^{40}Ca(α,α):resonances 1984Ch15

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 190,1 (2023)	20-Jun-2023

1984Ch15: E=4.33-5.68 MeV (ΔE=5 keV) $^4He^+$ beam produced from the Van de Graaff at BARC. Targets of natural CaF_2 (96.92% ^{40}Ca) evaporated onto thin carbon backings. Four surface barrier detectors for detecting scattered alpha particles. Measured absolute $\sigma(E_\alpha,\theta)$. Deduced resonances, J^π, widths from R-Matrix analysis. Uncertainty in measured cross section is about 6%.

Others:

1983Fr03: E=4.4-9.12 MeV (ΔE=4 keV) alpha beam produced from the Dynamitron-Tandem accelerator at the Ruhr-Universitat Bochum. Target of 5 μg/cm^2 metallic Ca evaporated onto a 6 μg/cm^2 carbon backing. Measured $\sigma(E_\alpha,\theta)$. Deduced resonances, J^π, widths from R-Matrix analysis.

1976Fr08. E=7.035-7.405 MeV (ΔE=5 keV) alpha beam produced from the Dynamitron-Tandem accelerator at the Ruhr-Universitat Bochum. Target of 13 μg/cm^2 ^{40}Ca and 10 μg/cm^2 gold evaporated onto a 26 μg/cm^2 carbon backing. Measured $\sigma(E_\alpha,\theta)$. Deduced resonances, J^π, widths from R-Matrix analysis for a resonance at E_α=7260 keV.

1987Se09: E=5-9 MeV. Measured $\sigma(E_\alpha,\theta)$.Deduced resonances.

1969La20: E=23 MeV alpha beam produced from the University of Louvain cyclotron. Natural calcium target. Silicon detectors. Measured $\sigma(E_\alpha,\theta)$.

1998Mi33: analyzed $\sigma(\theta)$ data, deduced optical-model parameter and detailed review of α-cluster structure features for ^{44}Ti, as deduced from ^{40}Ca(α,α) and (^{6}Li,d) reactions.

See 1976Fr08 for $\sigma(\theta)$ data (above 11000 excitation energy) corresponding to Eα(lab)=7035 to 7405.

^{44}Ti Levels

γ_α^2 is reduced α width, defined by $\Gamma_\alpha=2P_l\gamma_\alpha^2$ where P_l is the penetrability for angular momentum=l.

E(level)†	J^π‡	Γ_α (keV)‡	γ_α^2 (keV)‡	Comments
9077 *5*	(2$^+$)	0.3	69	E_α=4345 *5*.
9109 *5*	4$^+$	0.1	157	E_α=4380 *5*.
9132 *5*	2$^+$	0.9	186	E_α=4405 *5*.
9145 *5*	(0$^+$)	0.5	36	E_α=4420 *5*.
9191 *5*	4$^+$	0.2	315	E_α=4470 *5*.
9227 *5*	2$^+$	0.3	39	E_α=4510 *5*.
9304 *5*	2$^+$	0.6	59	E_α=4595 *5*.
9350 *5*	4$^+$	0.2	122	E_α=4645 *5*.
9382 *5*	3$^-$	0.5	88	E_α=4680 *5*.
9436 *5*	4$^+$	0.2	88	E_α=4740 *5*.
9491 *5*	3$^-$	0.5	61	E_α=4800 *5*.
9522 *5*	2$^+$	0.8	38	E_α=4835 *5*.
9563 *5*	0$^+$	1.5	27	E_α=4880 *5*.
9645 *5*	2$^+$	0.5	16	E_α=4970 *5*.
9682 *5*	0$^+$	1.5	20	E_α=5010 *5*.
9745 *5*	(2$^+$)	0.2	5	E_α=5080 *5*.
9780 *5*	0$^+$	1.0	10	E_α=5140 *5*.
9845 *5*	3$^-$	0.5	20	E_α=5190 *5*.
9882 *5*	3$^-$	0.4	15	E_α=5230 *5*.
9909 *5*	(0$^+$)	0.5	4	E_α=5260 *5*.
9918 *5*	(0$^+$)	1.5	11	E_α=5270 *5*.
9950 *5*	0$^+$	1.5	10	E_α=5305 *5*.
9977 *5*	0$^+$	2.0	12	E_α=5335 *5*.
10009 *5*	2$^+$	1.0	12	E_α=5370 *5*.
10027 *5*	2$^+$	1.0	11	E_α=5390 *5*.
10072 *5*	0$^+$	2.0	10	E_α=5440 *5*.
10113 *5*	(3$^-$)	0.5	10	E_α=5485 *5*.
10182 *5*	(0$^+$)	1.0	4	E_α=5560 *5*.

Continued on next page (footnotes at end of table)

$^{40}Ca(\alpha,\alpha)$:resonances 1984Ch15 (continued)

^{44}Ti Levels (continued)

E(level)[†]	J^{π}[‡]	Γ_{α} (keV)[‡]	γ^2_{α} (keV)[‡]	Comments
10227 *5*	(2^+)	0.5	4	E_{α}=5610 *5*.
11072[#]	0^+[#]			E_{α}=6540. L=0 (1987Se09).
11191[@]	0^+[@]			E_{α}=6670. Γ=550 keV (1983Fr03).
11691[@]	1^-[@]			E_{α}=7220. Γ=40 keV (1983Fr03).
11727[#]	1^-[#]			E_{α}=7260. L=1 (1987Se09). Γ_{α}=31 keV, Γ=51 keV (1976Fr08).
12118[#]	2^+[#]			E_{α}=7690. L=2 (1987Se09).
12172[@]	2^+[@]			E_{α}=7750. Γ=300 keV (1983Fr03).
12563[#]	(3^-)[#]			E_{α}=8180. L=(3) (1987Se09).
12772[@]	3^-[@]			E_{α}=8410. Γ=220 keV (1983Fr03).
12854[#]	(4^+)[#]			E_{α}=8500. L=(4) (1987Se09).

† From E_{α}(c.m.)+S(α) with E_{α}(c.m.) from E_{α}(lab) in 1984Ch15 and S(α)=5127.1 *7* from 2021Wa16, unless otherwise noted.
‡ From R-Matrix analysis of resonance data in 1984Ch15, unless otherwise noted. Estimated uncertainty for widths ranges from 30% for stronger levels to 50% for weaker ones (1984Ch15).
# From 1987Se09.
@ From 1983Fr03.