predicted in (1985Po10) and (1989Go24); see also $J^{\pi}=1^{+}$ predicted in (1986Be02).
4.1×10^{3} *6*	5.6 MeV *15*	6.8 *6*	B D	E(level): From weighted average of E(^{3}H+3n)=6.6 MeV *7* ^{9}Be(π^{-},pd) and 7.3 MeV *10* ^{11}B(π^{-},p^{4}He) (2003Gu17,2009Gu17). Γ: From weighted average of Γ=5.5 MeV *20* ^{9}Be(π^{-},pd) and 5.8 MeV *20* ^{11}B(π^{-},p^{4}He) (2003Gu17,2009Gu17).
8.0×10^{3} *8*	4 MeV *2*	10.7 *7*	B	E(level),Γ: From ^{9}Be(π^{-},pd) (2003Gu17,2009Gu17).
12.3×10^{3} *7*	4.2 MeV *15*	15.0 *6*	B D	E(level): From weighted average of E(^{3}H+3n)=15.3 MeV *7* ^{9}Be(π^{-},pd) and 14.5 MeV *10* ^{11}B(π^{-},p^{4}He) (2003Gu17,2009Gu17). Γ: From weighted average of Γ=3 MeV *2* ^{9}Be(π^{-},pd) and 5.5 MeV *20* ^{11}B(π^{-},p^{4}He) (2003Gu17,2009Gu17).
18.7×10^{3} *5*	3.9 MeV *9*	21.4 *4*	B D	E(level): From weighted average of E(^{3}H+3n)=21.3 MeV *4* ^{9}Be(π^{-},pd) and 22.0 MeV *10* ^{11}B(π^{-},p^{4}He) (2003Gu17,2009Gu17). Γ: From weighted average of Γ=3.5 MeV *10* ^{9}Be(π^{-},pd) and 5.5 MeV *20* ^{11}B(π^{-},p^{4}He) (2003Gu17,2009Gu17).

^{7}Li(^{7}Li,^{8}B) 1984Al08

The nucleus ^{6}H is first reported in this reaction (1984Al08); see (2012Th01). At E(^{7}Li)=82 MeV from Kurchatov Institute cyclotron, the spectrum of the outgoing ^{8}B was measured at θ_{lab}=10°; the cross section was about 60 nb/sr. The energy of the ^{6}H was deduced and the mass defect of the resonant state, which is assumed to be the ^{6}H ground state, was found to be 41.9 MeV *4*, from which it follows that ^{6}H is unstable against the decay $^{6}H \rightarrow ^{3}H+3n$ by 2.7 MeV *4*, and the width is Γ=1.8 MeV *5*, which gives for the ^{6}H lifetime a value 3.7×10^{-22} s (1984Al08,2012Th01).

^{6}H Levels

E(level)	Γ	E_{res}(^{3}H+3n)(MeV)
0	1.8 MeV *5*	2.7 *4*

^{9}Be(π^{-},pd) 2003Gu17,2009Gu17

Resonances in ^{6}H were observed at LAMPF by measuring the ^{3}He+3n missing mass spectrum following the capture of stopped π^{-} on a ^{9}Be target, via ^{9}Be(π^{-},pd). Measurements were also carried out on a ^{11}B target. Also see (2005Gu07,2007Gu24).

^{6}H Levels

E(level)	Γ	E_{res}(^{3}H+3n)(MeV)
3.4×10^{3} *8*	5.5 MeV *20*	6.6 *7*
8.0×10^{3} *8*	4 MeV *2*	10.7 *7*
12.6×10^{3} *8*	3 MeV *2*	15.3 *7*
18.6×10^{3} *5*	3.5 MeV *10*	21.3 *4*

^{9}Be(^{11}B,^{14}O) 1986Be35

E(^{11}B)=88 MeV from Dubna U-300 cyclotron; the ^{14}O ejectile energy spectrum was analyzed in the 52 to 58 MeV region. A broad enhancement was observed near 53 MeV which was attributed to an unbound state of ^{6}H at 2.6 MeV *5* above the ^{3}H+3n threshold with a width of 1.3 MeV *5*. The cross section at the peak was found to be about 16 nb/sr at a $\theta_{lab}\approx 8°$.

^{6}H Levels

E(level)	Γ	E_{res}(^{3}H+3n)(MeV)
0	1.3 MeV *5*	2.6 *5*

^{11}B(π^-,p^{4}He) 2003Gu17,2009Gu17

Resonances in ^{6}H were observed at LAMPF by measuring the ^{3}H+3n missing mass spectrum following the capture of stopped π^- on a ^{11}B target, via ^{11}B(π^-,pα). Measurements were also carried out on a ^{9}Be target. Also see (2005Gu07,2007Gu24).

^{6}H Levels

E(level)	Γ	E_{res}(^{3}H+3n)(MeV)
4.1×10^3 *7*	5.8 MeV *20*	7.3 *10*
12.3×10^3 *7*	5.5 MeV *20*	14.5 *10*
18.7×10^3 *5*	5.5 MeV *20*	22.0 *10*

$^{12}C(^{8}He,^{6}H)$ 2008Ca22

A $E(^{8}He)$=15.4 MeV/nucleon beam from the GANIL-SPIRAL facility, produced via the $^{12}C(^{13}C,^{8}He)$ reaction, impinged on a C_4H_{10} gas target. In $^{12}C(^{8}He,^{6}H)^{14}N$ reactions, the ^{6}H decays into ^{3}H+3n. Events with ^{14}N and ^{3}H detected in coincidence were analyzed, and a resonance was observed at 2.91 MeV *+85-95* above the ^{3}H+3n threshold with a width of 1.5 MeV *+18-4*. The cross section was found to be 19 μb/sr *+62-13* over the range of angles from 8.7° to 48.2°.

^{6}H Levels

E(level)	Γ	$E_{res}(^{3}H+3n)$(MeV)	Comments
0	≈1.52 MeV	≈2.91	E(level): From $E_{res}(^{3}H+3n)$=2.91 MeV *+85-95*. Γ: From Γ=1.5 MeV *+18-4*.

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