^{2}H(^{6}He,^{3}He)

History

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

This reaction is interpreted as one in which a proton from the incident ^{6}He is transferred to the ^{2}H target allowing the low lying states of ^{5}H to be populated.

2003Si15: The experiment was at JINR at Dubda. The 150 MeV ^{6}He beam was directed onto a liquid ^{2}H target. The ^{3}He reaction product and the ^{3}H from the decay of ^{5}H were detected and the ^{5}H spectrum determined by the missing mass method. A single narrow resonance structure was observed at E_{res}=1.8 MeV above the ^{3}H+2n threshold which the authors assume to be the $1/2^{+}$ ground state of ^{5}H. See related discussion in (2003Te06,2003Te16).

2004St18: This experiment was also performed at JINR at Dubna. A primary ^{11}B beam with energy 32 MeV/nucleon colliding with a Be target produced a secondary ^{6}He beam with an energy of 132 MeV which struck a ^{2}H gas target. The ^{3}He reaction product and the ^{3}H from the decay of ^{5}H were detected and the ^{5}H spectrum determined by the missing mass method. The authors interpret the results as two resonances, one corresponding to the $1/2^{+}$ ground state at E_{res}=1.8 MeV *2* with an observable width of Γ=1.3 MeV *5*. A second broad resonance is shown at around 7 MeV in the figure, though discussion on the second resonance is limited to the statement, "one can only say that, in the present case, it seems to be a rather broad resonance-like structure".

2005Te05: This experiment was also performed at JINR at Dubna. The secondary ^{6}He beam with an energy of 132 MeV collided with a ^{2}H target, the ^{3}He reaction product and the ^{3}H from the decay of ^{5}H were detected and the ^{5}H spectrum determined by the missing mass method. A resonance at E_{res}=2.2 MeV *3* and width Γ≈2.5 MeV was observed. The authors also comment that the observed spectrum shows the effects of interference between the $1/2^{+}$ state and a higher energy $3/2^{+}$ and $5/2^{+}$ doublet. The reaction ^{2}H(^{6}He,^{3}H)^{5}He was also studied and the T=3/2 analog of the ground ^{5}H was observed in ^{5}He.

2017Wu03: Experiment was conducted at NSCL at Michigan State University. The ^{6}He secondary beam with energy 55 MeV/nucleon was obtained from ^{18}O primary beam with energy 120 MeV/nucleon on a ^{9}Be target. The ^{6}He beam bombarded a thin Cd_2 target. The ^{3}He reaction product and the ^{3}H from the decay of ^{5}H were detected. The resonance energy and width were determined to be E_{res}=2.4 MeV *3* above the ^{3}H+2n threshold and Γ=5.3 MeV *4*. Analysis of the data suggested that the ^{5}H decay into ^{3}H+2n showed a slight preference for dineutron emission process over the democratic two neutron emission process.

In the discussion of (2017Wu03), the impact of energy conservation and momentum matching on the observed lineshape are examined for this extremely negative $Q(\beta^{-})$value reaction. Distortions of the lineshape are investigated for various experimental conditions of their results and past results. The total collection of reported parameters for $^{5}H_{g.s.}$ is rather discrepant; however, the quality of the data in (2017Wu03) that is attributed to suppression of the high-energy yield due to momentum matching effects, along with their detailed analysis and discussion weigh heavily in the adoption of their results for $^{5}H_{g.s.}$.

It is also noted in (2017Wu03) "...that ^{5}H is important in the context of the hypernucleus $^{6}_{\Lambda}$H..." The point is that adding a Λ to ^{5}H could produce a bound $^{6}_{\Lambda}$H even if ^{5}H is unbound since the Λ provides an additional attractive interaction. Experimental evidence for bound $^{6}_{\Lambda}$H is given in (2012Ag06) and against a bound $^{6}_{\Lambda}$H in (2017Ho15). Theoretical discussions of $^{6}_{\Lambda}$H are given in (2013Ga51,2013Hi03) and references therein. (We are greatful to John Millener (BNL) for his input regarding $^{6}_{\Lambda}$H and its relation to ^{5}H.).

^{5}H Levels

E(level)	J^{π}†	Γ	E_{res}(^{3}H+2n)(MeV)	Comments
0	($1/2^{+}$)	5.3 MeV *4*	2.4 *3*	E(level),Γ: From (2017Wu03); these results are adopted as the ground state properties. Other reported values are E_{res}(^{3}H+2n)=1.8 MeV *2*, Γ=1.3 MeV *5* (2004St18); E_{res}(^{3}H+2n)=2.2 MeV *3*, Γ≈2.5 MeV (2005Te05). E(level): Also see (2003Si15) who report a narrow resonance (Γ<0.5 MeV) with E_{res}(^{3}H+2n)≈1.8 MeV (2003Si15).
≈5?			≈7	E(level): From (2004St18). Γ: Broad.

† From systematics.