Adopted Levels 1992Ti02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, D. R. Tilley, H. R. Weller and G. M. Hale	NP A541 1 (1992)	8-Oct-1991

S(n)=1.14×10^{4} *SY*; S(p)=-3.10×10^{3} *22* 2012Wa38
Note: Current evaluation has used the following Q record.
S(p)=3.10×10^{3} *21*; 1997Au07

The stability of ^{8}B against particle decay into ^{4}He+^{4}Li, sets an upper limit of 1.7 MeV on the separation energy of ^{4}Li into p+^{3}He (1952Sh44). The instability of ^{4}h against particle decay (discussion in 1992Ti02) makes the particle stability of ^{4}Li very unlikely, since the Coulomb energy of ^{4}Li is approximately 1.7 MeV larger than that of ^{4}He (1963We10), and the nuclear energies should be identical because of charge symmetry. Indeed all decisive tests of the stability of ^{4}Li have failed. Searches for its β decay have given negative results (discussion in 1992Ti02). Indirect proof of the non-existence of ^{4}Li can be provided by a measurement of the solar neutrino flux which would be strongly influenced by the existence of ^{4}Li. See 1968Me03. For other theoretical work on ^{4}Li see 1979Hu02, 1981Ka39, 1988Co15.

The level structure of ^{4}Li presented here is based on an R-matrix analysis (discussed in 1992Ti02) that gives a good representation of all the p+^{3}He scattering data at proton energies below 20 MeV. Breit-Wigner resonance parameters from the analysis are given. The spin-correlation and ^{3}He analyzing-power data included in the p-^{3}He analysis determined that the lower 1^{-} level is primarily in the ^{3}p state, while the upper 1^{-} is primarily in the ^{1}p state, removing the ambiguities in the earlier phase-shift solutions, as was discussed in 1973Fi04.

As in the case of the ^{4}h levels, which were based on the ^{4}Li parameters, all the levels are at least 1 MeV lower than they were in 1973Fi04. The only significant difference between the ^{4}h and ^{4}Li levels is the position of the ground state above the nucleon-trinucleon threshold, as would be expected from the simple model used to obtain the ^{4}h parameters. Again, the parameters predict very broad, positive- parity, T=1 states in the E_{ex}=15-20 MeV range and antibound p-wave states that cannot yet be identified in the data. The known T=1 levels in the A=4 nuclei are summarized in the isobar diagram of 1992Ti02 fig.4.

The s-matrix poles resulting from the analysis are all far from the real axis with large decay widths, while their residues are relatively small, leading to small values of the strengths. Although the connection is not clear, the small residues for these poles may be connected with the anomalously small widths that have been observed in 1990Br14 and 1990Br17 that detect ^{4}Li states in the particle spectra of breakup reactions. It may even be possible that these experiments are not detecting the 2^{-} and 1^{-} states as they assume, but positive parity states (0^{+} and 1^{+}) whose s-matrix poles are much lower in energy than are the K(R)-matrix poles.

^{4}Li Levels

Cross Reference (XREF) Flags

A ^{3}He(p,p)

E(level)[†]	J^{π}	$T_{1/2}$	XREF	Comments
0.0	2^{-}		A	%p=100 Γ=6.03 MeV; T=1 4.07 MeV above the p+^{3}He mass.
320	1^{-}	7.35 MeV	A	%p=100 T=1 Strength is primarily $^{3}p_{1}$.
2080	0^{-}	9.35 MeV	A	%p=100 T=1
2850	1^{-}	13.51 MeV	A	%p=100 T=1 Strength is primarily $^{1}p_{1}$.

† Level energies from an R-matrix calculation.