$^{35}_{18}$Ar levels – References

^{36}Ar(p,d): NP A108 113(68), PR 172 1078(68), NP A214 1(73)
^{36}Ar(d,t): PR C1 1455(70), NP A214 1(73)
^{36}Ar(^{3}He,α): PR C8 660(73); **others:** BAPS 10 1126(65)
^{33}S(^{3}He,n),^{33}S(^{3}He,nγ): NP A250 221(75)

● ^{36}Ar(p,d)
▲ ^{36}Ar(d,t)
■ ^{36}Ar(^{3}He,α)
●○ ^{33}S(^{3}He,n),^{33}S(^{3}He,nγ)

T

8.02
7.84
7.50
7.42
7.29
7.12
3/2,5/2+ 7.05
6.96
3/2,5/2+ 6.82
1/2+ 6.63
6.26
6.15
3/2,5/2+ 6.03
5.91
3/2,5/2+ 5.59
(3/2+) (3/2) 5.54
3/2,5/2+ 5.48
5.39
5.20
(3/2,5/2+) 5.12
5.05
4.78
1/2+ 4.72
4.53
4.35
1/2,3/2− 4.14
4.11
1/2,3/2− 4.01
1/2+ 3.88
5/2,7/2− 3.20
3/2,5/2+ 2.97
3/2,5/2+ 2.601
5/2,3/2+ 1.750
1/2+ 1.184
3/2+ 0

$^{35}_{18}$Ar

$^{35}_{18}$Ar

Δ: −23.0489 *16* {ANDT 19 175(77)}
π: β^+ {PR 59 403(41), PR 59 63(41)}
$t_{1/2}$: 1.770 *6* s {NP A138 209(69)}; 1.787 *12* s {CJP 49 663(71)}; 1.763 *3* s {PR 129 1723(63)}; 1.83 *2* s {PR 116 134(59)}; **others:** {PL 29B 296(69), PR 117 1297(60), ZNat 15a 593(60), PR 104 154(56), RSI 19 458(48), PR 59 403(41)}
Class: A; **Ident:** excit {PR 59 63(41), PR 58 846(40)}
Prod: ^{32}S(α,n) {PR 58 846(40), RSI 19 458(48)}; ^{35}Cl(p,n) {PR 59 63(41), NP A138 209(69), PL 34B 128(71), CJP 49 663(71)}
β^+: **4.96** *4* (93.0 *25*%), other β^+ groups observed (total intensity 7.0% *mag* {PR 104 154(56)}
4.93 *5 mag* {PR 117 1297(60)}
γ: **1.2185** *5* (γ 1.22 *5*%), $\gamma_{1.763}$ (γ 0.234 *13*%) *Ge(Li)* {PR 175 1426(68), NP A138 209(69), EB}
(intensities relative to $\dagger_\gamma$1000 for $\gamma_{1.219}$) $\gamma^\pm$ ($\dagger_\gamma$1.63×10^5), $\gamma_{1.763}$ ($\dagger_\gamma$200 *27*), $\gamma_{2.694}$ ($\dagger_\gamma$102 *15*), $\gamma_{3.003}$ ($\dagger_\gamma$90 *15*) *Ge(Li)* {CJP 49 663(71)}
(intensities relative to $\dagger_\gamma$1000 for $\gamma_{1.219}$) $\gamma_{1.763}$ ($\dagger_\gamma$180 *20*), $\gamma_{2.694}$ ($\dagger_\gamma$160 *20*), $\gamma_{3.003}$ ($\dagger_\gamma$58 *15*) *Ge(Li)* {PL 34B 128(71)}
others: {PR 104 154(56)}

$^{35}_{19}$K

Δ: −11.169 *20* {ANDT 19 175(77)}
Class: R; **Ident:** ^{40}Ca(^{3}He,^{8}Li) {PR C13 1479(76)}

^{40}Ca(^{3}He,^{8}Li)

2.69
1.56
0
$^{35}_{19}$K

$^{35}_{19}$K levels – References
^{40}Ca(^{3}He,^{8}Li): PR C13 1479(76)

A = 36 (EB; JMD)

2+ 0.34 s
$^{36}_{19}$K
β^+
Q_{EC} 12.805 *8*

2+
3.00×10^5 y
$^{36}_{17}$Cl
EC 1.9%
β^+ 0.0017%
β^- 98.1%
0+
$^{36}_{18}$Ar
Q_{β^-} 0.70955 *30*
Q_{EC} 1.1442 *15*
0+
$^{36}_{16}$S

$^{36}_{14}$Si

Δ: −12.67 (from systematics) {ANDT 19 175(77)}
Class: R; **Ident:** ^{232}Th(^{40}Ar,^{36}Si) {NP A176 284(71)}

$^{36}_{15}$P

Δ: −20.77 (from systematics) {ANDT 19 175(77)}
Class: R; **Ident:** ^{232}Th(^{40}Ar,^{36}P) {NP A176 284(71)}

● ^{34}S(t,p),^{34}S(t,pγ)
▲ ^{37}Cl(d,^{3}He)

7.71 ▲
1,2+ 7.12 ●▲
4+ 6.51 ●▲
6.225 ●▲
0.06 ps 6.187 ●▲
0.19 ps 5.573 ●▲
5.5091 ●▲
0.07 ps 5.391 ●▲
0.06 ps 5.251 ●▲
0.02 ps 2+ 4.575 ●▲
0.8 ps 1+ 4.523 ●▲
3− 4.192 ●▲
8.8 ns 0+ 3.346 ●▲
0.08 ps 2+ 3.291 ●▲
0+ 0 ●▲
$^{36}_{16}$S

$^{36}_{16}$S levels – References
Decay: Phil s7v46 1337(55), Phil s8v7 1223(62), PR 159 951(67), JINC 28 937(66)
^{34}S(t,p),^{34}S(t,pγ): PR C5 1238(72), PR C3 2323(71), NP A214 1(73)
^{37}Cl(d,^{3}He): PR 177 1624(69), NP A140 494(70), NP A214 1(73)

2+ 3.00×10^5 y
$^{36}_{17}$Cl
EC,β^+ 1.9%
0+ 0 EC 1.9% *13.5*, β^+ 0.0017% *14.5*
$^{36}_{16}$S

$^{36}_{16}$S

%: 0.017 (deep terrestrial sources); 0.015 to 0.020 (other sources) {BNL-NCS-50605(77)}
Δ: −30.6659 *15* {ANDT 19 175(77)}
I: 0 *MA* {PR 75 529(49)}
σ_c: 0.15 *3* (reactor spectrum) {PC77 Holden}
$t_{1/2}$(levels): **3.291:** 76 *21* fs *Doppler* {PR C5 1238(72)}; **3.346:** 8.8 *2* ns *delay coinc* {PR C3 2323(71)}; **4.192:** 0.8 *3* ps *Doppler* {PR C5 1238(72)}; **4.523:** 17 *8* fs *Doppler* {PR C5 1238(72)}; **4.575:** 55 *10* fs *Doppler* {PR C5 1238(72)}; **5.251:** 69 *28* fs *Doppler* {PR C5 1238(72)}; **5.391:** <28 ns *delay coinc* {PR C3 2323(71)}, >0.2 ps *Doppler* {PR C5 1238(72)}; **5.509:** 0.19 *5* ps *Doppler* {PR C5 1238(72)}; **5.573:** <0.14 ps *Doppler* {PR C5 1238(72)}; **6.187:** 55 *21* fs *Doppler* {PR C5 1238(72)}; **6.225:** <21 fs *Doppler* {PR C5 1238(72)}; **6.51:** <0.3 ps *delay coinc* {PR C3 2323(71)}; **7.12:** <0.3 ps *delay coinc* {PR C3 2323(71)}; **others:** {PR C3 2323(71)}

14 reactions
≈100 additional levels above 5.518 MeV.

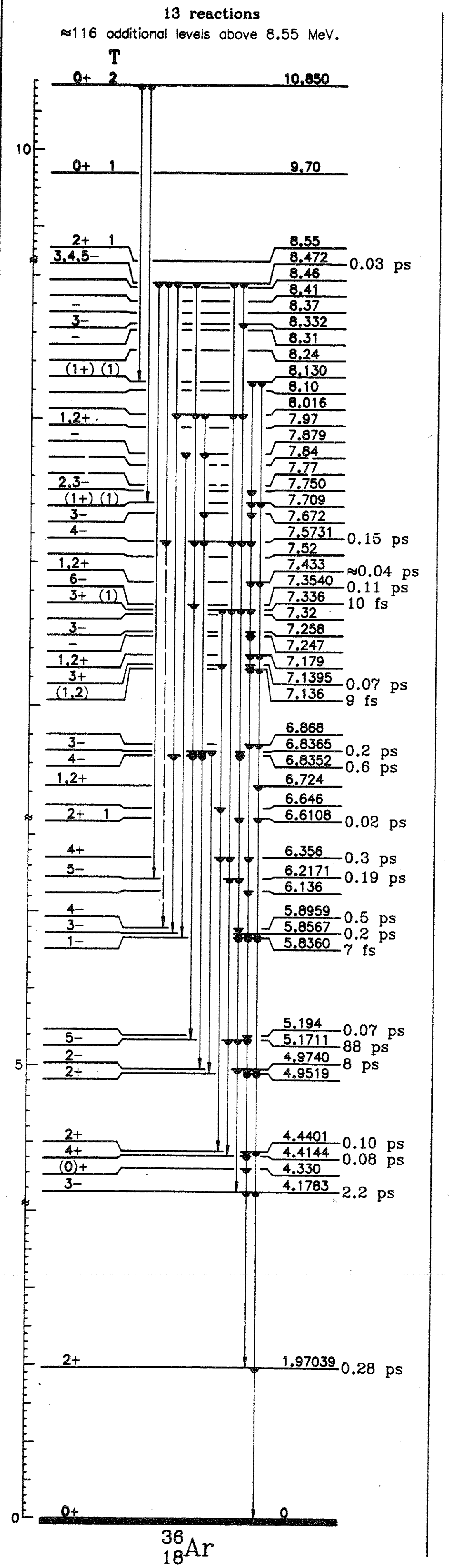
T

2+ 2 7.564
(8) 5.7600
3− 5.5175
(1,2)− 5.4634
(7+) 5.3291
5.3134 20 ps
5.3069
5.2627
(2,3)− 5.2464
5.2046
5.1505
5.0791
5.0180
4.9986
4.9562
(1,2)+ 4.884
4.8439
4.8292
3− 4.7576
4.735
3− 4.720
(1,2)+ 4.5981
4.553
(1,2)− 4.5250
4.4963
4.408
0+ 2 4.3151
(6−) 4.300
4.2944
4.205
4.1388
4.0338
(1,2)− 3.9972 0.02 ps
(1,2)− 3.9626
3.8305
(4)− 3.7238 0.05 ps
3.6614
1− 3.6353 0.02 ps
3− 3.5990 0.04 ps
3.566
3.473
(1,2)+ 3.4694
(1,2)− 3.3318 0.07 ps
2− 3.2090 0.10 ps
0+ ≈3.12
4− 3.1006 0.15 ps
2.9944 0.06 ps
(2,3)− 2.8960 0.6 ps
2.89
(2,3)+ 2.8637(c)
4− 2.8104 3 ps
(1)+ 2.6760
5− 2.5182 1.6 ns
2+ 2.4921 0.04 ps
3− 2.4679 1.0 ps
2+ 1.9592 0.04 ps
2− 1.9510 1.8 ps
(1)+ 1.60088 0.6 ps
1+ 1.16475 6 ps
3+ 0.78842 20 ps
2+ 0
$^{36}_{17}$Cl

$^{36}_{17}$Cl

Δ: −29.52177 *21* {ANDT 19 175(77)}
I: 2 *MA* {PR 76 691(49), PR 83 1249(51), PR 98 1317(55)}
σ_c: <1 (reactor spectrum) {PC77 Holden}
π: β^- 98.1%, EC 1.9 *1*%, β^+ 0.0017 *1*% {Phil s7v46 1337(55), PR 159 951(67)}; β^+ 0.0012 *4*% {Phil s8v7 1223(62)}; β^+ 0.002 *1*% {PL 2 332(62)}
$t_{1/2}$: 3.002×10^5 y *sp act + mass spect* {JINC 28 937(66)}; 3.02 *3*×10^5 y *sp act + mass spect* {CJP 33 43(55)}; 2.64×10^5 y *sp act, yield* {NSEg 2 427(57)}; 4.34×10^5 y *sp act* {PR 76 692(49)}; **others:** {PR 72 888(47)}
Class: A; **Ident:** chem, n-capt {PR 60 909(41)}
Prod: ^{35}Cl(n,γ) {PR 60 909(41), PR 72 888(47)}
β^-: **0.7087** *6 semicond* {NP A99 625(67)}
0.712 *1 semicond* {ZP 271 107(74)}
0.714 *4 scint* {PR 102 1142(56)}
0.714 *5 mag* {PR 87 1091(52)}
β^+: **0.115** *18 scint* $\beta\gamma^\pm\gamma^\pm$ *coinc* {PR 159 951(67)}
γ: no γ rays observed *ion ch, scint* {PR 76 692(49), Phil s7v46 1337(55)}
$t_{1/2}$(levels): **0.788:** 21 *1* ps *recoil dist Doppler* {JPAL 6 L37(73)}, 22.4 *17* ps *recoil dist Doppler* {JPPo 37 1(76)}, 16.0 *14* ps *recoil dist Doppler* {NP A256 277(76)}, 2.1 *8* ps *Doppler* {PR C8 684(73)}
1.165: 7.2 *4* ps *recoil dist Doppler* {NP A256 277(76)}, 4.9 *4* ps *recoil dist Doppler* {JPAL 6 L37(73)}, 9 *3* ps *recoil dist Doppler* {JPGL 2 131(76)}, 2.1 *8* ps *Doppler* {PR C8 684(73)}
1.601: 0.55 *10* ps *Doppler* {PR C8 684(73)}
1.951: 2.0 *1* ps *recoil dist Doppler* {NP A256 277(76)}, 1.62 ps *recoil dist Doppler* {JPGL 2 249(76)}
1.959: 42 *10* fs *Doppler* {PR C8 684(73)}
2.468: 1.0 *1* ps *Doppler* {PR C7 1120(73)}, 0.33 *4* ps *Doppler* {PR C8 684(73)}
2.492: 42 *7* fs *Doppler* {PR C8 684(73)}
2.518: 1.6 *1* ns *recoil dist Doppler* {JPAL 6 L37(73), PR C14 160(76)}
2.676: <7 fs *Doppler* {PR C8 684(73)}
2.810: 2.3 *2* ps *recoil dist Doppler* {JPGL 2 249(76)}, 3.4 *7* ps *recoil dist Doppler* {NP A256 277(76)}, 6.2 *4* ps *recoil dist Doppler* {JPAL 6 L37(73)}, 1.9 *7* ps *Doppler* {PR C8 684(73)}
2.864: <10 fs *Doppler* {PR C8 684(73)}
2.896: 0.60 *6* ps *Doppler* {PR C8 684(73)}
2.994: 62 *8* fs *Doppler* {PR C8 684(73)}
3.101: 0.15 $^{+5}_{-3}$ ps *Doppler* {PR C8 684(73)}
3.209: 97 *14* fs *Doppler* {PR C8 684(73)}
3.332: 73 *7* fs *Doppler* {PR C8 684(73)}
3.469: <24 fs *Doppler* {PR C8 684(73)}
3.599: 42 *14* fs *Doppler* {PR C8 684(73)}
3.635: 21 *11* fs *Doppler* {PR C8 684(73)}
3.661: <56 fs *Doppler* {PR C8 684(73)}
3.724: 49 *11* fs *Doppler* {PR C8 684(73)}
3.963: <21 fs *Doppler* {PR C8 684(73)}
3.997: 21 *7* fs *Doppler* {PR C8 684(73)}
4.294: <7 ps *recoil dist Doppler* {PR C14 996(76)}
4.300: <35 fs *Doppler* {CJP 53 1734(75)}
5.313: 18.9 *12* ps *recoil dist Doppler* {PR C14 160(76)}, 222 ps *recoil dist Doppler* {PR C14 996(76)}
5.780: 0.3 ps<$t_{1/2}$<0.7 ns *recoil dist Doppler* {PR C14 996(76)}
others: {NP A256 277(76), PR C8 684(73), PR C7 1120(73)}
EC: EC(L)/EC(K) 0.112 *8* {Phil s8v7 1223(62)}
Internal bremsstrahlung endpoint: **1.138** *8 scint* {YadF 18 239(73)}; **1.178** *15 scint* {NP 59 504(64)}; **1.158** *18 scint* {PL 18 293(65), AKoz 7 183(65)}; **others:** {PL 2 332(62)}

$^{36}_{17}$Cl levels – References
14 reactions: NP A214 1(73), NP A264 63(76), PR C14 996(76), PR C14 160(76), PR C13 461(76), NP A239 189(75), JPGL 2 249(76), PR C8 684(73), NP A256 277(76), NP A265 220(76)

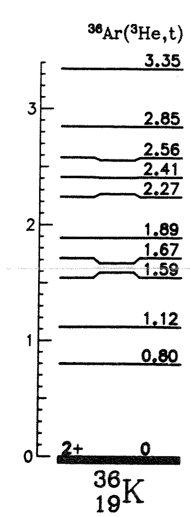


$^{36}_{18}$Ar

%: 0.337 (atmospheric sources; large variations reported for other sources) {BNL−NCS−50605(77)}
Δ: −30.231328 {ANDT 19 175(77)}
I: 0 0 {ZP 105 389(37), HPAc 26 811(53)}
σ_c: 5 1 (reactor spectrum) {PC77 Holden}
σ(n,α): 0.0055 1 (subcadmium) {PC77 Holden}
$t_{1/2}$(levels): **1.970:** 0.305 ps *Doppler* {PL 34B 389(71)}, 0.248 ps *Doppler* {NP A218 333(74)}
4.178: 2.03 ps *recoil dist Doppler* {JPGL 2 249(76)}, 2.86 ps *recoil dist Doppler* {NP A256 277(76)}
4.330: >0.5 ps *Doppler* {NP A218 333(74)}
4.414: 896 fs *Doppler* {NIM 124 265(75)}, 8714 fs *Doppler* {CR 270B 115(70), JPPa 31 131(70)}, 6012 fs *Doppler* {NP A194 481(72)}
4.440: 1064 fs *Doppler* {NIM 124 265(75)}, 6521 fs *Doppler* {CR 270B 115(70), JPPa 31 131(70)}, 6928 fs *Doppler* {NP A218 333(74)}
4.952: <35 fs *Doppler* {NP A218 333(74)}
4.974: 6.214 ps *recoil dist Doppler* {JPGL 2 249(76)}, 13.622 ps *recoil dist Doppler* {NP A256 277(76)}
5.171: 884 ps *recoil dist Doppler* {JPAL 6 L37(73)}
5.194: 6921 fs *Doppler* {NP A218 333(74)}
5.836: 62 fs *Doppler* {NP A194 481(72)}, 104 fs *Doppler* {NP A218 333(74)}
5.857: 0.188 ps *Doppler* {NP A218 333(74)}, 0.2412 ps *Doppler* {NP A194 481(72)}
5.896: 0.5524 ps *Doppler* {BAPS 15 806(70)}, 0.21^{+45}_{-10} ps *Doppler* {NP A218 333(74)}, 0.28^{+97}_{-14} ps *Doppler* {NP A194 481(72)}
6.217: 0.196 ps *Doppler* {NP A194 481(72)}, 0.164 ps *Doppler* {NP A218 333(74)}, 0.246 ps *Doppler* {BAPS 15 806(70)}
6.356: 0.3011 ps *Doppler* {NP A194 481(72)}
6.611: 157 fs *Doppler* {NP A218 333(74)}
6.835: 0.5517 ps *Doppler* {BAPS 15 806(70)}
6.836: 0.166 ps *Doppler* {NP A194 481(72)}, 0.146 ps *Doppler* {NP A218 333(74)}, 0.2110 ps *Doppler* {CR 270B 115(70), JPPa 31 131(70)}
7.136: 94 fs *Doppler* {NP A218 333(74)}
7.140: 6935 fs *Doppler* {NP A194 481(72)}
7.247: <21 fs *Doppler* {NP A194 481(72)}
7.258: <13 fs *Doppler* {NP A194 481(72)}
7.338: 105 fs *Doppler* {NP A194 481(72)}
7.354: 9721 fs *Doppler* {NP A218 333(74)}, 13262 fs *Doppler* {NP A194 481(72)}, 16652 fs *Doppler* {BAPS 15 806(70)}
7.433: 35^{+42}_{-28} fs *Doppler* {NP A194 481(72)}
7.573: 0.217 ps *Doppler* {NP A194 481(72)}, 0.116 ps *Doppler* {NP A218 333(74)}
8.472: 307 fs *Doppler* {NP A218 333(74)}
others: {NP A256 277(76), NP A218 333(74), JPAL 6 L37(73), PR C7 1120(73), NP A194 481(72), CR 270B 115(70), JPPa 31 131(70), NP A127 13(69)}

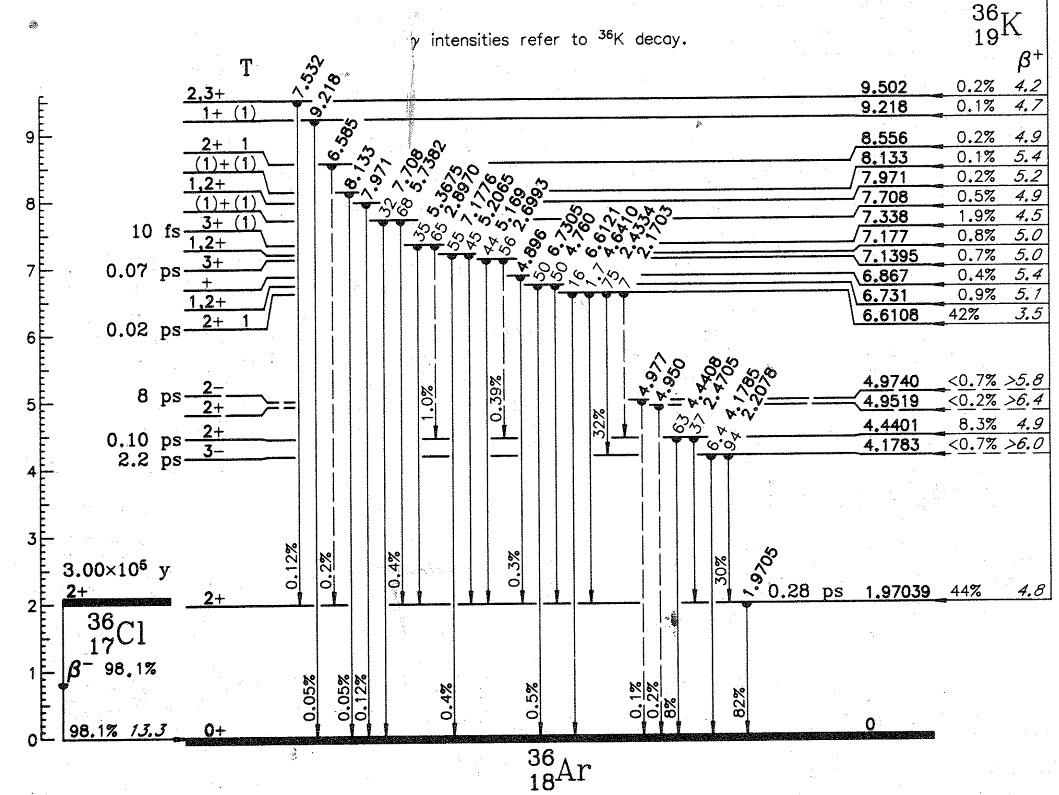
$^{36}_{19}$K

Δ: −17.4268 {ANDT 19 175(77)}
I: 2 *OP/RD* {JPJS 34 164(73), NP A246 187(75)}
✱: β^+ {PR C4 1800(71)}
$t_{1/2}$: 3443 ms {PR C13 331(76)}; 3416 ms {PR C6 869(72)}; 3364 ms {PR C4 1800(71)}; 26525 ms {PR 153 1165(67)}; **others:** {BAPS 15 1690(70)}
Class: A; **Ident:** excit {PR C6 869(72), PR C4 1800(71)}; genet energy levels {PR 153 1165(67), PR C6 869(72)}
Prod: ^{36}Ar(p,n) {PR 153 1165(67), PR C4 1800(71), PR C6 869(72), PR C13 331(76)}
γ: ⟨**norm:** $\gamma_{1.970}$ (γ 822%), from level scheme⟩ **1.97044**46 ($\dagger_\gamma$100 10), **2.17029**20? ($\dagger_\gamma$3.7 4), **2.20783**30 ($\dagger_\gamma$36.5 17), **2.43343**21 ($\dagger_\gamma$38.8 18), **2.47046**42 ($\dagger_\gamma$5.8 23), **2.69928**45? ($\dagger_\gamma$0.470 35), **2.89697**34? ($\dagger_\gamma$1.21 9), **4.17853**41 ($\dagger_\gamma$2.5 1), **4.44079**34 ($\dagger_\gamma$9.8 6), **4.64096**50 ($\dagger_\gamma$0.88 10), **4.75960**72 ($\dagger_\gamma$0.54 9), **4.89627**109 ($\dagger_\gamma$0.42 8), **4.95004**91? ($\dagger_\gamma$0.20 6), **4.97715**105? ($\dagger_\gamma$0.17 6), **5.16951**77 ($\dagger_\gamma$0.37 8), **5.20653**42 ($\dagger_\gamma$0.38 9), **5.36752**47 ($\dagger_\gamma$0.66 8), **5.73824**55 ($\dagger_\gamma$0.44 7), **6.58505**49? ($\dagger_\gamma$0.20 7), **6.61213**37 ($\dagger_\gamma$8.1 6), **6.73053**50 ($\dagger_\gamma$0.55 7), **7.17762**52 ($\dagger_\gamma$0.46 6), **7.53157**104 ($\dagger_\gamma$0.155 30), **7.70824**65 ($\dagger_\gamma$0.21 3), **7.97053**69 ($\dagger_\gamma$0.155 25), **8.13262**140 ($\dagger_\gamma$0.065 20), **9.21835**118 ($\dagger_\gamma$0.060 15) *Ge(Li)* {PR C13 331(76)}
1.96985 ($\dagger_\gamma$100 10), **2.1715**9 ($\dagger_\gamma$2.8 6), **2.2083**4 ($\dagger_\gamma$37 5), **2.4337**4 ($\dagger_\gamma$42 5), **2.4720**8 ($\dagger_\gamma$5.6 9), **4.1804**10 ($\dagger_\gamma$3.9 9), **4.4417**6 ($\dagger_\gamma$11.8 6), **6.6127**8 ($\dagger_\gamma$9 1) *Ge(Li)* {PR C6 869(72)}
1.97007 ($\dagger_\gamma$100 2), **2.2067**10 ($\dagger_\gamma$21 2), **2.4344**7 ($\dagger_\gamma$26 6), **4.1783**9 ($\dagger_\gamma$2.2 6), **4.4398**12 ($\dagger_\gamma$5 1), **6.6096**20 ($\dagger_\gamma$2.6 6) *Ge(Li)* {PR 153 1165(67)}

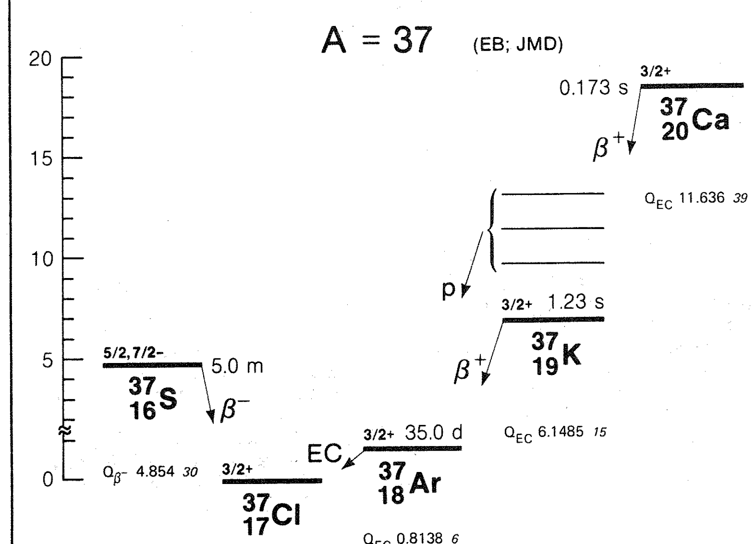


$^{36}_{19}$K levels − References
^{36}Ar(^{3}He,t): PL 33B 302(70), NP A214 1(73)

$^{36}_{18}$Ar levels − References
Decay: PR C13 331(76), PR C6 869(72), NP A214 1(73)
13 reactions: NP A214 1(73), NP A218 333(74), PR C14 1320(76), JPGL 2 249(76), NP A211 405(73), PL 49B 263(74)



A = 37 (EB; JMD)

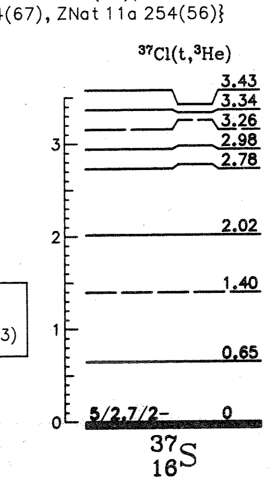


$^{37}_{15}$P

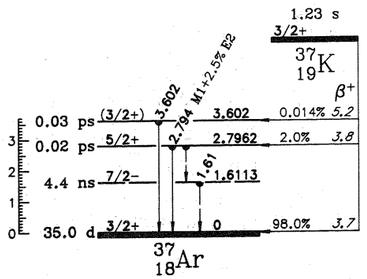
Δ: −19.01 (from systematics) {ANDT 19 175(77)}
Class: R; **Ident:** ^{232}Th(^{40}Ar,^{37}P) {NP A176 284(71)}

$^{37}_{16}$S

Δ: −26.908 30 {ANDT 19 175(77)}
✱: β^- {HPAc 18 263(45), PR 163 1094(67)}
$t_{1/2}$: 4.992 m {NP A223 620(74)}; 5.071 m {NSEg 5 55(59)}; 5.042 m {HPAc 19 137(46)}; **others:** {NP A98 451(67), PR 163 1094(67), RSCi 8 13(67), NP 9 334(58)}
Class: A; **Ident:** chem, excit, cross bomb {HPAc 18 263(45), HPAc 19 137(46)}; genet energy levels {NP A156 28(70), PR C7 854(73)}
Prod: ^{37}Cl(n,p) {PR 163 1094(67), NP A118 185(68), NP A156 28(70)}; ^{40}Ar(n,α) {PR C3 413(71), PR C7 854(73)}; ^{36}S(n,γ) {HPAc 19 137(46), HPAc 18 263(45)}
β^-: **4.75**4 (5.6 6%), **1.64**4 (94%), **1.04**4 *mag* {PR 163 1094(67)}
others: {HPAc 19 137(46), HPAc 18 263(45)}
γ: ⟨**norm:** $\gamma_{3.103}$ (γ 94.2 6%), from level scheme⟩ **0.9063**4 ($\dagger_\gamma$0.062 1), **3.1033**2 ($\dagger_\gamma$100), **3.7404**5 ($\dagger_\gamma$0.23 2), **4.0093**7 ($\dagger_\gamma$0.018 4) *Ge(Li), Ge(Li)−scint γγ coinc* {PR C9 1453(74)}
0.9081 ($\dagger_\gamma$0.063 4), **3.1030**3 ($\dagger_\gamma$100), **3.7416**4 ($\dagger_\gamma$0.28 2), **4.011**1 ($\dagger_\gamma$0.033 4) *Ge(Li)* {NP A223 620(74)}
3.10333 ($\dagger_\gamma$100), **3.7418**4 ($\dagger_\gamma$0.30 3) *Ge(Li)* {NP A156 28(70), PR C7 854(73)}
others: {PR C3 413(71), PR C2 948(70), NP A118 185(68), RaAc 10 1(68), PR 163 1094(67), ZNat 11a 254(56)}



$^{37}_{16}$S levels − References
^{37}Cl(t,^{3}He): NP A142 641(70), NP A214 1(73)



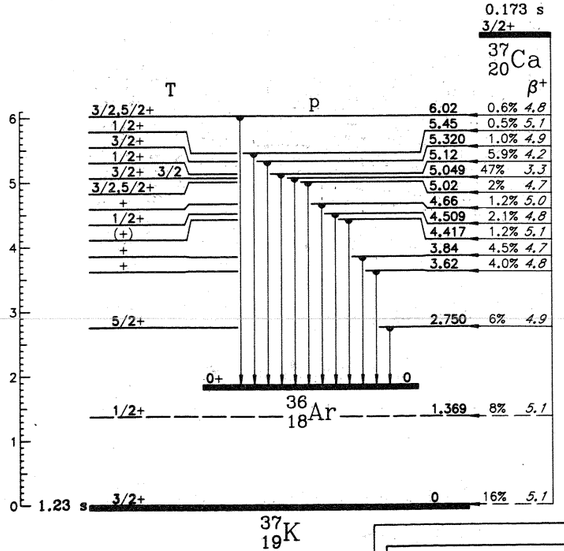
$^{37}_{18}$Ar levels – References

Decay: NP A170 111(71), PL 12 229(64), PR 175 1426(68), NP A214 1(73), NP A258 341(76)
14 reactions: NP A214 1(73), JPAL 7 83(74), JPGL 1 35(75), PR C14 996(76), CJP 53 2534(75), PR C10 1050(74), NP A250 309(75), PL 60B 32(75)

$^{37}_{19}$K

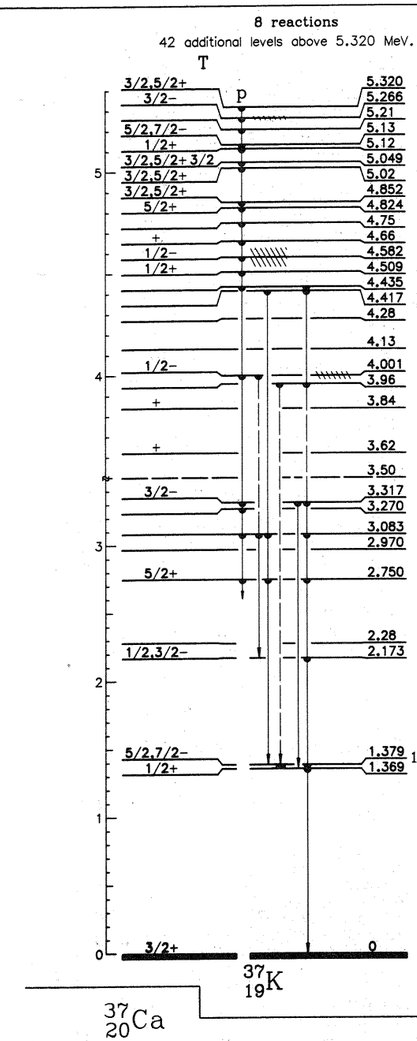
Δ: −24.7994 *14* {ANDT 19 175(77)}
I: 3/2 *OP/RD* {PL 26B 721(68)}
%: β^+ {PR 84 1059(51)}
$t_{1/2}$: 1.232 s {PR 110 1414(58)}; 1.254 s {PL 12 229(64), PL 13 358(64)}; **others:** {NP A170 111(71), PR 117 1297(60), PR 109 109(58), PR 96 773(54), PR 84 1059(51), PR 74 1559(48)}
Class: A; **Ident:** excit {PR 74 1559(48)}; genet energy levels {PR 175 1426(68), NP A170 111(71)}
Prod: ^{40}Ca(p,α) {PR 117 1297(60), PR 109 109(58), PR 110 1414(58), PL 12 229(64), PL 13 358(64), NP A170 111(71)}; ^{36}Ar(^{3}He,d) {PR 175 1426(68)}
β^+: **5.15** *7 mag* {PR 117 1297(60)}
5.10 *7 mag* {PR 109 109(58)}
others: {PR 84 1059(51)}
γ: (**norm:** $\gamma_{2.794}$ (γ 2.04%), PL 12 229(64)) **2.7944** *8* ($\dagger_\gamma$100), **3.602** *2* ($\dagger_\gamma$1.75) *Ge(Li)* {NP A170 111(71), PR 175 1426(68)}
1.61?, $\gamma_{2.794}$ ($\dagger_\gamma$100), $\gamma_{3.602}$ ($\dagger_\gamma$0.97 *17*) *Ge(Li)* {NP A258 341(76)}
$t_{1/2}$(1.379): 10.5 ns *delay coinc* {PRL 27 603(71)}

β^+ intensities to levels above 1.369 MeV were calculated from the relative proton intensities and the assumed log ft (=3.30) for the superallowed β transition to the 5.049-MeV level. The ground-state β^+ feeding was obtained from the mirror ^{37}Ar decay.



$^{37}_{19}$K levels – References

Decay: NP A234 130(74), PR 152 995(66), PRL 13 767(64), PRL 13 764(64)
8 reactions: NP A214 1(73)

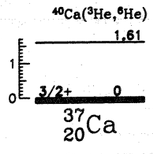


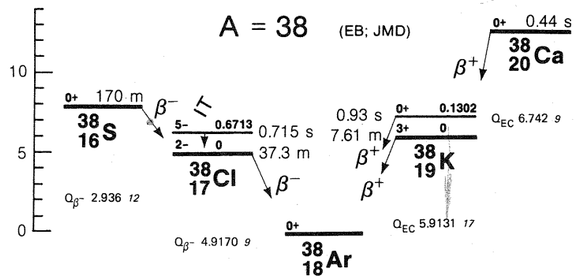
Δ: −13.164 *39* {ANDT 19 175(77)}
%: β^+, β^+p {PRL 13 764(64), PRL 13 767(64)}
$t_{1/2}$: 0.173 *4* s {PRL 13 764(64)}; 0.177 *5* s {PR 152 995(66)}; 0.170 *5* s {PRL 13 767(64)}
Class: A; **Ident:** excit, decay charac {PRL 13 767(64), PRL 13 764(64)}; genet energy levels {PR 152 995(66)}
Prod: ^{39}K(p,3n) {PRL 13 764(64)}; ^{40}Ca(p,d2n) {PRL 13 764(64)}; ^{36}Ar(^{3}He,2n) {PRL 13 767(64), PR 152 995(66)}
p: **0.870** *15* (†13.8 *15*), **1.709** *10* (†8.7 *8*), **1.925** *10* (†9.7 *6*), **2.498** *20* (†2.5 *3*), **2.580** *20* (†4.5 *4*), **2.745** *20* (†2.5 *10*), **3.063** *15* (†4.0 *12*), $p_{3.103}$ (†100), **3.173** *10* (†12.8 *10*), **3.339** *30* (†1.7 *4*), **3.487** *20* (†1.1 *4*), **4.046** *20* (†1.4 *2*) *semicond* {NP A234 130(74)}
1.69 *3* (†8), **1.934** (†6), **2.186** (†3), **2.476** (†6), **2.696** (†7), **3.078** *19* (†100), **4.01** *3* (†2.1), **4.37** *6* (†1.0), **4.57** *6* (†1.0), **4.99** *3* (†0.7) *semicond* {PR 152 995(66)}
others: {NP 81 113(66), PRL 13 767(64), PRL 13 764(64)}

$^{37}_{20}$Ca levels – References

^{40}Ca(^{3}He,^{6}He): PR 174 1247(68), PR 166 1096(68), PR C8 210(73), NP A214 1(73)

^{40}Ca(^{3}He,^{6}He)



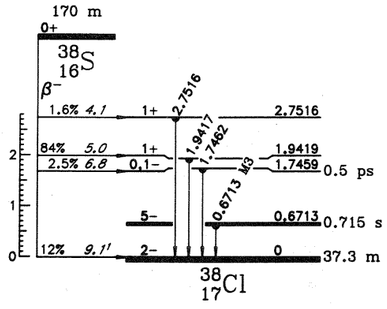


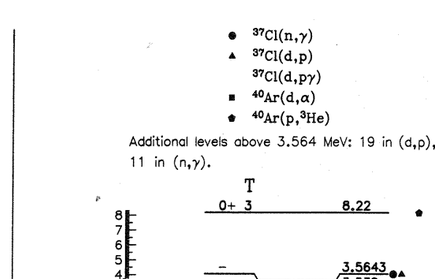
$^{38}_{15}$P

Δ: −14.56 (from systematics) {ANDT 19 175(77)}
Class: R; **Ident:** ^{232}Th(^{40}Ar,^{38}P) {NP A176 284(71)}

$^{38}_{16}$S

Δ: −26.862 *12* {ANDT 19 175(77)}
%: β^- {PR 109 504(58), PR C3 180(71)}
genet: parent ^{38}Cl, not parent ^{38m}Cl {PR 109 504(58), RaAc 17 212(72)}
$t_{1/2}$: 169.6 *7* m {PR C3 180(71)}; 170.0 *8* m {RaAc 17 212(72)}; 172 *1* m {PR 109 504(58)}
Class: A; **Ident:** chem, genet {PR 109 504(58), RaAc 17 212(72)}; sep isotopes, genet, genet energy levels {PR C3 180(71)}
Prod: ^{37}Cl(α,3p) {PR 109 504(58)}; ^{36}S(t,p) {PR C3 180(71)}; ^{40}Ar(γ,2p) {RaAc 17 212(72)}
β^-: **1.005** *20 semicond–Ge(Li) βγ coinc* {PR C3 180(71)}
0.994 *12 Si(Li)–Ge(Li) βγ coinc* {RaAc 17 212(72)}
3.02 *2* (53%), **1.1** *1* (95%) *abs, scint, scint–scint βγ coinc* {PR 109 504(58)}
γ: (**norm:** $\gamma_{1.942}$ (γ 84 *2*%), NP A214 1(73)) **1.7462** *2* ($\dagger_\gamma$3.44), **1.9417** *2* ($\dagger_\gamma$100) *Ge(Li), Ge(Li)–scint γγ coinc* {PR C3 180(71)}
0.1962 *4* ($\dagger_\gamma$0.20 *7*, coinc $\gamma_{1.746}$), **1.7459** *5* ($\dagger_\gamma$2.6 *3*), **1.9421** *3* ($\dagger_\gamma$100), **2.7516** *5* ($\dagger_\gamma$1.9 *2*) *Ge(Li), Ge(Li) anti–Compt, Ge(Li)–Ge(Li) γγ coinc* {RaAc 17 212(72)}
others: {PR 109 504(58)}





$^{38}_{17}$Cl levels – References

Decay: NP A214 1(73), PR C3 180(71), RaAc 17 212(72), ZP 170 76(62), RaAc 21 214(74)
^{37}Cl(n,γ): ZP 170 76(62), NIM 104 45(72), NP A215 260(73), NP A214 1(73)
^{37}Cl(d,p), ^{37}Cl(d,pγ): PR 100 1317(55), PR 128 305(62), NP 83 80(66), PR C5 431(72), NP A214 1(73), NP A225 93(74), PR C7 1956(73), PR C10 1213(74)
^{40}Ar(d,α): JPJa 30 1523(71), NP A214 1(73)
^{40}Ar(p,^{3}He): PR C1 561(70)

$^{38}_{17}$Cl

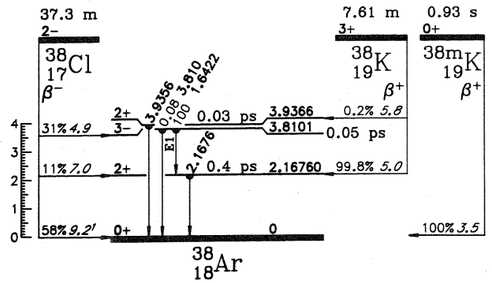
Δ: −29.7980 *4* {ANDT 19 175(77)}
%: β^- {PR 49 368(36)}
$t_{1/2}$: 37.294 m {PR 80 917(50)}; 37.18 *7* m {RaAc 12 214(69)}; 37.42 m {NSEg 48 319(72)}; 37.12 m {NIM 17 225(62)}; **others:** {BARB 41 467(55), BARB 40 802(54), ArkM 33An9(46), ArkM 32An16(45), PRSL 174A 546(40), PR 51 1033(37), PR 49 889(36)}
Class: A; **Ident:** chem, n-capt {PRSL 149A 522(35)}; chem, sep isotopes {PR 57 843(40)}
Prod: ^{37}Cl(n,γ) {PRSL 149A 522(35), PR 57 843(40), PR 72 888(47), PPMJ 23 599(41)}; ^{37}Cl(d,p) {NP A112 372(68)}; daughter ^{38}S {PR 109 504(58), PR C3 180(71)}
β^-: **4.913** *5* (57.6 *13*%), $\beta_{2.77}$ (11.1 *6*%), $\beta_{1.11}$ (31.3 *6*%) *mag* {NP A112 372(68)}
4.81 *5* (53%), **2.77** *5* (16%), **1.11** *1* (31%) *mag* {PR 77 50(50)}
others: {PPMJ 23 618(41), PPMJ 21 626(39)}
γ: (**norm:** $\gamma_{2.168}$ (γ 42 *2*%), from level scheme) **1.64216** *13* ($\dagger_\gamma$73.8 *9*), **2.16760** *16* ($\dagger_\gamma$100), **3.810** *2* ($\dagger_\gamma$0.061 *5*) *Ge(Li)* {NP A112 372(68)}
1.64242 *15* ($\dagger_\gamma$76.7 *7*), **2.16741** *12* ($\dagger_\gamma$100) *Ge(Li)* {NP A215 260(73)}
others: {HPAc 46 99(73), RaAc 17 212(72), PR C3 180(71), HPAc 40 340(67), PR 154 1116(67), PR 140 B1529(65), NP 60 544(64), NP 51 684(64), NIM 17 225(62), PR 75 992(49), ArkM 33An9(46), PPMJ 23 605(41), PRSL 174A 546(40)}
$\beta\gamma(\theta)$: {HPAc 41 77(68)}
$\gamma\gamma(\theta)$: {HPAc 46 99(73), PR 95 456(54), PR 80 115(50)}
$\beta\gamma_{cp}(\theta)$: {HPAc 41 77(68)}
$t_{1/2}$(levels): **0.755:** 225 *24* fs *Doppler* {PR C10 1213(74)}, 201 *21* fs *Doppler* {PR C7 1956(73)}; **1.309:** 0.35 *3* ps *Doppler* {PR C10 1213(74)}, 0.39^{+10}_{-7} ps *Doppler* {PR C7 1956(73)}, 0.69 *21* ps *Doppler* {PRL 25 1352(70)}; **1.617:** 1.5 *1* ps *Doppler* {PR C7 1120(73)}, 0.77^{+13}_{-9} ps *Doppler* {PR C10 1213(74)}, 1.0^{+2}_{-4} ps *Doppler* {PR C7 1956(73)}; **1.692:** 0.92^{+13}_{-13} ps *Doppler* {PR C10 1213(74)}, 0.83^{+21}_{-14} ps *Doppler* {PR C7 1956(73)}; **1.746:** 0.44^{+13}_{-8} ps *Doppler* {PR C10 1213(74)}, 0.72 ps *Doppler* {PR C7 1956(73)}; **1.785:** 69 *10* fs *Doppler* {PR C10 1213(74)}; **1.981:** 0.232 ps *Doppler* {PR C10 1213(74)}, 0.396 ps *Doppler* {PR C7 1120(73)}, 0.306 ps *Doppler* {PR C5 431(72)}, 0.186 ps *Doppler* {PR C7 1956(73)}; **2.743:** 28 *14* fs *Doppler* {PR C7 1956(73)}, <20 fs *Doppler* {PR C5 431(72), PR C10 1213(74)}; **others:** {PR C7 1956(73), PR C5 431(72), PRL 25 1352(70)}

$^{38m}_{17}Cl$

Δ: −29.12674 {ANDT 19 175(77)}
☢: IT {ZP 170 76(62)}
$t_{1/2}$: 0.715429 s {NIM 104 45(72)}; **others:** {RaAc 21 214(74), ZP 170 76(62), PR 95 613(54)}
Class: C; **Ident:** n−capt, sep isotopes {PR 95 613(54)}
Prod: ^{37}Cl(n,γ) {ZP 170 76(62), PR 95 613(54), NIM 104 45(72)}
γ: (**norm:** $\gamma_{0.671}$ (γ 99.95 1%), from level scheme) **0.67133**20 (e/γ 5.012×10^{-4}) *Ge(Li), scint, scint conv* {RaAc 21 214(74), ZP 170 76(62)}

$^{38}_{18}Ar$

%: 0.063 (atmospheric sources; large variations reported for other sources) {BNL−NCS−50605(77)}
Δ: −34.71508 {ANDT 19 175(77)}
I: 0 *O* {HPAc 26 811(53)}
σ_a: 0.82 (reactor spectrum) {PC77 Holden}
$t_{1/2}$(levels): **2.166:** 0.472 ps *Doppler* {PR C14 596(76)}, 0.375 ps *Doppler* {NP A138 588(69)}, 0.318 ps *Doppler* {NP A127 13(69)}
3.377: 192 ps *recoil dist Doppler* {NP A181 403(72)}, 244 ps *recoil dist Doppler* {NP A182 529(72)}
3.810: 4814 fs *Doppler* {NP A108 233(68), PC68 Lieb, NP A214 1(73)}, 5221 fs *Doppler* {NP A138 588(69)}
3.937: 3212 fs *Doppler* {NP A168 56(71)}, 7311 fs *Doppler* {NP A107 305(68)}, <28 fs *Doppler* {NP A168 56(71)}
4.480: 1.9$^{+14}_{-9}$ ps *Doppler* {NP A168 56(71)}, 1.1$^{+8}_{-3}$ ps *Doppler* {NP A182 529(72)}
4.565: 337 fs *Doppler* {NP A107 305(68)}, 5114 fs *Doppler* {NP A168 56(71)}
4.585: 1344 ps *recoil dist Doppler* {PR C13 1217(76)}, 1304 ps *recoil dist Doppler* {PR C13 1944(76)}
4.710: >0.4 ps *Doppler* {NP A220 317(74)}
4.877: 279 fs *Doppler* {NP A107 305(68)}, 3111 fs *Doppler* {NP A220 317(74)}
5.084: 5721 fs *Doppler* {NP A168 56(71)}
5.157: 2813 fs *Doppler* {NP A168 56(71)}, 157 fs *Doppler* {NP A220 317(74)}
5.349: 13542 fs *Doppler* {NP A168 56(71)}, 14649 fs *Doppler* {NP A220 317(74)}
5.513: 0.196 ps *Doppler* {NP A168 56(71)}, 0.2111 ps *Doppler* {NP A220 317(74)}
5.552: 86 fs *Doppler* {NP A220 317(74)}
5.595: 7621 fs *Doppler* {NP A220 317(74)}
5.658: 4410 fs *Doppler* {NP A107 305(68)}, 288 fs *Doppler* {NP A220 317(74)}, 6428 fs *Doppler* {NP A168 56(71)}
5.734: <4 fs *Doppler* {NP A220 317(74)}
5.825: 0.24$^{+62}_{-14}$ ps *Doppler* {NP A220 317(74)}
5.857: <11 fs *Doppler* {NP A220 317(74)}
5.975: >1.7 ps *Doppler* {NP A220 317(74)}
6.042: 6228 fs *Doppler* {NP A220 317(74)}
6.053: 6928 fs *Doppler* {NP A220 317(74)}
6.211: 6217 fs *Doppler* {NP A107 305(68)}
6.214: 76 fs *Doppler* {NP A220 317(74)}
6.339: <13 fs *Doppler* {NP A220 317(74)}
6.353: 43 fs *Doppler* {NP A220 317(74)}
6.408: 1.03 ps *Doppler* {NP A226 326(74)}
6.496: 87 fs *Doppler* {NP A220 317(74)}
6.574: <4 fs *Doppler* {NP A220 317(74)}
6.601: 175 fs *Doppler* {NP A107 305(68)}, 117 fs *Doppler* {NP A220 317(74)}
6.622: 3528 fs *Doppler* {NP A220 317(74)}
6.674: 165 fs *Doppler* {NP A220 317(74)}
6.682: >28 fs *Doppler* {NP A220 317(74)}
6.773: <3 fs *Doppler* {NP A220 317(74)}
6.824: <14 fs *Doppler* {NP A220 317(74)}
7.070: 5114 fs *Doppler* {ZP A278 319(76)}
7.101: <3 fs *Doppler* {NP A220 317(74)}
7.288: 5321 fs *Doppler* {ZP 271 195(74)}
7.431: <13 fs *Doppler* {NP A220 317(74)}
7.508: <1.4 ps *recoil dist Doppler* {PR C13 1944(76)}, ≥0.04 ps *Doppler* {ZP A278 319(76)}
7.609: 63 ps *recoil dist Doppler* {PR C13 1944(76)}
8.013: 42 ps *recoil dist Doppler* {NP A272 466(76), PR C13 1944(76)}
8.077: 0.113 ps *Doppler* {ZP A278 319(76)}
8.972: ≦28 fs *Doppler* {ZP A278 319(76)}
9.341: 7317 fs *Doppler* {ZP 271 195(74)}
10.173: <1.4 ps *recoil dist Doppler* {NP A272 466(76)}
11.614: 52 ps *recoil dist Doppler* {PR C13 1944(76)}
others: {PR C13 1944(76), NP A226 326(74), PL 51B 133(74), NP A214 1(73), PR C8 168(73), NP A187 1(72), NP A182 529(72), NP A181 403(72), NP A172 401(71), NP A168 56(71), JPAL 3 73(70), PL 33B 353(70), NP A138 588(69), NP A108 233(68), NP A107 305(68), PC68 Lieb}

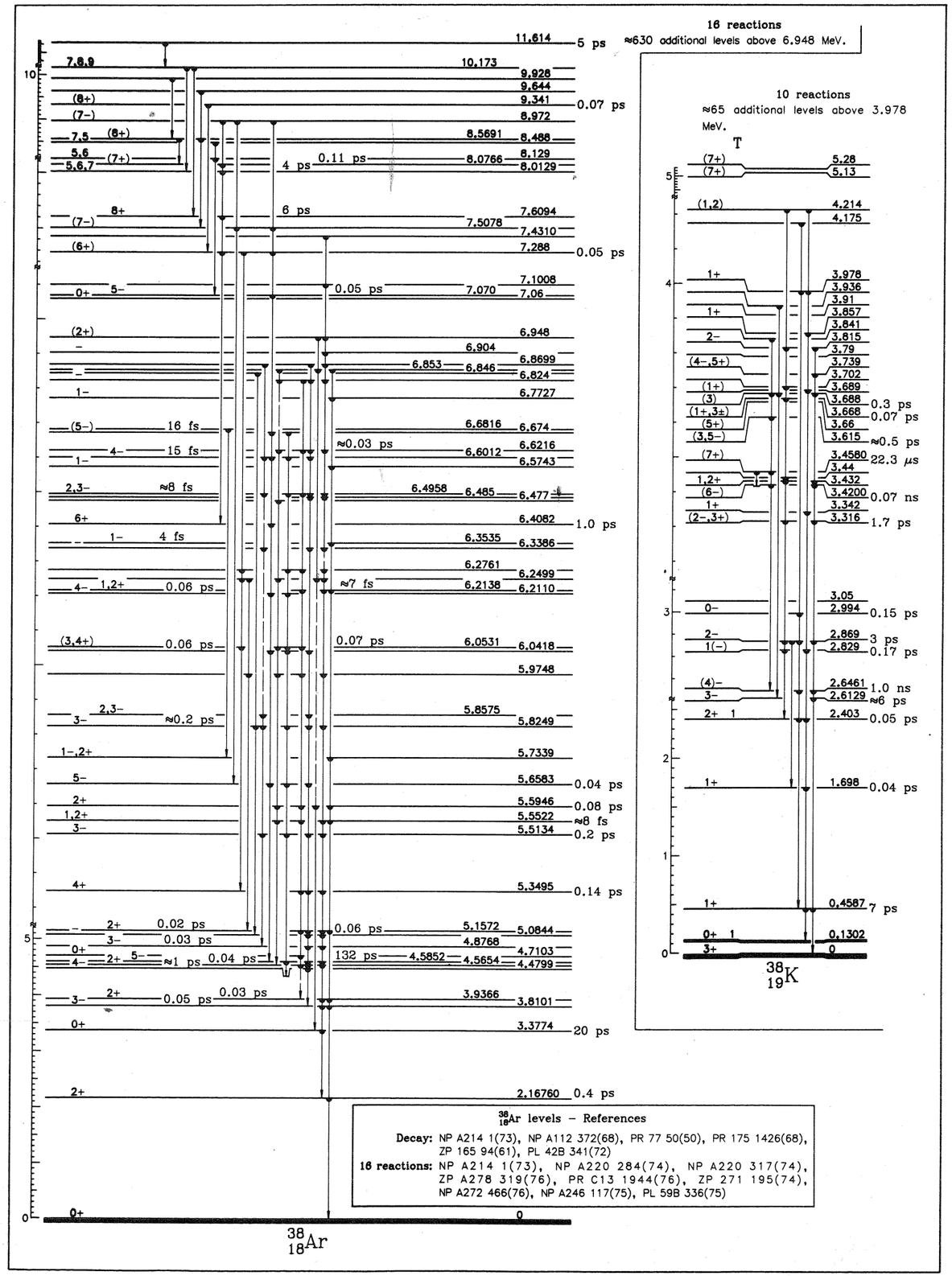


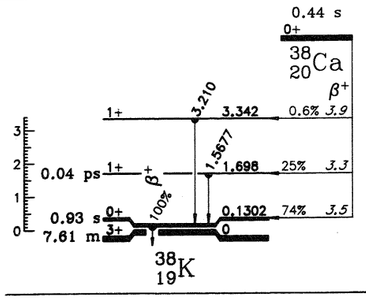
$^{38}_{19}K$

Δ: −28.80201 6 {ANDT 19 175(77)}
I: 3 *AB* {PR 138 B773(65)}
☢: β+ {PR 51 1033(37)}
$t_{1/2}$: 7.6131 m {RaAc 14 46(70)}; 7.604 m {IzF 31 284(67)}; 7.702 m {NP 61 479(65)}; 7.675 m {NP 63 438(65)}; **others:** {PR 175 1426(68), PR 138 B773(65), NP 41 364(63), PR 101 776(56), PR 74 442(48), PR 72 639(47), PR 52 889(37), PR 51 1033(37)}
Class: A; **Ident:** chem, cross bomb {PR 51 1033(37), PR 51 1107(37)}
Prod: ^{35}Cl(α,n) {PR 51 1033(37), PR 52 889(37), PR 51 1107(37), PR 72 639(47), IzF 31 284(67)}; ^{40}Ca(d,α) {PR 51 1033(37), RaAc 14 46(70)}; ^{36}Ar(^{3}He,p) {PR 175 1426(68)}
β+: no $\beta_{4.69}$ (<0.6%), **2.685** *mag* {PR 101 776(56)}
2.605 *mag* {IzF 31 284(67)}
γ: **2.16753** (γ 99.805%), **3.93565** (γ 0.205%) *Ge(Li)* {PR 175 1426(68)}
$\gamma_{2.168}$ (γ 99.9 1%), $\gamma_{3.937}$ (γ 0.1415%) *Ge(Li)* {NP A258 341(76)}
1.65 (I$_\gamma$0.51), **2.17** (I$_\gamma$100) *scint, scint−scint γγ coinc* {NP 60 544(64)}
others: {NP 41 364(63), PR 84 847(51)}
$\beta\gamma_{cp}(\theta)$: {NIM 122 369(74)}
$t_{1/2}$(levels): **0.459:** 7.06 ps *recoil dist Doppler* {NP A226 326(74)}, 8.314 ps *recoil dist Doppler* {PR C15 303(77)}
1.698: 4512 fs *Doppler* {PR C8 2240(73)}, 3717 fs *Doppler* {NP A162 295(71)}, 5724 fs *Doppler* {PR C11 1925(75)}
2.403: 6217 fs *Doppler* {PR C8 2240(73)}, 3717 fs *Doppler* {NP A162 295(71)}, 5335 fs *Doppler* {PR C11 1925(75)}
2.613: 6.2$^{+49}_{-14}$ ps *Doppler* {PR C8 2240(73)}
2.646: 0.9810 ns *recoil dist Doppler* {NP A226 326(74)}
2.829: 0.195 ps *Doppler* {PR C8 2240(73)}, 0.14$^{+5}_{-4}$ ps *Doppler* {PR C11 1925(75)}
2.869: 3.18 ps *Doppler* {PR C8 2240(73)}
2.994: 15235 fs *Doppler* {PR C8 2240(73)}
3.316: 1.73 ps *Doppler* {PR C8 2240(73)}
3.342: <38 fs *Doppler* {PR C8 2240(73)}
3.420: 7010 ps *recoil dist Doppler* {NP A226 326(74)}
3.432: <0.12 ps *Doppler* {PR C11 1925(75)}
3.458: 22.56 μs {PR C9 1857(74)}, 22.17 μs {PL 48B 28(74)}
3.615: 0.5$^{+6}_{-2}$ ps *Doppler* {PR C11 1925(75)}
3.668: 6638 fs *Doppler* {PR C11 1925(75)}
3.688: 0.28$^{+11}_{-6}$ ps *Doppler* {PR C11 1925(75)}
3.702: >0.76 ps *Doppler* {PR C11 1925(75)}
3.857: <83 fs *Doppler* {PR C11 1925(75), PR C8 2240(73)}
3.978: <38 fs *Doppler* {PR C11 1925(75), PR C8 2240(73)}
others: {PR C11 1925(75), PR C8 2240(73), NP A162 295(71)}

$^{38m}_{19}K$

Δ: −28.6713 {ANDT 19 175(77)}
☢: β+ {HPAc 26 691(53), PR 92 1076(53)}; no IT {NuoC s10v25 41(62)}
$t_{1/2}$: 0.92567 s {NP A242 62(75)}; 0.92231 s {PR C13 2517(76)}; 0.929235 s {PL 42B 341(72)}; 0.9388 s {ZNat 15a 593(60)}; 0.94412 s {ZP 158 111(60)}; 0.9517 s {PR 108 1495(57)}; 0.94810 s {ZP 165 94(61)}; 0.9707 s {NP 7 296(58)}; **others:** {PR 96 1620(54), PR 92 1076(53)}
Class: C; **Ident:** excit {HPAc 26 691(53), PR 92 1076(53), PR 96 1620(54)}
Prod: ^{35}Cl(α,n) {ZP 158 111(60), ZP 165 94(61)}; ^{39}K(γ,n) {PR 92 1076(53), PR 96 1620(54), NuoC s10v25 41(62)}; ^{40}Ca(d,α) {NP 48 129(63), NP 63 504(65), PR 116 981(59)}; ^{36}Ar(t,n) {PL 42B 341(72)}
β+: **5.007** *scint* {ZP 165 94(61)}
others: {IzF 31 284(67)}
γ: no γ rays observed *scint* {NuoC s10v25 41(62)}





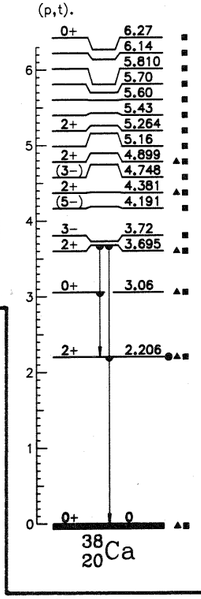
$^{38}_{19}$K levels – References

Decay: NP A214 1(73), PR 175 1426(68), PR 186 1160(69)
10 reactions: NP A214 1(73), PR C11 1925(75), PR C8 2240(73), NP A226 326(74), PR C9 1857(74), PR C10 2184(74), PR C15 303(77), PR C14 908(76), PR C10 1422(74), PR C13 2077(76), NP A265 220(76)

$^{38}_{20}$Ca

● ^{24}Mg(^{16}O,2n)
▲ ^{36}Ar(^{3}He,n) ^{36}Ar(^{3}He,nγ)
■ ^{40}Ca(p,t)

Additional levels above 6.27 MeV: 7 in (p,t).

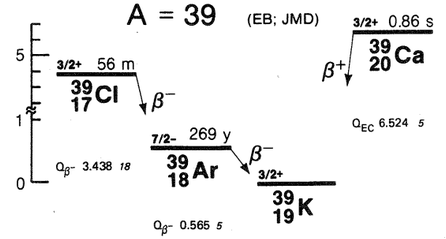


Δ: −22.060*9* {ANDT 19 175(77)}
%: β⁻ {PR 108 1495(57)}
genet: parent ^{38m}K, not parent ^{38}K {PR 175 1426(68), PR 186 1160(69)}
$t_{1/2}$: 439 *12* ms {PR 186 1160(69)}; 470 *20* ms {PR 175 1426(68)}; 660 *50* ms {PR 108 1495(57)}; **others:** {NP A181 465(72)}
Class: A; **Ident:** excit, decay charac {PR 108 1495(57)}; genet energy levels {PR 175 1426(68)}
Prod: ^{40}Ca(γ,2n) {PR 108 1495(57)}; ^{36}Ar(^{3}He,n) {PR 175 1426(68), PR 186 1160(69)}; ^{24}Mg(^{16}O,2n) {NP A181 465(72)}
γ: ⟨**norm:** $\gamma_{1.568}$ (γ 25 *4*%), from level scheme⟩ **1.5677** *5* ($\dagger_\gamma$100), no $\gamma_{3.5}$ ($\dagger_\gamma$<0.4) *Ge(Li)* {PR 175 1426(68)}
$\gamma_{1.568}$ ($\dagger_\gamma$100), **3.210** *2* ($\dagger_\gamma$2.3 *5*) *Ge(Li)* {PR 186 1160(69)}
3.5 *1 scint* {PR 108 1495(57)}

$^{38}_{20}$Ca levels – References

^{24}Mg(^{16}O,2n): NP A181 465(72), NP A214 1(73)
^{36}Ar(^{3}He,n), ^{36}Ar(^{3}He,nγ): NP A128 73(69), NP A144 17(70), NP A214 1(73)
^{40}Ca(p,t): NP A276 201(77), PL 49B 37(74), PL 23 487(66), PR C5 485(72), NP A214 1(73)

A = 39 (EB; JMD)



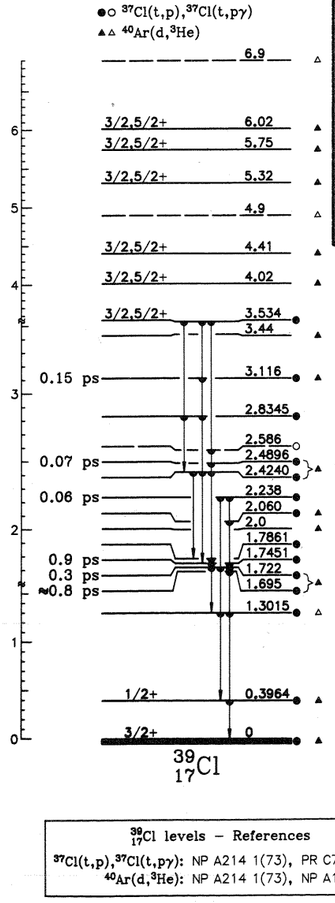
$^{39}_{16}$S

Δ: −23.00 (from systematics) {ANDT 19 175(77)}
Class: R; **Ident:** ^{232}Th(^{40}Ar,^{39}S) {NP A176 284(71)}

$^{39}_{17}$Cl

Δ: −29.803 *18* {ANDT 19 175(77)}
%: β⁻ {PR 76 704(49)}
$t_{1/2}$: 56.2 *6* m {PR C5 128(72)}; 55.5 *2* m {PR 76 704(49)}; **others:** {PR 87 358(52), UCRL−142(48)}
Class: A; **Ident:** chem {UCRL−142(48)}; chem, excit {PR 76 704(49)}
Prod: ^{40}Ar(α,αp) {PR 104 740(56)}; ^{40}Ar(γ,p) {PR 76 704(49), PR 80 318(50)}; ^{37}Cl(t,p) {PR C5 128(72)}
β⁻: **3.45** *2* (72%), **2.18** (8 *4*%), **1.91** *2* (85 *6*%) *mag* {PR 104 740(56)}
γ: ⟨**norm:** $\gamma_{1.267}$ (γ 54.3 *13*%), from level scheme⟩ **0.250267** ($\dagger_\gamma$86.6 *30*), **0.8414** *13* ($\dagger_\gamma$0.10 *6*), **0.8566** *13* ($\dagger_\gamma$0.07 *5*), **0.98579** *14* ($\dagger_\gamma$4.0 *2*), **1.09097** *11* ($\dagger_\gamma$4.7 *2*), **1.2354** *10* ($\dagger_\gamma$0.21 *8*), **1.267205** ($\dagger_\gamma$100), **1.3121** *10* ($\dagger_\gamma$0.53 *6*), **1.51736** *8* ($\dagger_\gamma$1.0 *1 5*), **1.5616** *10* ($\dagger_\gamma$0.58 *6*), **2.093** *1* ($\dagger_\gamma$0.15 *2*) *Ge(Li), Ge(Li)−scint γγ coinc* {PR C5 128(72)}
$\gamma_{0.250}$ (e/γ <0.002), $\gamma_{1.267}$ (e/γ <0.0016), $\gamma_{1.517}$ (e/γ <0.003) *scint, scint−scint γβ coinc, scint−scint γγ coinc* {PR 104 740(56)}
$\beta\gamma_{cp}(\theta)$: {ZP A277 173(76)}
$t_{1/2}$(levels): **0.396:** >1.4 ps *Doppler* {PR C7 170(73)}
1.301: >2 ps *Doppler* {PR C7 170(73)}
1.695: 0.8 $^{+10}_{-4}$ ps *Doppler* {PR C7 170(73)}
1.722: 0.30 *6* ps *Doppler* {PR C7 170(73)}
1.745: 0.9 *3* ps *Doppler* {PR C7 170(73)}
1.786: >1.4 ps *Doppler* {PR C7 170(73)}
2.060: <35 fs *Doppler* {PR C7 170(73)}
2.238: 55 *28* fs *Doppler* {PR C7 170(73)}
2.424: >1.4 ps *Doppler* {PR C7 170(73)}
2.490: 69 *35* fs *Doppler* {PR C7 170(73)}
2.586: <0.21 ps *Doppler* {PR C7 170(73)}
2.834: >1.4 ps *Doppler* {PR C7 170(73)}
3.116: 0.15 *4* ps *Doppler* {PR C7 170(73)}
3.534: <0.11 ps *Doppler* {PR C7 170(73)}

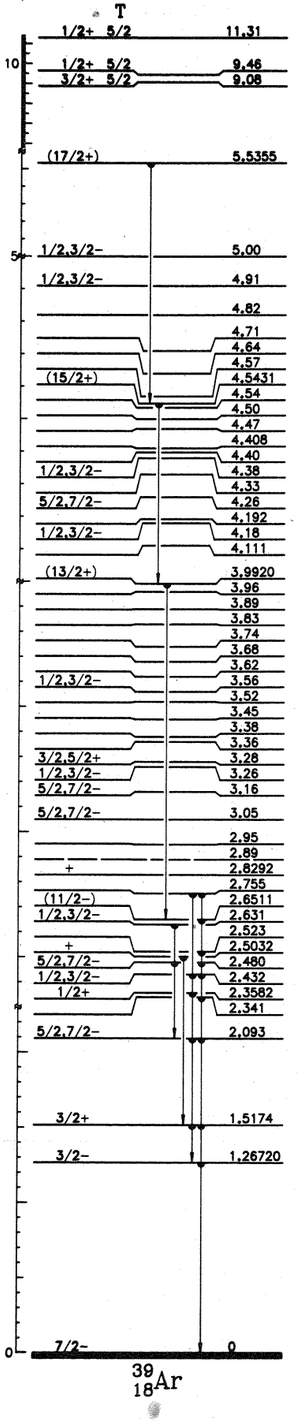
●○ ^{37}Cl(t,p),^{37}Cl(t,pγ)
▲△ ^{40}Ar(d,^{3}He)



$^{39}_{17}$Cl levels – References

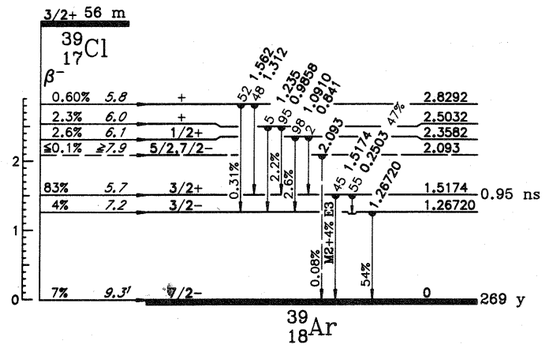
^{37}Cl(t,p),^{37}Cl(t,pγ): NP A214 1(73), PR C7 170(73)
^{40}Ar(d,^{3}He): NP A214 1(73), NP A129 469(69)

11 reactions
55 additional levels above 5.00 MeV.



$^{39}_{18}$Ar

Δ: −33.241 *5* {ANDT 19 175(77)}
I: 7/2 *0* {JOSA 57 1452(67)}
σ_0: 600 *300* (reactor spectrum) {PC77 Holden}
%: β⁻ {PR 79 902(50)}
$t_{1/2}$: 269 *3* y *sp act* {Sci 148 1325(65)}; ≈265 y *sp act* {PR 86 811(52)}
Class: B; **Ident:** chem, excit {PR 86 811(52)}
Prod: neutrons on KCl {PR 86 811(52)}; ^{38}Ar(n,γ) {PR 87 886(52)}
β⁻: **0.565** *5 mag* {PR 79 902(50)}
γ: no γ rays observed (lim γ 0.1%) *scint* {PR 79 902(50)}
$t_{1/2}$(levels): **1.517:** 0.955 ns *delay coinc* {PR 104 740(56)}
2.651: <3 ps *Doppler* {PR C13 1762(76)}
3.992: <3 ps *Doppler* {PR C13 1762(76)}
4.543: 0.7 ps<$t_{1/2}$<2 ps *Doppler* {PR C13 1762(76)}
5.536: <0.7 ps *Doppler* {PR C13 1762(76)}



$^{39}_{18}$Ar levels – References

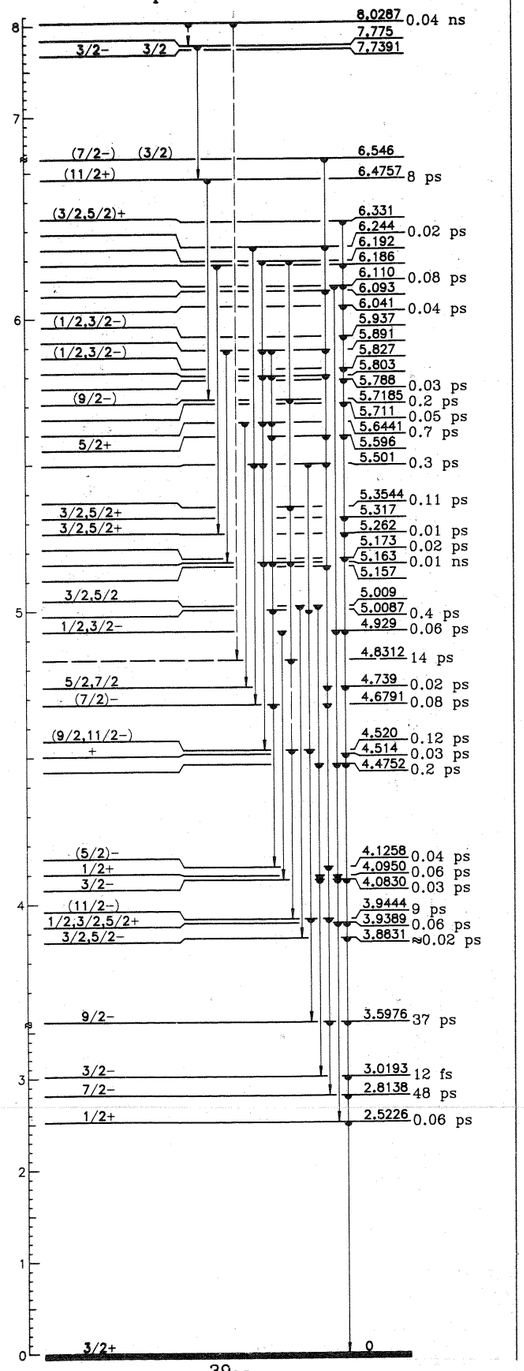
Decay: PR C5 128(72), PR 104 740(56), NP A214 1(73), ZP A277 173(76)
11 reactions: NP A214 1(73), PR C15 505(77), PR C13 1762(76), PL 60B 32(75), NP A250 45(75)

$^{39}_{19}$K

%: 93.26 {BNL−NCS−50605(77)}
Δ: −33.8062 *8* {ANDT 19 175(77)}
I: 3/2 *0, AB* {Nat 140 276(37), PR 47 739(35), PR 48 746(35)}
σ_0: 2.1 *2* (reactor spectrum) {PC77 Holden}
σ(n,α): 0.00435 {PC77 Holden}
$t_{1/2}$(levels): **2.523:** 61 *12* fs *Doppler* {PR C3 2232(71)}, 73 *22* fs *Doppler* {NP A132 481(69)}, 49 *13* fs *Doppler* {NP A219 1(74)}, 22 *8* fs *Doppler* {PScr 1 169(70)}
2.814: 494 ps *delay coinc* {CJP 52 1090(74)}, 486 ps *recoil dist Doppler* {PR C9 953(74)}, 434 ps *recoil dist Doppler* {ZP A272 403(75)}, 546 ps *recoil dist Doppler* {PR C6 873(72)}
3.019: 154 fs *Doppler* {PScr 1 169(70)}, 104 fs *Doppler* {NP A151 465(70)}
3.598: 353 ps *recoil dist Doppler* {ZP A272 403(75)}, 344 ps *recoil dist Doppler* {PR C9 953(74)}, 413 ps *recoil dist Doppler* {PR C6 873(72)}
3.883: 19 *14* fs *Doppler* {PR C3 2232(71)}
3.939: 62 *14* fs *Doppler* {PRL 28 1723(72), NP A219 1(74)}
3.944: 9.8 *10* ps *recoil dist Doppler* {PR C11 110(75), PR C9 953(74)}, 7.9 *11* ps *recoil dist Doppler* {ZP A272 403(75)}, 0.8 *3* ps *Doppler* {PRL 28 1723(72), NP A219 1(74)}
4.083: 30 *10* fs *Doppler* {NP A219 1(74)}, 54 *26* fs *Doppler* {PR C3 2232(71)}
4.095: 55 *14* fs *Doppler* {NP A219 1(74)}
4.126: 31 *10* fs *Doppler* {NP A219 1(74)}, 69 *28* fs *Doppler* {PR C3 2232(71)}
4.475: 0.15 *6* ps *Doppler* {NP A219 1(74)}
4.514: 28 *14* fs *Doppler* {PRL 28 1723(72), NP A219 1(74)}
4.520: 118 *31* fs *Doppler* {PRL 28 1723(72), NP A219 1(74)}
4.679: 76 *21* fs *Doppler* {NP A219 1(74)}
4.739: 24 *7* fs *Doppler* {NP A219 1(74)}
4.831: 14 *4* ps *recoil dist Doppler* {PR C11 110(75), PR C9 953(74)}, 13 *4* ps *recoil dist Doppler* {ZP A272 403(75)}
4.929: 64 *17* fs *Doppler* {NP A219 1(74)}
5.0087: 0.43 $^{+17}_{-10}$ ps *Doppler* {NP A219 1(74)}
5.009: <35 fs *Doppler* {NP A219 1(74)}
5.163: 12 *7* ps *Doppler* {NP A223 253(74)}
5.173: 15 *6* fs *Doppler* {NP A219 1(74)}
5.262: 14 *7* fs *Doppler* {NP A219 1(74)}

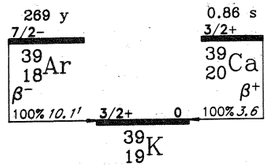
(Continued on next page)

22 reactions
≈66 additional levels above 6.331 MeV.



$^{39}_{19}$K (Continued)

5.317: <28 fs *Doppler* {NP A219 1(74)}
5.354: 113 *35* fs *Doppler* {NP A219 1(74)}
5.501: 0.31 *13* ps *Doppler* {NP A219 1(74)}
5.596: <14 fs *Doppler* {NP A219 1(74)}
5.644: 0.67^{+42}_{-21} ps *Doppler* {NP A219 1(74)}
5.711: 49 *31* fs *Doppler* {NP A219 1(74)}
5.718: 0.17 *4* ps *Doppler* {JPGL 1 L33(75)}, 1.9 *10* ps *recoil dist Doppler* {PR C9 953(74)}
5.788: 28 *14* fs *Doppler* {NP A219 1(74)}
5.803: >0.5 ps *Doppler* {NP A219 1(74)}
5.827: <14 fs *Doppler* {NP A219 1(74)}
5.937: <14 fs *Doppler* {NP A219 1(74)}
6.041: 42 *21* fs *Doppler* {NP A219 1(74)}
6.110: 76 *28* fs *Doppler* {NP A219 1(74)}
6.244: 21 *14* fs *Doppler* {NP A219 1(74)}
6.331: <55 fs *Doppler* {NP A219 1(74)}
6.476: 8.2 *4* ps *recoil dist Doppler* {ZP A272 403(75)}, >3.5 ps *Doppler* {JPGL 1 L33(75)}, 0.7 ps≤$t_{1/2}$<2 ps *recoil dist Doppler* {PR C9 953(74)}
8.029: 38 *17* ps *recoil dist Doppler* {PR C11 110(75), PR C9 953(74)}, 7 ps<$t_{1/2}$<35 ps *recoil dist Doppler* {ZP A272 403(75)}
others: {JPGL 1 L33(75), ZP A272 403(75), CJP 52 1090(74), NP A219 1(74), PScr 10 43(74), NP A206 193(73), PR C3 2232(71), NP A151 465(70), Cf69 MntrIC 137, NP A132 481(69), NP 35 472(62)}



$^{39}_{19}$K levels – References

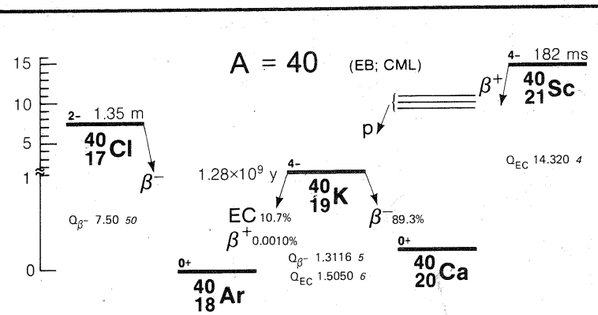
Decay: PR C8 657(73), PL 34B 128(71), PR 112 1972(58), PR 79 902(50), Sci 148 1325(65), NP A214 1(73)
22 reactions: NP A214 1(73), NP A219 1(74), PR C11 110(75), PR C9 953(74), JPGL 1 L33(75), ZP A272 403(75), PScr 10 43(74), NP A263 210(76), NP A233 317(74)

$^{39}_{20}$Ca

Δ: −27.282 *5* {ANDT 19 175(77)}
%: β^+ {HPAc 16 33(43)}
$t_{1/2}$: 0.8604 *30* s {PR C8 657(73)}; 0.86 *1* s {NP 7 296(58)}; 0.873 *8* s {ZP 158 111(60)}; 0.88 *1* s {PR 112 1972(58)}; 0.90 *1* s {PR 96 1620(54)}; **others:** {NP 54 549(64), PR 117 1297(60), CJP 31 70(53), PR 90 995(53), HPAc 16 33(43)}
Class: B; **Ident:** excit {HPAc 16 33(43), PR 75 542(49)}
Prod: ^{39}K(p,n) {PR 112 1972(58), PR 117 1297(60), PL 34B 128(71), PR C8 657(73)}; ^{40}Ca(γ,n) {NP 7 296(58), HPAc 21 200(48), HPAc 16 33(43), PR 75 542(49), PR 96 1620(54)}
β^+: **5.490** *25 mag* {PR 112 1972(58)}
others: {PR 117 1297(60), PPSL 67A 443(54), PR 84 1059(51)}
γ: no γ rays observed (lim γ 0.06%) *Ge(Li)* {PL 34B 128(71)}
others: {NP A258 341(76), PR 119 272(60), PR 112 1972(58)}
$t_{1/2}$(levels): **2.467:** 0.18 *6* ps *Doppler* {NP A206 193(73)}
2.796: 62 *17* ps *Doppler* {NP A223 253(74)}
3.024: <8 ps *Doppler* {NP A223 253(74)}
3.640: 17 *10* ps *Doppler* {NP A223 253(74)}
3.870: <3.5 ps *Doppler* {NP A223 253(74)}
3.890: <26 ps *Doppler* {NP A223 253(74)}
3.936: <3.5 ps *Doppler* {NP A223 253(74)}
3.951: 21 *17* ps *Doppler* {NP A223 253(74)}
others: {NP A206 193(73)}

$^{39}_{20}$Ca levels – References

^{40}Ca(^{3}He,α),^{40}Ca(^{3}He,αγ): NP A214 1(73), NP 84 651(66), PL 18 61(65), NP A177 307(71), NP A187 96(72), PR C13 461(76); **others:** NP A246 477(75), NP A148 299(70), PL 27B 76(68), NP 73 33(65), PL 14 113(65)
^{40}Ca(p,d): PR 172 1078(68), NP A185 465(72), PScr 11 79(75); **others:** NP A255 187(75), JPCo 31 C2-119(70), NP A126 60(69), NP A117 385(68), PL 27B 76(68), PR 170 1003(68), PL 14 113(65)
^{40}Ca(d,t): PR 154 898(67), NP A119 161(68), NP A263 210(76); **others:** PL 27B 76(68), PL 22 638(66)
^{36}Ar(α,nγ): NP A223 253(74)

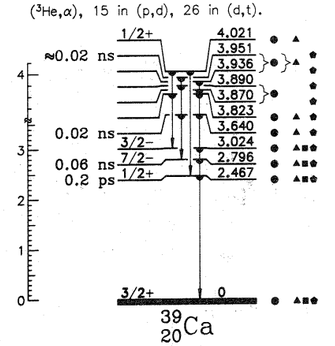


$^{40}_{16}$S

Δ: −22.24 (from systematics) {ANDT 19 175(77)}
Class: R; **Ident:** ^{232}Th(^{40}Ar,^{40}S) {NP A176 284(71)}

$^{40}_{17}$Cl

Δ: −27.545 *0* {ANDT 19 175(77)}
%: β^- {PR 103 504(56)}
$t_{1/2}$: 1.322 m {NP A197 229(72)}; 1.38 *2* m {Th58 Robinsn}; 1.44 *8* m {PR C2 948(70)}; **others:** {PR 103 504(56)}
Class: A; **Ident:** chem, genet energy levels {PR 103 504(56)}; genet energy levels {NP A197 229(72), PR C2 948(70)}
Prod: ^{40}Ar(n,p) {NP 62 172(65), PR 103 504(56), PR C2 948(70)}
β^-: ≈7.5, ≈3.2 *scint* {PR 103 504(56)}
γ: (**norm:** $\gamma_{1.461}$ (γ 77%), from level scheme) **0.2225** *5* (t_γ 2.0 *6*), **0.2390** *5* (t_γ 2.0 *6*), **0.2600** *5* (t_γ 10 *1*), **0.3030** *6* (t_γ 0.7 *4*), **0.3150** *5* (t_γ 0.3 *1*), **0.3613** *5* (t_γ 0.9 *2*), **0.3690** *6* (t_γ 0.2 *1*), **0.3810** *5* (t_γ 1.0 *4*), **0.4720** *4* (t_γ 3 *1*), **0.4794** *4* (t_γ 10 *1*), **0.6211** *6* (t_γ <3), **0.6431** *3* (t_γ 80 *6*), **0.6597** *2* (t_γ 31 *3*), **0.7880** *3* (t_γ 10 *1*), **0.8810** *3* (t_γ 33 *3*), **1.0423** *3* (t_γ 62), **1.0511** *5* (t_γ 62), **1.0629** *2* (t_γ 30 *3*), **1.0876** *4* (t_γ 1.0 *5*), **1.0925** *5* (t_γ 3.0 *4*), **1.1562** *4* (t_γ 6 *1*), **1.1867** *4* (t_γ 9 *1*), **1.3172** *5* (t_γ 5.0 *6*), **1.3334** *8* (t_γ 4.0 *7*), **1.3537** *5* (t_γ 2.5 *10*), **1.3947** *3* (t_γ 152), **1.4321** *4* (t_γ 192), **1.4608** *1* (t_γ 1000), **1.5587** *4* (t_γ 6.0 *7*), **1.5799** *8* (t_γ 4 *1*), **1.5889** *3* (t_γ 122), **1.7465** *2* (t_γ 35 *3*), **1.7769** *8* (t_γ 0.20 *3*), **1.7978** *2* (t_γ 33 *4*), **2.0505** *4* (t_γ 132), **2.0630** *10* (t_γ 52), **2.2201** *2* (t_γ 95 *8*), **2.4579** *2* (t_γ 66 *6*), **2.5241** *2* (t_γ 27 *3*), **2.6219** *3* (t_γ 196 *16*), **2.8402** *3* (t_γ 386 *30*), **3.1010** *10* (t_γ 140 *20*), **3.1937** *10* (t_γ 1.0 *5*), **3.2082** *3* (t_γ 6 *1*), **3.3566** *8* (t_γ 4 *1*), **3.5110** *5* (t_γ 2.0 *8*), **3.7046** *8* (t_γ 10 *1*), **3.7599** *10* (t_γ 1.0 *3*), **3.7849** *6* (t_γ 8 *1*), **3.9186** *2* (t_γ 51 *5*), **3.9417** *2* (t_γ 2.0 *5*), **4.0821** *8* (t_γ 3.0 *6*), **4.1477** *10* (t_γ 11 *1*), **4.1787** *3* (t_γ 3.0 *7*), **4.3242** *3* (t_γ 2.0 *5*), **4.3576** *3* (t_γ 5.0 *7*), **4.4807** *3* (t_γ 3.0 *7*), **4.5801** *5* (t_γ 1.0 *4*), **4.7375** *4* (t_γ 5 *1*), **4.7687** *3* (t_γ 6 *1*), **5.1655** *10* (t_γ 1.0 *5*), **5.3096** *10* (t_γ 2 *1*), **5.4001** *8* (t_γ 2.0 *8*), **5.6290** *10* (t_γ 1.0 *5*), **5.8799** *8* (t_γ 49 *4*), **5.9500** *10* (t_γ 0.5 *3*), **6.0531** *8* (t_γ 4.0 *6*), **6.2080** *8* (t_γ 0.5 *3*), **6.3385** *8* (t_γ 3.0 *5*), **6.4755** *8* (t_γ 2.0 *3*) *Ge(Li), Ge(Li)-scint γγ coinc* {NP A197 229(72)}
0.2390 *3* (t_γ 5 *1*), **0.2616** *3* (t_γ 10 *1*), **0.4802** *3* (t_γ 18 *3*), **0.6438** *2* (t_γ 93 *10*), **0.6605** *2* (t_γ 32 *3*), **0.7882** *3* (t_γ 10 *1*), **0.8816** *3* (t_γ 31 *3*), **1.0634** *3* (t_γ 28 *3*), **1.0946** *10* (t_γ 5 *1*), **1.4320** *15* (t_γ 21 *3*), **1.4607** *15* (t_γ 1000), **1.5891** *3* (t_γ 132), **1.7464** *3* (t_γ 30 *3*), **1.7978** *3* (t_γ 24 *3*), **2.4570** *4* (t_γ 45 *8*), **2.5242** *4* (t_γ 23 *3*), **2.6216** *2* (t_γ 166 *17*), **2.8398** *4* (t_γ 292 *29*), **3.1018** *4* (t_γ 50 *30*), **3.9187** *4* (t_γ 42 *8*), **5.875** *3* (t_γ 65 *13*), **6.334** *3* (t_γ 72) *Ge(Li), scint-scint γγ coinc* {PR C2 948(70)}
others: {PR C7 854(73), JINC 30 685(68), NP 62 172(65), PR 103 504(56)}

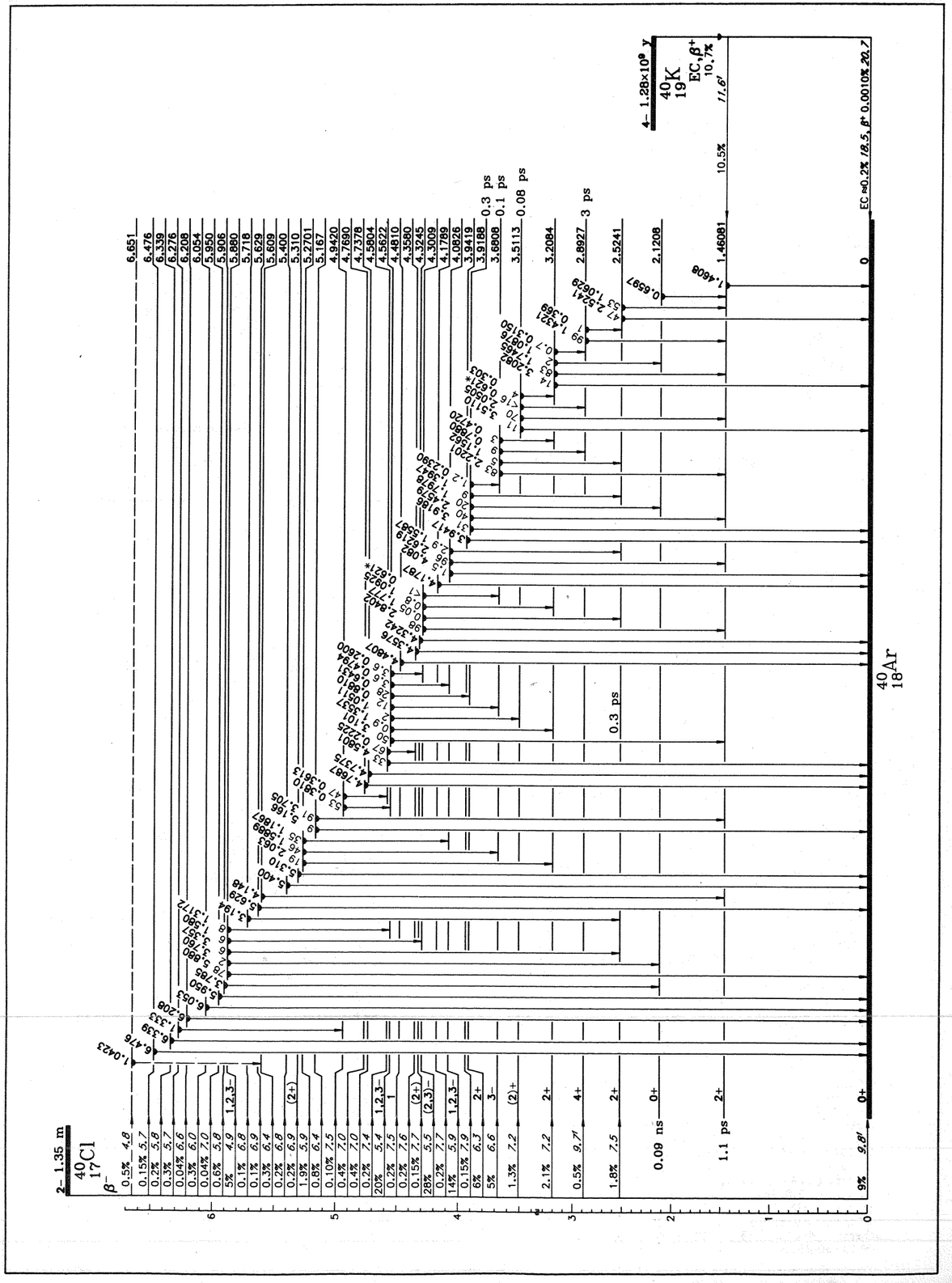


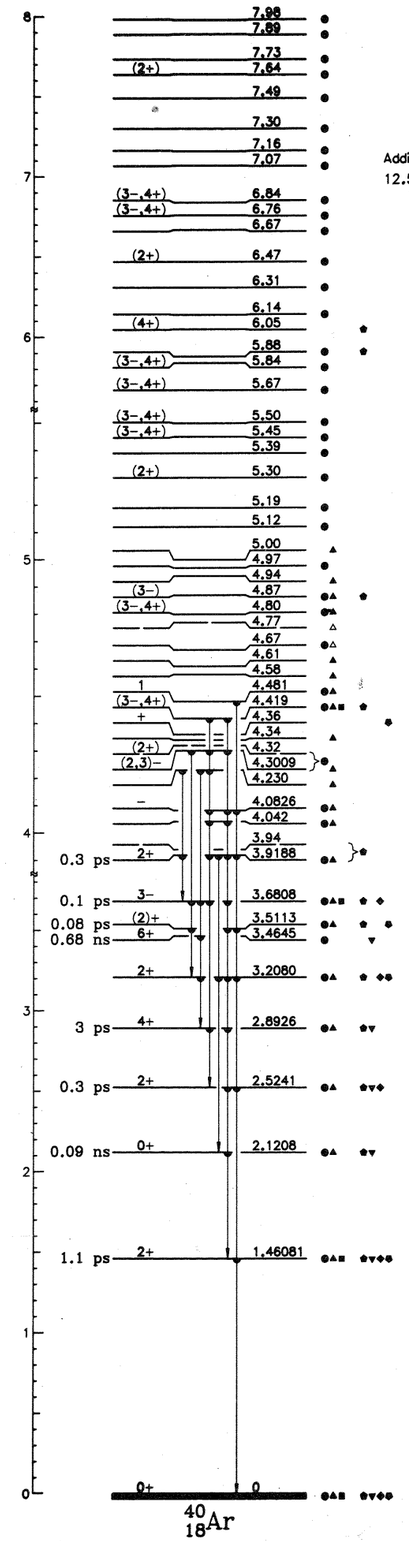
$^{40}_{17}$Cl(0.10 s)

%: β^-? {NIM 59 339(68), NuoC s10v54B 349(68)}
$t_{1/2}$: 0.10 *7* s {NIM 59 339(68), NuoC s10v54B 349(68)}
Class: F; **Ident:** excit {NIM 59 339(68), NuoC s10v54B 349(68)}
Prod: ^{40}Ar(n,p) {NIM 59 339(68), NuoC s10v54B 349(68)}

$^{40}_{18}$Ar

%: 99.60 (atmospheric sources; variations reported for other sources) {BNL-NCS-50605(77)}
Δ: −35.040 *27* {ANDT 19 175(77)}
I: 0 *0* {ZP 105 389(37), HPAc 26 811(53)}
σ_s: 0.645 {PC77 Holden}
$t_{1/2}$(levels): **1.461:** 1.33 *21* ps *Coulomb excit* {PRL 24 903(70)}, 0.87 *21* ps *Coulomb excit* {YadF 2 794(65)}, 0.83 *26* ps *Doppler* {NP A172 401(71)}, 1.35 *35* ps *Doppler* {JPGL 2 117(76)}
2.121: 104 *14* ps *delay coinc* {PR C5 791(72)}, 48 *28* ps *Doppler* {BAPS 13 1381(68)}
2.524: 0.23 *4* ps *e⁻ Coulomb excit* {PR 104 1466(56)}, 0.19 *5* ps *Doppler* {NP A172 401(71)}, 0.37 *10* ps *Doppler* {JPGL 2 117(76)}
2.893: 2.9 *14* ps *recoil dist Doppler* {PR C12 1392(75)}, 3.0^{+18}_{-9} ps *Doppler* {JPGL 2 117(76)}
3.208: <24 fs *Doppler* {JPGL 2 117(76)}
3.464: 0.69 *2* ns *delay coinc* {PR C12 1407(75)}, 0.64 *3* ns *recoil dist Doppler* {PR C12 1392(75)}
3.511: 83 *31* fs *Doppler* {JPGL 2 117(76)}
3.681: 97^{+62}_{-46} fs *Doppler* {JPGL 2 117(76)}
3.919: 0.30 *9* ps *Doppler* {JPGL 2 117(76)}
4.481: <69 fs *Doppler* {JPGL 2 117(76)}
others: {JPGL 2 117(76), NP A172 401(71), JPAL 3 73(70)}





Additional levels: 27 ^{40}Ar(γ,n) levels between 10.3 and 12.5 MeV.

$^{40}_{18}$Ar levels – References

Decay: NP A197 229(72), PR C2 948(70), NP A214 1(73)
^{38}Ar(t,p): NP A246 117(75), PL 43B 473(73)
^{40}Ar(p,p'),^{40}Ar(p,p'γ): NP A267 263(76), JPGL 2 117(76), NP A214 1(73), NP A166 378(71), BAPS 13 1381(68), PR C3 2259(71), PC71 Place, PR C5 791(72), BAPS 17 92(72), NP 39 335(62), PR 150 912(66); **others:** NP A117 273(68), NP 67 542(65), NP 27 665(61)
^{40}Ar(α,α'): NP 12 1(69), NP 56 259(64); **others:** PR C13 994(76), PRL 34 748(75), PRL 28 694(72), JPJa 28 1107(70), PL 33B 343(70), RRou 15 1093(70), StCF 22 477(70), NP A137 177(69), NP A128 81(69), RRou 12 525(67), NP 10 583(59)
^{40}Ar(d,d'): NP A266 173(76); **others:** NP A143 113(70), NP A115 570(68), NP A111 265(68), ZNat 21a 964(66), NP 70 383(65)
^{37}Cl(α,p),^{37}Cl(α,pγ): JPAL 3 73(70), NP A172 401(71), NP A214 1(73), PR C12 1407(75), PR C12 1392(75)
Coul. ex.,^{40}Ar(e,e'): PR 104 1466(56), YadF 2 794(65), NP A274 28(76), PRL 24 903(70); **others:** NP A219 450(74), CJP 49 2073(71), ZP 243 132(71), PR 129 312(63)
^{41}K(d,^{3}He): BAPS 13 87(68)
Other reactions:
^{40}Ar(n,n'γ): NP 81 468(66), PR 160 816(67)
^{40}Ar(^{3}He,^{3}He'): NP A125 449(69), NP A129 502(69), NP 50 549(64), PRSL 257A 13(60)
^{44}Ca(^{3}He,^{7}Be): NP A266 424(76)
^{40}Ar(γ,n): CJP 51 1176(73), PRL 28 1526(72)
^{40}Ar(γ,p): ZP 225 303(69)
^{40}Ar(e,e'p): PR 127 1746(62)

$^{40}_{19}$K

%: 0.0117 {BNL–NCS–50605(77)}
Δ: −33.5352*8* {ANDT 19 175(77)}
I: 4 *AB* {PR 76 1068(49)}
σ_0: 70*20* (reactor spectrum) {PC77 Holden}
σ(n,α): 0.39*3* (reactor spectrum) {PC77 Holden}
σ(n,p): 4.4*3* (reactor spectrum) {PC77 Holden}
%: β^- 89.33*11*%, EC 10.67*11*%, β^+ 0.00103*11*% {NP A214 1(73), ZP 187 151(65), PR 126 1818(62), Phil s8v1 199(56)}; **others:** {PR 103 1045(56), PR 103 987(56), AnaC 27 921(55), PR 99 771(55), PR 97 86(55), CJP 32 681(54), PR 94 1793(54), PR 93 645(54), PR 91 1223(53), PR 88 150(52), ArkF 3 171(51), Nat 165 356(50), PR 80 916(50), PR 80 909(50), PR 79 490(50), PR 78 624(50), ZP 128 657(50)}
$t_{1/2}$: 1.277*8*×10^9 y (from $t_{1/2}(\beta^-)$, $t_{1/2}$(EC)) *sp act* {NP A214 1(73)}
$t_{1/2}(\beta^-)$: 1.429*9*×10^9 y (if natural abundance = 0.01178 *4*%; weighted average) *sp act* {NP A214 1(73)}; **others:** {AmJP 40 721(72), Nwis 53 272(66), Phca 31 1305(65), ZP 187 151(65), Atya 12 320(62), AANY 91 166(61), PNII 26A 486(60), NP 11 492(59), Sci 126 545(57), Phil s8v1 199(56), PR 103 987(56), AnaC 27 921(55), JPJa 10 495(55), PR 99 771(55), Nat 172 361(53), PR 81 1058(51), PR 81 158(51), Nat 165 356(50), PR 79 940(50), PR 79 490(50), PR 78 624(50), ZP 128 657(50), PR 76 1535(49), PR 75 1107(49), PR 75 1106(49), PR 74 831(48)}
$t_{1/2}$(EC): 1.204*11*×10^{10} y (if natural abundance = 0.01178 *4*%; weighted average) *sp act* {NP A214 1(73)}; **others:** {Phca 32 991(66), ZP 187 151(65), PNII 26A 486(60), Sci 126 545(57), AnaC 27 921(55), ZNat 10a 920(55), Nat 172 361(53), Nat 165 356(50), PR 78 624(50), ZP 128 657(50), PR 76 1535(49), PR 74 279(48), RMP 20 305(48)}
Class: A; **Ident:** chem {Phil s6v10 584(5), PCam 14 15(6), PCam 14 211(6)}; chem, mass spect {PR 51 178(37)}

(Continued on next page)

$^{40}_{19}K$ (Continued)

Prod: natural source {Phil s8v1 199(56), PR 126 1818(62)}

β^-: **1.325** *15 mag* {PR 87 1091(52)}
1.36 *3 mag* {PR 78 629(50)}
1.32 *2 scint* {JPJa 10 495(55)}
1.35 *2 scint* {NP 1,1 492(59)}
1.36 *5 scint* {PR 77 399(50)}
others: {Nwis 53 272(66)}

β^+: $\beta_{0.483}$ (β^+/β^- 1.12 *14*$\times10^{-5}$) *scint* $\beta\gamma^\pm\gamma^\pm$ *coinc* {PR 126 1818(62)}
$\beta_{0.483}$ (β^+/β^- 1.5$\times10^{-5}$) *scint* $\beta\gamma^\pm\gamma^\pm$ *coinc* {ZP 187 151(65)}

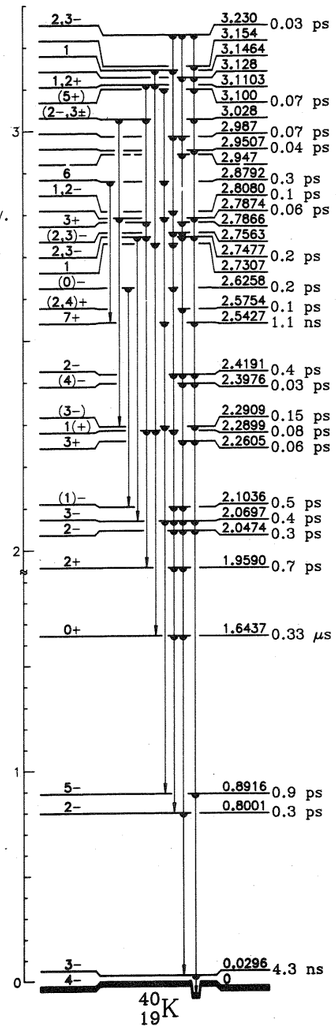
γ with EC: (**norm:** $\gamma_{1.461}$ (γ 10.67 *13*%), NP A214 1(73)) **1.46075** *6 Ge(Li)* {NIM 52 349(67)}
$\gamma_{1.461}$ (γ/β^- 0.1195 *14*) *scint, ion ch* {Phil s8v1 199(56), ZP 187 151(65), NP A214 1(73)}
others: {RaAc 13 171(70), JNST 5 432(68), Phca 32 991(66), PR 134 B506(64), PR 81 891(51), PR 80 631(50), PR 79 173(50), PR 77 841(50)}

$t_{1/2}$(levels): **0.030:** 4.30 *6* ns *delay coinc* {PL 49B 261(74)}, 4.26 *8* ns *delay coinc* {CJP 47 591(69)}
0.800: 0.26 *7* ps *Doppler* {NP A172 401(71)}, 0.35 *10* ps *Doppler* {NP A170 557(71)}, 0.40 *11* ps *Doppler* {PR C7 1956(73)}
0.892: 0.69 *18* ps *Doppler* {NP A172 401(71)}, 1.0 *3* ps *Doppler* {NP A170 557(71)}, 1.1 *3* ps *Doppler* {PR C7 1956(73)}
1.644: 0.340 *7* μs *delay coinc* {PL 26B 295(68)}, 0.292 μs *delay coinc* {NP A180 587(72)}
1.959: 0.65 *18* ps *Doppler* {NP A172 401(71)}, 0.76 *24* ps *Doppler* {NP A170 557(71)}, 0.42$^{+30}_{-17}$ ps *Doppler* {PR C7 1956(73)}
2.047: 0.35 *11* ps *Doppler* {NP A172 401(71)}, 0.39 *12* ps *Doppler* {NP A170 557(71)}, 0.31 *9* ps *Doppler* {PR C7 1956(73)}
2.070: 0.41 *12* ps *Doppler* {NP A172 401(71)}, 0.49 *21* ps *Doppler* {NP A170 557(71)}, 0.26$^{+15}_{-11}$ ps *Doppler* {PR C7 1956(73)}
2.104: 0.45 *14* ps *Doppler* {NP A172 401(71)}, 0.69 *21* ps *Doppler* {NP A170 557(71)}, 0.36 *11* ps *Doppler* {PR C7 1956(73)}
2.260: 61 *17* fs *Doppler* {NP A172 401(71)}, 55 *21* fs *Doppler* {NP A170 557(71)}
2.290: 79 *23* fs *Doppler* {NP A172 401(71)}, 76 *21* fs *Doppler* {NP A170 557(71)}
2.291: 0.14 *4* ps *Doppler* {NP A172 401(71)}, 0.17 *6* ps *Doppler* {NP A170 557(71)}, 0.21$^{+14}_{-10}$ ps *Doppler* {PR C7 1956(73)}
2.398: 35 *14* fs *Doppler* {NP A170 557(71)}
2.419: 0.46$^{+30}_{-18}$ ps *Doppler* {NP A172 401(71)}, >0.7 ps *Doppler* {NP A170 557(71)}, 0.28$^{+29}_{-12}$ ps *Doppler* {PR C7 1956(73)}
2.543: 1.10 *8* ns *recoil dist Doppler* {PR C13 1217(76), PR C14 160(76)}
2.575: 0.15 *6* ps *Doppler* {NP A172 401(71)}, 0.07 *2* ps *Doppler* {NP A170 557(71)}, 0.14$^{+9}_{-5}$ ps *Doppler* {PR C7 1956(73)}
2.626: 0.17 *7* ps *Doppler* {NP A172 401(71)}, 0.26 *8* ps *Doppler* {NP A170 557(71)}, 0.22$^{+15}_{-10}$ ps *Doppler* {PR C7 1956(73)}
2.731: <38 fs *Doppler* {NP A172 401(71)}
2.748: 0.19$^{+15}_{-10}$ ps *Doppler* {NP A172 401(71)}
2.756: <21 fs *Doppler* {NP A172 401(71)}
2.7874: 55 *22* fs *Doppler* {NP A172 401(71)}
2.808: 0.10 *7* ps *Doppler* {NP A172 401(71)}
2.879: 0.27 *10* ps *Doppler* {NP A172 401(71)}
2.951: 35 *19* fs *Doppler* {NP A172 401(71)}
2.987: 69 *27* fs *Doppler* {NP A172 401(71)}
3.028: <42 fs *Doppler* {NP A172 401(71)}
3.100: 73 *21* fs *Doppler* {NP A172 401(71)}
3.128: <21 fs *Doppler* {NP A172 401(71)}
3.154: <21 fs *Doppler* {NP A172 401(71)}
3.230: 28 *22* fs *Doppler* {PR C7 1956(73)}
others: {JPAL 6 844(73), PC73 Alexder, PR C8 168(73), PR C7 1956(73), BAPS 17 92(72), NP A172 401(71), PRL 25 1352(70), PRL 14 593(65), PR 114 825(59)}

EC: EC(L+M+...)/EC(K) 0.34 *8* {NP A98 577(67)}; EC(L+M+...)/EC(K) 0.47 *16* {ZP 208 234(68), NP A214 1(73)}

$^{37}Cl(\alpha,n\gamma)$
$^{40}Ar(p,n\gamma)$
$^{39}K(n,\gamma)$
$^{39}K(d,p)$,$^{39}K(d,p\gamma)$
$^{41}K(d,t)$,$^{41}K(p,d)$
$^{41}Ca(d,^3He)$
$^{38}Ar(\alpha,d)$
$^{42}Ca(d,\alpha)$
$^{42}Ca(p,^3He)$

84 additional levels above 3.230 MeV.



$^{40}_{19}K$ levels – References

$^{37}Cl(\alpha,n\gamma)$: NP A172 401(71), NP A170 557(71), JPAL 6 844(73), NP A214 1(73), JPAL 7 1985(74); **others:** PL 32B 602(70)
$^{40}Ar(p,n\gamma)$: JPAL 6 844(73), NP A170 557(71), NP A143 481(70), NP A214 1(73); **others:** PRL 27 1081(71), PL 29B 570(69), PL 26B 295(68)
$^{39}K(n,\gamma)$: NP A180 579(72), CJP 48 1109(70), NP A214 1(73), NP A222 388(74); **others:** PR C8 1833(73), NIM 105 301(72), ZP 233 154(70), CJP 47 591(69), NP A124 34(69), NP 89 254(66), NP 71 221(65), CzJP B9 544(59), Atya 1 28(56), PR 102 1109(56), CJP 31 927(53), PR 85 1012(52)
$^{39}K(d,p)$,$^{39}K(d,p\gamma)$: NP A225 93(74), PR 115 949(59), NP A156 305(70), NP A214 1(73); **others:** PR C7 1956(73), PRL 25 1352(70), PPSL 73 677(59), ZETF 33 1313(57), PR 91 1502(53), PR 77 794(50)
$^{41}K(d,t)$,$^{41}K(p,d)$: NP A213 317(73)
$^{41}Ca(d,^3He)$: NP A253 380(75)
$^{38}Ar(\alpha,d)$: NP A265 220(76)
$^{42}Ca(d,\alpha)$: NP A168 267(71), PL 32B 277(70), NP A214 1(73)
$^{42}Ca(p,^3He)$: PL 32B 277(70), PL 22 1439(69), PR C1 561(70), NP A214 1(73)
Other reactions:
$^{40}Ar(^3He,t)$: PR 172 1072(68), PRL 25 829(70), NP A214 1(73)
In-beam γ spect: PR C13 1217(76), PR C14 160(76)
$^{39}K(n,n')$: Cf65 Antwrp 526
$^{41}K(n,2n\gamma)$: NP A180 587(72)
$^{42}Ca(p,\alpha)$: Cf63 Vienna 289

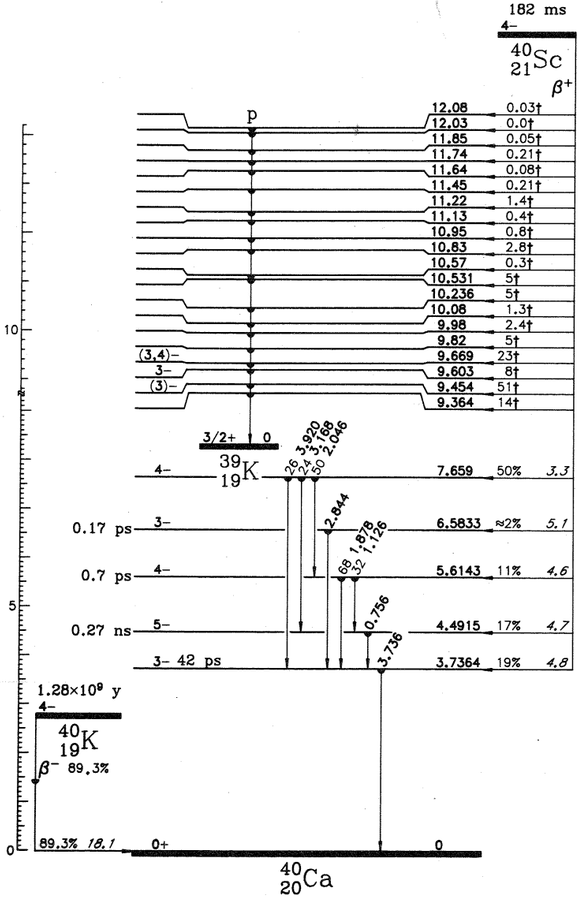
$^{40}_{20}Ca$

%: 96.94 {BNL-NCS-50605(77)}
Δ: −34.8468 *8* {ANDT 19 175(77)}
I: 0 0 {ZP 71 89(31)}
σ_a: 0.41 *11* (reactor spectrum) {PC77 Holden}
σ(n,α): 0.002 *1* (reactor spectrum) {PC77 Holden}

$t_{1/2}$(levels): **3.352:** 2.15 *8* ns *recoil dist Doppler* {JPPa 27 521(66)}, 2.14 *10* ns *delay coinc* {NP A216 90(73)}
3.736: 41 *3* ps *recoil dist Doppler* {PL 40B 635(72)}, 46 *2* ps e^- *Coulomb excit* {PR C2 2181(70)}, 49 *2* ps e^- *Coulomb excit* {PR 104 1466(56)}
3.904: 37 *4* fs *Coulomb excit* {PR 188 1815(69)}, 28 *6* fs *Coulomb excit* {ZP 234 416(70)}, 17 *4* fs *Doppler* {NP A122 373(68)}, 48 *13* fs *Doppler* {NP A108 6(68)}
4.491: 272 *8* ps *recoil dist Doppler* {PRL 23 594(69)}
5.213: 1.02 ps *Doppler* {PR 181 1606(69)}, 1.9 *8* ps *Doppler* {NP A108 6(68)}
5.249: 0.15 *2* ps *Doppler* {NP A108 6(68)}, 0.076 *24* ps *Doppler* {JPPa 34 281(73)}, 0.10 *5* ps *Doppler* {PR 181 1606(69)}
5.279: 0.21 *4* ps *Doppler* {PR C3 219(71)}, 0.19 *6* ps *Doppler* {NP A108 6(68)}, 0.24 *6* ps *Doppler* {NP A178 612(72)}
5.614: 0.58 *14* ps *Doppler* {PR 181 1606(69)}, 0.66 *17* ps *Doppler* {NP A131 113(69)}, 0.76 *22* ps *Doppler* {JPPa 34 281(73)}
5.630: 53 *15* fs *Doppler* {NP A131 113(69)}
5.903: 42 *14* fs *Doppler* {NP A131 113(69)}
6.026: 0.18 *2* ps *Doppler* {NP A131 113(69)}, 0.17 *5* ps *Doppler* {JPPa 34 281(73)}, 0.12 *6* ps *Doppler* {PR 181 1606(69)}
6.029: 0.30 *10* ps *Doppler* {PR 181 1606(69)}, 0.49 *15* ps *Doppler* {JPPa 34 281(73)}, 0.39 *13* ps *Doppler* {NP A131 113(69)}
6.286: 0.31 *8* ps *Doppler* {NP A108 6(68)}, 0.35 *9* ps *Doppler* {JPPa 34 281(73)}, 0.40 *7* ps *Doppler* {PR 181 1606(69)}, 0.26 *8* ps *Doppler* {PR 175 1446(68)}
6.508: 0.13 *4* ps *Doppler* {JPPa 34 281(73)}, 0.11 *4* ps *Doppler* {NP A131 113(69)}
6.544: 0.12 *4* ps *Doppler* {JPPa 34 281(73)}, 0.13 *4* ps *Doppler* {NP A131 113(69)}
6.583: 0.17 *5* ps *Doppler* {JPPa 34 281(73)}, 0.17 *5* ps *Doppler* {NP A131 113(69)}
6.751: 83 *35* fs *Doppler* {JPPa 34 281(73)}, 128 *45* fs *Doppler* {NP A178 612(72)}
6.909: 2.36 fs *nucl res fluor* {PR 165 1245(68)}
6.931: 0.34$^{+9}_{-7}$ ps *Doppler* {PR C14 171(76)}, 0.10 *4* ps *Doppler* {JPPa 34 281(73)}
6.932: 0.21 *9* ps *Doppler* {JPPa 34 281(73)}
6.951: 0.83 *14* fs *nucl res fluor* {PR 165 1245(68)}
7.112: 55 *31* fs *Doppler* {JPPa 34 281(73)}
7.114: 0.035 *23* ps *Doppler* {JPPa 34 281(73)}, 0.31 *9* ps *Doppler* {NP A122 373(68)}
7.239: 0.10 *5* ps *Doppler* {JPPa 34 281(73)}
7.278: 49 *37* fs *Doppler* {JPPa 34 281(73)}
7.301: 0.12 *5* ps *Doppler* {JPPa 34 281(73)}
7.397: 0.47 *18* ps *Doppler* {JPPa 34 281(73)}
7.425: 0.20 *15* ps *Doppler* {JPPa 34 281(73)}
7.447: 0.14 *6* ps *Doppler* {JPPa 34 281(73)}
7.466: 74 fs *Doppler* {PR 175 1446(68)}
7.533: 0.15 *5* ps *Doppler* {JPPa 34 281(73)}
7.562: 0.17 *6* ps *Doppler* {JPPa 34 281(73)}
7.624: 0.11 *4* ps *Doppler* {JPPa 34 281(73)}
7.659: <10 fs *Doppler* {JPPa 34 281(73)}
7.676: 0.21 *7* ps *Doppler* {JPPa 34 281(73)}
7.694: <6 fs *Doppler* {NP A122 373(68)}
7.769: 0.17 *5* ps *Doppler* {JPPa 34 281(73)}
7.872: <14 fs *Doppler* {JPPa 34 281(73)}
7.928: 49 *37* fs *Doppler* {JPPa 34 281(73)}
7.976: <42 fs *Doppler* {JPPa 34 281(73)}
8.091: <28 fs *Doppler* {JPPa 34 281(73)}
8.099: 12.5 *17* ps *recoil dist Doppler* {PR C14 171(76)}
8.113: <14 fs *Doppler* {JPPa 34 281(73)}
8.138: <28 fs *Doppler* {JPPa 34 281(73)}
8.187: <17 fs *Doppler* {JPPa 34 281(73)}
8.323: 42 *23* fs *Doppler* {JPPa 34 281(73)}
8.359: 0.10 *3* ps *Doppler* {JPPa 34 281(73)}
8.424: <14 fs *Doppler* {PL 34B 131(71)}, <17 fs *Doppler* {JPPa 34 281(73)}
8.484: 24 *15* fs *Doppler* {JPPa 34 281(73)}
8.541: <28 fs *Doppler* {JPPa 34 281(73)}
8.551: <21 fs *Doppler* {PL 34B 131(71), JPPa 34 281(73)}
others: {JPPa 34 281(73), NP A178 612(72), JPCo 32 C6-287(71), PL 34B 131(71), PR C3 219(71), ZP 234 416(70), Cf69 MntrlC 137, PR 188 1815(69), PR 181 1606(69), NP A122 373(68), NP A108 6(68), PR 175 1446(68), PR 114 240(59)}

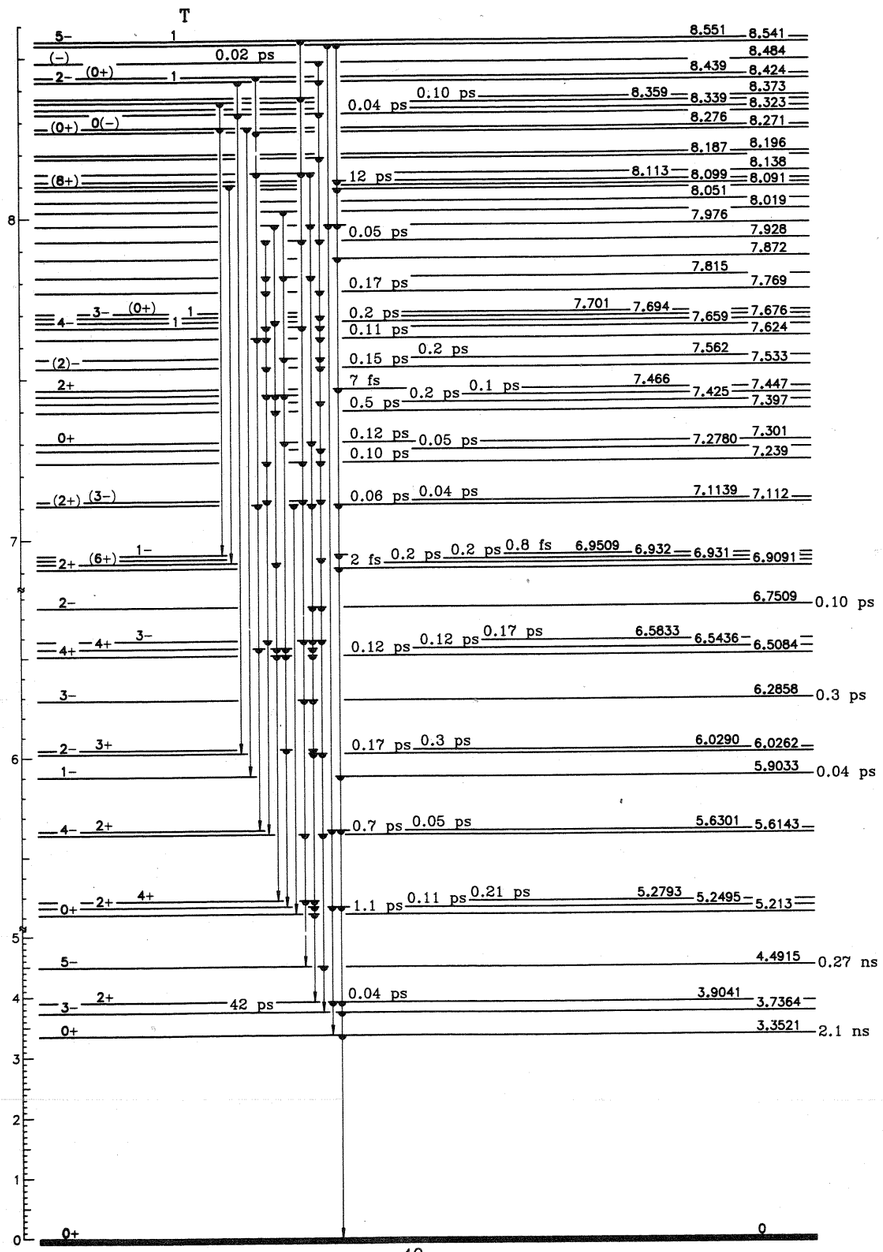
$^{40}_{20}Ca$ levels – References

Decay: NP A234 130(74), NP A203 414(73), NP A155 109(70), NP A214 1(73)
32 Reactions: NP A214 1(73), PR C11 1159(75), JPPa 34 281(73), PR C15 186(77), PRL 33 233(74), PR C10 680(74), NP A233 91(74), NP A246 477(75), PR C14 171(76), PRL 35 23(75), NP A253 380(75); **others:** PR C13 699(76), PL 55B 439(75), JPJa 36 10(74), PR C10 1798(74), PR C9 1901(74), PRL 33 853(74), ParN 6 127(73), Fzka 4 65(72)



32 Reactions

Many additional levels above 8.551 MeV.



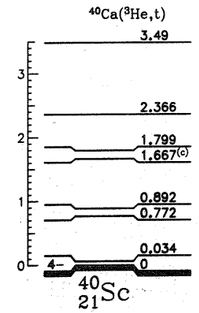
$^{40}_{20}Ca$

$^{40}_{21}Sc$

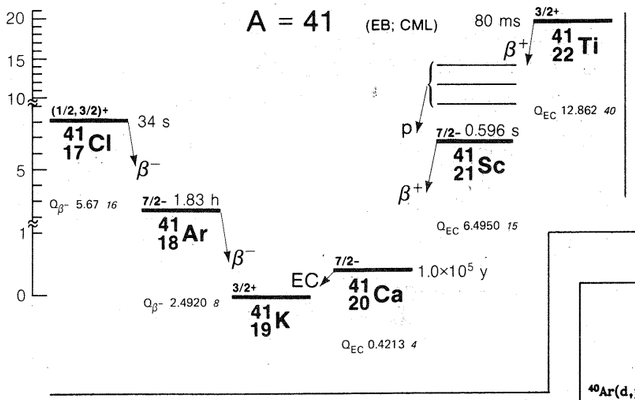
Δ: −20.527 *4* {ANDT 19 175(77)}
☢: β^+, β^+p {NP A127 635(69), NP A234 130(74)}
$t_{1/2}$: 182.7 *8* ms {PR 165 1194(67)}; 179 *2* ms {NP 33 47(62)}; 186 *4* ms {NP 77 401(66)}; **others:** {NP A203 414(73), PR 98 1251(55), PR 96 773(54)}
Class: A; **Ident:** excit {PR 98 1251(55)}; genet energy levels {PR 165 1194(67), PR 172 1124(68), NP A203 414(73)}
Prod: ^{40}Ca(p,n) {PR 98 1251(55), NP 33 47(62), NP A234 130(74)}; ^{40}Ca(^{3}He,2np) {NP A234 130(74)}
β^+: **9.58** *4* (20 *1*%), **8.76** *10* (15 *1*%), **7.53** *20* (15 *1*%), **5.73** *15* (50 *1*%) *mag* {PR 165 1194(67)}
9.10 *9 scint* {NP 77 401(66)}
others: {PL 17 296(65), NP 33 47(62), PR 98 1251(55)}
p: **1.000** *15* (†27.3 *30*), **1.085** *10* (†100), **1.248** *15* (†14.5 *18*), **1.339** *25* (†4.4 *10*), **1.454** *15* (†8.9 *15*), **1.612** *25* (†4.7 *6*), **1.709** *10* (†2.6 *7*), **1.846** *20* (†9.4 *10*), **2.113** *25* (†9 *1*), **2.443** *25* (†5.4 *9*) *semicond* {NP A234 130(74)}
1.083 (†100), **1.273** (†10.2 *2*), **1.483** (†3.09 *19*), **1.584** (†1.50 *18*), **1.723** (†1.28 *18*), **1.883** (†4.26 *14*), **2.153** (†7.12 *16*), **2.245** (†0.399), **2.443** (†5.18 *14*), **2.623** (†1.24 *12*), **2.805** (†0.62 *12*), **2.893** (†2.07 *12*), **3.123** (†0.325), **3.315** (†0.122), **3.413** (†0.325), **3.525** (†0.082), **3.705** (†0.082), **3.955** (†0.052) *ion ch, semicond* {NP A127 635(69)}
γ with β^+: **0.7556** *8* (γ 41 *4*%), **1.126** *3* (γ 12 *2*%), **1.8778** *7* (γ 25.0 *15*%), **2.0458** *7* (γ 25.5 *15*%), **2.844** *3* (γ 2.1 *10*%), **3.1679** *7* (γ 12 *2*%), **3.7356** *8* (γ 100%), **3.920** *1* (γ 13 *2*%) *Ge(Li)* {NP A203 414(73)}
3.9068 *20*, **5.2550** *40*, other γ rays observed *Ge(Li)* {PR 172 1124(68)}
others: {PR 165 1194(67), NP 77 401(66), PR 98 1251(55)}

$^{40}_{21}Sc$ levels – References

^{40}Ca(^{3}He,t): NP A162 349(71), NP A214 1(73); **others:** PR C4 1219(71)



A = 41 (EB; CML)



$^{41}_{18}Ar$

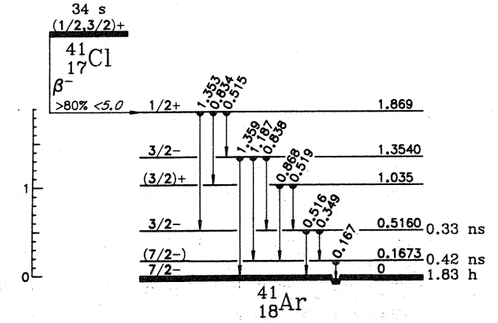
Δ: −33.0677 *9* {ANDT 19 175(77)}
σ_c: 0.5 *1* (reactor spectrum) {PC77 Holden}
☢: β^- {PR 49 555(36)}
$t_{1/2}$: 1.827 *7* h {HPAc 24 641(51)}; 1.85 *2* h {PR 103 1796(56)}; **others:** {PR C4 498(71), APAu 18 315(64), PR 87 886(52), HPAc 19 419(46), PR 49 555(36)}
Class: A; **Ident:** chem, excit {PR 49 555(36)}; mass spect {Phil s7v45 621(54)}
Prod: ^{40}Ar(n,γ) {PR 49 555(36)}
β^-: **1.1983** *11 mag* {APAu 18 315(64)}
2.485 *10* (0.78 *2*%), **1.195** *8* (99.22 *2*%) *mag* {IzF 25 189(61)}
others: {PR 103 1796(56), PR 78 649(50)}
γ: **1.29364** *4 Ge(Li)* {NIM 66 70(68)}
⟨**norm:** $\gamma_{1.294}$ (γ 99.16 *2*%), from level scheme⟩ $\gamma_{1.294}$ (†γ100), **1.6770** *3* (†γ0.052 *5*) *Ge(Li)* {PR C4 498(71)}
1.290 *4* (e/γ 6.8 *9*×10^{-5}) *mag conv* {IzF 25 189(61)}
$\gamma_{1.294}$ (†$\gamma\gamma$/†γ <6×10^{-5}) *scint–scint γγ coinc* {ArkF 21 559(62)}
others: {RaAc 10 1(68), NP A91 453(67), NP 61 13(65), PR 139 B509(65), PR 103 1796(56), Phca 21 604(55)}
$\beta\gamma(\theta)$: {APAu 23 204(66), NP 14 615(60)}
$\beta\gamma_{cp}(\theta)$: {PL 41B 461(72), YadF 15 1142(72), PL 30B 39(69), ZP 201 153(67), CR 255 503(62), PR 125 2021(62), PRL 5 326(60), ZP 157 586(60)}
$t_{1/2}$(levels): **0.167:** 419 *31* ps *delay coinc* {PR 152 984(66)}
0.516: 329 *21* ps *delay coinc* {PR 152 984(66)}
1.354: <97 ps *delay coinc* {PR 152 984(66)}

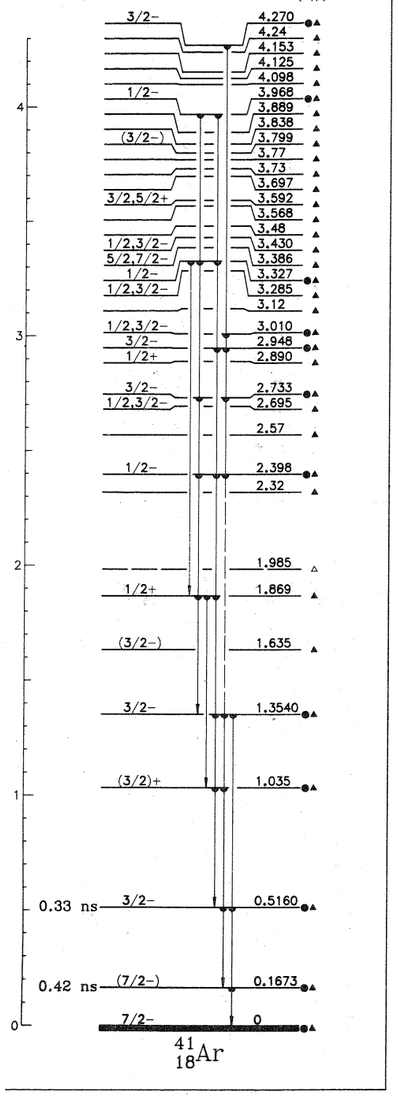
$^{41}_{17}Cl$

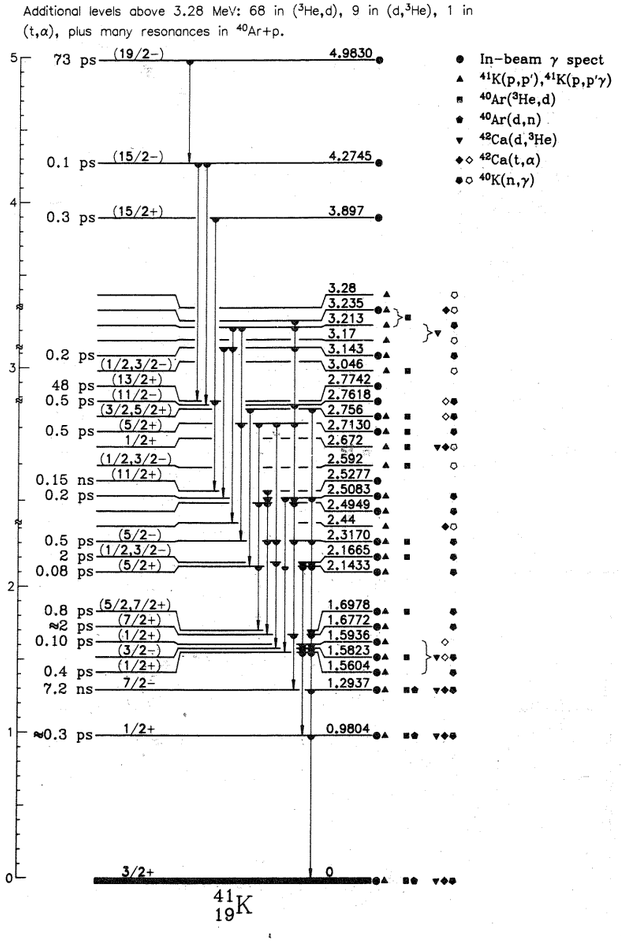
Δ: −27.40 *16* {ANDT 19 175(77)}
☢: β^- {YadF 19 1167(74)}
$t_{1/2}$: 34 *3* s {YadF 19 1167(74)}
Class: A; **Ident:** mass spect, genet energy levels {YadF 19 1167(74)}
Prod: ^{40}Ar on ^{181}Ta {YadF 19 1167(74)}
β^-: **3.80** *15 scint, scint–scint βγ coinc* {YadF 19 1167(74)}
γ: **0.167, 0.349, 0.515, 0.516, 0.519, 0.838, 0.868, 1.187, 1.353, 1.359** *Ge(Li), Ge(Li)–scint γγ coinc* {YadF 19 1167(74)}

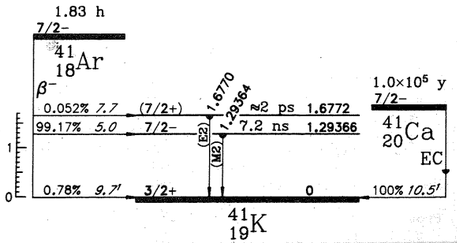
$^{41}_{18}Ar$ levels – References

Decay: YadF 19 1167(74)
^{40}Ar(n,γ): Phca 1 85(70), NP A181 225(72); **others:** PR C11 457(75), ArkF 35 527(68), NP A115 697(68), NP A105 1(67), NP A100 33(67)
^{40}Ar(d,p),^{40}Ar(d,pγ): PR 124 1917(61), NP 79 505(66), NP A114 392(68), PR 154 1058(67), JPPa 32 225(71), Cf69 MntrlC 197, PR 152 984(66), NP A214 1(73), NP A250 45(75); **others:** NuoC s11v28A 12(75)
Other reactions:
^{40}Ar(n,n'): PR C11 457(75)









%: 6.73 {BNL−NCS−50605(77)}
Δ: −35.5597 9 {ANDT 19 175(77)}
I: 3/2 *AB* {PR 49 921(36)}
σ_c: 1.463 {PC77 Holden}

$t_{1/2}$(levels): **0.980:** 0.29 $^{+21}_{-10}$ ps *Doppler* {NP A260 307(76)}, 0.3 $^{+3}_{-1}$ ps *Doppler* {NP A179 737(72)}, 3.5 10 ps *Doppler* {JPGL 2 577(76)}; **1.294:** 7.3 2 ns *delay coinc* {PL 28B 651(69)}, 7.1 3 ns *delay coinc* {IzF 38 155(74)}; **1.560:** 0.42 10 ps *Doppler* {JPGL 2 577(76)}, 0.40 15 ps *Doppler* {NP A260 307(76)}; **1.582:** >3.1 ps *Doppler* {JPGL 2 577(76)}; **1.594:** 973 5 fs *Doppler* {JPGL 2 577(76)}; **1.677:** 4 $^{+2}_{-1}$ ps *recoil dist Doppler*, *Doppler* {NP A260 307(76)}, 1.6 4 ps *Doppler* {JPGL 2 577(76)}, 9.5 43 ps *recoil dist Doppler* {PRL 31 1067(73)}; **1.698:** 0.8 2 ps *Doppler* {JPGL 2 577(76)}, 0.9 3 ps *Doppler* {NP A260 307(76)}; **2.143:** 76 21 fs *Doppler* {JPGL 2 577(76)}; **2.166:** 1.7 6 ps *Doppler* {JPGL 2 577(76)}; **2.317:** 0.54 15 ps *Doppler* {JPGL 2 577(76)}; **2.495:** >3.1 ps *Doppler* {JPGL 2 577(76)}; **2.508:** 0.166 ps *Doppler* {JPGL 2 577(76)}; **2.528:** 1598 ps *recoil dist Doppler* {NP A223 445(75)}, 1387 ps *recoil dist Doppler* {PRL 31 1067(73)}, 159 10 ps *recoil dist Doppler* {NP A260 307(76)}; **2.713:** 0.52 15 ps *Doppler* {JPGL 2 577(76)}; **2.756:** <69 fs *Doppler* {JPGL 2 577(76)}; **2.762:** 0.46 12 ps *Doppler* {JPGL 2 577(76)}; **2.774:** 47.0 14 ps *recoil dist Doppler* {PRL 31 1067(73)}, 50.3 24 ps *recoil dist Doppler* {PR C13 1217(76)}, 47 3 ps *recoil dist Doppler* {NP A260 307(76)}; **3.143:** 0.166 ps *Doppler* {JPGL 2 577(76)}; **3.897:** 0.31 8 ps *Doppler* {JPGL 2 577(76)}; **4.275:** 0.106 ps *Doppler* {JPGL 2 577(76)}, 0.62 55 ps *recoil dist Doppler* {NP A260 307(76)}; **4.983:** 704 ps *recoil dist Doppler* {NP A223 445(75)}, 746 ps *recoil dist Doppler* {PR C13 1217(76)}; **others:** {JPGL 2 577(76), NP A260 307(76), NP A223 445(75), PRL 31 1067(73), PR 90 259(53), PR 85 942(52)}

$^{41}_{19}$K levels − References

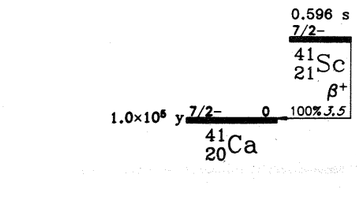
Decay: PR 103 1796(56), PR 139 B509(65), NIM 66 70(68), PR C4 498(71)
In-beam γ spect: PR C11 110(75), PRL 31 1067(73), JPGL 2 577(76); **others:** NP A260 307(76)
^{41}K(p,p'),^{41}K(p,p'γ): AR58 MIT 111, PR C4 498(71), PR 124 1557(61), NP A214 1(73)
^{40}Ar(^{3}He,d): PR C11 1937(75), PR C12 401(75); **others:** NP A148 497(70), BAPS 13 103(68)
^{40}Ar(d,n): NP A152 404(70); **others:** PL 31B 14(70)
^{42}Ca(d,^{3}He): NP A263 210(76); **others:** PL 57B 413(75), PR 186 1144(69)
^{42}Ca(t,α): NP A118 409(68), NP A139 711(69), NP A214 1(73)
^{40}K(n,γ): PC71 Beckstd, PR C3 208(71), NP A214 1(73)
Other reactions:
^{40}Ar(p,p'),^{40}Ar(p,n),^{40}Ar(p,α): NP 89 590(66), NP 85 504(66), HPAc 40 346(67), NP A96 238(67), HPAc 40 832(67), PR 172 1139(68), PR 172 1148(68), PR C5 1295(72), ArkF 31 83(66), NP A214 1(73); **others:** CR 261 949(65), NP 40 82(63), NP 28 428(61), IzF 23 841(59), PR 110 446(58)
^{40}Ar(p,γ): IzF 35 1676(72), IzF 34 1752(70), HPAc 40 832(67), HPAc 37 722(64), NP 24 500(61), JPJa 18 1709(63), ArkF 27 41(64); **others:** IzF 26 1137(62), IzF 24 891(60)
^{41}K(γ,γ'): NP 57 403(64)
^{41}K(n,n'γ): PR 166 1074(68)
Coul. ex.: IzF 32 1671(68), IzF 32 1674(68)
^{44}Ca(p,α): NP A179 737(72)

$^{41}_{20}$Ca

Δ: −35.1385 9 {ANDT 19 175(77)}
I: 7/2 *N* {PRL 9 166(62)}
: EC {PR 84 1243(51)}
$t_{1/2}$: 1.034×10^5 y *yield* {JINC 36 1687(74)}; 1.42×10^5 y *yield* {NP A214 1(73), CJC 40 833(62), NP A169 95(71), EB}; **others:** {NSEg 48 319(72), PRSL 220A 203(53)}
Class: B; **Ident:** chem, n−capt, sep isotopes {PR 84 1243(51)}
Prod: ^{40}Ca(n,γ) {PR 84 1243(51), PR 82 960(51), CJC 31 242(53), CJC 40 833(62)}
$t_{1/2}$(levels): **1.943:** 0.42 10 ps *Doppler* {JPGL 2 577(76)}, 0.55 5 ps *Doppler* {PR C12 1212(75)}, 0.28 9 ps *Doppler* {NP A164 289(71)}, 0.32 10 ps *Doppler* {NP A164 279(71)}; **2.010:** 0.465 ns *recoil dist Doppler* {PR C14 160(76)}, 0.56 14 ns *delay coinc* {PR C2 1365(70)}; **2.462:** 2.46 ps *Doppler* {JPGL 2 577(76)}, 3.8 $^{+12}_{-8}$ ps *Doppler* {PR C12 1212(75)}; **2.575:** 0.107 28 ps *Doppler* {JPGL 2 577(76)}, 0.18 2 ps *Doppler* {PR C12 1212(75)}, 0.066 21 ps *Doppler* {NP A164 289(71)}; **2.605:** 0.27 7 ps *Doppler* {JPGL 2 577(76)}, 0.39 5 ps *Doppler* {PR C12 1212(75)}, 0.11 4 ps *Doppler* {NP A164 289(71)}; **2.670:** 2.7 $^{+7}_{-5}$ ps *Doppler* {PR C12 1212(75)}, 0.17 5 ps *Doppler* {JPGL 2 577(76)}, 0.33 10 ps *Doppler* {NP A164 279(71)}; **2.883:** 21 17 fs *Doppler* {PR C12 1212(75)}, <14 fs *Doppler* {NP A164 289(71), JPGL 2 577(76)}; **2.959:** 247 fs *Doppler* {JPGL 2 577(76)}, 41 13 fs *Doppler* {PR C12 1212(75)}; **3.049:** 0.49 14 ps *Doppler* {JPGL 2 577(76)}, 1.12 $^{+19}_{-15}$ ps *Doppler* {PR C12 1212(75)}, 0.24 $^{+30}_{-15}$ ps *Doppler* {NP A164 279(71)}; **3.201:** 35 14 fs *Doppler* {JPGL 2 577(76)}, 40 20 fs *Doppler* {PR C12 1212(75)}, 19 17 fs *Doppler* {NP A164 289(71)}; **3.369:** 20.5 14 ps *recoil dist Doppler* {PRL 31 1067(73)}; **3.400:** 82 21 fs *Doppler* {PR C12 1212(75)}, <69 fs *Doppler* {JPGL 2 577(76)}; **3.495:** 0.30 6 ps *Doppler* {PR C12 1212(75)}; **3.525:** 33 17 fs *Doppler* {PR C12 1212(75)}; **3.613:** 159 fs *Doppler* {NP A164 289(71)}; **3.614:** 0.17 3 ps *Doppler* {PR C12 1212(75)}; **3.676:** 44 12 fs *Doppler* {JPGL 2 577(76)}, 5328 fs *Doppler* {PR C12 1212(75)}; **3.730:** 52 14 fs *Doppler* {JPGL 2 577(76)}, 38 14 fs *Doppler* {NP A164 289(71)}, 256 49 fs *Doppler* {PR C12 1212(75)}; **3.739:** <32 fs *Doppler* {PR C12 1212(75)}; **3.830:** 3.15 13 ns *delay coinc* {NP A262 189(76)}, 2.88 14 ns *Doppler* {PR C11 1468(75)}, 3.22 ns *recoil dist Doppler* {PR C13 1217(76)}, 3.02 ns *recoil dist Doppler* {NP A223 445(74)}; **3.846:** 0.11 3 ps *Doppler* {PR C12 1212(75)}; **3.915:** 1.23 ps *Doppler* {JPGL 2 577(76)}, 2.17 ps *recoil dist Doppler* {NP A260 307(76)}, 1.86 ps *recoil dist Doppler* {NP A223 445(74)}; **3.944:** <37 fs *Doppler* {PR C12 1212(75)}, <17 fs *Doppler* {NP A164 279(71)}; **3.973:** 24 10 fs *Doppler* {JPGL 2 577(76)}, 88 35 fs *Doppler* {PR C12 1212(75)}; **4.015:** 104 fs *Doppler* {JPGL 2 577(76)}; **4.094:** <20 fs *Doppler* {PR C12 1212(75)}; **4.184:** 39 12 fs *Doppler* {PR C12 1212(75)}; **4.279:** <26 fs *Doppler* {PR C12 1212(75)}; **4.328:** <0.11 ps *Doppler* {PR C12 1212(75)}; **4.340:** 0.133 ps *Doppler* {PR C12 1212(75)}, 0.123 ps *Doppler* {JPGL 2 577(76)}; **4.417:** 42 10 fs *Doppler* {PR C12 1212(75)}, 28 24 fs *Doppler* {JPGL 2 577(76)}; **4.447:** 83 31 fs *Doppler* {JPGL 2 577(76)}; **4.519:** <49 fs *Doppler* {JPGL 2 577(76)}; **4.547:** 97 28 fs *Doppler* {JPGL 2 577(76)}, 87 31 fs *Doppler* {PR C12 1212(75)}; **4.603:** <37 fs *Doppler* {PR C12 1212(75)}; **4.728:** <30 fs *Doppler* {PR C12 1212(75)}; **4.730:** 21 10 fs *Doppler* {JPGL 2 577(76)}, 40 13 fs *Doppler* {PR C12 1212(75)}; **4.753:** 30 10 fs *Doppler* {PR C12 1212(75)}; **4.778:** <15 fs *Doppler* {PR C12 1212(75)}; **4.814:** <37 fs *Doppler* {PR C12 1212(75)}; **4.876:** <34 fs *Doppler* {PR C12 1212(75)}; **4.970:** <25 fs *Doppler* {PR C12 1212(75)}, 49 45 fs *Doppler* {JPGL 2 577(76)}; **5.057:** 0.14 6 ps *Doppler* {JPGL 2 577(76)}; **5.120:** <46 fs *Doppler* {PR C12 1212(75)}, 76 69 fs *Doppler* {JPGL 2 577(76)}; **5.154:** <0.13 ps *Doppler* {JPGL 2 577(76)}; **5.219:** <28 fs *Doppler* {JPGL 2 577(76)}; **5.282:** <37 fs *Doppler* {PR C12 1212(75)}; **5.411:** <30 fs *Doppler* {PR C12 1212(75)}; **5.506:** 62 21 fs *Doppler* {JPGL 2 577(76)}; **5.817:** <28 fs *Doppler* {NP A254 189(75)}; **6.826:** >0.14 ps *Doppler* {PRL 31 1067(73)}, <1.7 ps *recoil dist Doppler* {NP A260 307(76)}; **others:** {JPGL 2 577(76), NP A260 307(76), PR C13 1217(76), NP A254 189(75), PR C12 1212(75), NP A223 445(74), NuoL s2v8 783(73), PRL 31 1067(73), NP A164 289(71), NP A164 279(71), BAPS 15 601(70), PR 158 1063(67)}
Internal bremsstrahlung endpoint: {NP A215 79(73)}

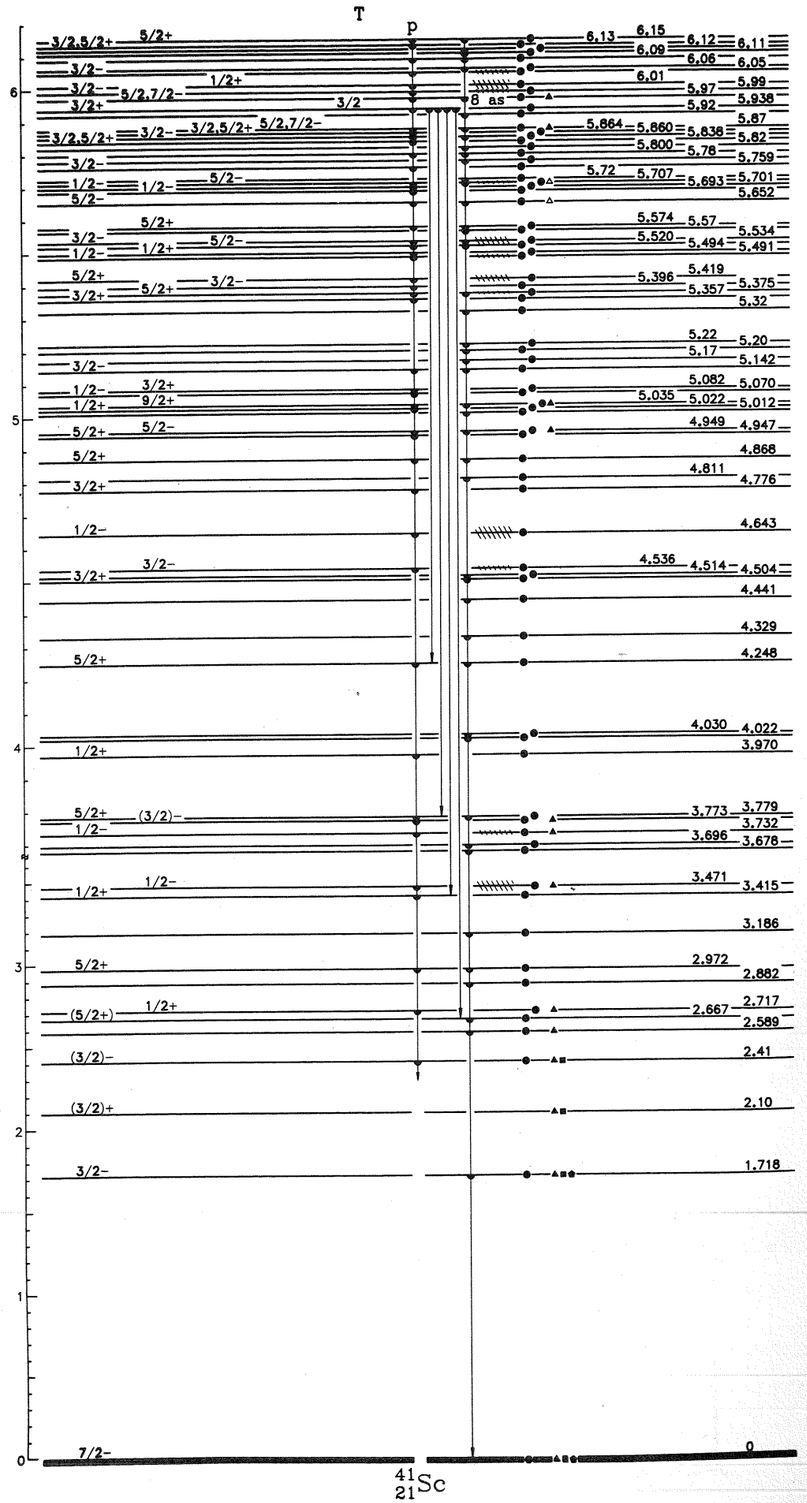
$^{41}_{20}$Ca levels − References

Decay: NP 34 580(62), PR 60 489(41)
25 Reactions: NP A214 1(73), PR C12 1212(75), NP A225 267(74), PR C9 200(74), PR C8 2200(73), ZP 269 315(74), PL 53B 171(74), PR C14 946(76), PR C11 1089(75), NP A254 189(75), JPGL 2 577(76), PR C11 110(75), PRL 31 1067(73), NP A223 445(74), NuoL s2v11 617(74), NuoL s2v8 783(73), PR C12 1524(75), PL 60B 32(75), NP A240 171(75), PR C11 1983(75), PR C10 1798(74); **others:** NP A230 173(74), NP A227 245(74), PR C10 2143(74)



- ^{40}Ca(p,p'),^{40}Ca(p,γ)
- ▲△ ^{40}Ca(d,n)
- ■ ^{40}Ca(^{3}He,d)
- ● ^{40}Ca(α,t)

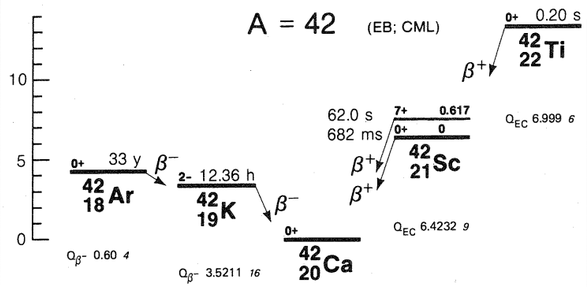
Many additional levels above 6.15 MeV.



$^{41}_{21}$Sc

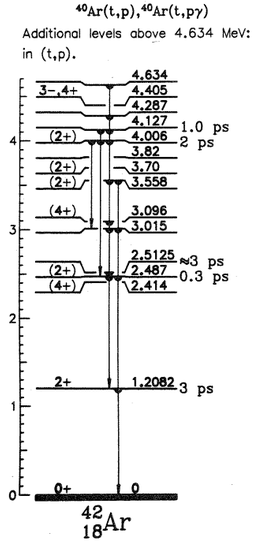
$^{41}_{22}$Ti

Δ: −15.784 {ANDT 19 175(77)}
π: β^+p {PRL 13 767(64), PR 152 995(66), NP A234 130(74)}
$t_{1/2}$: 80.2 ms {NP A234 130(74)}; **others:** {PR 152 995(66), PRL 13 767(64)}
Class: A; **Ident:** excit, decay charac {PRL 13 767(64)}; genet energy levels {NP A234 130(74)}
Prod: ^{40}Ca(^{3}He,2n) {PRL 13 767(64), PR 152 995(66), PL 43B 33(73), NP A234 130(74)}
p: **1.000** *15* (†38.6*24*), **1.248** *15* (†3.9*9*), **1.546** *15* (†21.6*7*), **1.983** *25* (†3.1*6*), **2.063** *30* (†4.1*5*), **2.271** *10* (†26.1*9*), **2.409** *20* (†14.7*3*), **2.662** *20* (†8.1*8*), **2.814** *15* (†4.9*5*), **3.077** *15* (†60.3*38*), **3.148** *20* (†4.0*11*), **3.339** *30* (†2.3*4*), **3.487** *20* (†2.8*4*), **3.605** *15* (†9.7*4*), **3.690** *15* (†15.5*8*), **3.749** *10* (†31*2*), **3.836** *25* (†2.4*2*), **3.904** *25* (†1.5*2*), **4.187** *15* (†15.4*5*), **4.379** *15* (†7.2*4*), **4.564** *20* (†2.2*3*), **4.638** *10* (†22.1*7*), **4.734** *4* (†100), **4.832** *25* (†3.0*3*), **4.876** *20* (†3.4*4*), **4.925** *20* (†2.9*3*), **5.177** *30* (†1.5*3*) *semicond* {NP A234 130(74)}
others: {PL 43B 33(73), PR 152 995(66), PRL 13 767(64)}



$^{42}_{17}$Cl

Δ: −24.42 (from systematics) {ANDT 19 175(77)}
Class: R; **Ident:** ^{232}Th(^{40}Ar,^{42}Cl) {NP A176 284(71)}



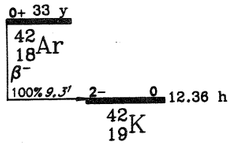
$^{42}_{18}$Ar levels – References
^{40}Ar(t,p),^{40}Ar(t,pγ): PR C7 1061(73), PR C9 598(74), NP A246 117(75); **others:** PL 43B 473(73)

$^{42}_{18}$Ar

Δ: −34.424 {ANDT 19 175(77)}
π: β^- {PR 87 886(52)}
$t_{1/2}$: 32.9 *11* y *sp act* {Sci 148 1325(65)}; **others:** {NP 51 363(64), PR 87 886(52)}
Class: B; **Ident:** chem, genet {PR 87 886(52)}
Prod: ^{40}Ar(n,γ)^{41}Ar(n,γ) {PR 87 886(52)}; ^{40}Ar(t,p) {PR 123 909(61)}
$t_{1/2}$(levels): **1.208:** 2.6$^{+7}_{-5}$ ps *Doppler* {PR C9 598(74)}
2.487: 0.28 *11* ps *Doppler* {PR C9 598(74)}
2.512: 2.8$^{+21}_{-9}$ ps *Doppler* {PR C9 598(74)}
3.015: <0.08 ps *Doppler* {PR C9 598(74)}
3.096: >3 ps *Doppler* {PR C9 598(74)}
3.558: <0.06 ps *Doppler* {PR C9 598(74)}
4.006: 2.3*6* ps *Doppler* {PR C9 598(74)}
4.127: 0.97*21* ps *Doppler* {PR C9 598(74)}
4.287: <0.03 ps *Doppler* {PR C9 598(74)}
4.634: <0.03 ps *Doppler* {PR C9 598(74)}

$^{42}_{19}$K

Δ: −35.0228 *13* {ANDT 19 175(77)}
I: 2 *AB* {Phil s7 v44 33(53)}
π: β^- {PR 49 368(36)}
$t_{1/2}$: 12.361 *3* h {IIso 18 334(67)}; 12.358 *7* h {CJP 40 1044(62)}; **others:** {NIM 17 225(62), JINC 10 17(59), NSEg 2 427(57), Nat 172 361(53), PR 91 1212(53), Nat 167 365(51), ArkM 34Bn4(47), PR 51 1033(37)}
Class: A; **Ident:** chem, n–capt {PRSL 149A 522(35)}; chem, cross bomb {Nat 135 580(35), KDVM 14n5(36), Nat 137 185(36)}; mass spect {Phil s7 v45 621(54)}
Prod: ^{41}K(n,γ) {PRSL 149A 522(35), PR 51 1033(37), PR 72 888(47)}
β^-: **3.519** *4 mag* {NP A112 372(68)}
3.524 *6 mag* {PR C11 1735(75)}
3.56 (81.2*6*%), **1.97** (18.3*6*%) *mag, mag–scint βγ coinc* {PR 91 1212(53), JINC 10 17(59), NP A105 1(67), NP A214 1(73)}
others: {NIM 34 93(65), PR 136 B1240(64), PR 101 1315(56), ArkM 34Bn4(47)}
γ: ⟨**norm:** $\gamma_{1.525}$ (γ 18.8*6*%), from level scheme⟩ **0.31260** *25* (t_γ1.8*6 11*), no $\gamma_{0.587}$ (t_γ<0.002), **0.6920** *8* (t_γ0.018*4*), **0.8997** *4* (t_γ0.285*14*), **1.0212** *9* (t_γ0.111*8*), **1.2280** *15* (t_γ0.013*6*), **1.5246** *3* (t_γ100), **1.9208** *10* (t_γ0.228*22*), **2.4243** *7* (t_γ0.110*16*) *Ge(Li), Ge(Li)–scint γγ coinc* {JPJa 29 43(70)}
0.31 *1* (t_γ1.1), **0.60** *2* (t_γ0.1), **0.90** *2* (t_γ0.1), **1.02** *2* (t_γ0.1), **1.52** *1* (t_γ100), **1.92** *1* (t_γ0.3), **2.42** *2* (t_γ0.2) *scint, scint–scint γγ coinc* {PR 122 555(61)}
$\gamma_{1.525}$ (γ 17.9*5*%) *scint–scint γγ coinc* {AcRa 58 192(62)}
$\gamma_{1.525}$ (t_e± 100*4*), **1.836** (t_e± 202*4*), $\gamma_{1.920}$ (t_e± 2.1*2*), $\gamma_{2.424}$ (t_e± 1.0*4*) *mag conv* {IzF 35 806(71)}
0.301 *3* (t_e− 10), **1.830** *9* (t_e− 10*1*, $e^\pm/e^-$ 9*2*) *mag conv* {PR 123 262(61)}
others: {NP 51 684(64), JINC 13 13(60), JINC 10 17(59), PR 101 1315(56), PPSL 68A 346(55), ZNat 9a 1052(54), PR 91 1212(53), ArkM 34Bn4(47)}
βγ(θ): {JPGL 1 956(75), PR 123 1787(61), PR 92 1191(53), PR 84 1071(51), PR 79 728(50)}
γγ(θ): {ArkF 15 303(59), PR 116 741(59), PR 114 1146(59)}
$\beta\gamma_{ep}$(θ): {HPAc 41 77(68), CR 258 884(64), ZNat 16a 1118(61)}
$\beta\gamma_{lin\ p}$(θ): {PR 92 1191(53)}
$t_{1/2}$(levels): **0.108:** 0.28*4* ns *recoil dist Doppler* {NP A246 231(75)}
0.258: 133*9* ps *recoil dist Doppler* {NP A246 231(75)}, 118*28* ps *recoil dist Doppler* {PR C11 700(75)}
0.699: <14 ps *recoil dist Doppler* {PR C11 700(75)}, 41*8* ps *recoil dist Doppler* {NP A246 231(75)}
1.376: 1.17*8* ns *recoil dist Doppler* {NP A246 231(75)}, 0.762*1* ns *recoil dist Doppler* {PR C11 700(75)}
1.948: ≤6 ps *recoil dist Doppler* {NP A246 231(75)}
others: {PR C11 700(75), BAPS 14 585(69)}

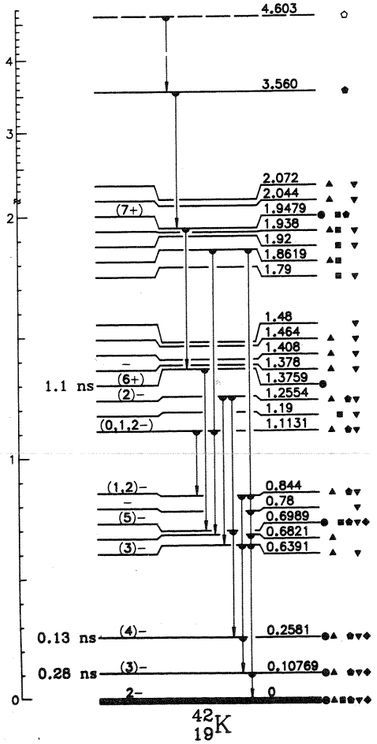


$^{42}_{19}$K levels – References

Decay: NP A214 1(73)
In-beam γ spect: PR C11 700(75), NP A246 231(75)
^{41}K(n,γ): NP A180 569(72), NP A214 1(73); **others:** CJP 48 1109(70), BAPS 13 103(68), Cf67 TokyoC 147
^{40}Ar(α,d): NP A265 220(76); **others:** PR 141 1021(66)
^{44}Ca(d,α): CJP 52 772(74), PR C10 1422(74), NP 48 129(63)
^{41}K(d,p),^{41}K(d,pγ): AR58 MIT 114, NP A127 343(69), BAPS 14 585(69), NP A156 305(70); **others:** PR C5 1576(72)
^{43}Ca(d,^{3}He): PR 186 1144(69)
Other reactions:
^{44}Ca(p,^{3}He): PR C7 637(73)
^{45}Sc(n,α): NP A105 1(67), NP A115 697(68), BAPS 12 1041(67), YadF 8 7(68)
^{41}K(n,n′): PR 109 926(58)

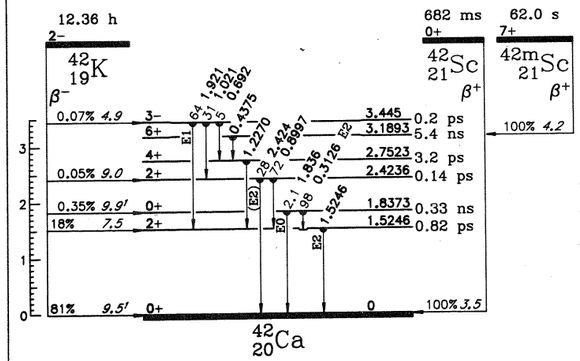
- ● In-beam γ spect
- ▲ ^{41}K(n,γ)
- ■ ^{40}Ar(α,d)
- ★○ ^{44}Ca(d,α)
- ▼ ^{41}K(d,p),^{41}K(d,pγ)
- ◆ ^{43}Ca(d,^{3}He)

The transition from the 4.603−MeV level may alternatively be placed between a level at 2.991 MeV and the 1.9479−MeV level.
Additional levels above 2.072 MeV: 38 in (d,p), 2 in (α,d).



$^{42}_{20}$Ca

%: 0.647 {BNL−NCS−50605(77)}
Δ: −38.5439 *14* {ANDT 19 175(77)}
σ_c: 0.72 (reactor spectrum) {PC77 Holden}
$t_{1/2}$(levels): **1.525:** 0.823 ps *Coulomb excit* {NP A204 574(70)}, 1.12 ps *Doppler* {PR 177 1725(69), PC69 Kossler, NP A214 1(73)}, 0.62 ps *Doppler* {NP A164 209(71)}
1.837: 0.332 ns *delay coinc* {PR 121 1169(61)}, 0.421 *1* ns *delay coinc* {ZNat 18a 671(63)}
2.424: 0.123 ps *Doppler* {NP A164 209(71)}, 0.215 ps *Doppler* {PR 177 1725(69), PC69 Kossler, NP A214 1(73)}
2.752: 3.53 ps *recoil dist Doppler* {PR C11 700(75), PR C10 997(74)}, 2.63 ps *recoil dist Doppler* {JPGL 1 57(75), ZP 267 399(74)}
3.189: 5.27 *14* ns *delay coinc* {NP A262 189(76)}, 5.32 ns *delay coinc* {PRL 25 1033(70)}, 5.52 ns *delay coinc* {PRL 25 1342(70)}
3.250: 0.122 ps *Doppler* {NP A164 209(71)}, 0.219 ps *Doppler* {PR 177 1725(69), PC69 Kossler, NP A214 1(73)}
3.297: >0.9 ps *Doppler* {PR 177 1725(69), PC69 Kossler, NP A214 1(73)}
3.388: 0.122 ps *Doppler* {NP A164 209(71)}, 0.236 ps *Doppler* {PR 177 1725(69), PC69 Kossler, NP A214 1(73)}
3.445: 0.207 ps *Doppler* {NP A164 209(71)}, 0.451 *4* ps *Doppler* {PR 177 1725(69), PC69 Kossler, NP A214 1(73)}
3.650: 0.053 ps *Doppler* {NP A164 209(71)}
4.100: <0.7 ps *recoil dist Doppler* {JPGL 1 57(75)}
4.715: 83 *32* fs *Doppler* {ZP A276 295(76)}
5.491: <1.7 ps *recoil dist Doppler* {PR C11 700(75)}
5.744: 10.5 *10* ps *recoil dist Doppler* {JPGL 1 57(75)}
6.409: 31.1 *25* ps *recoil dist Doppler* {JPGL 1 57(75)}
6.554: 423 ps *recoil dist Doppler* {PR C11 700(75)}, 447 ps *recoil dist Doppler* {JPGL 1 57(75)}
6.633: 36 *15* fs *Doppler* {ZP A276 295(76)}
7.369: 1.58 ps *recoil dist Doppler* {JPGL 1 57(75)}, 2.61 *1* ps *recoil dist Doppler* {PR C11 700(75)}
8.298: <1.7 ps *recoil dist Doppler* {PR C11 700(75)}
others: {NP A214 1(73), PR C8 1406(73), NP A164 209(71), PR C2 2241(70), PC69 Kossler, PR 181 1552(69), PR 177 1725(69), PR 148 1133(66)}

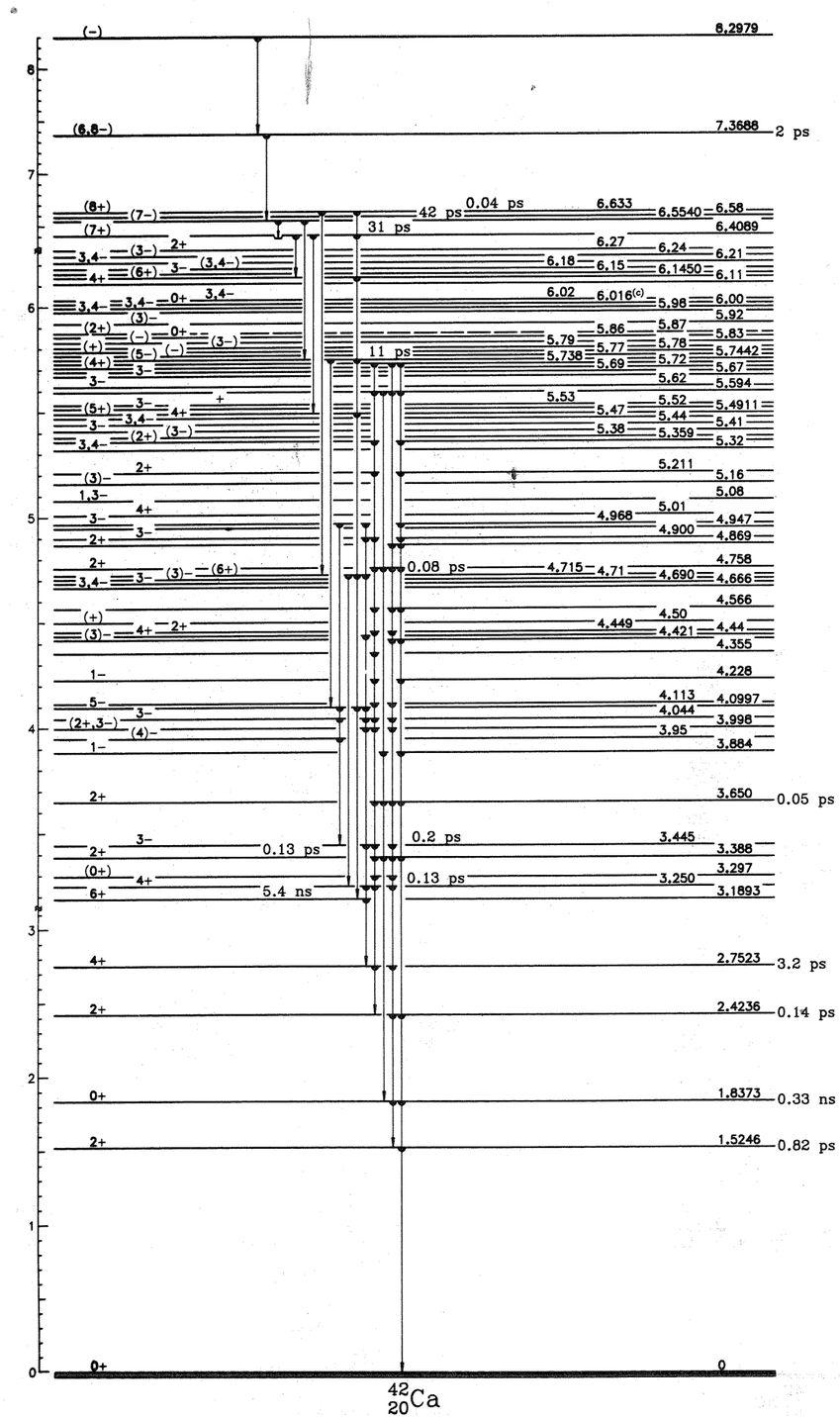


$^{42}_{20}$Ca levels – References

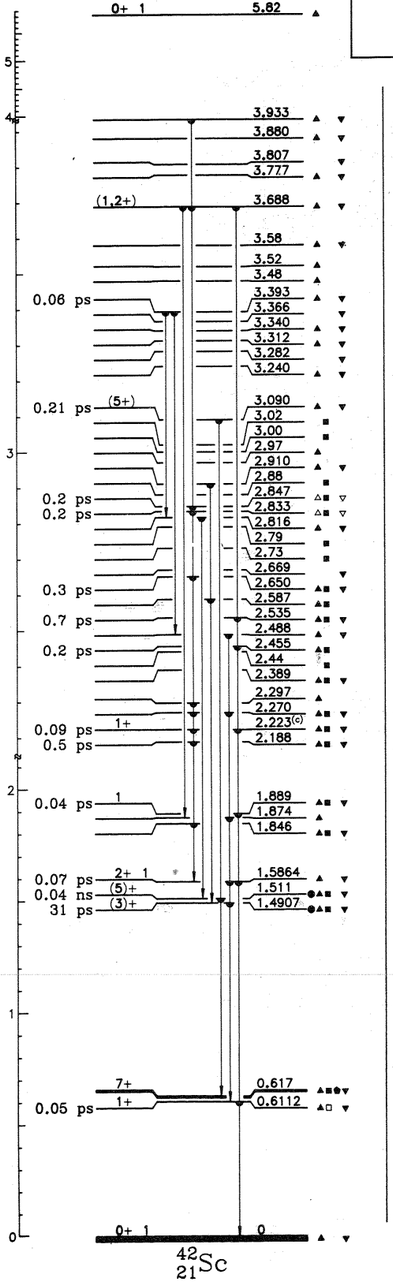
Decay: JPJa 29 43(70), PR 186 1160(69), ZP 165 94(61), NP A214 1(73)
30 Reactions: NP A214 1(73), PR C11 700(75), ZP A276 295(76), PR C13 1922(76), JPGL 1 57(75), NP A243 100(75), PR C8 1782(73), PR C13 536(76); **others:** NP A263 349(76), PR C11 100(75), PL 49B 425(74)

30 Reactions

Additional levels above 6.3 MeV: ≈410 levels, including ≈60 ^{38}Ar(α,γ) resonances, ≈300 ^{41}K+p resonances.

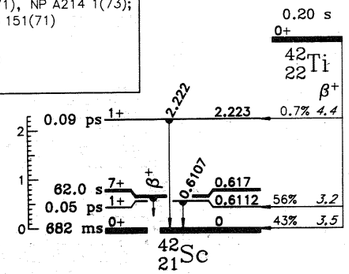


● $^{39}K(\alpha,n\gamma)$
▲△ $^{40}Ca(^3He,p),^{40}Ca(^3He,p\gamma)$
■□ $^{40}Ca(\alpha,d)$
★ $^{40}Ca(^{12}C,^{10}B)$
▼▽ $^{42}Ca(^3He,t)$



$^{42}_{21}$Sc levels – References

Decay: PR 186 1160(69), NP A124 97(69)
$^{39}K(\alpha,n\gamma)$: NP A192 524(72), PR C9 1033(74), BAPS 16 1178(71), NP A214 1(73)
$^{40}Ca(^3He,p),^{40}Ca(^3He,p\gamma)$: BAPS 10 25(65), NP 80 259(66), NP A116 516(68), NP A124 97(69), NP A176 577(71), NP A203 401(73), PR C2 215(70), PRL 19 1482(67), PRL 20 175(68), PR C9 1033(74), NP A214 1(73)
$^{40}Ca(\alpha,d)$: JPAL 6 1763(73), PR 141 1021(66); **others:** APPo 31 299(67), JPJa 21 2445(66)
$^{40}Ca(^{12}C,^{10}B)$: PRL 28 1659(72), NP A214 1(73)
$^{42}Ca(^3He,t)$: APNY 66 548(71), NP A164 145(71), NP A214 1(73); **others:** PRL 33 320(74), NP A168 151(71)
Other reactions:
$^{42}Ca(^6Li,^6He)$: PR C11 1963(75), PL 51B 451(74)
$^{40}Ca(d,\alpha)$: NP A224 561(74)



$^{42}_{21}$Sc

Δ: −32.1207 *16* {ANDT 19 175(77)}
π: β^+ {PR 100 431(55)}
$t_{1/2}$: 680.98 *62* ms {PR C13 2517(76)}; 684.5 *12* ms {PL 42B 341(72)}; 683.0 *15* ms {PL 17 317(65)}; **others:** {NP 62 434(65), ZP 165 94(61), CJP 35 1190(57), PR 100 431(55)}
Class: C; **Ident:** decay charac {PR 100 431(55)}; excit {CJP 35 1190(57), NP 62 434(65)}
Prod: $^{39}K(\alpha,n)$ {PR 100 431(55), ZP 165 94(61), NP 62 434(65)}; $^{40}Ca(t,n)$ {PL 42B 341(72)}; $^{42}Ca(p,n)$ {PR C13 2517(76)}
β^+: **5.32** *10 scint* {ZP 165 94(61)}
others: {CJP 35 1190(57)}
γ: no $\gamma_{1,525}$ (γ <0.02%), no other γ rays observed *Ge(Li)* {PL 35B 563(71), PRL 27 198(71)}
others: {CJP 35 1190(57)}
$t_{1/2}$(levels): **0.611:** 97 *28* fs *Doppler* {NP A203 401(73)}, 28 *12* fs *Doppler* {NP A176 577(71)}
1.491: 315 ps *recoil dist Doppler* {NP A192 524(72)}, 31^{+7}_{-5} ps *recoil dist Doppler* {PR C9 1033(74)}
1.511: 408 ps *recoil dist Doppler* {PR C9 1033(74)}, 518 ps *recoil dist Doppler* {NP A192 524(72)}
1.586: 0.072 ps *Doppler* {NP A176 577(71)}
1.846: >0.7 ps *Doppler* {NP A176 577(71)}
1.874: <0.07 ps *Doppler* {NP A176 577(71)}
1.889: 0.042 ps *Doppler* {NP A203 401(73)}
2.188: 0.542*4* ps *Doppler* {NP A176 577(71)}
2.223: 87 *30* fs (or 0.6 *3* ps; possibly two levels) *Doppler* {NP A176 577(71), EB}
2.455: 0.18 *11* ps *Doppler* {NP A176 577(71)}
2.488: <0.05 ps *Doppler* {NP A176 577(71)}
2.535: 0.66 *30* ps *Doppler* {NP A176 577(71)}
2.650: 0.33*24* ps *Doppler* {NP A176 577(71)}
2.816: <0.07 ps *Doppler* {NP A176 577(71)}
2.833: 0.21 *11* ps *Doppler* {NP A176 577(71)}
2.847: 0.20 *12* ps *Doppler* {NP A176 577(71)}
2.910: >0.8 ps *Doppler* {NP A176 577(71)}
3.090: 0.21*4* ps *Doppler* {NP A176 577(71)}
3.393: 0.065 ps *Doppler* {NP A176 577(71)}
3.688: <0.03 ps *Doppler* {NP A176 577(71)}
3.933: <0.05 ps *Doppler* {NP A176 577(71)}
others: {NP A203 401(73), BAPS 16 1178(71), NP A176 577(71)}

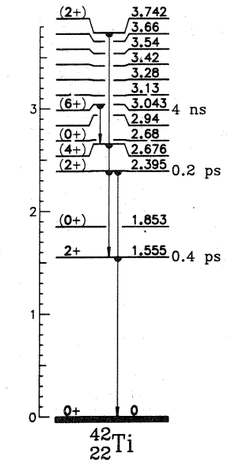
$^{42m}_{21}$Sc

Δ: −31.5032 *19* {ANDT 19 175(77)}
π: β^+ {PR 129 2653(63)}
$t_{1/2}$: 62.03 s {PR C10 1993(74)}; 62.04 s {PR 129 2653(63)}; 60.6 *4* s {NP 62 434(65)}
Class: A; **Ident:** chem, cross bomb, excit, genet energy levels {PR 129 2653(63)}
Prod: $^{39}K(\alpha,n)$ {PR 129 2653(63), NP 62 434(65)}; $^{42}Ca(p,n)$ {PR C10 1993(74)}
β^+: **2.82** *30 scint* {NP 62 434(65)}
2.87 *10 scint* {PR 129 2653(63)}
γ: (**norm:** $\gamma_{1,525}$ (γ 100%), from level scheme) **0.4375***5*, **1.2270***5*, **1.5245***5 Ge(Li)* {PR 186 1160(69)}
0.438*3* (I_γ100*3*), **1.226** *10* (I_γ100*1*), **1.520** *10* (I_γ100) *scint, scint–scint γγ coinc* {PR 129 2653(63)}
others: {NP 62 434(65)}

$^{42}_{22}$Ti levels – References

$^{40}Ca(^3He,n),^{40}Ca(^3He,n\gamma)$: NP A217 400(75), PL 26B 432(68), NP A114 401(68), PR C10 1013(74), NP A230 109(74), PR C12 813(75), NuoL s2v1 695(71), BAPS 16 555(71), NP A203 401(73), NP A214 1(73); **others:** NP A94 261(67)
Other reactions:
$^{40}Ca(^{12}C,^{10}Be)$: PRL 28 1657(72)
$^{28}Si(^{16}O,2n)$: PRL 29 795(72)

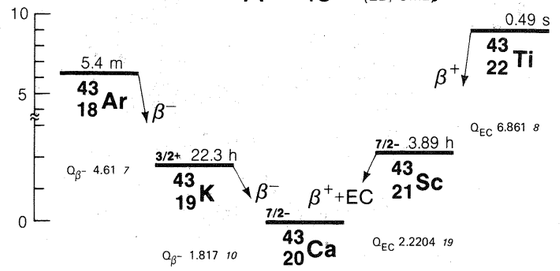
$^{40}Ca(^3He,n),^{40}Ca(^3He,n\gamma)$
14 additional levels above 3.742 MeV.



$^{42}_{22}$Ti

Δ: −25.122*6* {ANDT 19 175(77)}
π: β^+ {PL 30B 165(69)}
genet: parent ^{42}Sc, not parent ^{42m}Sc {PR 186 1160(69), PL 30B 165(69), NP A124 97(69)}
$t_{1/2}$: 0.202*5* s {PR 186 1160(69)}; 0.200*20* s {NP A124 97(69)}; 0.173*14* s {PL 30B 165(69)}; 0.230*50* s {NP A181 465(72)}
Class: C; **Ident:** excit, genet energy levels {NP A124 97(69), PR 186 1160(69), PL 30B 165(69)}
Prod: $^{40}Ca(^3He,n)$ {NP A124 97(69), PR 186 1160(69), PL 30B 165(69)}; $^{28}Si(^{16}O,2n)$ {NP A181 465(72)}
β^+: **6.0** *6 scint* {Th62 Oberhlz}
γ: **0.6107***5* (I_γ100), **1.885***2*? (I_γ≤2), **2.222***2* (I_γ1.2*4*) *Ge(Li), Ge(Li) anti–Compt* {PR 186 1160(69)}
$\gamma_{0,611}$ (γ 56*14*%) *Ge(Li)* {PL 30B 165(69)}
others: {NP A181 465(72), NP A124 97(69)}
$t_{1/2}$(levels): **1.555:** 0.39*11* ps *Doppler* {NP A203 401(73)}, 0.37*15* ps *Doppler* {Cf71 Legnaro 123}, 0.52*21* ps *Doppler* {NP A217 400(73)}; **1.853:** >0.14 ps *Doppler* {NP A217 400(73)}; **2.395:** 0.21*12* ps *Doppler* {NP A203 401(73)}, 0.24*17* ps *Doppler* {NP A217 400(73)}; **2.676:** >1.4 ps *Doppler* {NP A217 400(73)}; **3.043:** 3.5*14* ns *delay coinc* {PR C12 813(75)}, 183 ns *delay coinc* {NP A217 400(73)}; **3.742:** <0.17 ps *Doppler* {NP A217 400(73)}; **others:** {NP A203 401(73), BAPS 16 555(71), NuoL s2v1 695(71)}

A = 43 (EB; CML)



$^{43}_{17}$Cl

Δ: −23.146 {ANDT 19 175(77)}
Class: R; **Ident:** $^{48}Ca(^3He,^8B)$ {PR C14 1773(76)}

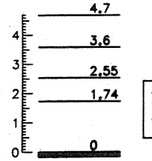
$^{43}_{18}$Ar

Δ: −31.987 {ANDT 19 175(77)}
π: β^- {PL 28B 415(69), NP A151 634(70)}
$t_{1/2}$: 5.37 *6* m {NP A151 634(70)}; 6.5 *18* m {NP A133 237(69)}; **others:** {PL 28B 415(69)}
Class: A; **Ident:** mass spect {PL 28B 415(69)}; excit, genet energy levels {NP A133 237(69)}; mass spect, genet energy levels {NP A151 634(70)}
Prod: protons on Ti {PL 28B 415(69), NP A151 634(70)}; $^{48}Ca(\gamma,\alpha n)$ {NP A133 237(69)}
γ: **0.1666***19*? (I_γ12), **0.4136***4* (I_γ52), **0.4791***2* (I_γ103), **0.547**? (weak), **0.5609***4* (I_γ94), **0.7380***1* (I_γ437), **0.8904***4* (I_γ135), **0.9752***1* (I_γ10012), **1.1105***6* (I_γ54), **1.2051***8* (I_γ179), **1.3115***10*? (I_γ33), **1.3705***4* (I_γ196), **1.4400***3* (I_γ399), **1.8666***8* (I_γ106), **2.3353***11* (I_γ115), **2.3455***5* (I_γ289), **2.4810***12*? (I_γ76), **2.8927***12*? (I_γ16) *Ge(Li), Ge(Li)–scint γγ coinc, sum scint* {NP A151 634(70)}
others: {NP A133 237(69), PL 28B 415(69)}

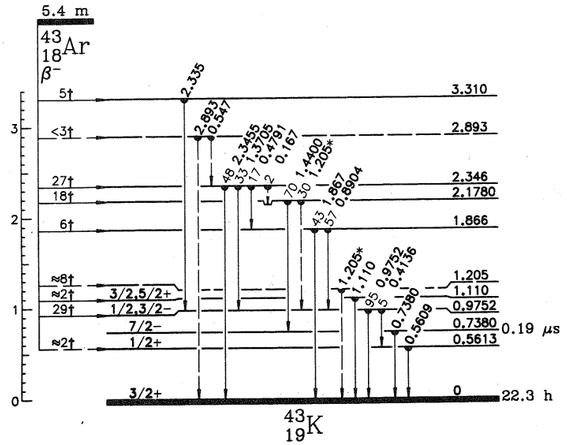
$^{43}_{19}$K

Δ: −36.588 *10* {ANDT 19 175(77)}
I: 3/2 *AB* {PR 116 734(59)}
π: β^- {PR 75 231(49)}
$t_{1/2}$: 22.2 *7* h {NSEg 48 319(72)}; 22.6 *2* h {RaAc 17 63(72)}; 21.75 *50* h {CJC 41 2194(63)}; **others:** {Phil s7v45 621(54), PR 95 444(54), PR 75 231(49)}
Class: A; **Ident:** chem, excit {PR 75 231(49)}; mass spect {Phil s7v45 621(54)}
Prod: $^{40}Ar(\alpha,p)$ {NP 56 259(64), PR 75 231(49), PR 115 108(59)}
β^-: **1.814***25* (1.3%), **1.24** (3.5%), **0.825** *10* (87%), **0.465***25* (8%) *mag* {PR 115 108(59)}
1.839*30* (1.7%), **1.218***25* (5.7%), **0.827***20* (87%), **0.460***20* (5.7%) *mag* {PR 95 444(54), NP A214 1(73)}
others: {PR 75 231(49)}
γ: (**norm:** $\gamma_{0.618}$ (γ 80*2*%), from level scheme) **0.1840***2* (I_γ0.268*55*), **0.2211***2* (I_γ4.13*21*), **0.3729***2* (I_γ87.8*14*), **0.3970***2* (I_γ11.5*1*), **0.4056***2* (I_γ0.110*8*), **0.5936***2* (I_γ11.1*3*), **0.6178***2* (I_γ81), no $\gamma_{0.678}$ (I_γ<0.005), **0.8024***2* (I_γ0.148*10*), **0.9882***2* (I_γ0.336*4*), **1.0151***10* (I_γ0.163*71*), **1.0221***2* (I_γ1.89*7*), no $\gamma_{1.086}$ (I_γ<0.007), **1.3926***10* (I_γ0.103*12*) *Ge(Li)* {RaAc 17 63(72)}
$\gamma_{0.618}$ (*e*/γ ≈2×10^{-4}), other γ rays observed *mag conv* {PR 95 444(54)}
others: {RaAc 13 61(70), CJP 47 1539(69), PR 169 911(68), PR 115 108(59), ArkF 11 465(57), PR 97 1092(55)}
$\beta\gamma(\theta)$: {ArkF 12 495(57)}
$\gamma\gamma(\theta)$: {ArkF 12 495(57)}
$t_{1/2}$(0.738): 1824 ns *delay coinc* {PR C14 1179(76)}, 205 *10* ns *delay coinc* {NP A250 257(75)}

$^{48}Ca(\alpha,^9Be)$



$^{43}_{18}$Ar levels – References
$^{48}Ca(\alpha,^9Be)$: PR C9 2067(74)

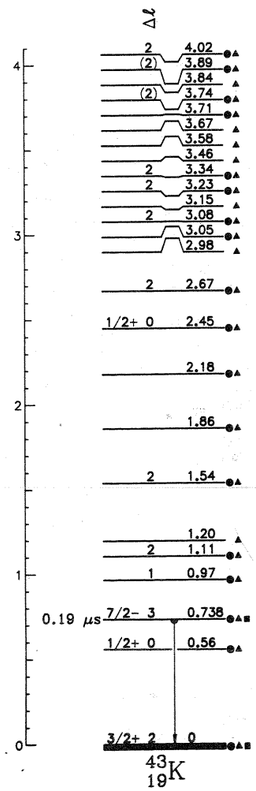


$^{43}_{19}$K levels – References

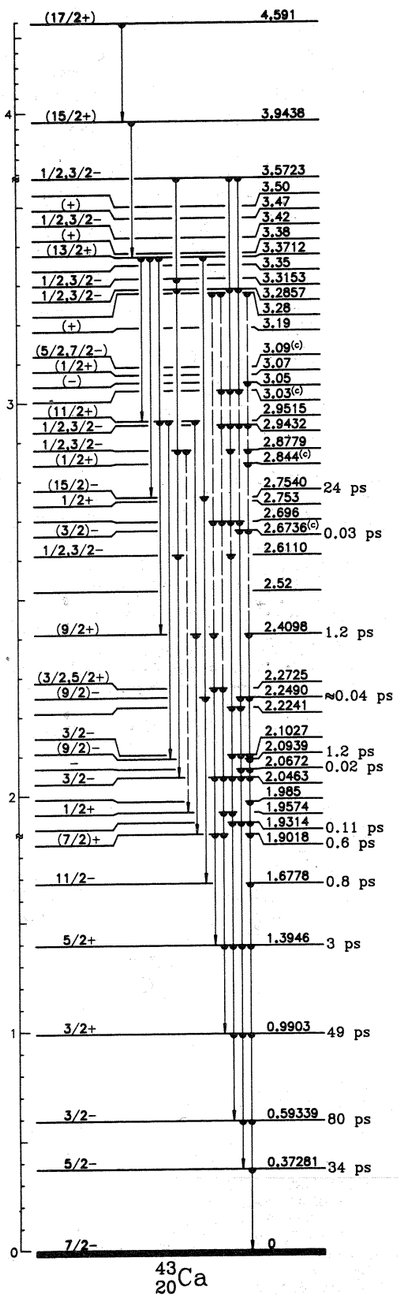
Decay: NP A151 634(70)
^{44}Ca(d,^{3}He): NP A263 210(76), NP A230 393(74), PR 186 1144(69); **others:** PL 57B 413(75)
^{44}Ca(t,α): NP A118 409(68), NP A139 711(69), NP A142 641(70)
^{40}Ar(α,pγ): PR C14 1179(76), NP A250 257(75)

- ● ^{44}Ca(d,^{3}He)
- ▲ ^{44}Ca(t,α)
- ■ ^{40}Ar(α,pγ)

Δℓ values from both (d,^{3}He) and (t,α).
Additional levels above 4.02 MeV: 17 in (t,α), 7 in (d,^{3}He).



18 Reactions
≈100 additional levels above 3.572 MeV.

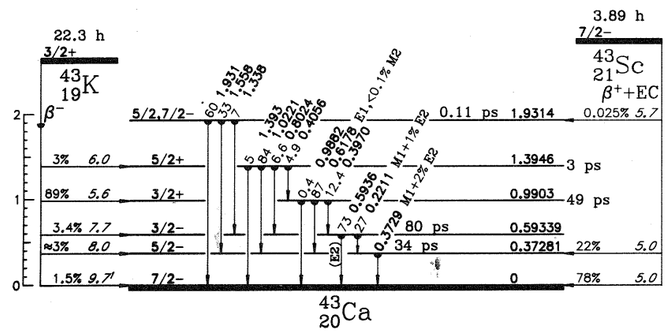


$^{43}_{20}$Ca levels – References

Decay: PR 169 911(68), RaAc 17 63(72), PR C12 567(75), NP A214 1(73), PR C13 2262(76)
18 Reactions: NP A214 1(73), PR C13 1180(76), PR C10 997(74), PR C10 1798(74), NP A225 267(74), NP A263 210(76), PR C13 2262(76), PL 60B 32(75); **others:** ZP 267 399(74)

$^{43}_{20}$Ca

%: 0.135 {BNL-NCS-50605(77)}
Δ: −38.4054 *14* {ANDT 19 175(77)}
I: 7/2 *N*, *O* {PR 90 1130(53), PPSL 67A 450(54)}
σ_c: 6 *1* (reactor spectrum) {PC77 Holden}
$t_{1/2}$(levels): **0.373:** 353 ps *Doppler* {PR C6 784(72)}, 296 ps *Doppler* {NIM 116 185(74)}; **0.593:** 803 ps *Doppler* {PR C6 784(72)}, 719 ps *Doppler* {NP A195 302(72)}, 98 *10* ps *Doppler* {NIM 116 185(74)}; **0.990:** 463 ps *Doppler* {PR C6 784(72)}, 456 ps *Doppler* {NP A195 302(72)}, 647 ps *Doppler* {NIM 116 185(74)}, 518 ps *recoil dist Doppler* {PR C13 1180(76)}, 8328 ps *delay coinc* {PR C2 1365(70)}; **1.395:** 3.46 ps *Doppler* {NP A195 302(72)}, 1.73 ps *Doppler* {NP A179 737(72)}; **1.678:** 0.83 *14* ps *Doppler* {NP A179 737(72)}; **1.902:** 0.55 *10* ps *Doppler* {NP A179 737(72)}; **1.931:** 0.11 *3* ps *Doppler* {NP A179 737(72)}; **2.046:** >0.5 ps *Doppler* {NP A179 737(72)}; **2.067:** 207 fs *Doppler* {NP A179 737(72)}; **2.094:** 1.24 ps *Doppler* {NP A179 737(72)}; **2.224:** <0.05 ps *Doppler* {NP A179 737(72)}; **2.249:** 392 *1* fs *Doppler* {NP A179 737(72)}; **2.272:** >0.3 ps *Doppler* {NP A179 737(72)}; **2.410:** 1.25 ps *Doppler* {NP A179 737(72)}; **2.674:** 31 *13* fs *Doppler* {NP A179 737(72)}; **2.696:** <0.07 ps *Doppler* {NP A179 737(72)}; **2.754:** 23.6 *10* ps *recoil dist Doppler* {PR C13 1180(76), PR C10 997(74)}, 273 ps *recoil dist Doppler* {ZP 267 399(74)}; **2.951:** <14 ps *recoil dist Doppler* {PR C13 1180(76)}; **3.371:** <14 ps *recoil dist Doppler* {PR C13 1180(76)}; **3.944:** <3.5 ps *recoil dist Doppler* {PR C13 1180(76)}; **others:** {NP A179 737(72), CJP 40 660(62)}

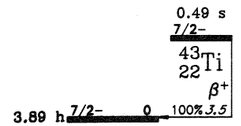


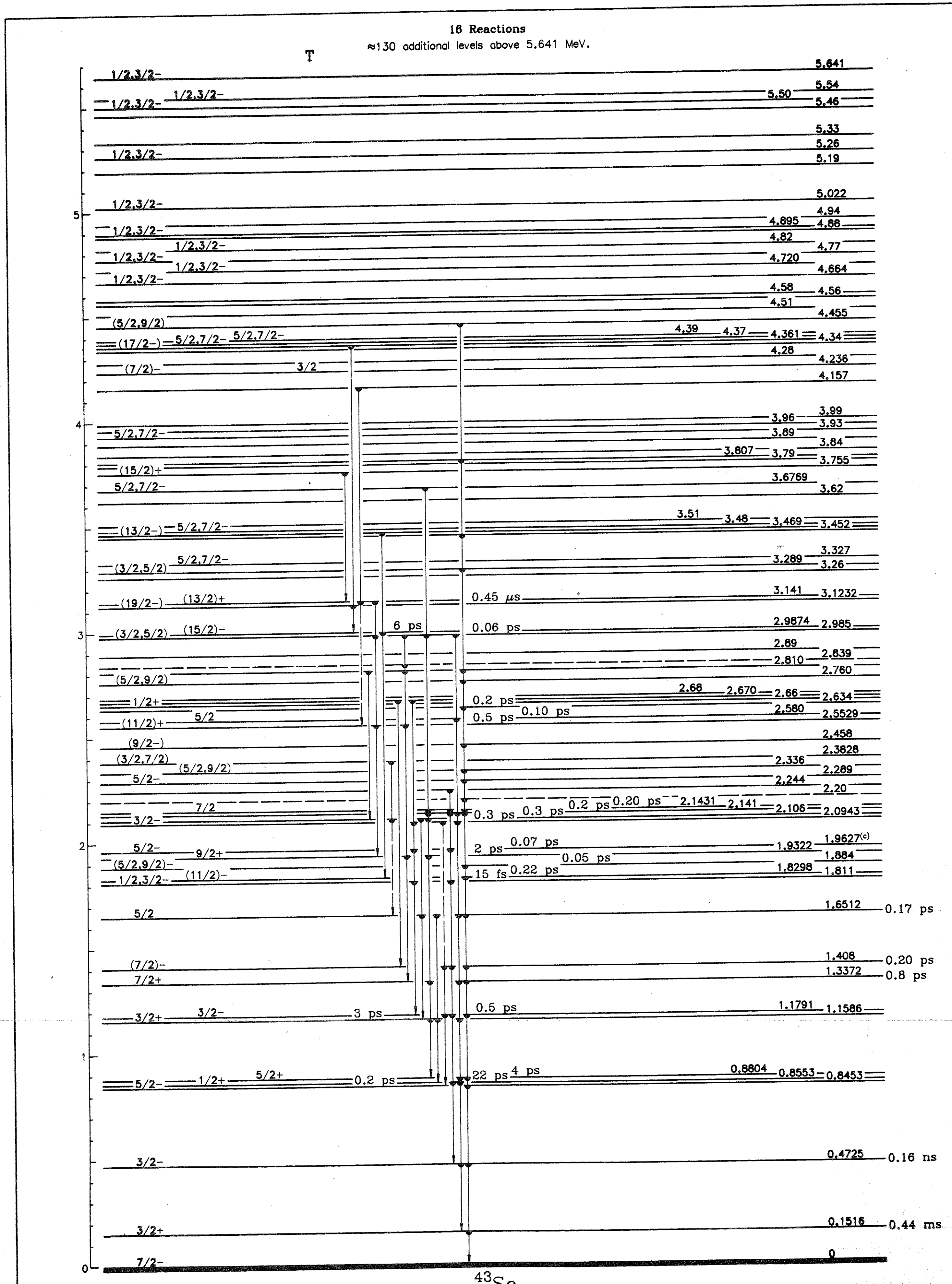
$^{43}_{21}$Sc

Δ: −36.1850 *24* {ANDT 19 175(77)}
I: 7/2 *AB* {PR 141 1106(66)}
%: β^++EC {PR 95 1535(54), PR 88 876(52), PR C12 567(75)}
$t_{1/2}$: 3.8855 h {JINC 31 1883(69)}; 3.922 h {PR 67 289(45)}; 3.952 h {AR63 Chalmrs}; **others:** {Phil s7v45 621(54), JACS 75 2246(53), PR 57 163(40)}
Class: A; **Ident:** chem, excit {Nat 136 220(35)}; mass spect {Phil s7v45 621(54)}
Prod: ^{40}Ca(α,p) {Nat 136 220(35), PR 57 163(40), PR C12 567(75)}; ^{40}Ca(α,n)^{43}Ti(β^+) {Nat 136 220(35), PR 57 163(40), PR C12 567(75)}
β^+: **1.20** *1* (†79), **0.82** *2* (†17), **0.39** *3* (†4) *mag* {PR 95 1535(54)}
1.18 *2* (†76), **0.77** *4* (†24) *mag* {PR 88 876(52)}
1.22 *4* (†67), **0.82** *4* (†26), **0.50** *4* (†7) *mag, mag−scint βγ coinc* {ZETF 47 1162(64)}
γ: ⟨**norm:** $\gamma_{0.373}$ (γ 22 *1*%), from level scheme⟩ **0.3729** *3* ($\dagger_\gamma$100), $\gamma^\pm$ ($\dagger_\gamma$783 *24*), **0.5933** *7* ($\dagger_\gamma$0.0095 *32*), **1.3379** *7* ($\dagger_\gamma$0.008 *1*), **1.5583** *6* ($\dagger_\gamma$0.0375 *22*), **1.9307** *6* ($\dagger_\gamma$0.0672 *34*) *Ge(Li)* {PR C12 567(75)}
others: {PR 169 911(68), ZETF 47 1162(64), PR 95 1535(54), PR 92 207(53), PR 88 876(52)}
$t_{1/2}$(levels): **0.152:** 435 *7* μs *delay coinc* {PRL 13 241(64)}, 421 *21* μs *delay coinc* {PL 24B 661(67)}, 450 *21* μs *delay coinc* {YadF 14 3(71)}; **0.472:** 157 *13* ps *recoil dist Doppler* {NP A115 204(68)}, 152 *21* ps *recoil dist Doppler* {PL 37B 366(71)}; **0.845:** 0.16 ps *Doppler* {PR C3 1939(71)}, 0.31 ps *Doppler* {NP A180 517(72)}; **0.855:** 22 *3* ps *recoil dist Doppler* {PL 37B 366(71)}; **0.880:** 4.9 *10* ps *recoil dist Doppler* {PR C13 1180(76)}, 4.2 *10* ps *recoil dist Doppler* {PL 37B 366(71)}; **1.159:** 3.5^{+14}_{-8} ps *Doppler* {NP A180 517(72)}, 4.4 *10* ps *recoil dist Doppler* {PL 37B 366(71)}, 2.1^{+19}_{-8} ps *Doppler* {PR C3 1939(71)}; **1.179:** 0.59 *10* ps *Doppler* {NP A180 517(72)}, 0.28 *13* ps *Doppler* {PR C3 1939(71)}; **1.337:** 0.59 *17* ps *Doppler* {PR C3 1939(71)}, 1.4 *3* ps *Doppler* {NP A180 517(72)}; **1.408:** 0.17 *3* ps *Doppler* {PR C3 1939(71)}, 0.27 *5* ps *Doppler* {NP A180 517(72)}; **1.651:** 0.16 *3* ps *Doppler* {NP A180 517(72)}, 0.23 *7* ps *Doppler* {PR C3 1939(71)}; **1.811:** 155 fs *Doppler* {PR C3 1939(71)}; **1.830:** 0.21 *3* ps *Doppler* {PR C3 1939(71)}, 0.26 *5* ps *Doppler* {NP A180 517(72)}; **1.884:** 552 *1* fs *Doppler* {NP A180 517(72)}; **1.932:** 2.4 *6* ps *Doppler* {NP A180 517(72)}; **1.963:** 0.07 *1* ps *Doppler* {PR C3 1939(71)}; **2.094:** 0.32 *9* ps *Doppler* {NP A180 517(72)}; **2.106:** 0.28 *6* ps *Doppler* {NP A180 517(72)}; **2.141:** 0.24 *10* ps *Doppler* {NP A180 517(72)}; **2.143:** 0.18 *5* ps *Doppler* {PR C3 1939(71)}, 0.30 *11* ps *Doppler* {NP A180 517(72)}; **2.289:** <0.02 ps *Doppler* {NP A180 517(72)}; **2.336:** <0.04 ps *Doppler* {NP A180 517(72)}; **2.458:** <0.04 ps *Doppler* {NP A180 517(72)}; **2.553:** 0.51 *7* ps *Doppler* {NP A180 517(72)}; **2.580:** 0.10 *3* ps *Doppler* {PR C3 1939(71)}; **2.634:** 0.21 *7* ps *Doppler* {NP A180 517(72)}; **2.760:** <0.05 ps *Doppler* {NP A180 517(72)}; **2.810:** <0.08 ps *Doppler* {NP A180 517(72)}; **2.985:** 0.06 *1* ps *Doppler* {PR C3 1939(71)}; **2.987:** 5.6 *8* ps *recoil dist Doppler* {PR C9 1033(74)}; **3.123:** 0.451 *14* μs *delay coinc* {PRL 27 155(71)}; **3.289:** <4 fs *Doppler* {PR C3 1939(71)}; **3.452:** <7 fs *Doppler* {PR C3 1939(71)}; **3.807:** <4 fs *Doppler* {PR C3 1939(71)}; **4.455:** <4 fs *Doppler* {PR C3 1939(71)}; **others:** {PR C13 1180(76), NP A180 517(72), PR C3 1939(71), PScr 2 261(70), RRou 13 911(68), PL 25B 328(67), YadF 1 198(65), NIM 31 322(64), NP 59 33(64)}

$^{43}_{21}$Sc levels – References

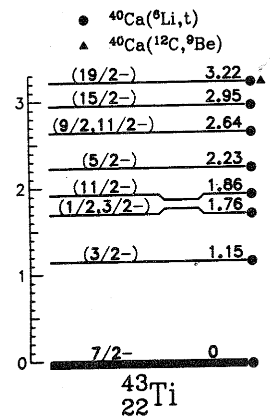
Decay: ZP 165 94(61), ZETF 45 1385(63), NP A98 323(67)
16 Reactions: NP A214 1(73), PScr 7 5(73), PR C10 1678(74), PL 48B 209(74), PR C13 1180(76); **others:** NP A271 49(76)



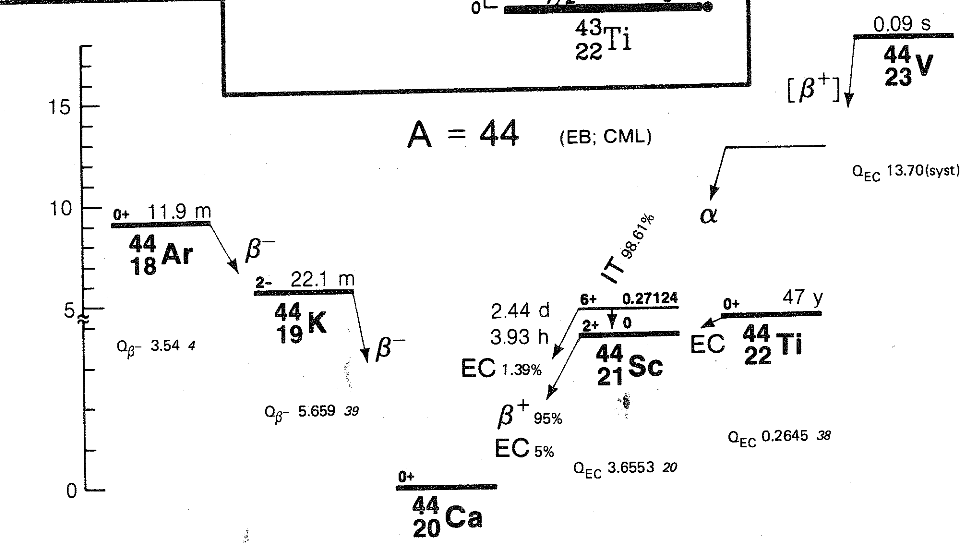


$^{43}_{22}$Ti

Δ: −29.324*7* {ANDT 19 175(77)}
☢: β^+ {ZP 165 94(61)}
$t_{1/2}$: 0.490*10* s {NP A98 323(67)}; 0.400*50* s {ZETF 45 1385(63)}; **others:** {VMos 1969n5 3(69), IzF 25 1115(61), ZP 165 94(61), ZNat 15a 593(60), PR 96 773(54), RSI 19 458(48)}
Class: C; **Ident:** excit {RSI 19 458(48)}; excit, decay charac {ZP 165 94(61)}
Prod: ^{40}Ca(α,n) {RSI 19 458(48), ZP 165 94(61), ZETF 45 1385(63)}
β^+: **5.80***4 mag* {VMos 1969n5 3(69)}
5.81 *15 scint* {ZP 165 94(61)}
others: {ZETF 45 1385(63)}

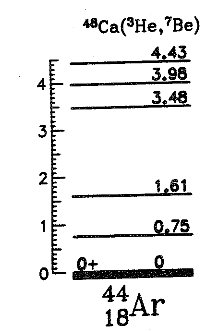


$^{43}_{22}$Ti levels – References
^{40}Ca(^{6}Li,t): PL 48B 209(74)
^{40}Ca(^{12}C,^{9}Be): PRL 28 1659(72)
Other reactions:
^{40}Ca(α,n): NP A98 323(67)
^{46}Ti(^{3}He,^{6}He): PR C12 51(75), PRL 29 434(72)



$^{44}_{18}$Ar

Δ: −32.271*20* {ANDT 19 175(77)}
☢: β^- {NP A133 237(69), NP A151 634(70)}
$t_{1/2}$: 11.87*5* m {NP A151 634(70)}; 14.0*15* m {NP A133 237(69)}
Class: A; **Ident:** genet, excit {NP A133 237(69)}; mass spect {NP A151 634(70)}
Prod: protons on Ti {NP A151 634(70)}; ^{48}Ca(γ,α) {NP A133 237(69)}
γ: ⟨**norm:** $\gamma_{1.705}$ (γ 66*20*%), from level scheme⟩ **0.1823***1* (†γ99*11*), **0.4063***5* (†γ8*6*), **0.4276***10* (†γ4*3*), **1.7047***4* (†γ100*30*), **1.8867***5* (†γ50*30*) *Ge(Li)* {NP A151 634(70)}
others: {NP A133 237(69)}



$^{44}_{18}$Ar levels – References
^{48}Ca(^{3}He,^{7}Be): PL 64B 143(76)

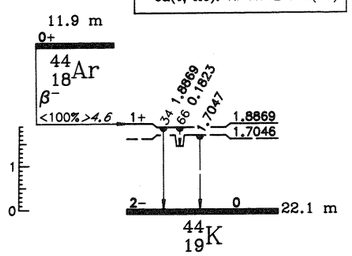
$^{44}_{19}$K

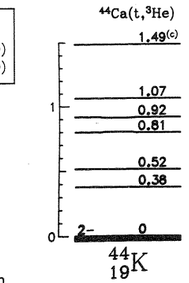
Δ: −35.807*39* {ANDT 19 175(77)}
☢: β^- {PR 52 663(37)}
$t_{1/2}$: 22.15*20* m {NP A203 164(73)}; 22.0*5* m {PR 94 117(54)}; **others:** {Oest 98 195(61), JPJa 15 1909(60), PR 57 177(40), PR 52 663(37)}
Class: A; **Ident:** chem, excit {PR 52 663(37)}; chem, sep isotopes, cross bomb {PR 94 117(54)}; mass spect {Phil s7v45 621(54)}
Prod: ^{44}Ca(n,p) {PR 94 117(54), PR 52 663(37), PR 57 177(40), Oest 98 195(61), JPJa 15 1909(60)}
β^-: **5.580***80* (34%) *scint* {YadF 11 483(70)}
5.25*2* (35*10*%), **4** (9*4*%), **2** (≈30%) *scint, scint−scint βγ coinc* {Oest 98 195(61)}
others: {JPJa 15 1909(60), PR 94 117(54)}
γ: ⟨**norm:** $\gamma_{1.157}$ (γ 58*9*%), from level scheme⟩ **0.17435***25* (†γ1.0*2*); **0.20998***25* (†γ0.3*2*), **0.263532***55* (†γ1.9*5*), **0.353665***250* (†γ0.3*2*), **0.368207***14* (†γ38.8*7*), **0.374845***98* (†γ3.3*8*), **0.403862***196* (†γ1.1*3*), **0.46330***35* (†γ0.3*3*), **0.646473***315* (†γ1.5*5*), **0.651355***9* (†γ52*2*), **0.682338***29* (†γ1.3*7*), **0.696895** (†γ≤0.1), **0.726490***16* (†γ65*2*), **0.7330***4* (†γ2.8*12*), **0.747630***28* (†γ36*2*), **0.7611***3* (†γ2*1*), **0.7668***5* (†γ0.8*7*), **0.772975** (†γ≤0.1), **0.876530***29* (†γ29.8*6*), **0.891095***120* (†γ1.6*6*), **0.938577***153* (†γ3*1*), **1.0050***9* (†γ0.5), **1.019548***68* (†γ14.5*6*), **1.024738***17* (†γ115*2*), **1.050596***95* (†γ9.6*14*), **1.074137***385* (†γ1.5*9*), **1.10130***45* (†γ0.2*2*), **1.10626***25* (†γ1.7*5*), **1.107978***93* (†γ11.5*8*), **1.11970***35* (†γ0.3*2*), **1.126076***10* (†γ131*2*), **1.157002***3* (†γ1000*1*), **1.1954** (†γ0.8*7*), **1.222500***76* (†γ8.3*8*), **1.244747***53* (†γ14.3*5*), **1.27276***35* (†γ1.4*13*), **1.285***1* (†γ≤0.3), **1.3637***8* (†γ0.2*2*), **1.37762***45* (†γ2*1*), **1.4275***4* (†γ1.9*9*), **1.42866***40* (†γ0.4*2*), **1.499451***36* (†γ135*5*), **1.525011**, **1.575864***309* (†γ3.0*9*), **1.582?** (†γ≤0.1), **1.625049***716* (†γ0.6*4*), **1.634520***107* (†γ4.0*9*), **1.658690***181* (†γ3.7*9*), **1.701879***305* (†γ1.7*7*), **1.752629***10* (†γ70*1*), **1.777973***20* (†γ36.5*8*), **1.810438***682* (†γ1.2*8*), **1.884542***1000* (†γ0.4*3*), **1.887205***279* (†γ2*1*), **1.893207***438* (†γ1.9*9*), **1.8960***9* (†γ1.9*14*), **1.9160***8* (†γ2.3*12*), **1.923?** (†γ≤0.9), **1.976913***691* (†γ0.9*7*), **1.992421***516* (†γ1.2*8*), **2.144231***76* (†γ12.9*8*), **2.150786***17* (†γ391*8*), **2.167841***580* (†γ1.3*7*), **2.2003** (†γ0.2*2*), **2.268525***953* (†γ0.5*4*), **2.2808***7*? (†γ≤0.5), **2.3243** (†γ0.6*4*), **2.338287***552* (†γ0.7*4*), **2.423339***587* (†γ0.7*4*), **2.497291***869* (†γ0.6*5*), **2.504394***62* (†γ11.2*9*), **2.518991***18* (†γ167*3*), **2.598355***592* (†γ0.7*5*), **2.619164***120* (†γ3.6*7*), **2.656411***30* (†γ16.9*8*), **2.668** (†γ≤0.05), **2.711** (†γ0.3*3*), **2.7404***8* (†γ0.11*9*), **2.745***1* (†γ≤0.2), **2.847646***693* (†γ0.5*3*), **2.9378***10* (†γ0.8*3*), **2.973***1* (†γ0.3*2*), **2.982469***149* (†γ2.2*3*), **3.0670***8*? (†γ0.2*2*), **3.103175***401* (†γ1.1*4*), **3.158070***201* (†γ2.6*4*), **3.201274***73* (†γ12.1*9*), **3.217313***546* (†γ0.5*3*), **3.227132***763* (†γ0.3*2*), **3.241958***485* (†γ0.6*3*), **3.252072***124* (†γ2.7*4*), **3.278995***650* (†γ0.3*2*), **3.301210***139* (†γ5.5*9*), **3.307728***450* (†γ0.3*1*), **3.395508***44* (†γ28.7*8*), **3.404646***551* (†γ0.8*4*), **3.415538***634* (†γ1.0*4*), **3.661363***11* (†γ105*2*), **3.676732***624* (†γ0.25*11*), **3.708898***124* (†γ≤0.8), **3.726634***411* (†γ0.5*1*), **3.7471** (†γ≤0.01), **3.755173***850* (†γ0.14*9*), **3.868555***216* (†γ1.1*3*), **3.967822** (†γ0.11*9*), **4.005** (†γ0.02*2*), **4.044** (†γ≤0.05), **4.074***1* (†γ0.08*8*), **4.162545***765*? (†γ0.09*8*), **4.167792***543* (†γ0.16*8*), **4.2101***10* (†γ0.09*8*), **4.337935***747*? (†γ0.09*9*), **4.355** (†γ≤0.05), **4.403611***625* (†γ0.06*4*), **4.408911***184* (†γ0.92*15*), **4.436994***647* (†γ0.12*8*), **4.471537***601* (†γ0.11*8*), **4.651** (†γ0.14*8*), **4.865812***151* (†γ2.8*1*), **4.892324***782* (†γ0.06*5*), **5.0254***8* (†γ0.03*2*), **5.161959***101* (†γ1.11*7*), **5.2310** (†γ≤0.01), **5.5613***10*? (†γ0.05*4*) *Ge(Li), Ge(Li) anti−Compt, Ge(Li)−Ge(Li) γγ coinc* {PR C13 847(76)}
others: {NP A203 164(73), RaAc 13 61(70), YadF 11 483(70), Oest 98 195(61), JPJa 15 1909(60), PR 94 117(54)}

$^{44}_{18}$K levels – References

Decay: NP A151 634(70)

^{44}Ca(t,^{3}He): NP A142 641(70)





$^{44}_{20}$Ca

%: 2.09 {BNL-NCS-50605(77)}

Δ: −41.4660 *14* {ANDT 19 175(77)}

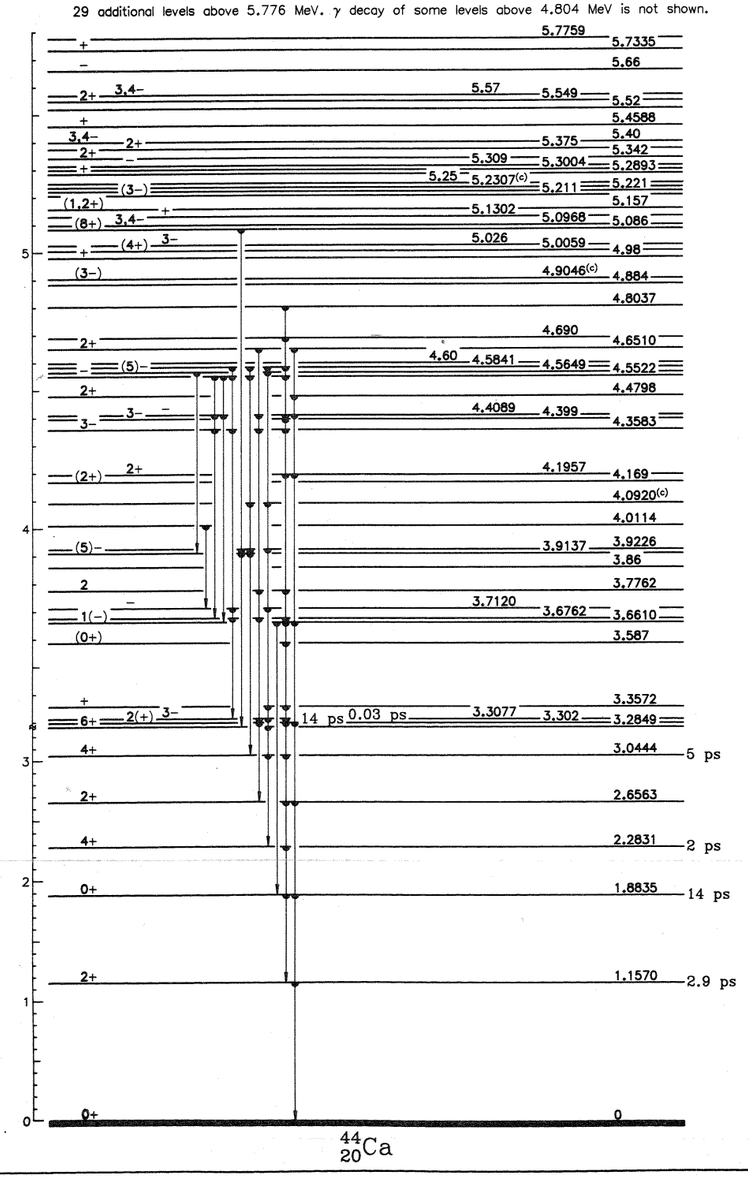
σ_g: 0.885 {PC77 Holden}

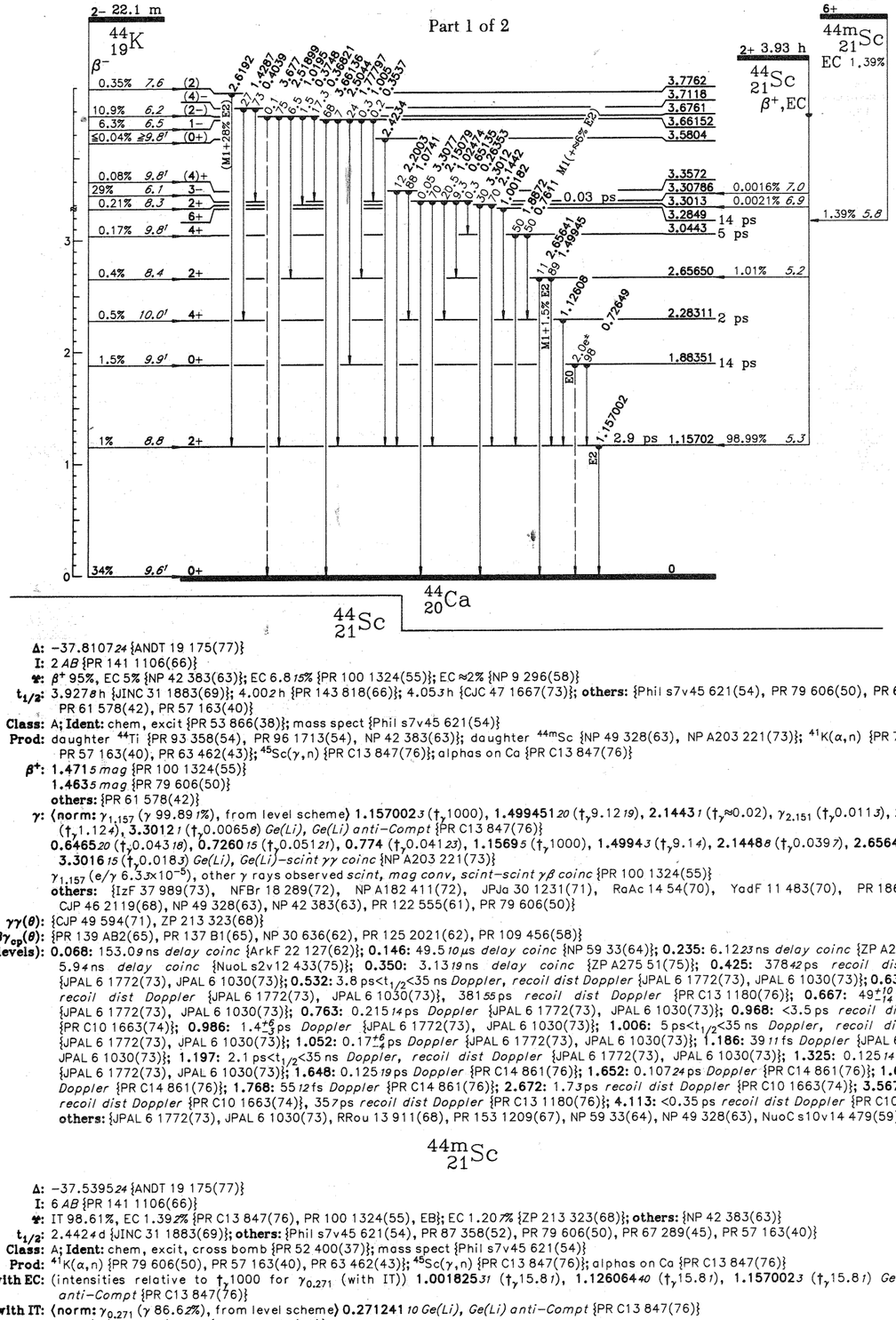
$t_{1/2}$(levels): **1.157:** 2.88 *12* ps *Coulomb excit* {NP A204 574(73)}; **1.884:** 144 ps *Doppler* {PR C8 1406(73)}; **2.283:** 1.97 ps *Doppler* {PR C8 1406(73)}; **2.656:** <0.02 ps *Doppler* {PR C8 1406(73)}; **3.044:** 4.6 $^{+12}_{-10}$ ps *Doppler* {PR C8 1406(73)}; **3.285:** 13.6 *12* ps *recoil dist Doppler* {PR C9 1033(74)}; **3.301:** 35 *17* fs *Doppler* {PR C8 1406(73)}; **3.357:** <0.03 ps *Doppler* {PR C8 1406(73)}

others: {PR C13 1180(76), PR C10 1798(74), ParN 6 119(73), PR C8 1406(73), NP A179 737(72), NuoL s2v5 913(72), PR C5 513(72), BAPS 16 1183(71), NP A164 353(71), BAPS 13 104(68), IzF 25 832(61)}

24 Reactions

29 additional levels above 5.776 MeV. γ decay of some levels above 4.804 MeV is not shown.





Δ: −37.8107 *24* {ANDT 19 175(77)}

I: 2 *AB* {PR 141 1106(66)}

%: $β^+$ 95%, EC 5% {NP 42 383(63)}; EC 6.8 *15%* {PR 100 1324(55)}; EC ≈2% {NP 9 296(58)}

$t_{1/2}$: 3.927 *8* h {JINC 31 1883(69)}; 4.00 *2* h {PR 143 818(66)}; 4.05 *3* h {CJC 47 1667(73)}; **others:** {Phil s7v45 621(54), PR 79 606(50), PR 67 289(45), PR 61 578(42), PR 57 163(40)}

Class: A; **Ident:** chem, excit {PR 53 866(38)}; mass spect {Phil s7v45 621(54)}

Prod: daughter ^{44}Ti {PR 93 358(54), PR 96 1713(54), NP 42 383(63)}; daughter ^{44m}Sc {NP 49 328(63), NP A203 221(73)}; ^{41}K(α,n) {PR 79 606(50), PR 57 163(40), PR 63 462(43)}; ^{45}Sc(γ,n) {PR C13 847(76)}; alphas on Ca {PR C13 847(76)}

$β^+$: **1.471** *5 mag* {PR 100 1324(55)}; **1.463** *5 mag* {PR 79 606(50)}; **others:** {PR 61 578(42)}

γ: (**norm:** $γ_{1.157}$ (γ 99.89 *1*%), from level scheme) **1.157002** *3* ($t_γ$1000), **1.499451** *20* ($t_γ$9.12 *19*), **2.1443** *1* ($t_γ$≈0.02), $γ_{2.151}$ ($t_γ$0.011 *3*), **2.656411** *30* ($t_γ$1.12 *4*), **3.3012** *1* ($t_γ$0.0065 *8*) *Ge(Li), Ge(Li) anti-Compt* {PR C13 847(76)}; **0.6465** *20* ($t_γ$0.043 *18*), **0.7260** *15* ($t_γ$0.051 *21*), **0.774** ($t_γ$0.041 *23*), **1.1569** *5* ($t_γ$1000), **1.4994** *3* ($t_γ$9.1 *4*), **2.1448** *8* ($t_γ$0.039 *7*), **2.6564** *5* ($t_γ$1.3 *1*), **3.3016** *15* ($t_γ$0.018 *3*) *Ge(Li), Ge(Li)–scint γγ coinc* {NP A203 221(73)}; $γ_{1.157}$ (*e*/γ 6.3×10^{-5}), other γ rays observed *scint, mag conv, scint–scint γβ coinc* {PR 100 1324(55)}

others: {IzF 37 989(73), NFBr 18 289(72), NP A182 411(72), JPJa 30 1231(71), RaAc 14 54(70), YadF 11 483(70), PR 186 1160(69), CJP 46 2119(68), NP 49 328(63), NP 42 383(63), PR 122 555(61), PR 79 606(50)}

γγ(θ): {CJP 49 594(71), ZP 213 323(68)}

$βγ_{cp}$(θ): {PR 139 AB2(65), PR 137 B1(65), NP 30 636(62), PR 125 2021(62), PR 109 456(58)}

$t_{1/2}$(levels): **0.068:** 153.0 *9* ns *delay coinc* {ArkF 22 127(62)}; **0.146:** 49.5 *10* μs *delay coinc* {NP 59 33(64)}; **0.235:** 6.12 *23* ns *delay coinc* {ZP A275 51(75)}, 5.9 *4* ns *delay coinc* {NuoL s2v12 433(75)}; **0.350:** 3.13 *19* ns *delay coinc* {ZP A275 51(75)}; **0.425:** 378 *42* ps *recoil dist Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **0.532:** 3.8 ps<$t_{1/2}$<35 ns *Doppler, recoil dist Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **0.631:** 411 *30* ps *recoil dist Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}, 381 *55* ps *recoil dist Doppler* {PR C13 1180(76)}; **0.667:** 49 $^{+10}_{-14}$ fs *Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **0.763:** 0.215 *14* ps *Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **0.968:** <3.5 ps *recoil dist Doppler* {PR C10 1663(74)}; **0.986:** 1.4 $^{+6}_{-3}$ ps *Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **1.006:** 5 ps<$t_{1/2}$<35 ns *Doppler, recoil dist Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **1.052:** 0.17 $^{+6}_{-4}$ ps *Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **1.186:** 39 *11* fs *Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **1.197:** 2.1 ps<$t_{1/2}$<35 ns *Doppler, recoil dist Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **1.325:** 0.125 *14* ps *Doppler* {JPAL 6 1772(73), JPAL 6 1030(73)}; **1.648:** 0.125 *19* ps *Doppler* {PR C14 861(76)}; **1.652:** 0.107 *24* ps *Doppler* {PR C14 861(76)}; **1.681:** 97 *23* fs *Doppler* {PR C14 861(76)}; **1.768:** 55 *12* fs *Doppler* {PR C14 861(76)}; **2.672:** 1.7 *3* ps *recoil dist Doppler* {PR C10 1663(74)}; **3.567:** 48.3 *17* ps *recoil dist Doppler* {PR C10 1663(74)}, 35 *7* ps *recoil dist Doppler* {PR C13 1180(76)}; **4.113:** <0.35 ps *recoil dist Doppler* {PR C10 1663(74)}; **others:** {JPAL 6 1772(73), JPAL 6 1030(73), RRou 13 911(68), PR 153 1209(67), NP 59 33(64), NP 49 328(63), NuoC s10v14 479(59)}

$^{44m}_{21}$Sc

Δ: −37.5395 *24* {ANDT 19 175(77)}

I: 6 *AB* {PR 141 1106(66)}

%: IT 98.61%, EC 1.39 *2*% {PR C13 847(76), PR 100 1324(55), EB}; EC 1.20 *7*% {ZP 213 323(68)}; **others:** {NP 42 383(63)}

$t_{1/2}$: 2.442 *4* d {JINC 31 1883(69)}; **others:** {Phil s7v45 621(54), PR 87 358(52), PR 79 606(50), PR 67 289(45), PR 57 163(40)}

Class: A; **Ident:** chem, excit, cross bomb {PR 52 400(37)}; mass spect {Phil s7v45 621(54)}

Prod: ^{41}K(α,n) {PR 79 606(50), PR 57 163(40), PR 63 462(43)}; ^{45}Sc(γ,n) {PR C13 847(76)}; alphas on Ca {PR C13 847(76)}

γ with EC: (intensities relative to $t_γ$1000 for $γ_{0.271}$ (with IT)) **1.001825** *31* ($t_γ$15.8 *1*), **1.126064** *40* ($t_γ$15.8 *1*), **1.157002** *3* ($t_γ$15.8 *1*) *Ge(Li), Ge(Li) anti-Compt* {PR C13 847(76)}

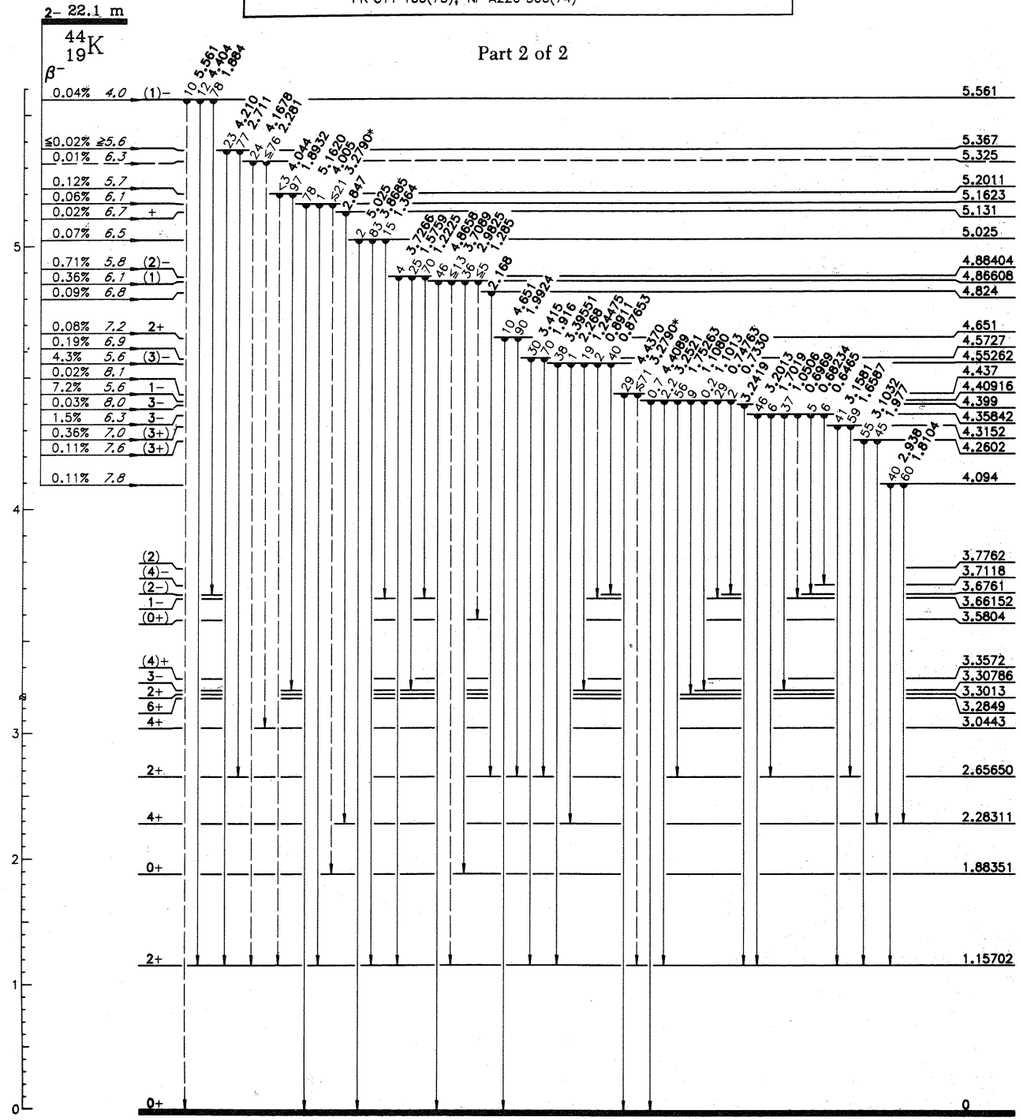
γ with IT: (**norm:** $γ_{0.271}$ (γ 86.6 *2*%), from level scheme) **0.271241** *10 Ge(Li), Ge(Li) anti-Compt* {PR C13 847(76)}; $γ_{0.271}$ (*e*/γ 0.139 *3*) *scint* {PR 100 1324(55)}; no $γ_{0.068}$ (γ <0.06%) *scint, scint–scint γγ coinc* {NP 49 328(63)}

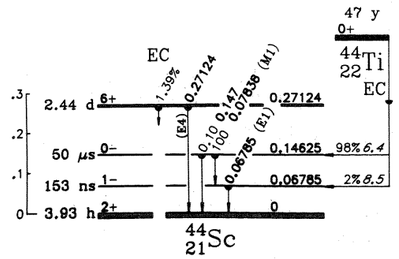
γ: others: {NFBr 18 289(72), JPJa 30 1231(70), RaAc 14 54(70), PR 186 1160(69), CJP 46 2119(68), ZP 213 323(68), CJP 45 2446(67), PR 79 606(50), PR 61 578(42), PR 60 415(41)}

$^{44}_{20}$Ca levels – References

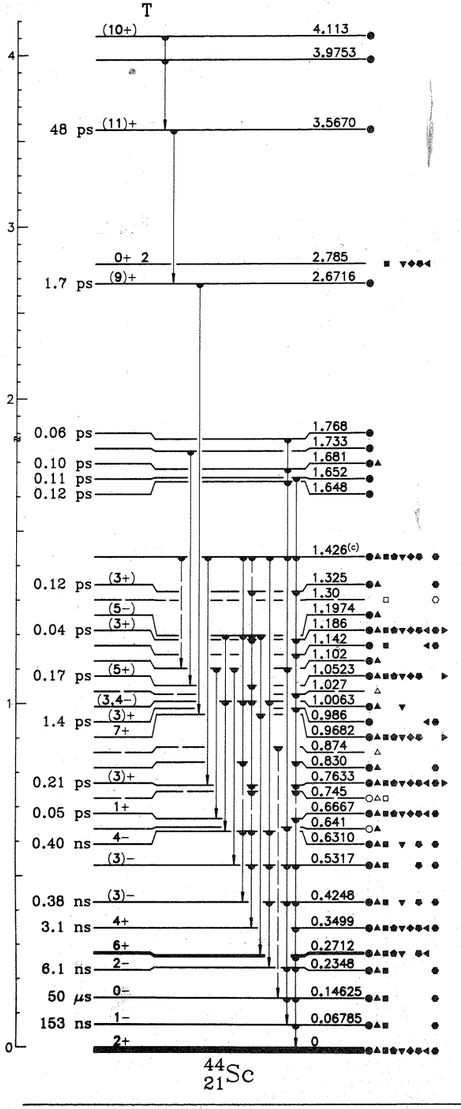
Decay: PR C13 847(76)
24 Reactions: NP A214 1(73), PR C10 1798(74), PR C11 2108(75); **others:** PR C11 100(75), NP A226 506(74)

Part 2 of 2





Additional levels above 1.426 MeV: 20 in (^{3}He,p), 70 in (^{3}He,d), 2 in (p,d), 21 in (d,t), 8 in (^{3}He,α), 1 in (d,α), ≈26 plus many resonances in (p,γ).



●○ In-beam γ spect
▲△ ^{43}Ca(p,γ)
■□ ^{44}Ca(^{3}He,t)
● ^{45}Sc(p,d)
▼ ^{45}Sc(d,t)
◆ ^{45}Sc(^{3}He,α)
● ^{43}Ca(^{3}He,d)
◀ ^{42}Ca(^{3}He,p)
●○ ^{46}Ti(d,α)
▶ ^{42}Ca(α,d)

$^{44}_{21}$Sc levels – References

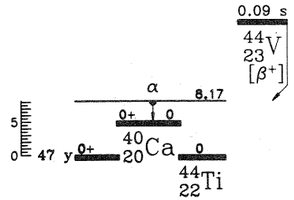
Decay: NP 49 328(63), PR 153 1209(67), IzF 37 987(73), JPAL 6 1030(73)
In-beam γ spect: JPAL 6 1772(73), JPGL 2 67(76), PR C10 1663(74), PScr 8 191(73), PR C14 861(76), JPAL 6 1030(73); others: PR C13 1180(76), ZP A275 51(75), JPAL 7 2289(74), NuoL s2v9 29(74)
^{43}Ca(p,γ): Cf71 Legnaro 375; others: PR 169 911(68)
^{44}Ca(^{3}He,t): PR C6 851(72); others: NP A168 151(71)
^{45}Sc(p,d): PR 134 B378(64)
^{45}Sc(d,t): PR C3 158(71); others: NP A213 510(73)
^{45}Sc(^{3}He,α): NP A168 177(71); others: PR C1 1776(70)
^{43}Ca(^{3}He,d): Th67 Lynen, PR 175 1453(68), JPAL 7 L97(74)
^{42}Ca(^{3}He,p): NP A153 502(70), NP A214 1(73), JPPo 34 771(73); others: PRL 18 1140(67)
^{46}Ti(d,α): NP 51 641(64); others: NP A192 125(72)
^{42}Ca(α,d): NP A265 220(76)
Other reactions:
^{48}Ti(p,^{3}He): PL 32B 596(70)
^{44}Ca(p,n): JPAL 7 L97(74), NuoC s11v18A 593(73), NP A99 6(67)

$^{44}_{22}$Ti

Δ: −37.5462*31* {ANDT 19 175(77)}
☢: EC {PR 93 358(54), PR 96 1713(54)}
$t_{1/2}$: 48.2 y {JINC 27 493(65)}; 46.4 *17* y {JINC 27 487(65)}; others: {PR 106 90(57)}
Class: A; Ident: chem, genet {PR 93 358(54), PR 96 1713(54), PR 106 90(57), NP 42 383(63)}
Prod: ^{45}Sc(p,2n) {PR 93 358(54), PR 96 1713(54), JINC 27 493(65)}; ^{45}Sc(d,3n) {PR 106 90(57), JINC 27 487(65)}
γ: (norm: $\gamma_{0.068}$ (γ 88*2*%), from level scheme) **0.06785** *4* ($\dagger_\gamma$100, e_K/γ 0.12323), **0.07838** *4* ($\dagger_\gamma$106.2*8*, e_K/γ 0.0315), **0.1470** *15* ($\dagger_\gamma$0.106*32*) *Ge(Li)–scint γγ coinc, Ge(Li)–ion ch γγ coinc* {PR 153 1209(67)}
0.0679 *5* ($\dagger_\gamma$100, *e/γ* 0.14*5*), **0.0784** *5* ($\dagger_\gamma$107.9*54*, *e/γ* <0.07), **0.1463** ($\dagger_\gamma$<0.45) *Ge(Li)* {IzF 37 987(73)}
0.06785 *7* ($\dagger_\gamma$100, *e/γ* 0.10*5*), **0.07844** *7* ($\dagger_\gamma$127*18*, *e/γ* 0.017*8*) *scint, mag, mag conv, ion ch, scint–scint γγ coinc* {NP 49 328(63)}
others: {NuoC s10v14 479(59), PR 106 90(57)}
γγ(θ): {NP A115 234(68), PR 153 1209(67), NP 49 328(63), ArkF 22 307(62)}
$t_{1/2}$(levels): **1.083:** 3.1*8* ps *Doppler* {NP A202 579(73)}
1.904: >0.5 ps *Doppler* {NP A202 579(73)}
2.454: 0.42*8* ps *Doppler* {NP A202 579(73)}
2.531: 0.98*14* ps *Doppler* {NP A202 579(73)}
2.886: 0.29*10* ps *Doppler* {NP A202 579(73)}
3.176: <2 ps *Doppler* {NP A202 579(73)}
3.415: 0.48*8* ps *Doppler* {NP A202 579(73)}
3.980: 0.62 ps *Doppler* {PRL 31 946(73)}
4.015: 0.39*6* ps *Doppler* {PRL 31 946(73)}
6.508: <0.5 ps *Doppler* {PR C12 468(75)}
7.671: 1.9*3* ps *Doppler* {PR C12 468(75)}
8.040: 2.1*4* ns *delay coinc* {NP A262 189(76)}
others: {PR C10 1663(74)}

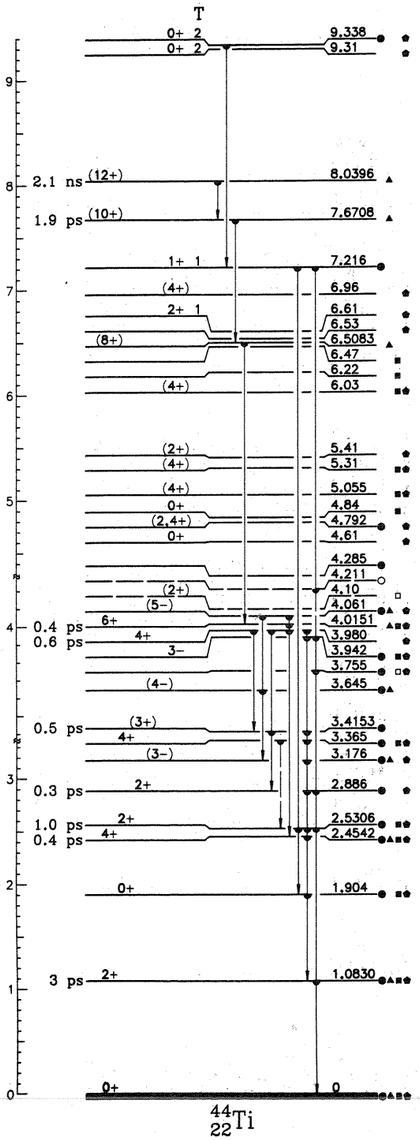
$^{44}_{22}$Ti levels – References

Decay: PL 37B 380(71)
^{40}Ca(α,γ): NP A202 579(73), PR C4 443(71), PRL 31 946(73), PRL 29 1472(72), Cf71 Legnaro 211; others: PR C13 1745(76), NP A232 269(74), PL 30B 478(69), CR 266B 972(68), CR 265B 859(67)
In-beam γ spect: PR C10 1663(74), PR C12 468(75)
^{40}Ca(^{6}Li,d): PRL 29 735(72), PR C9 965(74); others: PRL 30 666(73), IzF 33 586(69)
^{48}Ti(p,t): NP A197 568(72), PR C5 453(72), PL 58B 286(75); others: PRL 36 279(76), APNY 76 437(73), PL 32B 596(70), PRL 25 1035(70), PR 136 B1006(64), PRL 12 726(64)
Other reactions:
^{42}Ca(^{3}He,n): NP A230 109(74)
^{42}Ca(^{16}O,^{14}C): PR C13 699(76)
^{40}Ca(α,α): ZP A276 317(76), AnBx s1v83 371(69)
^{40}Ca(^{12}C,^{8}Be): NP A259 129(76)
^{40}Ca(^{7}Li,t): IzF 33 586(69), CEN-1600(72), JPCo 33 C5-66(72)
^{40}Ca(^{16}O,^{12}C): PL 47B 335(73)



●○ ^{40}Ca(α,γ)
▲ In-beam γ spect
■□ ^{40}Ca(^{6}Li,d)
● ^{48}Ti(p,t)

Additional levels above 7.22 MeV: 20 in (α,γ), 9 in (^{6}Li,d).

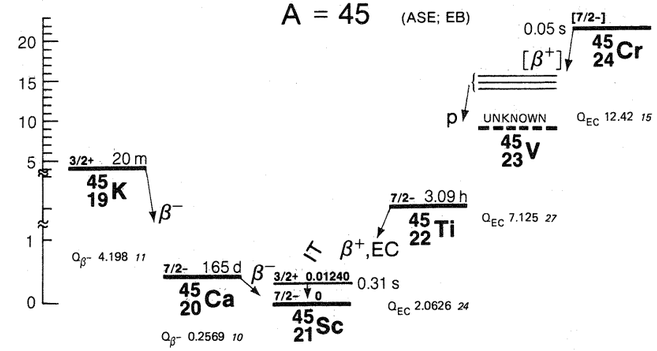


$^{44}_{22}$Ti

$^{44}_{23}$V

Δ: −23.85 (from systematics) {ANDT 19 175(77)}
π: [$β^+$], $β^+α$ {PL 37B 380(71)}
$t_{1/2}$: 90 25 ms {PL 37B 380(71)}
Class: E; Ident: excit {PL 37B 380(71)}
Prod: ^{40}Ca(^{6}Li,2n) {PL 37B 380(71)}
α: 2.77 2 *semicond* {PL 37B 380(71)}

A = 45 (ASE; EB)



$^{45}_{18}$Ar

Δ: −29.736 {ANDT 19 175(77)}
Class: R; Ident: ^{48}Ca(α,^{7}Be) {PR C9 2067(74)}

^{48}Ca(α,^{7}Be)

$^{45}_{18}$Ar

^{45}Ar levels – References
^{48}Ca(α,^{7}Be): PR C9 2067(74)

$^{45}_{19}$K

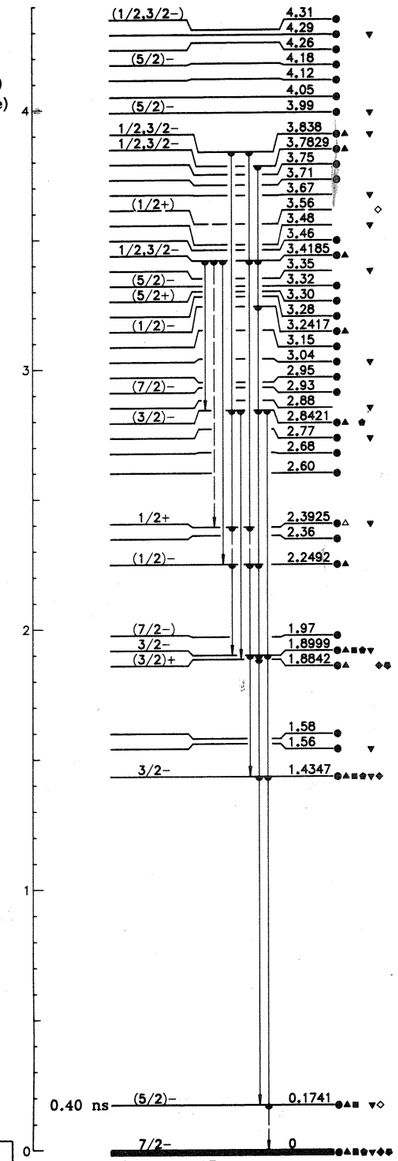
Δ: −36.611 11 {ANDT 19 175(77)}
I: 3/2 *AB* {PR 161 1152(67)}
π: $β^-$ {PL 11 148(64)}
$t_{1/2}$: 20 1 m {PL 11 148(64)}; **others:** {PR 161 1152(67), JINC 27 2493(65), Phil s7v45 621(54)}
Class: A; Ident: chem, genet energy levels {PL 11 148(64)}; mass spect {Phil s7v45 621(54)}; cross bomb {PL 11 148(64), PR 161 1152(67), RaAc 13 61(70)}
Prod: ^{48}Ca(d,αn) {PL 11 148(64)}; ^{46}Ca(γ,p) {RaAc 13 61(70)}; ^{48}Ca(p,α) {PR 161 1152(67)}
$β^-$: 4.0 2 (≈8%), 2.1 1 (≈69%), 1.1 2 (≈23%) *scint* {PL 11 148(64)}
γ: ⟨norm: $γ_{1.706}$ (γ ≈69%), from level scheme⟩ 0.1743 5 ($†_γ$1.1540), 0.9575 6? (weak), 1.2607 8 ($†_γ$105), 1.4351 9? (weak), 1.6346 2 (weak), 1.7056 6 ($†_γ$100), 2.3542 5 ($†_γ$20 6), 2.5988 10 ($†_γ$5 2) *Ge(Li)* {RaAc 13 61(70)}
0.1751, 0.4433?, 1.2623, 1.7082, no $γ_{1.900}$, 2.1823?, 2.3553, 2.6026 *Ge(Li)* {PR 161 1152(67)}
others: {PL 11 148(64)}

● ^{46}Ca(t,α)
▲ ^{46}Ca(d,^{3}He)

^{45}K levels – References
^{46}Ca(t,α): NP A118 409(68); **others:** PL 24B 568(67)
^{46}Ca(d,^{3}He): PR C4 1621(71)

Additional levels above 4.31 MeV: 2 in (n,γ), 52 in (d,p).

● ^{44}Ca(d,p)
▲△ ^{44}Ca(n,γ)
■ ^{44}Ca(d,pγ)
● ^{44}Ca(^{17}O,^{16}O)
▼ ^{48}Ca(^{3}He,^{6}He)
◆◇ ^{46}Ca(d,t)
● ^{46}Ca(^{3}He,α)



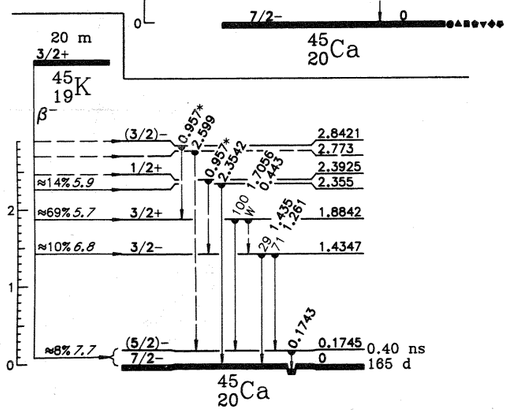
$^{45}_{20}$Ca

^{44}Ca levels – References

Decay: NP A133 545(69), RaAc 13 61(70)
^{44}Ca(d,p): NP A225 267(74), PR 156 1255(67); **others:** YadF 19 583(74), NP A153 145(70), NP A120 421(68), NP A120 401(68), PL 27B 159(68)
^{44}Ca(n,γ): NP A114 463(68), NP A133 545(69), UCRL−51060(71); **others:** NP A181 225(74), AuJP 24 671(71), YadF 10 31(69)
^{44}Ca(d,pγ): NuoC s10v56B 137(68)
^{44}Ca(^{17}O,^{16}O): NP A230 173(74)
^{48}Ca(^{3}He,^{6}He): PR C14 2089(76)
^{46}Ca(d,t): PR C4 1621(71), PR 160 889(67); **others:** PR 186 1144(69)
^{46}Ca(^{3}He,α): NP A177 307(71)

$^{45}_{20}$Ca

Δ: −40.8096 15 {ANDT 19 175(77)}
π: $β^-$ {PR 57 177(40)}
genet: parent ^{45m}Sc (0.0017%) {ND B4 237(70)}
$t_{1/2}$: 165.1 7 d {NSEg 11 74(61)}; 163 2 d {JadE 16 303(70)}; 167 3 d {Nucl 17n10 86(59)}; 164 4 d {PR 89 529(53)}; **others:** {BLie 26 29(57), PR 72 163(47), PR 57 177(40)}
Class: A; Ident: chem, excit, cross bomb {PR 57 177(40)}
Prod: ^{44}Ca(n,γ) {PR 57 177(40), PR 72 888(47)}
$β^-$: 0.258 2 *mag* {PR 140 B563(65)}
0.254 3 *mag* {PR 78 318(50)}
0.255 4 *scint* {PR 80 758(50)}
0.253 4 *ion ch* {JadE 16 303(70)}
0.261 4 *mag* {PR 92 1511(53)}
others: {PR C9 1143(74), StCF 25 283(73)}
γ: ⟨norm: $γ_{0.012}$ (γ 3.1×10^{-6}%), from level scheme⟩ 0.01247$^{+14}_{-30}$ (K 0.0014$^{+5}_{-3}$%, with ^{45m}Sc) *mag conv* {PR 140 B563(65)}
$t_{1/2}$(levels): 0.174: 400 40 ps *delay coinc* {NP A129 129(69)}
1.435: <25 ns *delay coinc* {NP A133 545(69)}
Internal bremsstrahlung endpoint: {JPGL 2 331(76), JPGL 2 43(76)}

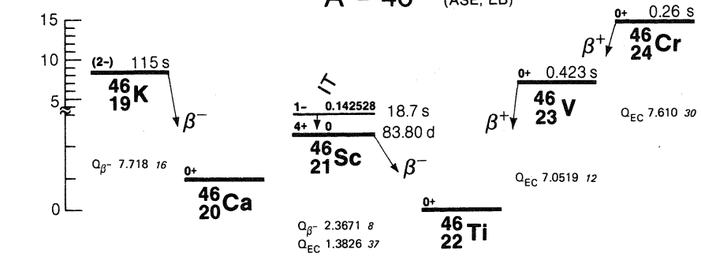


$^{45}_{20}$Ca

$^{45}_{21}$Sc

%: 100 {BNL−NCS−50605(77)}
Δ: −41.0665 14 {ANDT 19 175(77)}
I: 7/2 *O* {ZP 92 82(34), Nwis 22 758(34)}
$σ_0$(to ^{46}Sc): 17 3 (reactor spectrum) {PC77 Holden}
$σ_0$(to ^{46m}Sc): 9 3 (reactor spectrum) {PC77 Holden}
$t_{1/2}$(levels): 0.376: >1.1 ps *Doppler* {NP A219 232(74)}
0.543: 122 ps *nucl res fluor* {PR C7 1490(73)}, 6.4$^{+47}_{-23}$ ps *Doppler* {NP A262 307(76)}
0.720: 0.222 ps *nucl res fluor* {PR C12 312(75), PR C7 1490(73)}, 0.1528 6 ps *Doppler* {NP A219 232(74)}
0.939: 7.3$^{+57}_{-32}$ ps *Doppler* {NP A262 307(76)}
0.974: 2.7$^{+28}_{-4}$ ps *nucl res fluor* {PR C7 1490(73)}, 2.2$^{+6}_{-5}$ ps *Doppler* {NP A262 307(76)}
1.067: 0.35$^{+13}_{-9}$ ps *Doppler* {JPPa 37 303(76)}
1.236: 1.82 14 ps *nucl res fluor* {PR C12 312(75)}, 1.6$^{+21}_{-6}$ ps *Doppler, recalc* {NP A219 232(74), PR C12 312(75)}, 0.79 4 ps *nucl res fluor* {PR C7 1490(73)}
1.303: 2.4$^{+12}_{-7}$ ps *Doppler* {NP A262 307(76)}
1.409: 0.282 ps *nucl res fluor* {PR C12 312(75)}, 0.24$^{+3}_{-2}$ ps *nucl res fluor* {PR C7 1490(73)}, 0.422 1 ps *Doppler* {NP A219 232(74)}, 0.43$^{+13}_{-8}$ ps *Doppler* {JPPa 37 303(76)}
1.433: 5.4$^{+30}_{-15}$ ps *Doppler* {NP A262 307(76)}
1.555: 0.28$^{+13}_{-8}$ ps *Doppler* {JPPa 37 303(76)}
1.661: 0.105 9 ps *nucl res fluor* {PR C12 312(75)}, 0.14$^{+5}_{-3}$ ps *Doppler* {JPPa 37 303(76)}, 0.076 21 ps *Doppler* {NP A219 232(74)}
1.801: 0.11$^{+4}_{-3}$ ps *Doppler* {NP A262 307(76)}, 0.066$^{+62}_{-35}$ ps *Doppler* {PR C9 1436(74)}
2.030: 1.1$^{+6}_{-3}$ ps *Doppler* {NP A262 307(76)}
2.092: 5.57 fs *nucl res fluor* {PR C12 312(75)}, 8.32 1 fs *Doppler* {PR C9 1436(74)}
2.106: >5.5 ps *Doppler* {JPPa 37 303(76)}
2.151: 60$^{+17}_{-12}$ fs *Doppler* {PR C9 1436(74)}
2.304: 55$^{+35}_{-17}$ fs *Doppler* {PR C9 1436(74)}
2.352: 42$^{+28}_{-17}$ fs *Doppler* {PR C9 1436(74)}
2.531: 81$^{+38}_{-17}$ fs *Doppler* {PR C9 1436(74)}
2.562: 1.4$^{+6}_{-4}$ ps *Doppler* {NP A262 307(76)}
2.590: 35 8 fs *Doppler* {PR C9 1436(74)}
others: {JPPa 37 303(76), PR C9 1436(74), ZP 245 45(71), NP A132 369(69)}

A = 46 (ASE; EB)



$^{46}_{18}Ar$

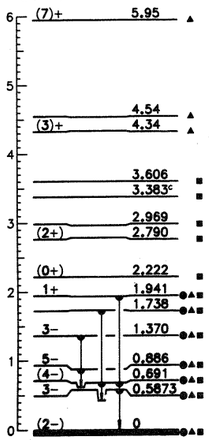
Δ: −29.737 {ANDT 19 175(77)}
Class: R; **Ident:** ^{48}Ca(^{6}Li,^{8}B) {PR C9 2067(74)}

$^{46}_{19}$K levels – References

^{48}Ca(d,αγ): PR C10 136(74)
^{48}Ca(d,α): PR C10 136(74), PR C10 1422(74); **others:** NP A168 267(71), PL 14 46(65)
^{48}Ca(p,^{3}He): PR C7 150(73), PR C7 637(73), PL 31B 68(70)

● ^{48}Ca(d,αγ)
▲ ^{48}Ca(d,α)
■ ^{48}Ca(p,^{3}He)

Additional levels above 5.95 MeV: 1 in (p,^{3}He).



$^{46}_{20}$Ca levels – References

Decay: PL 23 269(66)
^{48}Ca(p,t): PR C8 574(73), PR C7 150(73), PR C7 637(73); **others:** NP A157 93(70), PL 31B 68(70), PR 170 1003(68)
^{44}Ca(t,p): NP A103 33(67), PR 164 1419(67)
^{44}Ca(t,pγ): PR C10 99(74)
^{46}Ca(d,d'): PR 138 B1067(65)
^{46}Ca(p,p'): PR C7 2593(73); **others:** PR 138 B1067(65)
Coul. ex.: NuoL s2v5 913(72)
^{48}Ca(α,α2nγ),^{48}Ca(p,p2nγ): NuoL s2v12 53(75), PR C12 813(75)

$^{46}_{19}$K

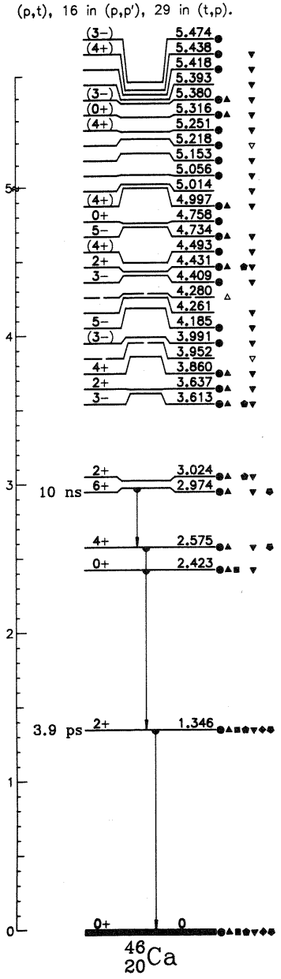
Δ: −35.420 16 {ANDT 19 175(77)}
π: β⁻ {PL 23 269(66)}
$t_{1/2}$: 1154 s {PL 23 269(66)}
Class: A; **Ident:** chem, sep isotopes, genet energy levels {PL 23 269(66)}
Prod: ^{48}Ca(d,α) {PL 23 269(66)}
β⁻: **6.3** *3 scint* {PL 23 269(66)}
γ: (**norm:** $\gamma_{1.347}$ (γ 91 4%), from level scheme, ASE) **1.347** *1* (t_γ100 *1*), **1.439** *2*? (t_γ3 *2*), **1.670** *2*? (t_γ5 *2*), **1.780** *2* (t_γ92), **2.274** *2* (t_γ95), **3.015** *5* (t_γ105), **3.700** *5* (t_γ31 *1*) *Ge(Li), scint–scint γγ coinc* {PL 23 269(66)}

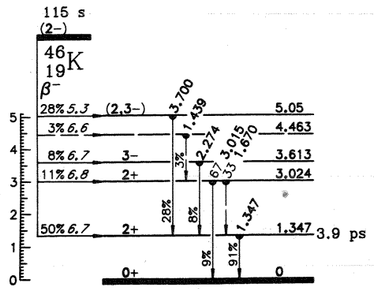
$^{46}_{20}$Ca

%: 0.0035 {BNL–NCS–50605(77)}
Δ: −43.1382 37 {ANDT 19 175(77)}
σ_0: 0.7 *2* (reactor spectrum) {PC77 Holden}
$t_{1/2}$(levels): **1.347:** 3.9^{+5}_{-3} ps *Coulomb excit* {NuoL s2v5 913(72)}, >5.5 ps *Doppler* {PR C10 99(74)}
2.423: >4.5 ps *Doppler* {PR C10 99(74)}
2.974: 10.5 *6* ns *delay coinc* {PR C12 813(75)}
others: {NuoL s2v12 53(75)}

● ^{48}Ca(p,t)
▲△ ^{44}Ca(t,p)
■ ^{44}Ca(t,pγ)
★ ^{46}Ca(d,d')
▼▽ ^{46}Ca(p,p')
◆ Coul. ex.
✸ ^{48}Ca(α,α2nγ),^{48}Ca(p,p2nγ)

Additional levels above 5.474 MeV: 20 in (p,t), 16 in (p,p'), 29 in (t,p).





$^{46}_{21}$Sc levels – References

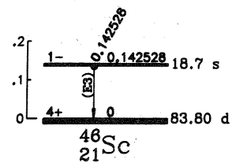
Decay: NP 84 661(66)
^{45}Sc(d,p): PR 151 939(66), RMxF 12 99(63); **others:** NP 51 641(64)
^{45}Sc(d,pγ): PR 168 1200(68)
^{45}Sc(t,d): NP A257 460(76)
^{47}Ti(d,^{3}He): PR C1 501(70)
^{48}Ti(d,α): PR 184 1081(69), NP A192 125(72); **others:** NP 51 641(64)
^{48}Ti(p,^{3}He): PR C13 540(76)
^{44}Ca(^{3}He,p): NP A153 502(70)
^{46}Ca(^{3}He,t): PR C4 1211(71)
^{45}Sc(n,γ): ND B4 272(70), NP 84 661(66), AiJP 23 255(70), PR 168 1317(68); **others:** NIM 105 301(72), NIM 60 103(68), IzF 30 1277(66)
Other reactions:
μ⁻ on Ti: NP A207 379(73)

$^{46}_{21}$Sc

Δ: −41.7556 15 {ANDT 19 175(77)}
I: 4 *AB* {PR 128 1740(62)}
σ_c: 8 *1* (subcadmium) {PC77 Holden}
π: β⁻, no EC {PR 72 527(47)}; no β⁺ (lim 0.0016%) {PPSL 64A 311(51)}
$t_{1/2}$: 83.80 *3* d {NP–15663(65)}; 83.89 *12* d {PR 105 1539(57)}; 84.34 *13* d {NSEg 55 450(74)}; **others:** {NIM 48 277(67), NSEg 2 427(57), JINC 3 160(56), Phil s7v46 1031(55), PPSL 67A 286(54), PRSL 171A 360(39)}
Class: A; **Ident:** n–capt, chem {KDVM 14n5(36), Nat 137 185(36)}; chem, excit, cross bomb {PR 52 669(37)}
Prod: ^{45}Sc(n,γ) {KDVM 14n5(36), Nat 137 185(36), PR 52 669(37), PR 72 888(47)}
β⁻: **0.357** *3 mag* {JPJa 8 435(53)}
1.475 *6* (0.0036 *7%*) *mag* {CJP 34 256(56)}
others: {PR 188 1930(69), PR 93 140(54), PR 81 640(51), PR 79 905(50), PR 74 297(48), JNBS 38 411(47), PR 72 527(47)}
γ: **0.889250** *18* (γ 100%, from level scheme), **1.120524** *25* (γ 100%, from level scheme) *Ge(Li)* {NIM 96 173(71)}
0.889253 *28*, **1.120506** *46 cryst* {NIM 105 169(72)}
$\gamma_{0.889}$ (e/γ 1.607×10^{-4}), $\gamma_{1.121}$ (e/γ 9.54×10^{-5}) *mag, mag conv* {ArkF 21 383(62)}
$\gamma_{0.889}$ (e/γ 1.748×10^{-4}), $\gamma_{1.121}$ (e/γ 9.85×10^{-5}) *mag conv* {PR 79 905(50)}
others: {RaAc 10 1(68), NP A90 650(67), PL 24B 49(67), NP 70 518(65), PL 18 36(65), ArkF 10 247(56), PR 96 855(54), PR 93 1053(54), ArkF 6 123(53), InJP 24 479(50), PR 79 1007(50), PR 76 182(49), PR 74 1049(48), PR 74 297(48), PR 73 141(48), JNBS 38 411(47), PR 72 527(47)}
βγ(θ): {PR 78 66(50)}
γγ(θ): {CRBu 20 1263(67), NP 50 599(64), RRou 9 717(64), NP 33 294(62), NuoC s10v3 800(56), JPJa 10 334(55), PR 78 66(50)}
$\beta_{ion\ p}$: {INR–798/I/PL(67), PR 107 909(57)}
$\beta\gamma_{cp}(\theta)$: {NP A129 270(69), NP A121 529(68), ZP 201 153(67), NP 76 385(66), PR 139 AB2(65), PR 137 B1(65), NP 45 529(63), NP 43 537(63), PR 132 1130(63), NP 33 118(62), PR 125 2021(62), ZETF 40 10(61), ZP 162 229(61), PRL 5 326(60), PR 115 980(59), NuoC s10v7 891(58), PR 109 456(58), ZNat 13a 505(58)}
$\gamma\gamma_{lin\ p}(\theta)$: {NIM 59 1(68), PR 78 551(50)}
$t_{1/2}$(levels): **0.052:** 8.8 *4* μs *delay coinc* {PR 168 1200(68)}
0.228: <0.27 ns *delay coinc* {PR 168 1200(68)}
0.281: <0.27 ns *delay coinc* {PR 168 1200(68)}
0.290: <0.38 ns *delay coinc* {PR 168 1200(68)}, >5 ps *Doppler* {JPAL 6 L41(73)}
0.444: <0.27 ns *delay coinc* {PR 168 1200(68)}
0.585: 6.3 ps *Doppler* {JPAL 6 L41(73)}
0.628: >5 ps *Doppler* {JPAL 6 L41(73)}, <0.2 ns *delay coinc* {PR 168 1200(68)}
0.835: <0.2 ns *delay coinc* {PR 168 1200(68)}
1.124: 1.6 2 ps *Doppler* {JPAL 6 L41(73)}
others: {PR 168 1200(68)}

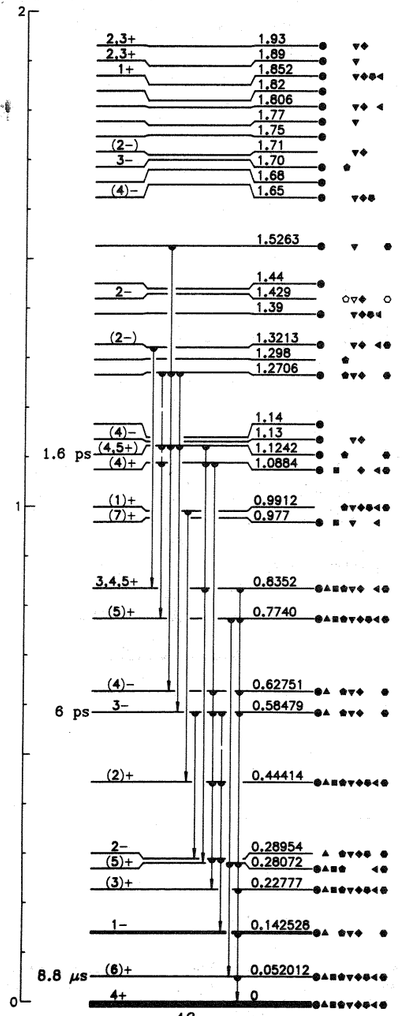
$^{46m}_{21}$Sc

Δ: −41.6131 15 {ANDT 19 175(77)}
π: IT {PR 74 1877(48)}
$t_{1/2}$: 18.726 s {JRaC 10 257(72)}; 18.67 9 s {NP A94 442(67)}; **others:** {PR 88 916(52), PR 82 115(51), PR 74 1877(48)}
Class: A; **Ident:** n–capt, resonance neutron activation {PR 74 1877(48)}
Prod: ^{45}Sc(n,γ) {PR 74 1877(48)}
γ: (**norm:** $\gamma_{0.143}$ (γ 62 1%), from level scheme) **0.142528** *3 cryst* {NP 84 661(66)}
0.142 (K/L 10 *3*) *mag conv* {PR 86 633(52)}
others: {PR 88 916(52), PR 82 115(51), PR 74 1877(48)}

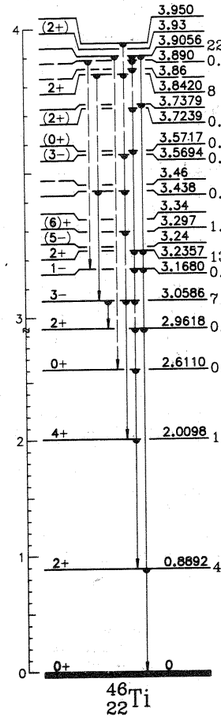


● ^{45}Sc(d,p)
▲ ^{45}Sc(d,pγ)
■ ^{45}Sc(t,d)
●○ ^{47}Ti(d,^{3}He)
▼▽ ^{48}Ti(d,α)
◆ ^{48}Ti(p,^{3}He)
● ^{44}Ca(^{3}He,p)
◀ ^{46}Ca(^{3}He,t)
●○ ^{45}Sc(n,γ)

Additional levels above 2.0 MeV: 121 in (d,p), 13 in (^{3}He,t), ≈19 in (n,γ), 16 in (d,α), 23 in (^{3}He,p), 38 in (p,^{3}He), 1 in (t,d).



Additional levels above 4 MeV: 2 in (p,p'γ), 17 in (p,γ), 7 in (p,p'), 6 in (α,α'), 94 in (^{3}He,d), 6 in (α,t), 26 in (^{3}He,α), 1 in (p,d), 1 in (d,t), ≈ 18 in (p,t), 7 in (^{3}He,n), 72 in (^{18}O,^{15}N), 2 in (n,n'γ).



$^{46}Ti(p,p'\gamma)$
$^{46}Ti(p,p')$
$^{46}Ti(n,n'\gamma)$
$^{46}Ti(d,d')$
$^{46}Ti(^3He,^3He')$
$^{46}Ti(\alpha,\alpha')$
$^{46}Ti(e,e')$
Coul. ex.
$^{48}Ti(p,t)$
$^{44}Ca(^3He,n)$
$^{44}Ca(^{18}O,^{14}C)$
$^{45}Sc(p,\gamma)$
$^{45}Sc(^3He,d)$
$^{45}Sc(\alpha,t)$
$^{45}Sc(^{18}O,^{15}N)$
$^{47}Ti(p,d)$
$^{47}Ti(d,t)$
$^{47}Ti(^3He,\alpha)$
$^{32}S(^{18}O,2p\gamma)$

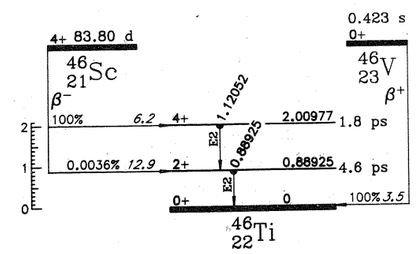
$^{46}_{22}$Ti levels – References

Decay: ND B4 269(70), CJP 34 256(56), NIM 96 173(71), ArkF 24 31(63), ArkF 24 127(63), PR 127 1659(62), PR 135 B389(64), PRL 33 320(74)
$^{46}Ti(p,p'\gamma)$: NP A180 131(72), NP A166 271(71), NP A118 609(68), NP A107 273(68); **others:** PL 26B 727(68), PR 160 894(67), NP 89 686(66), PL 22 476(66)
$^{46}Ti(p,p')$: ND B4 269(70), NP A117 185(68), NP 89 686(66), PR 187 1479(69), NP A111 17(68)
$^{46}Ti(n,n'\gamma)$: NSEg 54 191(74)
$^{46}Ti(d,d')$: NP A118 41(68); **others:** IzF 35 1700(71)
$^{46}Ti(^3He,^3He')$: PL 37B 491(71), NP A226 506(74), PL 47B 21(73)
$^{46}Ti(\alpha,\alpha')$: NP A146 597(70), PR 161 1137(67); **others:** NP A218 13(74), YadF 19 949(74)
$^{46}Ti(e,e')$: NP A164 353(71)
Coul. ex.: PR 104 967(56), IzF 23 223(59), NP 19 400(60), NP A150 417(70)
$^{48}Ti(p,t)$: NP A208 371(73), APNY 76 437(73), NP A197 568(72); **others:** PRL 25 1035(70), PR 136 B1006(64)
$^{44}Ca(^3He,n)$: NP A230 109(74)
$^{44}Ca(^{18}O,^{14}C)$: PRL 26 900(71), Cf72 Argonne 273
$^{45}Sc(p,\gamma)$: ZP 215 39(68), ND B4 275(70); **others:** ArkF 24 127(63), ArkF 24 31(63)
$^{45}Sc(^3He,d)$: NP A110 161(68), JPJa 25 953(68); **others:** ZP 242 360(71), NP A111 17(68)
$^{45}Sc(\alpha,t)$: PR 182 1121(69)
$^{45}Sc(^{18}O,^{15}N)$: PR C7 651(73)
$^{47}Ti(p,d)$: PR 135 B389(64)
$^{47}Ti(d,t)$: PR 127 1659(62), ZP 245 216(71)
$^{47}Ti(^3He,\alpha)$: NP A110 161(68), NP A116 112(68)
$^{32}S(^{18}O,2p\gamma)$: PR C7 1471(73)

Other reactions:
K^- on Cu and Ni: PRL 29 230(72)
$^{48}Ti(n,n')$: NP A229 189(74)
$^{45}Sc(p,n)$: NP A96 521(67)

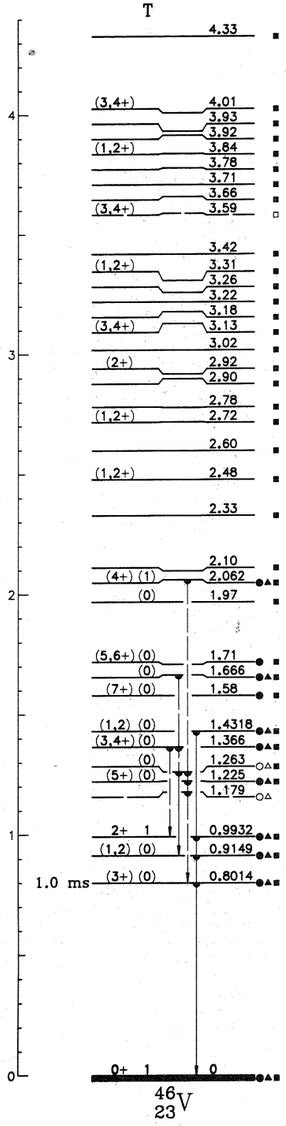
$^{46}_{22}$Ti

%: 8.2 {BNL-NCS-50605(77)}
Δ: −44.1227 *14* {ANDT 19 175(77)}
σ_0: 0.6 *1* (reactor spectrum) {PC77 Holden}
$t_{1/2}$(levels): **0.889:** 4.65 *35* ps *delay coinc* {NIM 134 525(76)}, 6.0 *3* ps *Coulomb excit* {NP A250 381(75)}, 4.7 *4* ps *Coulomb excit* {NP A150 417(70)}, 4.5 *5* ps *recoil dist Doppler* {PR C7 1471(73)}
2.010: 1.8 *2* ps *recoil dist Doppler* {PR C7 1471(73)}
2.611: 0.08 *2* ps *Doppler* {JPAL 7 1448(74)}
2.962: 488 *fs Doppler* {NP A180 131(72)}, 1524 *2* fs *Doppler* {JPAL 7 1448(74)}
3.059: 7 *2* ps *Doppler* {JPAL 7 1448(74)}
3.168: 498 *fs Doppler* {NP A180 131(72)}, 1463 *5* fs *Doppler* {JPAL 7 1448(74)}
3.236: 132 *fs Doppler* {NP A180 131(72)}
3.297: 1.1 *3* ps *Doppler* {JPAL 7 1448(74)}, 1.0 *5* ps *recoil dist Doppler* {PR C7 1471(73)}
3.438: 586 *ps recoil dist Doppler* {PR C7 1471(73)}, 10^{+7}_{-3} ps *Doppler* {JPAL 7 1448(74)}
3.569: 50^{+19}_{-10} *fs Doppler* {NP A180 131(72)}
3.572: 0.18 *4* ps *Doppler* {JPAL 7 1448(74)}
3.724: 52 *14* fs *Doppler* {JPAL 7 1448(74)}, 32^{+16}_{-10} fs *Doppler* {NP A180 131(72)}
3.842: 8.5 *24* fs *Doppler* {NP A180 131(72)}
3.890: 0.38 *10* ps *Doppler* {JPAL 7 1448(74)}
3.906: 22 *4* fs *Doppler* {NP A180 131(72)}
others: {PR C7 1471(73), NP A180 131(72), NP A174 37(71), APPo A38 651(70), PR 166 1227(68), IzF 27 862(63), PR 132 1200(63), ZETF 44 1811(63), NP 19 400(60), IzF 23 223(59), PR 104 967(56), Phil s7v46 1031(55)}



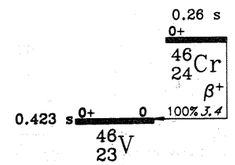
$^{46}_{23}$V

Δ: −37.0708 *18* {ANDT 19 175(77)}
π: β^+ {CJP 30 643(52)}
$t_{1/2}$: 0.422282 *3* s {PL 65B 122(76), NP A275 37(77)}; 0.424014 *7* s {PR C13 2517(76)}; 0.4259 *8* s {PL 17 317(65)}; 0.425320 s {PR C7 1440(73)}; **others:** {PRL 33 1647(74), PUC-1962-62(62), Dokl 109 935(56), PR 96 773(54), CJP 30 643(52)}
Class: B; **Ident:** excit {CJP 30 643(52)}; sep isotopes, excit {PL 6 69(63)}
Prod: ^{46}Ti(p,n) {PL 6 69(63), CJP 30 643(52), PR 96 773(54), NP A275 37(77)}
β^+: **6.043** *12 mag* {PUC-1962-62(62)}
$t_{1/2}$(0.801): 1.04 *10* ms {PL 24B 661(67)}, 1.0 *1* ms *delay coinc* {ZETF 43 438(62)}



$^{46}_{23}$V levels – References

Decay: NP A181 465(72)
$^{46}Ti(p,n)$: NP A177 625(71); **others:** PL 6 69(63), ZhPi 16 314(62)
$^{46}Ti(p,n\gamma)$: NP A177 625(71), PL 24B 661(67)
$^{46}Ti(^3He,t)$: NP A190 437(72), NP A177 625(71), NP A162 239(71); **others:** PRL 33 320(74)

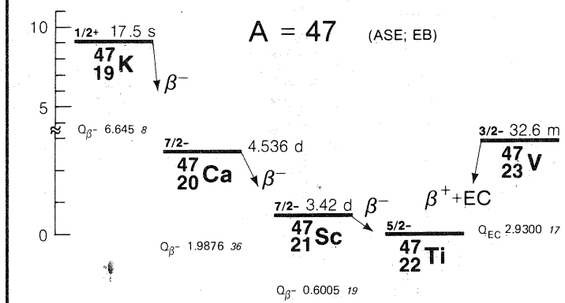


$^{46}_{24}$Cr

Δ: −29.461 *30* {ANDT 19 175(77)}
π: β^+ {NP A181 465(72)}
$t_{1/2}$: 0.26 *6* s {NP A181 465(72)}
Class: C; **Ident:** excit {NP A181 465(72)}
Prod: ^{32}S(^{18}O,2n) {NP A181 465(72)}
γ: no γ rays observed *Ge(Li)* {NP A181 465(72)}

$^{46}_{24}$Cr(1.1 s)

$t_{1/2}$: 1.1 s {PR 96 773(54)}
Class: G; **Ident:** activity not observed {NP A181 465(72)}; excit {PR 96 773(54)}
Prod: protons on Cr {PR 96 773(54)}; protons on V {PR 96 773(54)}

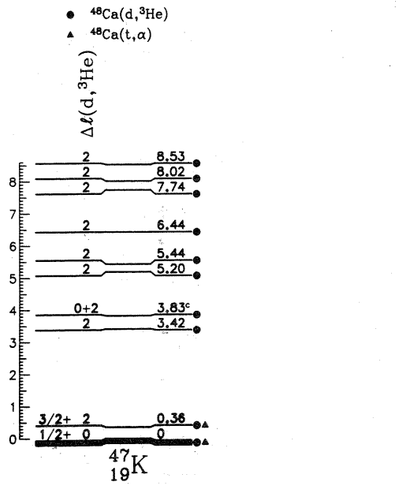


$^{47}_{19}$K

Δ: −35.698 *8* {ANDT 19 175(77)}
π: β^- {NP 50 417(64)}
$t_{1/2}$: 17.5 *3* s {NP 50 417(64)}; 18.1 *10* s {PR C2 1427(70)}
Class: A; **Ident:** chem, sep isotopes, excit {NP 50 417(64)}; genet energy levels {PR C2 1427(70)}
Prod: ^{48}Ca(γ,p) {NP 50 417(64)}; ^{48}Ca(t,α) {PR C2 1427(70)}
β^-: **6** (≈1%), **4.1** (99%) *scint* {NP 50 417(64)}
γ: (**norm:** $\gamma_{2.013}$ (γ 100%), from level scheme, ASE) **0.56474** *30* (t_γ 15), **0.58575** *30* (t_γ 85), **2.01313** *30* (t_γ 100), no $\gamma_{2.599}$ (t_γ <2) *Ge(Li)* {PR C2 1427(70), ASE}
others: {NP 50 417(64)}

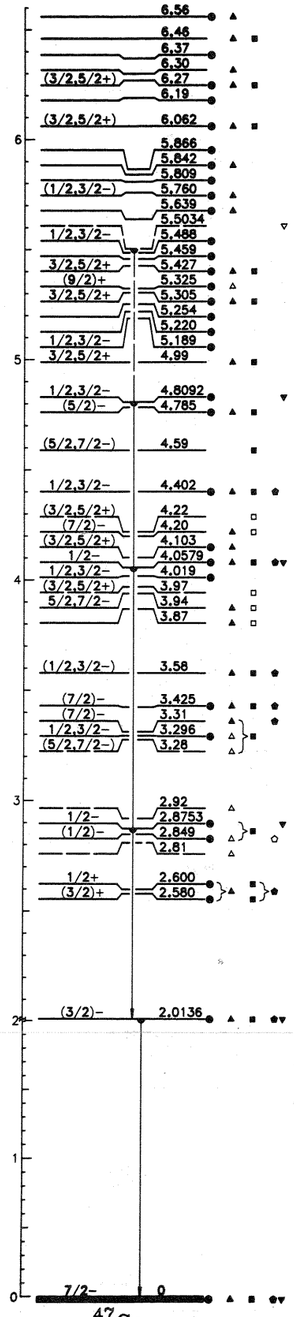
$^{47}_{19}$K levels – References

$^{48}Ca(d,^3He)$: NP A263 210(76), NP A110 366(68); **others:** PL 57B 413(75), PL 16 28(66)
$^{48}Ca(t,\alpha)$: NP A118 409(68), PL 22 162(66)

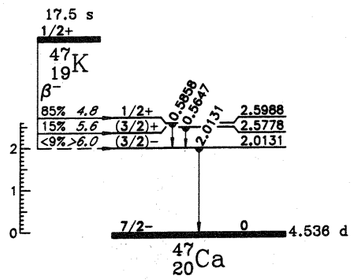


● ^{46}Ca(d,p)
▲△ ^{46}Ca(^{3}He,α)
■□ ^{48}Ca(p,d)
●○ ^{48}Ca(d,t)
▼▽ ^{46}Ca(n,γ)

Additional levels above 6.56 MeV: 8 in (^{3}He,α), 5 in (p,d).



$^{47}_{20}$Ca

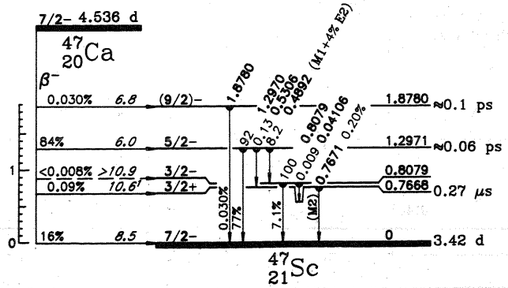


$^{47}_{20}$Ca levels – References

Decay: PR C2 1427(70)
^{46}Ca(d,p): PR 142 624(66), PR 138 B1097(65); **others:** NP A120 421(68), NP A120 401(68)
^{46}Ca(^{3}He,α): ZP 233 114(70); **others:** NP A177 307(71), NuoC s10v65A 318(70), NP A129 138(69), PL 27B 76(68), PR 142 633(66)
^{48}Ca(p,d): NP A185 465(72), PR 170 1003(68), GenK 14 99(69); **others:** PL 27B 76(68), PR 144 941(66)
^{48}Ca(d,t): ZP 233 114(70); **others:** PR 186 1144(69), PL 27B 76(68), PR 142 633(66)
^{46}Ca(n,γ): NP A153 413(70)

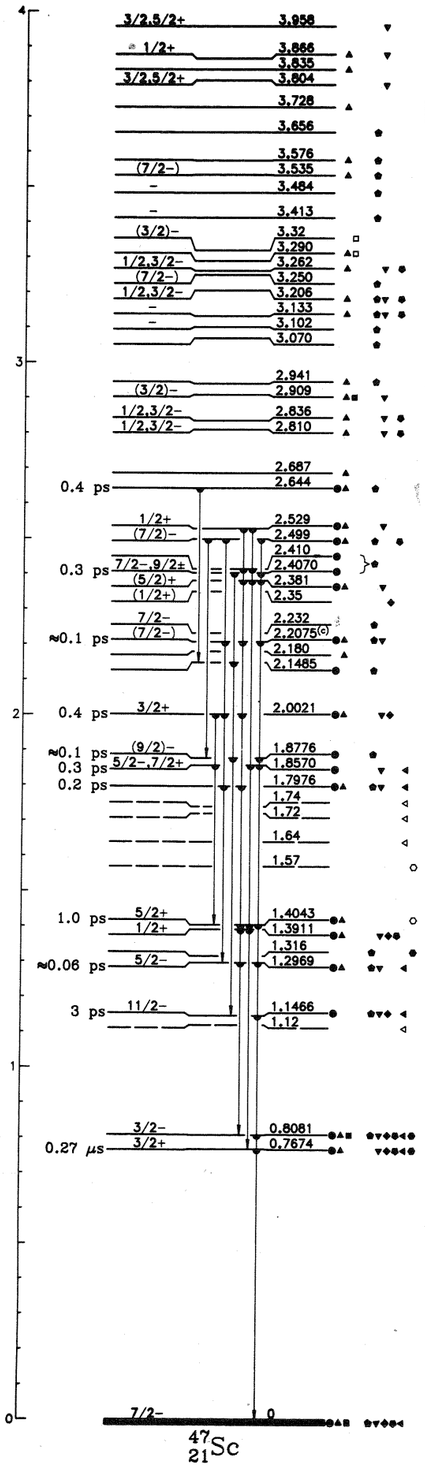
$^{47}_{20}$Ca

Δ: −42.3429*37* {ANDT 19 175(77)}
☢: β^- {PR 72 163(47)}
$t_{1/2}$: 4.5401*30* d {IIso 20 393(69)}; 4.530*4* d {NSEg 32 46(68)}; 4.535*4* d {RaAc 3 115(64)}; **others:** {JINC 37 873(75), NSEg 48 319(72), PR 173 1078(68), NP A101 688(67), NuoC s10v29 311(63), PR 132 2616(63), NSEg 11 74(61), PR 104 759(56), PR 100 1280(55), PR 92 1511(53), PR 90 444(53), PR 84 671(51)}
Class: A; **Ident:** chem, genet {PR 84 671(51)}
Prod: ^{46}Ca(n,γ) {PR 92 367(53), PR 90 1121(53)}
β^-: **1.9806***26* (16.1%), ≈**1.214**? (≤1.0%), ≈**0.684** (83.9%) *mag* {NP A101 688(67), ASE}
1.9795 (15.8%), **1.486***10* (≈1.8%), **0.67***10* (82.4%) *mag* {PR 132 2616(63)}
1.9883*25*, **1.219** (0.087*30*%) *mag, Si(Li)–Ge(Li) βγ coinc* {PR 173 1078(68)}
others: {NP A114 476(68), PR 104 759(56), PR 92 1511(53), PR 92 367(53)}
γ: (**norm:** $\gamma_{1.297}$ (γ 77*2*%), from level scheme) **0.4889***3* (t_γ8.8*5*), **0.5306***5* (t_γ0.127*13*), **0.7672***5* (t_γ0.257*19*), **0.8079***3* (t_γ8.8*5*), **1.2970***3* (t_γ100) *Ge(Li)* {PR 152 1005(66)}
0.04106*5* (t_γ0.0085*9*), **0.48923***10*, **0.80786***10*, **1.29709***10* (t_γ100), no $\gamma_{1.836}$ (t_γ<0.002), **1.8780***5* (t_γ0.038*4*) *Ge(Li), Ge(Li)–scint γγ coinc* {NP A126 300(69)}
0.4889*5* (t_γ9.0*9*), **0.53065**, **0.7671***5*, **0.8079***5* (t_γ8.8*9*), **1.29680***23* (t_γ100), **1.7660***10*? (t_γ0.012*4*), **1.8360***10*? (t_γ0.017*4*), **1.8781***10*? (t_γ0.045*9*) *Ge(Li), Ge(Li)–Si(Li) γβ coinc* {PR 173 1078(68)}
0.4889*6* (t_γ9.2*4*), **0.5299***6* (t_γ0.18*4*), **0.7670***8* (t_γ0.27*4*), **0.8079***8* (t_γ9.5*4*), **1.2965***4* (t_γ100) *Ge(Li)* {PR 152 1010(66)}
others: {NP A153 413(70), RaAc 10 1(68), NP A101 688(67), NP 88 169(66), PRL 13 241(64), PR 132 2616(63), PR 104 759(56), PR 100 1280(55), PR 92 367(53)}
γγ(θ): {NuoC s10v29 311(63)}
$\beta\gamma_{op}$(θ): {ZP 201 153(67), PR 139 AB2(65), PR 137 B1(65)}
$\gamma\gamma_{lin\ p}$(θ): {NuoC s10v29 311(63)}



Additional levels above 4.00 MeV: 24 in (p,γ), ≈35 in (t,α), 47 in (t,p), 24 in (^{3}He,d), 2 in (d,^{3}He).

● ^{44}Ca(α,pγ)
▲ ^{46}Ca(p,γ)
■□ ^{44}Ca(α,p)
⬟ ^{45}Sc(t,p)
▼ ^{48}Ti(t,α)
◆ ^{48}Ti(d,^{3}He)
● ^{46}Ca(^{3}He,d)
◀◁ ^{49}Ti(d,α)
●○ ^{50}Ti(p,α)



$^{47}_{21}$Sc levels – References

Decay: NP A126 300(69), PRL 13 241(64)
^{44}Ca(α,pγ): NP A227 309(74), NuoC s11v11A 1(72), NP A227 325(74)
^{46}Ca(p,γ): NP A239 221(75), PL 34B 597(71); **others:** IzF 34 1641(70)
^{44}Ca(α,p): NP A154 417(70)
^{45}Sc(t,p): NP A227 257(74)
^{48}Ti(t,α): NP A171 253(71)
^{48}Ti(d,^{3}He): PR C3 1192(71), ZP 202 236(67); **others:** PR C1 501(70), NP A110 366(68), PR 134 B976(64)
^{46}Ca(^{3}He,d): PR 153 1248(67); **others:** PRL 18 1140(67)
^{49}Ti(d,α): NP 51 641(64)
^{50}Ti(p,α): NP 73 131(65)
Other reactions:
^{48}Ti(n,d): ZP 211 213(68)
μ^- on Ti: NP A207 379(73)
^{46}Ca(p,p'): PL 34B 597(71), NP A239 221(75), NP A102 1(67)

$^{47}_{21}$Sc

Δ: −44.3305*24* {ANDT 19 175(77)}
I: 7/2 *AB* {PR 141 1106(66)}
☢: β^- {PR 67 313(45)}
$t_{1/2}$: 3.422*4* d {JINC 31 1883(69)}; 3.345*3* d {JINC 30 361(68)}; 3.43*3* d {PR 75 1693(49)}; **others:** {NP 51 174(64), JACS 75 2246(53), PR 92 1511(53), PR 92 367(53)}
Class: A; **Ident:** chem, cross bomb {PR 67 313(45)}; sep isotopes {PR 75 1693(49)}; mass spect {Phil s7v45 621(54)}
Prod: daughter ^{47}Ca {PR 84 671(51), PR 90 1121(53)}
β^-: **0.600***2* (≈40%), **0.439***2* (≈60%) *mag* {PR 101 1868(56)}
0.610*5* (26%), **0.450***10* (74%) *mag* {PR 104 759(56)}
$\beta_{0.439}$ (68.5*27*%) *ion ch, ion ch–scint βγ coinc* {IIso 19 593(68)}
others: {PR 100 1407(55), PR 92 1511(53), PR 92 367(53), PR 90 886(53)}
γ: (**norm:** $\gamma_{0.159}$ (γ 68.5*27*%), IIso 19 593(68)) **0.159381***15 Ge(Li)* {ANCR–1088 392(72)}
0.15939*5 Ge(Li)* {NP A126 300(69)}
$\gamma_{0.159}$ (γ 73*4*%) *scint* {NP 51 174(64)}
$\gamma_{0.159}$ (e/γ ≈0.0036) *scint, mag conv* {PR 90 886(53)}
$\gamma_{0.159}$ (K/L+M+... ≈10) *mag, mag conv* {PR 92 367(53)}
others: {PR 173 1078(68), RaAc 10 1(68), NP A90 558(67), PR 152 1010(66), PR 152 1005(66), PR 104 759(56), PR 101 1868(56), PR 100 1407(55), PR 99 728(55), PR 92 1511(53)}
$t_{1/2}$(levels): **0.767:** 274*10* ns *delay coinc* {PR 168 1228(68)}, 270*12* ns *delay coinc* {NP 88 169(66)}
0.808: <200 ps *delay coinc* {NuoC s10v29 311(63)}, >5.5 ps *Doppler* {NuoC s11v11A 1(72)}
1.147: 3.1*11* ps *Doppler* {NuoC s11v11A 1(72)}
1.297: 0.062*24* ps *Doppler* {NuoC s11v11A 1(72)}, 0.14*8* ps *Doppler* {NP A227 309(74)}
1.391: >4.2 ps *Doppler* {NuoC s11v11A 1(72)}
1.404: 0.97*28* ps *Doppler* {NuoC s11v11A 1(72)}
1.798: 0.21*6* ps *Doppler* {NuoC s11v11A 1(72)}, 0.68*44* ps *Doppler* {NP A227 309(74)}
1.857: 0.30*6* ps *Doppler* {NuoC s11v11A 1(72)}, 0.28*10* ps *Doppler* {NP A227 309(74)}
1.878: 0.12*6* ps *Doppler* {NP A227 309(74)}
2.002: 0.40*8* ps *Doppler* {NuoC s11v11A 1(72)}, 0.93*46* ps *Doppler* {NP A227 309(74)}
2.148: >2 ps *Doppler* {NP A227 309(74)}
2.208: 0.08*4* ps *Doppler* {NuoC s11v11A 1(72)}, 0.27*11* ps *Doppler* {NP A227 309(74)}
2.381: <0.17 ps *Doppler* {NP A227 309(74)}
2.407: 0.31*11* ps *Doppler* {NuoC s11v11A 1(72)}, 0.097*62* ps *Doppler* {NP A227 309(74)}
2.499: <0.15 ps *Doppler* {NP A227 309(74)}
2.529: <0.22 ps *Doppler* {NP A227 309(74)}
2.644: 0.41*29* ps *Doppler* {NP A227 309(74)}
others: {NP A227 309(74), NuoC s11v11A 1(72), PRL 13 241(64), NuoC s10v29 311(63)}

$^{47}_{23}V$

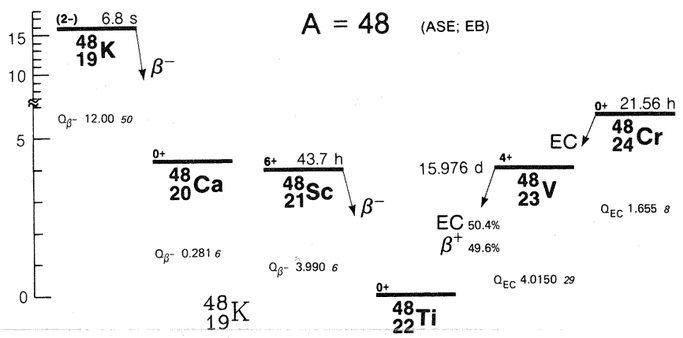
Δ: −42.0011 *17* {ANDT 19 175(77)}
I: 3/2 *AB* {BAPS 12 474(67)}
☢: β^++EC {PR 52 777(37)}
$t_{1/2}$: 32.6 *3* m {NP A204 516(73)}; 32.1 *1* m {ZNat 9a 104(54)}; 32.0 m {PR 166 1089(68)}; **others:** {ZETF 42 416(62), ZNat 9a 974(54), PR 75 1693(49), PR 62 413(42), PR 52 777(37)}
Class: A; **Ident:** chem, excit, cross bomb {PR 62 413(42)}; chem, sep isotopes {PR 75 1693(49)}; mass spect {Phil s7v45 621(54)}
Prod: ^{45}Sc(α,2n) {PR 75 1693(49), PR 62 413(42)}; ^{47}Ti(p,n) {PR 75 1693(49), PR 62 413(42)}; ^{46}Ti(d,n) {PR 52 777(37), PR 62 413(42)}; ^{47}Ti(d,2n) {JPJa 17 6(62)}
β^+: 1.89 *1 mag* {ZNat 9a 974(54)}
others: {JPJa 17 6(62), ZETF 42 416(62), ZNat 9a 104(54)}
γ: ⟨**norm:** $\gamma_{1,794}$ (γ 0.190 *11*%), from level scheme⟩ **0.1598** *5* (t_γ 55.9 *25*), **0.2444** *5* (t_γ 49.1 *23*), $\gamma^\pm$ (t_γ 1.01 *3*×10^5), **1.2435** *5* (t_γ 1.3 *3*), **1.3904** *4* (t_γ 41.5 *12*), **1.5499** *4* (t_γ 34.8 *10*), **1.7939** *4* (t_γ 100), **2.0031** *10* (t_γ 1.9 *2*), **2.0073** *10* (t_γ 5.2 *3*), **2.1630** *5* (t_γ 35.1 *8*), **2.3663** *5* (t_γ 4.4 *3*), **2.5256** *5* (t_γ 4.6 *2*), **2.5487** *5* (t_γ 3.5 *2*), **2.7933** *10* (t_γ 0.34 *6*) *Ge(Li)* {NP A204 516(73)}
0.1609 *30* (t_γ 53 *23*), **1.3914** *12* (t_γ 47 *9*), **1.5523** *24* (t_γ 38 *9*), **1.7949** *8* (t_γ 100 *9*), **2.0000** *40*? (t_γ <6), **2.1630** *12* (t_γ 28 *9*) *Ge(Li)* {NP A100 59(67)}
others: {YadF 5 1141(67), JPJa 17 6(62), ZETF 42 416(62), PR 104 759(56), ZNat 9a 104(54), Phca 19 1051(53), PR 75 1693(49)}
$t_{1/2}$(levels): **0.088:** 0.66 *4* ns *delay coinc* {NP A260 189(76)}, 0.85 *11* ns *recoil dist Doppler* {PR C13 1889(76)}
0.146: 0.54 *7* ns *delay coinc* {NP A260 189(76)}, 0.44 *9* ns *recoil dist Doppler* {PR C13 1889(76)}
0.260: 548 ps *delay coinc* {NP A260 189(76)}, 628 ps *recoil dist Doppler* {NuoC s11v15A 521(73)}
0.660: 2.8$^{+19}_{-14}$ ps *recoil dist Doppler* {NuoC s11v15A 521(73)}, 0.47$^{+100}_{-24}$ ps *Doppler* {AuJP 28 251(75)}
1.138: 1.7$^{+14}_{-8}$ ps *recoil dist Doppler* {NuoC s11v15A 521(73)}, 0.67$^{+118}_{-30}$ ps *Doppler* {AuJP 28 251(75)}
1.272: 0.27$^{+27}_{-10}$ ps *Doppler* {AuJP 28 251(75)}
1.295: 1.4$^{+7}_{-6}$ ps *recoil dist Doppler* {NuoC s11v15A 521(73)}
2.615: <1.4 ps *recoil dist Doppler* {NuoC s11v15A 521(73)}
others: {AuJP 28 251(75), NuoC s11v15A 521(73)}

$^{47}_{24}Cr$

see also ^{49}Mn

Δ: −34.618 *25* {ANDT 19 175(77)}
Class: R; **Ident:** ^{50}Cr(^{3}He,^{6}He) {PR C12 51(75), PRL 29 434(72)}

A = 48 (ASE; EB)



Δ: −32.22 *50* {ANDT 19 175(77)}
☢: β− {PL 57B 44(75)}
$t_{1/2}$: 6.8 *2* s {PL 57B 44(75)}; 1.0$^{+30}_{-5}$ s {FRNC-TH-337(72), PRL 29 1254(72)}
Class: A; **Ident:** genet energy levels {PL 57B 44(75)}
Prod: ^{48}Ca(n,p) {PL 57B 44(75)}; protons on U {PRL 29 1254(72)}
β−: no $\beta_{12.0}$ (<1%), **5.0** *3* *scint, scint-Ge(Li) βγ coinc* {PL 57B 44(75)}
γ: ⟨**norm:** $\gamma_{3,832}$ (γ 80 *1*%), from level scheme⟩ **0.67122** *13* (t_γ 45 *5*), **0.67523** *5* (t_γ 216 *8*), **0.7154** *3* (t_γ 175), **0.7533** *6* (t_γ 11 *7*), **0.78016** *3* (t_γ 398 *20*), **0.79311** *6* (t_γ 123 *8*), **0.86275** *15* (t_γ 55 *8*), **0.86650** *20* (t_γ 43 *8*), **1.3009** *2* (t_γ 113 *32*), **1.31565** *6* (t_γ 163 *13*), **1.52538** *20* (t_γ 50 *8*), **1.53784** *6* (t_γ 189 *11*), **1.6336** *2* (t_γ 80 *20*), **1.7831** *2* (t_γ 111 *18*), **2.0313** *2* (t_γ 375), **2.0737** *3* (t_γ 24 *7*), **2.1775** *3* (t_γ 306), **2.2830** *3* (t_γ 326), **2.38813** *7* (t_γ 137 *10*), **2.78890** *7* (t_γ 207 *12*), **3.06299** *20* (t_γ 48 *9*), **3.83153** *7* (t_γ 1000), **4.5072** *3* (t_γ 47 *12*), **6.6137** *5* (t_γ 170 *10*), **7.3009** *5* (t_γ 31 *8*) *Ge(Li)* {PC77 Multhf}

$^{48}_{20}Ca$

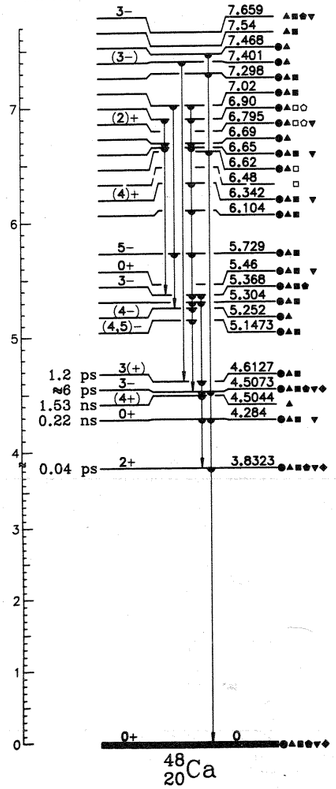
%: 0.187 {BNL-NCS-50605(77)}
Δ: −44.216 *4* {ANDT 19 175(77)}
σ_a: 1.1 *3* (reactor spectrum) {PC77 Holden}
$t_{1/2}(\beta^-)$: >1.1×10^{18} y *sp act* {PR 101 1041(56)}; **others:** {PR 85 941(52)}
$t_{1/2}(\beta\beta)$: ≥3.6×10^{19} y (for decay with two neutrinos) *sp act* {NP A158 337(70)}; ≥2×10^{21} y (for neutrinoless decay) *sp act* {NP A158 337(70)}; **others:** {PR 154 1050(67), PR 146 810(66), ZETF 49 751(65), ZETF 36 76(59), ZETF 34 505(58), Dokl 110 966(57), PR 101 1041(56), PR 97 1234(55), PPSL 65A 911(52)}
$t_{1/2}$(levels): **3.832:** 0.037 *17* ps *Doppler* {PR C2 1037(70)}
4.284: 0.223 *11* ns *delay coinc* {PR C2 1037(70)}
4.503: 1.533 ns *delay coinc* {NP A195 57(72), PR C15 2245(77)}
4.507: 6.1$^{+36}_{-19}$ ps *Doppler* {PR C2 1037(70)}
4.612: 1.25 *42* ps *Doppler* {NP A195 57(72)}

$^{48}_{20}$Ca levels – References

Decay: PL 57B 44(75), PC77 Multhf
^{48}Ca(p,p'γ): PR C12 2125(75), NP A127 438(69), PR C2 1037(70), NP A195 57(72), PR C15 2245(77); **others:** ZP 231 468(70), JPPa 29 135(68), CR 262B 1455(66)
^{48}Ca(p,p'): PR C6 944(72), NP A127 438(69); **others:** PL 20 516(66), PR 147 826(66)
^{48}Ca(α,α'): PR 163 1170(67), PR 140 B1479(65)
^{48}Ca(e,e'): PR 188 1815(69); **others:** PRL 21 1392(68)
^{48}Ca(t,p): NP A103 33(67)
^{48}Ca(^{18}O,^{16}O'): NP A203 1(73)

● ^{48}Ca(p,p'γ)
▲ ^{48}Ca(p,p')
■□ ^{48}Ca(α,α')
●○ ^{48}Ca(e,e')
▼ ^{48}Ca(t,p)
◆ ^{48}Ca(^{18}O,^{16}O')

Additional levels above 7.659 MeV: ≈25 in (p,p'γ), 10 in (p,p'), 1 in (α,α'), 9 in (t,p).



$^{48}_{21}Sc$

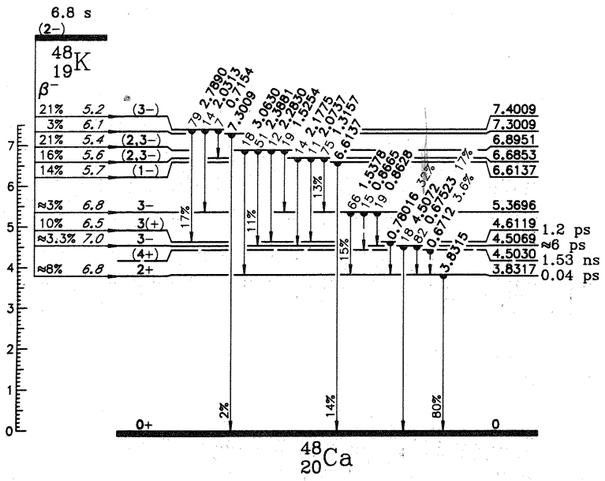
Δ: −44.498 *6* {ANDT 19 175(77)}
I: 6 *AB* {BAPS 12 474(67)}
☢: β− {PR 52 777(37)}
$t_{1/2}$: 43.67 *9* h {JINC 31 1883(69)}; 44.1 *3* h {PR 129 2227(63)}; **others:** {PR 115 989(59), Phil s7v45 621(54), PR 87 358(52), PR 75 1693(49), PR 67 313(45), PR 62 555(42), PR 57 163(40)}
Class: A; **Ident:** chem, excit {PR 52 777(37)}; sep isotopes {PR 75 1693(49)}; mass spect {Phil s7v45 621(54)}
Prod: ^{51}V(n,α) {PR 52 777(37), PR 52 239(37), PR 57 163(40)}; ^{50}Ti(d,α) {PR 75 1693(49)}; ^{48}Ca(p,n) {PR 67 313(45)}; ^{48}Ca(d,2n) {PR 61 578(42), PR 62 555(42), PR 64 147(43)}
β−: **0.654** *7 mag* {Phca 23 753(57)}
0.640 *4 mag* {PR 61 578(42)}
0.658 *26*, **0.475** *23 mag, mag-scint βγ coinc* {PR 129 2227(63)}
γ: ⟨**norm:** $\gamma_{0.984}$ (γ 100%), from level scheme⟩ **0.175357** *5* (t_γ 7.47 *7*), **0.983501** *2* (t_γ 100.0 *3*), **1.037496** *2* (t_γ 97.5 *3*), **1.212849** *7* (t_γ 2.38 *2*), **1.312087** *3* (t_γ 100.0 *3*) *Ge(Li), Ge(Li) anti-Compt* {JINC 38 1099(76)}
0.17533 (t_γ 9.4 *5*), **0.98334** (t_γ 100, e/γ 1.24 *12*×10^{-4}), **1.03715** (t_γ 98 *3*, e/γ 1.06 *7*×10^{-4}), **1.21237** (t_γ 2.5 *2*), **1.31146** (t_γ 100 *3*, e/γ 6.9 *9*×10^{-5}) *Ge(Li), scint, mag conv* {NP A90 558(67), Phca 23 753(57)}
others: {RRL 11 137(72), RaAc 14 54(70), RaAc 10 1(68), AFen n126(63), PR 129 2227(63), Phca 19 135(53), PR 92 1517(53), PR 92 205(53), PR 88 516(52), PR 87 528(52), PR 69 306(46), PR 64 147(43), PR 62 555(42)}
γγ(θ): {Phca 22 194(56), PR 92 205(53)}
βγ$_{cp}$(θ): {ZP 226 86(69), NP 84 380(66), PR 139 AB2(65), PR 137 B1(65)}

$^{48}_{21}Sc$(3h)

☢: decay mode uncertain {RRL 11 137(72)}
$t_{1/2}$: 3 h {RRL 11 137(72)}
Class: F; **Ident:** excit {RRL 11 137(72)}
Prod: ^{51}V(n,α) {RRL 11 137(72)}
γ: no γ rays observed *Ge(Li)* {RRL 11 137(72)}

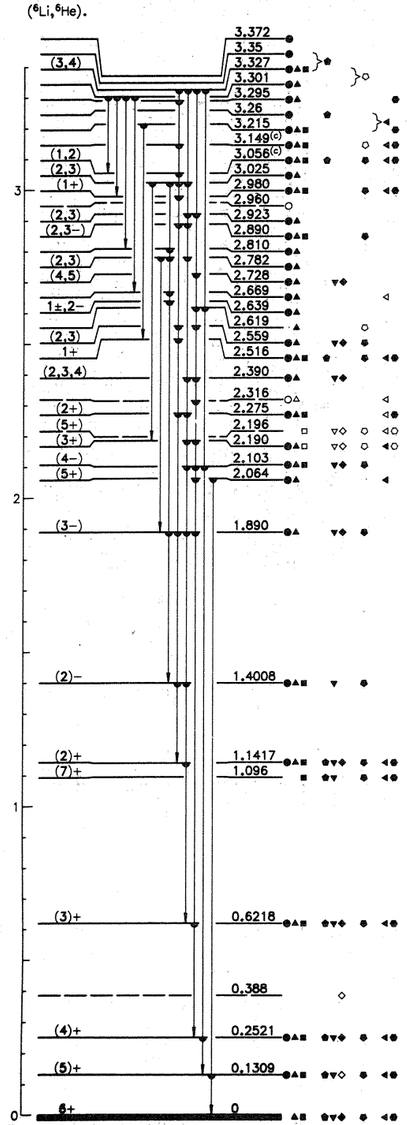
$^{48}_{21}$Sc levels – References

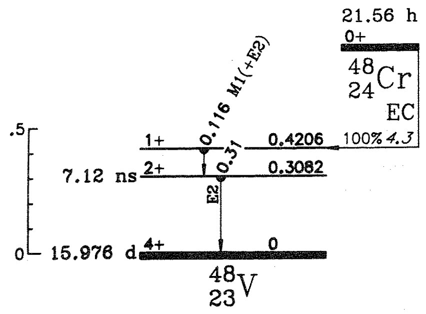
^{48}Ca(p,n): PR 171 1245(68), NP A99 6(67); **others:** NP A99 17(67), PR 140 B212(65), NP 12 426(59), PR 112 1200(58)
^{48}Ca(p,nγ): NP A255 360(75), NP A176 193(71), NuoL s2v2 537(71), NuoC s10v57B 453(68); **others:** PRL 20 159(68), ArkF 32 65(66), PR 140 B212(65)
^{48}Ca(^{3}He,t): PR C5 821(72); **others:** NP A168 151(71), PR C1 496(70), NP A129 417(69), PL 29B 567(69)
^{48}Ca(^{6}Li,^{6}He): NP A215 314(73), PL 51B 451(74)
^{49}Ti(d,^{3}He): PR C2 1725(70); **others:** PR 134 B976(64)
^{49}Ti(t,α): PRL 18 174(67)
^{50}Ti(d,α): PC69 WallenR, ND B4 351(70), NuoC s10v47B 255(67)
^{46}Ca(^{3}He,p): PR C5 1365(72), PR C5 1356(72), PR C1 496(70), PL 18 1140(67)
^{48}Ca(α,d): PR C5 814(72)



●○ ^{48}Ca(p,n)
▲△ ^{48}Ca(p,nγ)
■□ ^{48}Ca(^{3}He,t)
● ^{48}Ca(^{6}Li,^{6}He)
▼▽ ^{49}Ti(d,^{3}He)
◆◇ ^{49}Ti(t,α)
●○ ^{50}Ti(d,α)
◀◁ ^{46}Ca(^{3}He,p)
●○ ^{48}Ca(α,d)

Additional levels above 3.372 MeV: 24 in (p,nγ), 14 in (^{3}He,t), ≈6 in (d,α), 19 in (^{3}He,p), 2 in (α,d), 15 in (^{6}Li,^{6}He).





$^{48}_{23}$V levels – References

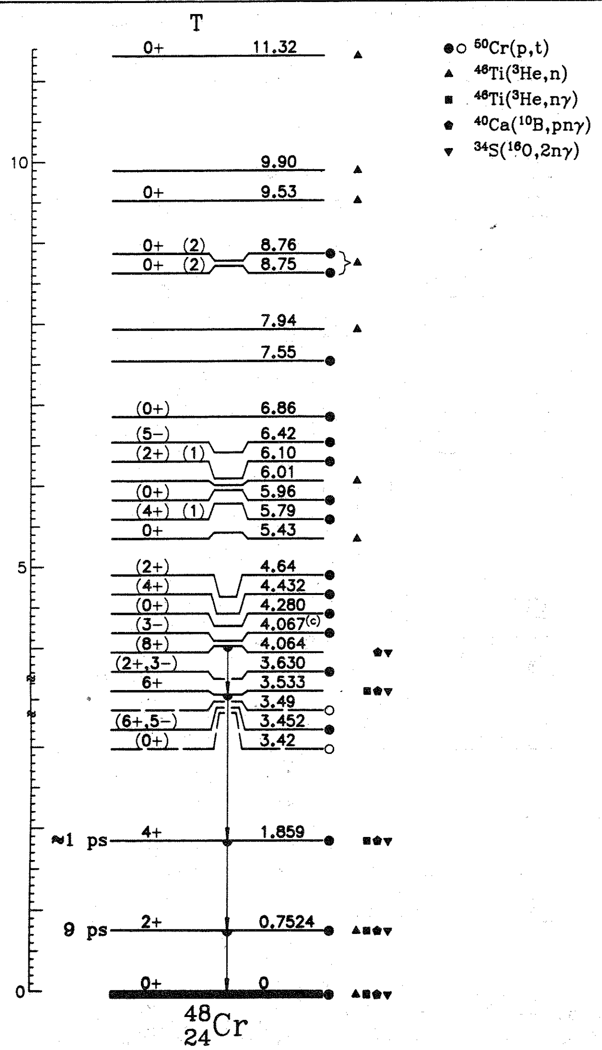
Decay: PR 100 223(55), PR 125 2005(62), NP A106 570(68), NP A94 427(67)
^{34}S(^{16}O,pnγ): PRL 33 105(74), NP A232 99(74), NP A236 405(74); **others:** NIM 123 73(75)
^{47}Ti(p,γ): IzF 36 2105(72)
^{40}Ca(^{10}B,2pγ),^{40}Ca(^{12}C,3pnγ): NuoC s11v15A 501(73)
^{45}Sc(α,nγ): PR C11 1122(75)
^{46}Ti(^{3}He,pγ): PR C8 2232(73)
^{48}Ti(^{3}He,t): PR C11 1141(75), NP A190 437(72); **others:** PL 24B 656(67)
^{46}Ti(^{3}He,p): NP A109 649(68), PR C8 2232(73); **others:** NP A94 261(67)
^{48}Ti(p,n): PR 125 2005(62); **others:** NP A97 232(67), PR 156 1249(67)
^{48}Ti(p,nγ): PR 130 312(63), PL 64B 140(76)
^{47}Ti(^{3}He,d): NP A112 385(68)
^{50}Cr(d,α): NP A209 373(73), NP A109 649(68); **others:** NP 51 641(64)
Other reactions:
π on ^{55}Mn: ZP 227 311(69)

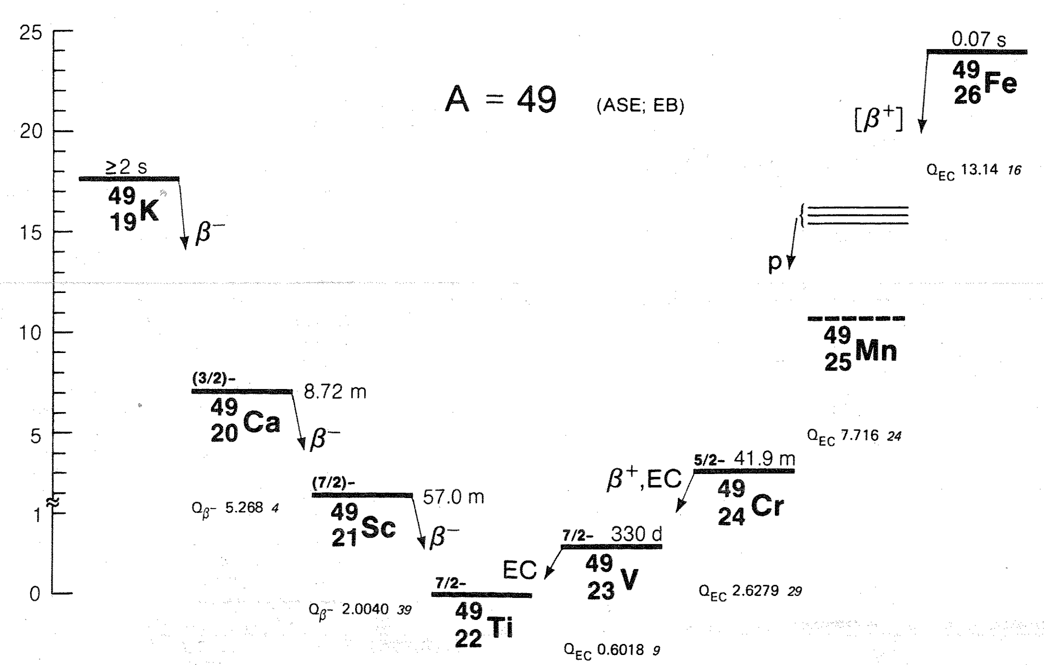
$^{48}_{24}$Cr

Δ: −42.818 *7* {ANDT 19 175(77)}
☢: EC, no β^+ (lim 2%) {PR 100 223(55), PR 99 165(55)}
$t_{1/2}$: 21.56 *3* h {PR C10 838(74)}; 22.96 *3* h {CJC 41 2194(63)}; **others:** {PR 166 1089(68), PR 100 223(55), PR 99 165(55)}
Class: A; **Ident:** chem, genet {PR 87 358(52)}
Prod: ^{46}Ti(α,2n) {PR 99 165(55)}
γ: ⟨**norm:** $\gamma_{0.308}$ (γ 99.42 *3*%), from level scheme⟩ **0.116** *2* ($\dagger_\gamma$95 *10*, *e/γ* 0.02 *1*), **0.305** *10* ($\dagger_\gamma$100, *e/γ* 0.006 *3*) *scint, mag conv, scint–scint γγ coinc* {PR 100 223(55)}
0.118 ($\dagger_\gamma$100), **0.31** ($\dagger_\gamma$100) *scint, sum scint* {PR 99 165(55)}
γγ(θ): {NP A94 427(67)}
$\gamma\gamma_{lin\ p}(\theta)$: {NP A106 570(68)}
$t_{1/2}$(levels): **0.752:** 11.6 *15* ps *recoil dist Doppler* {NP A238 253(75)}, 6.7 *18* ps *recoil dist Doppler* {NP A210 531(73)}
1.859: 1.0^{+14}_{-4} ps *recoil dist Doppler* {NP A210 531(73)}
4.064: <42 ps *recoil dist Doppler* {NP A210 531(73)}
others: {NP A238 253(75)}

$^{48}_{24}$Cr levels – References

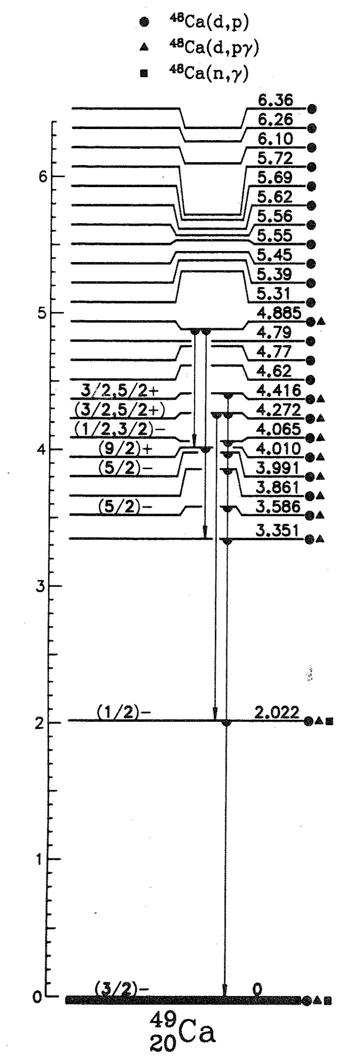
^{50}Cr(p,t): PL 37B 173(71), NP A197 17(72), PL 58B 286(75); **others:** PL 37B 58(71)
^{46}Ti(^{3}He,n): NP A94 261(67), YadF 12 253(70), NP A230 109(74), NP A243 269(75)
^{46}Ti(^{3}He,nγ): PR C10 620(74)
^{40}Ca(^{10}B,pnγ): NP A210 531(73)
^{34}S(^{16}O,2nγ): NP A238 253(75); **others:** NIM 123 73(75)





$^{49}_{19}$K

☢: β^- {PRL 29 1254(72)}
$t_{1/2}$: ≥2 s {FRNC–TH–337(72), PRL 29 1254(72)}
Class: F; **Ident:** chem, mass spect {PRL 29 1254(72)}
Prod: protons on U {PRL 29 1254(72)}

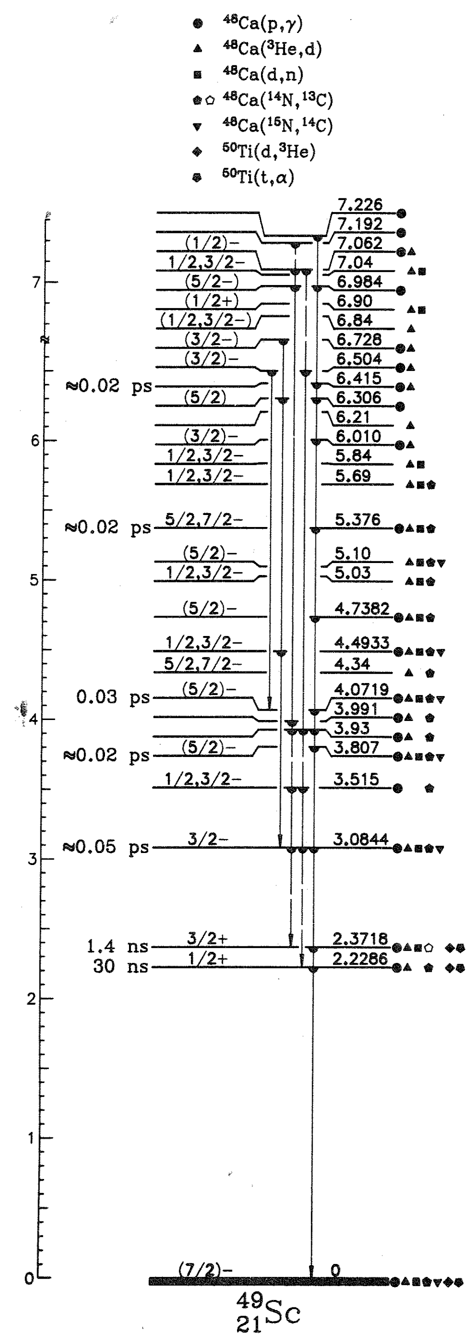


$^{49}_{20}$Ca levels – References

^{48}Ca(d,p): PR C12 827(75), NP A225 267(74), PR 135 B865(64); **others:** NP A197 337(72), NP A160 289(71), NP A153 145(70), NP A120 421(68), NP A120 401(68), PR 142 633(66)
^{48}Ca(d,pγ): PR C4 471(71)
^{48}Ca(n,γ): ND B4 351(70), Cf63 IntNeut 243, VANB 1969n3 97(69); **others:** NP A153 413(70)

$^{49}_{20}$Ca

Δ: −41.286 *5* {ANDT 19 175(77)}
☢: β^- {PR 79 192(50)}
$t_{1/2}$: 8.719 *13* m {RaAc 14 46(70)}; 8.715 *23* m {IIso 21 335(70)}; **others:** {PR 102 457(56), PR 101 1059(56), PR 79 192(50)}
Class: A; **Ident:** chem, n–capt, sep isotopes {PR 79 192(50)}
Prod: ^{48}Ca(n,γ) {PR 79 192(50)}
β^-: **1.95** *5* (†88), **0.89** *15* (†12) *scint* {PR 101 1059(56)}
others: {PR 102 457(56)}
γ: ⟨**norm:** $\gamma_{3.084}$ (γ 92 *1*%), from level scheme⟩ **0.1432** *2* ($\dagger_\gamma$0.038 *10*), **0.8561** *5* ($\dagger_\gamma$0.14 *3*), **0.9873** *5* ($\dagger_\gamma$0.083 *30*), **1.1445** *5* ($\dagger_\gamma$0.12 *3*), **1.2884** *5* ($\dagger_\gamma$0.080 *30*), **1.4089** *2* ($\dagger_\gamma$0.68 *7*), **2.2289** *5* ($\dagger_\gamma$0.21 *5*), **2.3717** *5* ($\dagger_\gamma$0.53 *10*), **3.0844** *1* ($\dagger_\gamma$100), **4.0719** *1* ($\dagger_\gamma$7.60 *80*), **4.7382** *2* ($\dagger_\gamma$0.23 *6*) *Ge(Li), scint pair* {PR C3 2268(71), NP A136 649(69)}
others: {Th75 Nuh, NP A153 413(70), RaAc 10 1(68), NP A98 337(67), PR 102 457(56), PR 101 1059(56)}
γγ(θ): {PR C3 2268(71)}
$\beta\gamma_{cp}(\theta)$: {NP A140 598(70)}



$^{49}_{21}$Sc levels – References

Decay: PR C3 2268(71)
^{48}Ca(p,γ): PR C7 1418(73), JPJa 35 317(73), PL 26B 285(68), PRL 18 219(67), ArkF 31 65(66), PL 27B 81(68); **others:** JPJa 35 325(73), NP A184 241(72), PRL 27 1013(71), IzF 34 1641(70)
^{48}Ca(^{3}He,d): PR 142 633(66), PR 140 B1226(65), PL 10 204(64)
^{48}Ca(d,n): NP A113 353(68)
^{48}Ca(^{14}N,^{13}C): PRL 31 320(73)
^{48}Ca(^{15}N,^{14}C): PL 55B 49(75)
^{50}Ti(d,^{3}He): NP A110 366(68); **others:** ZP 202 236(67), PR 134 B976(64)
^{50}Ti(t,α): PL 22 162(66)
Other reactions:
^{48}Ca(^{16}O,^{15}N): PL 43B 279(73)
^{48}Ca(p,n): PR 145 894(66), PL 26B 285(68), PR 177 1553(69), PR C6 1730(72)
^{48}Ca(p,p′): PL 26B 285(68), PR 177 1553(69), NP A184 241(72)
^{48}Ca(p,nγ): NuoC s10v57B 453(68), PL 20 159(68), PL 20 781(68), PR 177 1553(69), JPJa 35 325(73), NP A184 241(72), NP A252 343(75)
^{48}Ca(^{3}He,pd): PL 56B 449(75)