^{13}C(α,n),(α,α) 1965Ba32,1968Ke02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	C. G. Sheu, J. H. Kelley, J. Purcell	ENSDF	5-Aug-2021

1965Ba32: Cross sections for the reaction ^{13}C(α,α) at θ_{cm}=54.7°, 107.9°, 142.6°, 169.6° and for the reaction ^{13}C(α,n)^{16}O at θ_{cm}=0° were measured. A beam of E(α)=2-3.5 MeV from the 5.5-MeV Van de Graff accelerator bombarded a self-supporting foils made either from 41.6% ^{13}C-enriched methyl iodide, or from 56.7% ^{13}C-enriched methane with thickness ≈15 μg/cm^2. Using dispersion-theory analysis, a consistent set of J$^\pi$ and partial-width values for 11 excitation energies E$_x$=8-9 MeV were obtained. See also (1965BaZY).

1968Ke02: Cross sections of reactions ^{13}C(α,α_0) and ^{13}C(α,n) were measured by bombardment of an E$_\alpha$=12 MeV beam on to self-supporting, 20-30 μg/cm^2 thick, enriched ^{13}C targets at the Van de Graaff facility/Australian National University. Two surface-barrier detectors (for (α,α_0)) and two 2.5 cm×5 cm plastic scintillators (for (α,n)) were used to detect particles. Using a dispersion-theory analysis, the J$^\pi$ and partial width values were obtained for 11 states of ^{17}O with E$_x$=9-10 MeV.

1971Co14: ^{13}C(α,α), E=15,18,20 MeV; measured $\sigma(\theta)$; deduced optical model parameters. Enriched targets.

1972Ku19: ^{13}C(α,α), E=26.6 MeV; measured $\sigma(\theta)$.

1973Ku18: ^{13}C(α,α), E=18,19,22,24,25,26.6 MeV; measured σ(E; θ); deduced reaction mechanism.

1973Le28: ^{13}C(α,α), E=15-25 MeV; measured σ(E; θ). ^{17}O deduced resonances.

1974Ku15: ^{13}C(α,α), E=26.6 MeV; measured $\sigma(\theta)$.

1987Ab03: ^{13}C(α,α), E=48.7,54.1 MeV; deduced model parameters. ΔE-E telescopes. Optical model analyses.

1990Mu19: ^{13}C(α,α), E=65 MeV; analyzed $\sigma(\theta)$; deduced model parameters. Microscopic overlap integrals, vertex form factors.

1993AtZZ: ^{13}C(α,α),(α,α'), E=54.1,104,155 MeV; measured σ(E,θ); deduced model parameters. Coupled-channels analysis.

2012PrZY: ^{4}He(^{13}C,α), E=20.0,25.0,30.0,33.0,35.0 MeV; measured thick target reaction products. ^{17}O deduced yield vs E*, resonances.

2014My05: ^{4}He(^{13}C,^{13}C), E=1.75 MeV/nucleon; measured reaction products, E$_\alpha$, I$_\alpha$. ^{17}O; deduced $\sigma(\theta)$.

Theory:

1971Te10: ^{13}C(α,α), E=20,25 MeV; analyzed interference between states of transferred nucleus.

1974Ch58: ^{13}C(α,α), E=26.6 MeV; analyzed $\sigma(\theta)$.

1977Sa19: ^{13}C(α,α), E=40.5 MeV; calculated $\sigma(\theta)$ at forward angles.

1978Ze03: ^{13}C(α,α), E=26.6 MeV; calculated $\sigma(\theta)$.

1983Go27: ^{13}C(α,α), E=26.6 MeV; calculated $\sigma(\theta)$; deduced spin-orbit potential effects.

1987Le29: ^{13}C(α,α), E(cm)=1.59-4.34 MeV; analyzed, compiled data.

1988Le05: ^{13}C(α,α), E not given; calculated resonances, Γ. Optical model.

1991Le33: ^{13}C(α,α), E=1.5-10 MeV; compiled, reviewed backscattering σ data; deduced regions for ion-beam, depth profiling analyses.

1996Le06: ^{17}O; calculated levels using parameters for ^{13}C+α cluster system. Semi-microscopic algebraic cluster model.

2010DaZY: ^{13}C(α,α),(α,α'), E=388 MeV; calculated $\sigma(\theta)$; deduced radii for specified excited states.

2011Og09: ^{13}C(α,α), E(cm)<300 MeV; analyzed $\sigma(\theta)$ and difraction radii data; deduced abnormally large radii for excited states.

2011Og10: ^{13}C(α,α),(α,α'), E(cm)=388 MeV; analyzed $\sigma(\theta)$; deduced rms radii, diffraction radii, neutron halos in the excited states. Modified diffraction model.

^{17}O Levels

E(level)	J$^\pi$	Γ	E$_\alpha$(res) (keV)	Comments
7972†	1/2$^-$†	69† keV	2110	E(level): from E$_\alpha$=2110 keV. Γ: from Γ$_{lab}$=90 keV with Γ$_\alpha$/Γ=0.03.
8066†	3/2$^+$†	84† keV	2233	E(level): from E$_\alpha$=2233 keV. Γ: from Γ$_{lab}$=110 keV with Γ$_\alpha$/Γ=0.05.
8199†	3/2$^-$†	64† keV	2407	E(level): from E$_\alpha$=2407 keV. Γ: from Γ$_{lab}$=84 keV with Γ$_\alpha$/Γ=0.11.
8334†	1/2$^+$†	8† keV	2583	E(level): from E$_\alpha$=2583 keV. Γ: from Γ$_{lab}$=11 keV with Γ$_\alpha$/Γ=0.44.

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$^{13}C(\alpha,n),(\alpha,\alpha)$ 1965Ba32,1968Ke02 (continued)

^{17}O Levels (continued)

E(level)	J^π	Γ	E_α(res) (keV)	Comments
8395†	5/2+†	5† keV 2	2663	E(level): from E_α=2663 keV. Γ: from Γ_{lab}=7 keV 2 with Γ_α/Γ=0.08.
8462†	7/2+†	8† keV	2750	E(level): from E_α=2750 keV. Γ: from Γ_{lab}=10 keV with Γ_α/Γ=0.97.
8500†	5/2−†	5.0† keV 15	2800	E(level): from E_α=2800 keV. Γ: from Γ_{lab}=6.7 keV 20 with Γ_α/Γ=0.26.
8681†	3/2−†	52† keV	3037	E(level): from E_α=3037 keV. Γ: from Γ_{lab}=68 keV with Γ_α/Γ=0.06.
8875†	3/2+†	99† keV	3290	E(level): from E_α=3290 keV. Γ: from Γ_{lab}=130 keV with Γ_α/Γ=0.50.
8886†	7/2−†	6† keV	3305	E(level): from E_α=3305 keV; not observed in $^{13}C(\alpha,n)$. Γ: from Γ_{lab}=8 keV with Γ_α/Γ=1.00.
8947†	7/2−†	23† keV	3385	E(level): from E_α=3385 keV. Γ: from Γ_{lab}=30 keV with Γ_α/Γ=0.04.
9142‡	1/2−‡	6‡ keV	3640	E(level): from E_α=3640 keV. Γ: See also Γ_α/Γ=0.45 (1968Ke02).
9180‡	7/2−‡	3‡ keV	3690	E(level): from E_α=3690 keV; observed via $^{13}C(\alpha,\alpha_0)$ only. Γ: See also Γ_α/Γ=0.98 (1968Ke02).
9203‡	5/2+‡	5.5‡ keV	3720	E(level): from E_α=3720 keV. Γ: See also Γ_α/Γ=0.20 (1968Ke02).
9502‡	5/2−‡	15‡ keV	4110	E(level): from E_α=4110 keV. Γ: See also Γ_α/Γ=0.85 (1968Ke02).
9723‡	7/2+‡	16‡ keV	4400	E(level): from E_α=4400 keV. Γ: See also Γ_α/Γ=0.70 (1968Ke02).
9739‡	3/2+‡	61‡ keV	4420	E(level): from E_α=4420 keV. This level is associated with E_x=9786 keV in Adopted Levels. Γ: See also Γ_α/Γ=0.90 (1968Ke02).
9861‡	9/2+‡	12‡ keV	4580	E(level): from E_α=4580 keV. Γ: See also Γ_α/Γ=0.18 (1968Ke02). J^π: A doublet was populated and identified as J^π=9/2+. Two levels were subsequently identified with (5/2−) and (1/2−).
9953‡	7/2+‡	107‡ keV	4700	E(level): from E_α=4700 keV. Γ: See also Γ_α/Γ=0.78 (1968Ke02). J^π: Associated with 9976 keV: 5/2+ level in Adopted Levels.
10136‡	5/2+‡	138‡ keV	4940	E(level): from E_α=4940 keV. Γ: See also Γ_α/Γ=0.85 (1968Ke02).
10167‡	7/2−‡	46‡ keV	4980	E(level): from E_α=4980 keV. Γ: See also Γ_α/Γ=0.15 (1968Ke02).
10243‡	7/2+‡	122‡ keV	5080	E(level): from E_α=5080 keV. Γ: See also Γ_α/Γ=0.60 (1968Ke02).
10320‡	(7/2)‡#		5180	E(level): from E_α=5180 keV.
10412‡		≤20‡ keV	5300	E(level): from E_α=5300 keV.
10488‡	(5/2)‡#	75‡ keV 30	5400	E(level): from E_α=5400 keV.
10580‡	(7/2,9/2)‡#	45‡ keV 20	5520	E(level): from E_α=5520 keV.
10626?‡			(5580)	E(level): from E_α=(5580) keV.
10702‡	(7/2+)‡@	≤25‡ keV	5680	E(level): from E_α=5680 keV; observed via $^{13}C(\alpha,\alpha_0)$ only.
10779‡	(5/2)‡#	75‡ keV 30	5780	E(level): from E_α=5780 keV.
10916‡	≥3/2‡#	60‡ keV 20	5960	E(level): from E_α=5960 keV.
11046‡			6130	E(level): from E_α=6130 keV.
≈11253?‡			≈(6400)	E(level): from E_α=(≈6400) keV.

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^{13}C(α,n),(α,α) 1965Ba32,1968Ke02 (continued)

^{17}O Levels (continued)

† From (1965Ba32) where $\Gamma_n+\Gamma_\alpha=\Gamma$.
‡ From (1968Ke02). No states overlapping with those of (1965Ba32) were reported.
# Tentative assignments from ^{13}C(α,n) angular distribution data.
@ Inferred from comparison of elastic yield with calculated level shapes.