$^{12}C(^{8}He,^{13}N)$ 2008Ca22,2022Ca10

	History		
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	K. Setoodehnia, J. H. Kelley, J. E. Purcell	ENSDF	28-September-2023

2007Ca28, 2007Ca47, 2007CaZZ, 2008Ca22: The $^{12}C(^{8}He,^{13}N)^{7}H$ proton transfer reaction is studied by impinging an $E(^{8}He)$=15.4 MeV/nucleon beam, produced at the SPIRAL facility in GANIL, on a C_4H_{10} gas target. The ^{13}N and tritium (from ^{7}H decay) charged reaction products are detected in coincidence mode. Seven events are associated with ^{7}H. The energy of the ground state ^{7}H resonance is determined to be E_{res}=0.57 MeV *+42−21* above the ^{3}H+4n breakup threshold with a width of Γ=0.09 MeV *+94−6*. The uncertainties in E_{res} and Γ are large because of the small number of observed events. These experiments do not report on the ^{7}H spin and parity, and no reaction channel identification was possible. (2021Mu04) mentions that the results of these experiments are based on the assumption that only $^{7}H_{g.s.}$ was populated. This assumption however may be questionable because of the potential for the populations of $^{7}H^*$, as well as $^{12}C(^{8}He,\ ^{14}N)^{6}H$, and $^{12}C(^{8}He,\ ^{15}N)^{5}H$, which would complicate the detection of $^{7}H_{g.s.}$ in the absence of the reaction channel identification.

(2022Ca10): XUNDL dataset compiled by TUNL, 2023: The authors used the $^{19}F(^{8}He,\ ^{20}Ne)$ and $^{12}C(^{8}He,\ ^{13}N)$ reactions to investigate the ground state properties of ^{7}H.

A beam of ^{8}He ions with an intensity of 10^4 pps and an energy of 15.4 MeV/nucleon was produced in the SPIRAL facility at GANIL. The beam impinged on the MAYA active-target detector filled with 176 mbar of a mixture of helium and CF_4. The trajectories of the ^{20}Ne and ^{13}N recoils were measured with an angular resolution of 1.2°. The tritons from the decay of ^{7}H were detected, in coincidence with the recoils, in a ΔE-E telescope composed of 20 silicon detectors backed by 80 CsI crystals.

In comparison with the $^{19}F(^{8}He,^{20}Ne)$ events, the missing mass spectrum shows a less obvious peak associated to the contribution of the ^{12}C to the resonant formation of ^{7}H. This peak is in a region with a significant contribution from the lower tail of the non-resonant continuum. An upper limit of 0.2 mb/sr was estimated for the contributions other than those of the ^{7}H and its non-resonance continuum. The authors deduced the spectrum of ranges (16 mm resolution at FWHM) for those recoils whose emission angles were between θ_{lab}=45°−54°. This distribution shows a clear peak corresponding to the contribution of ^{12}C to the formation of ^{7}H. The peak was simulated with a Breit-Wigner probability distribution. The mass and width of the ^{7}H resonance were extracted from a log-likelihood minimization between the simulation and the measured range distribution. The angular distribution of the ^{7}H production with the ^{12}C target was measured. DWBA calculations were performed with the code FRESCO. The average production cross section with the ^{12}C yields 1.2 mb/sr *+5−6* between $\theta_{c.m.}$=6° and 27°. Systematic uncertainties are estimated to be ~0.7%. The measured angular distributions is rather featureless, and the DWBA fits suffered from large statistical and systematic uncertainties, which prevented a clear assignment of spin and parity.

^{7}H Levels

E(level)	Γ (MeV)	Comments
0	0.18 MeV *+41−12*	E(level): The resonance is at 0.64 MeV *+33−23* above the ^{3}H+4n threshold. $E_{res}(^{3}H+4n)$=0.64 MeV *+33−23*: the weighted average of 0.73 MeV *+58−47* from (2022Ca10) and 0.57 MeV *+42−21* from (2007Ca28, 2007Ca47, 2007CaZZ, 2008Ca22). Γ (MeV): The weighted average of 0.18 MeV *+47−16* from (2022Ca10) and 0.09 MeV *+94−6* from (2007Ca28, 2007Ca47, 2007CaZZ, 2008Ca22). $d\sigma/d\Omega$=40 μb/sr *+58−31* from (2007Ca28, 2007Ca47, 2007CaZZ, 2008Ca22), and $d\sigma/d\Omega$=1.2 μb/sr *+5−6* between $\theta_{c.m.}$=6°−27° with a systematic uncertainty of 0.7% from (2022Ca10).