

$^{13}\text{C}(^3\text{He},^3\text{He}),(^3\text{He},^3\text{He}')$ 1969Ba06,1981Pe08,2000Bu25

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, C. G. Sheu and J. E. Purcell		NDS 198,1 (2024)	1-Aug-2024

1966Ke08: $^{13}\text{C}(^3\text{He},^3\text{He})$, $E(^3\text{He})=12, 15$ and 18 MeV; angular distributions have been studied.
1967Ar17: ^{13}C ; deduced nuclear properties.
1968We15: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E(^3\text{He})=6-8$ MeV; measured $\sigma(\theta)$, deduced optical model parameters.
1969Ar08: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=36$ MeV; measured $\sigma(\theta)$; deduced optical model parameters.
1969Ar10: $^{13}\text{C}(^3\text{He},^3\text{He}')$ $E\approx 36$ MeV; measured $\sigma(E(^3\text{He}'),\theta)$. ^{13}C deduced deformation parameters.
1969Ba06: $^{13}\text{C}(^3\text{He},^3\text{He}')$ $E=40-50$ MeV; measured $\sigma(E(^3\text{He}'),\theta)$; deduced optical model parameters. ^{13}C deduced levels.
1969Zu02: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=15$ MeV, measured $\sigma(\theta)$. Enriched, natural targets.
1970Nu02: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=14$ MeV; measured $\sigma(\theta)$; deduced optical model parameters.
1973LuZL: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=20$ MeV polarized ^3He , measured $\sigma(\theta)$.
1975Ha33: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=15$ MeV; measured $\sigma(\theta)$; deduced optical parameters.
1976Ma26: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=18,20,24.5$ MeV; measured $\sigma(\theta)$ at backwards angles.
1977Pe23: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=20$ MeV; measured $\sigma(E(^3\text{He}),\theta)$.
1980PeZV: $^{13}\text{C}(^3\text{He},^3\text{He}')$ $E=43.6$ MeV; measured $\sigma(\theta)$. ^{13}C levels deduced analog character. DWBA analysis.
1980Tr02: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=41$ MeV; measured $\sigma(\theta)$. Optical model analysis.
1981Pe08: $^{13}\text{C}(^3\text{He},^3\text{He}')$ $E=43.6$ MeV; measured $\sigma(E(^3\text{He}),\theta)$. ^{13}C levels deduced isoscalar, isovector transition amplitude ratio.
DWBA, CCBA analyses.
1986Dr03: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=33$ MeV; measured $\alpha(\theta)$, $A(\theta)$; deduced optical model parameters. $^{13}\text{C}^*(0,3.68,7.55)$.
1987BuZR: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=39.6$ MeV; measured $\sigma(\theta)$. Optical model.
1992Ad06: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=50,60$ MeV; measured $\sigma(\theta)$; deduced model parameters.
1994Bu01: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=37.9$ MeV; measured $\sigma(\theta)$; deduced optical model parameters, rainbow mechanism.
2000Bu13: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=50,60$ MeV; measured $\sigma(\theta)$. Comparison with optical model calculations with energy-dependent terms.
2000Bu25, 2002Th01: $^{13}\text{C}(^3\text{He},^3\text{He})$, $^{13}\text{C}(^3\text{He},^3\text{He}')$ $E=37.9$ MeV; measured $\sigma(\theta)$, $\sigma(E,\theta)$; deduced optical model parameters.
 ^{13}C deduced levels, J , π , configurations. Comparisons with model predictions.

Theory:

1986Ze04: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=16-22$ MeV; calculated $\sigma(\theta)$; deduced model parameters. Optical model.
1987Ra36: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=41$ MeV; analyzed $\sigma(\theta)$; deduced model parameters.
1990De31: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=39.6, 12$ MeV; analyzed $\sigma(\theta)$; deduced model parameters, rainbow characteristics.
2009Pa07: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=450$ MeV; analyzed $\sigma(\theta)$ using global optical model potential GDP08; deduced set of global optical potential parameters.
2011Og09: $^{13}\text{C}(^3\text{He},^3\text{He})$, $E(\text{cm})<300$ MeV; analyzed $\sigma(\theta)$ and diffraction radii data; deduced abnormally large radii for the $^{13}\text{C}^*(3.09;1/2^+)$ state located 1.86 MeV below the neutron emission threshold.
2011Og10: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=39.6$ MeV; analyzed $\sigma(\theta)$; deduced rms radii, diffraction radii, neutron halos in the excited states. Modified diffraction model.
2014El01: $^{13}\text{C}(^3\text{He},^3\text{He})$, $^{13}\text{C}(^3\text{He},^3\text{He}')$ $E=37.9$ MeV; calculated σ , $\sigma(\theta)$; deduced deformation parameters from the best fit. M3Y-Reid effective interaction, comparison with available data.
2015Pa10: $^{13}\text{C}(^3\text{He},^3\text{He})$ $E=4-118.5$ MeV; analyzed $\sigma(\theta)$ for 142 sets of experimental data; deduced optical model parameters.
2016De39: $^{13}\text{C}(^3\text{He},^3\text{He}')$ $E=43.6$ MeV; $^{13}\text{C}(^3\text{He},^3\text{He})$, $E=39.6$ MeV; analyzed available data, discussed $^{13}\text{C}^*(3.09)$ radius.

 ^{13}C Levels

T: From (1969Ba06).

E(level) [†]	J^π [‡]	L^d	deformations $\beta^\#$	Comments
$0^+_{0\&}$				
$3.09\times 10^3_{\&ab}$	$1/2^+$	1	0.113	T=1/2

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$^{13}\text{C}(^3\text{He}, ^3\text{He}), (^3\text{He}, ^3\text{He}')$ **1969Ba06, 1981Pe08, 2000Bu25** (continued) ^{13}C Levels (continued)

E(level) [†]	J ^π [‡]	L ^d	deformations β [#]	Comments
3.68×10 ³ ^{&ab}	3/2 ⁻	2	0.166	T=1/2 E(level): Unresolved with 3.85 MeV level in (1969Ba06).
3.85×10 ³ ^{&ab}	5/2 ⁺	3	0.172	T=1/2 E(level): Unresolved with 3.68 MeV level in (1969Ba06).
6.86×10 ³ ^{&a}	5/2 ⁺	3	0.055	
7.49×10 ³ ^a				E(level): Unresolved with 7.55 MeV level.
7550 ^{&ab}	5/2 ⁻	2		T=1/2 E(level): Unresolved with 7.49 MeV level; the higher state is 5/2 ⁻ ; T=1/2 (1969Ba06). $\Delta L=2\&3$ for the unresolved pair.
7.68×10 ³ ^{@&}	3/2 ⁺	1	0.065	
8860 ^{ab} 30	1/2 ⁻	0	0.050	T=1/2
9500 ^{&a} 30	9/2 ⁺	5	0.072	
9.897×10 ³ [@]		2		
10.75×10 ³ [@]		2	^c	E(level): Unresolved with 10.82 MeV level (1981Pe08).
10.82×10 ³ [@]		2	^c	E(level): Unresolved with 10.75 MeV level (1981Pe08).
11.08×10 ³ ^a	(3/2 ⁻ , 5/2 ⁻)	2	0.046	J ^π : From the $\Delta L=2$ angular distributions seen in (1981Pe08). E(level): Weakly populated (1969Ba06).
11840 ^{ab} 30	(7/2 ⁺)		0.12	T=1/2 J ^π : In (1981Pe08) this level is identified with L=2 and J ^π =(3/2 ⁻), while in, for example (2000Bu25) it is identified with L=3 and 7/2 ⁺ .
15.11×10 ³ ^a		2	0.065	
16.0×10 ³ [@]		3	0.062	

[†] E_x from (1969Ba06) except where noted.[‡] From DWBA and shell model analysis in (2000Bu25, 2002Th01), except where noted.[#] From (1981Pe08).[@] Reported in (1981Pe08).[&] Also reported in (1986Dr03).^a Also reported in (1981Pe08).^b Also reported in (2000Bu25, 2002Th01).^c The deformations β value for the unresolved states at E_x=10.8 MeV is 0.035 (1981Pe08).^d From (1981Pe08, 2000Bu25).