## $^{42}$S $\beta^-$ decay (1.016 s) 2006Wi10

History

| Type | Author | Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | Jun Chen[#] and Balraj Singh | NDS 135, 1 (2016) | 31-May-2016 |

Parent: $^{42}$S: E=0; $J^\pi=0^+$; $T_{1/2}$=1.016 s *15*; Q($\beta^-$)=7.28×10$^3$ *14*; %$\beta^-$ decay=100.0

$^{42}$S-$T_{1/2}$: From $^{42}$S Adopted Levels.

$^{42}$S-Q($\beta^-$): From 2012Wa38.

2006Wi10: $^{42}$S isotope produced by fragmentation of a $^{48}$Ca beam at 70 MeV/nucleon hitting a $^9$Be target. The fragments were separated by A1200 fragment separator at NSCL, Michigan facility. Measured E$\gamma$, I$\gamma$, $\gamma\gamma$, $\beta$, $\beta\gamma$ coin using two Ge detectors for $\gamma$ rays and a plastic scintillator for $\beta$ rays. Comparisons with Shell-model calculations.

1998WiZX: reported preliminary result of 2006Wi10; measured $T_{1/2}$, E$\gamma$, I$\gamma$, $\gamma\gamma$-coin, neutrons. No delayed neutrons were observed by 1998WiZX; 1995So03 reported %$\beta^-$n<4.

2013Sz02 refer to a study of this decay by D. O'Donnell, Ph.D. thesis, University of the West Scotland (2008).

### $^{42}$Cl Levels

| E(level)[†] | $J^\pi$[‡] | Comments |
|---|---|---|
| 0.0 | (2$^-$) | |
| 118.19 *6* | (3$^-$) | |
| 588.96 *6* | (1$^-$,2,3$^+$) | |
| 639.44 *9* | (1$^-$,2,3$^+$) | |
| 841.90 *6* | (1$^-$,2,3$^+$) | |
| 1025.82 *23* | (1$^-$,2,3$^+$) | |
| 1267.48 *7* | 1$^+$ | |
| 1385.68 *18* | | |
| 1550.38 *10* | | |
| 1576.61? *19* | | |
| 1684.16? *11* | | |
| 1710.91 *8* | | |
| 1834.78? *13* | | |
| 2123.28 *9* | 1$^+$ | |
| 2221.00? *12* | | |
| 2241.16 *25* | (1$^+$) | $J^\pi$: log *ft*=5.5 from 0$^+$, however, due to weak $\beta$ feeding and incomplete decay scheme, $J^\pi$ is considered as tentative. |
| 2403.1? *4* | | |
| 3029.76 *12* | 1$^+$ | |

[†] From least-squares fit to E$\gamma$ data.

[‡] Strong $\beta^-$ feeding from 0$^+$. For states below 1.1 MeV, values are inferred from a comparison with the decay scheme of $^{40}$S (2006Wi10).

### $\beta^-$ radiations

| E(decay) | E(level) | I$\beta^-$[†‡#] | Log *ft*[‡] | Comments |
|---|---|---|---|---|
| (4.25×10$^3$ *14*) | 3029.76 | 16.2 *9* | 4.33 *7* | av E$\beta$=1909 *69* |
| (4.88×10$^3$[@] *14*) | 2403.1? | 1.0 *2* | 5.8 *1* | av E$\beta$=2215 *69* |
| (5.04×10$^3$ *14*) | 2241.16 | 2.2 *3* | 5.5 *1* | av E$\beta$=2294 *69* |
| (5.16×10$^3$ *14*) | 2123.28 | 63 *3* | 4.13 *6* | av E$\beta$=2352 *69* |
| (5.57×10$^3$ *14*) | 1710.91 | 1.6 *8* | 5.9 *2* | av E$\beta$=2554 *69* |
| (5.89×10$^3$ *14*) | 1385.68 | 0.7 *2* | 6.4 *2* | av E$\beta$=2713 *69* |
| (6.01×10$^3$ *14*) | 1267.48 | 17.6 *11* | 4.99 *6* | av E$\beta$=2771 *69* |

[†] From intensity balance.

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## $^{42}$S $\beta^-$ decay (1.016 s) 2006Wi10 (continued)

### $\beta^-$ radiations (continued)

‡ Due to large Q value, it is possible that there are unobserved levels above the currently known level at 3030, thus the $\beta$-feedings and log *ft* values are considered as limits only. However, $\beta$ transitions with large feedings (>15%) are considered as allowed.
# Absolute intensity per 100 decays.
@ Existence of this branch is questionable.

### $\gamma(^{42}Cl)$

I$\gamma$ normalization: $\Sigma$(I$\gamma$ to g.s.)=100, assuming zero feeding to g.s.

| $E_\gamma$ † | $I_\gamma$ ‡ | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ | Mult. |
|---|---|---|---|---|---|---|
| 118.25 *10* | 100 *5* | 118.19 | (3$^-$) | 0.0 | (2$^-$) | |
| 160.60 *9* | 1.57 *15* | 1710.91 | | 1550.38 | | |
| 202.42 *11* | 0.96 *11* | 841.90 | (1$^-$,2,3$^+$) | 639.44 | (1$^-$,2,3$^+$) | |
| 252.6 *4* | 0.35 *9* | 841.90 | (1$^-$,2,3$^+$) | 588.96 | (1$^-$,2,3$^+$) | |
| 288.49# *12* | 0.72 *9* | 2123.28 | 1$^+$ | 1834.78? | | |
| 425.61 *6* | 5.7 *4* | 1267.48 | 1$^+$ | 841.90 | (1$^-$,2,3$^+$) | |
| 439.09# *8* | 2.00 *17* | 2123.28 | 1$^+$ | 1684.16? | | |
| 470.78 *6* | 33.5 *12* | 588.96 | (1$^-$,2,3$^+$) | 118.19 | (3$^-$) | |
| 521.26 *10* | 2.0 *4* | 639.44 | (1$^-$,2,3$^+$) | 118.19 | (3$^-$) | |
| 588.78 *9* | 0.25 *5* | 588.96 | (1$^-$,2,3$^+$) | 0.0 | (2$^-$) | |
| 638.9 *4* | 0.55 *9* | 639.44 | (1$^-$,2,3$^+$) | 0.0 | (2$^-$) | |
| 670.55# *10* | 1.84 *16* | 2221.00? | | 1550.38 | | |
| 678.43 *7* | 12.9 *7* | 1267.48 | 1$^+$ | 588.96 | (1$^-$,2,3$^+$) | |
| 685.1 *3* | 1.22 *13* | 1710.91 | | 1025.82 | (1$^-$,2,3$^+$) | |
| 723.72 *7* | 37.6 *12* | 841.90 | (1$^-$,2,3$^+$) | 118.19 | (3$^-$) | |
| 737.8 *3* | 0.45 *13* | 2123.28 | 1$^+$ | 1385.68 | | |
| 796.80 *20* | 1.3 *3* | 1385.68 | | 588.96 | (1$^-$,2,3$^+$) | |
| 808.55# *15* | 1.48 *24* | 3029.76 | 1$^+$ | 2221.00? | | |
| 841.95 *8* | 9.4 *12* | 841.90 | (1$^-$,2,3$^+$) | 0.0 | (2$^-$) | |
| 868.94 *14* | 1.98 *22* | 1710.91 | | 841.90 | (1$^-$,2,3$^+$) | |
| 907.5 *5* | 0.39 *18* | 1025.82 | (1$^-$,2,3$^+$) | 118.19 | (3$^-$) | |
| 1025.9 *4* | 0.55 *17* | 1025.82 | (1$^-$,2,3$^+$) | 0.0 | (2$^-$) | |
| 1071.6 *3* | 1.3 *3* | 1710.91 | | 639.44 | (1$^-$,2,3$^+$) | |
| 1121.97 *13* | 3.0 *6* | 1710.91 | | 588.96 | (1$^-$,2,3$^+$) | |
| 1149.42 *13* | 1.7 *4* | 1267.48 | 1$^+$ | 118.19 | (3$^-$) | |
| 1193.1# *9* | 1.6† *3* | 3029.76 | 1$^+$ | 1834.78? | | |
| 1245.93# *24* | 1.08 *18* | 1834.78? | | 588.96 | (1$^-$,2,3$^+$) | |
| 1268.8# *7* | 1.65† *24* | 1267.48 | 1$^+$ | 0.0 | (2$^-$) | [M2] |
| 1281.44 *12* | 37.3 *14* | 2123.28 | 1$^+$ | 841.90 | (1$^-$,2,3$^+$) | |
| 1318.88 *11* | 9.1 *4* | 3029.76 | 1$^+$ | 1710.91 | | |
| 1399.1 *3* | 1.76 *19* | 2241.16 | (1$^+$) | 841.90 | (1$^-$,2,3$^+$) | |
| 1453.2# *3* | 1.31 *17* | 3029.76 | 1$^+$ | 1576.61? | | |
| 1458.53# *23* | 1.21 *20* | 1576.61? | | 118.19 | (3$^-$) | |
| 1534.26 *11* | 12.7 *6* | 2123.28 | 1$^+$ | 588.96 | (1$^-$,2,3$^+$) | |
| 1550.52 *14* | 2.85 *23* | 1550.38 | | 0.0 | (2$^-$) | |
| 1592.55 *18* | 1.94 *22* | 1710.91 | | 118.19 | (3$^-$) | |
| 1652.4 *4* | 0.80 *26* | 2241.16 | (1$^+$) | 588.96 | (1$^-$,2,3$^+$) | |
| 1684.1# *3* | 1.63 *19* | 1684.16? | | 0.0 | (2$^-$) | |
| 1814.2# *4* | 1.20 *19* | 2403.1? | | 588.96 | (1$^-$,2,3$^+$) | |
| 2004.93 *16* | 19.4 *7* | 2123.28 | 1$^+$ | 118.19 | (3$^-$) | |
| 2123.9# *5* | 1.47† *17* | 2123.28 | 1$^+$ | 0.0 | (2$^-$) | [M2] |

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## $^{42}$S $\beta^-$ decay (1.016 s) 2006Wi10 (continued)

### $\gamma(^{42}Cl)$ (continued)

| $E_\gamma$ [†] | $I_\gamma$ [‡] | $E_i$(level) | $J_i^\pi$ | $E_f$ | $J_f^\pi$ |
|---|---|---|---|---|---|
| 2187.2 *4* | 2.6 *3* | 3029.76 | $1^+$ | 841.90 | $(1^-,2,3^+)$ |
| 2440.6 *3* | 2.4 *3* | 3029.76 | $1^+$ | 588.96 | $(1^-,2,3^+)$ |
| 2911.7 *5* | 1.8 *3* | 3029.76 | $1^+$ | 118.19 | $(3^-)$ |

[†] From 1998WiZX only.
[‡] For absolute intensity per 100 decays, multiply by 0.87 *4*.
[#] Placement of transition in the level scheme is uncertain.

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### Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays

Legend
- $I_\gamma < 2\% \times I_\gamma^{max}$
- $I_\gamma < 10\% \times I_\gamma^{max}$
- $I_\gamma > 10\% \times I_\gamma^{max}$
- $\gamma$ Decay (Uncertain)
- Coincidence
- Coincidence (Uncertain)

$0^+$ 0 1.016 s *15*

$Q_{\beta^-}$=7.28×10$^3$ *14* $\%\beta^-$=100.0

$^{42}_{16}S_{26}$

| Iβ⁻ | Log *ft* | | |
|---|---|---|---|
| 16.2 | 4.33 | $1^+$ | 3029.76 |
| 1.0 | 5.8 | | 2403.1 |
| 2.2 | 5.5 | $(1^+)$ | 2241.16 |
| | | | 2221.00 |
| 63 | 4.13 | $1^+$ | 2123.28 |
| | | | 1834.78 |
| 1.6 | 5.9 | | 1710.91 |
| | | | 1684.16 |
| | | | 1576.61 |
| | | | 1550.38 |
| 0.7 | 6.4 | | 1385.68 |
| 17.6 | 4.99 | $1^+$ | 1267.48 |
| | | $(1^-,2,3^+)$ | 1025.82 |
| | | $(1^-,2,3^+)$ | 841.90 |
| | | $(1^-,2,3^+)$ | 639.44 |
| | | $(1^-,2,3^+)$ | 588.96 |
| | | $(3^-)$ | 118.19 |
| | | $(2^-)$ | 0.0 |

2911.7 1.6, 2440.6 2.1, 2187.2 2.3, 1453.2 1.14, 1318.88 7.9, 1193.1 1.4, 808.55 1.29, 1814.2 1.04, 1652.4 0.70, 1399.1 1.53, 670.55 1.60, 2123.9 [M2] 1.28, 2004.93 16.9, 1534.26 11.0, 1281.44 32.5, 737.8 0.39, 439.09 1.74, 288.49 0.63, 1245.93 0.94, 1592.55 1.69, 1121.97 2.6, 1071.6 1.1, 868.94 1.72, 685.1 1.06, 160.60 1.37, 1684.1 1.42, 1458.53 1.05, 1550.52 2.48, 796.80 1.1, 1268.8 [M2] 1.44, 1149.42 1.5, 678.43 11.2, 425.61 5.0, 1025.9 0.48, 907.5 0.34, 841.95 8.2, 723.72 32.7, 252.6 0.30, 202.42 0.84, 638.9 0.48, 521.26 1.7, 588.78 0.22, 470.78 29.1, 118.25 87

$^{42}_{17}Cl_{25}$