

Adopted Levels, Gammas

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. J. Martin, C. D. Nesaraja	NDS 186, 261 (2022)	31-Dec-2021

$Q(\beta^-)=2.70 \times 10^3$ 20; $S(n)=4.97 \times 10^3$ 22; $S(p)=6070$ SY; $Q(\alpha)=4.10 \times 10^3$ 20 [2021Wa16](#)

$\Delta S(p)=280$ (syst,[2021Wa16](#)).

$S(2n)=11040$ 200, $S(2p)=14170$ 280 (syst) ([2021Wa16](#)).

There are no new experimental data on ²⁴²Np since the previous evaluation by Y.A. Akevali ([2002Ak06](#)). The Adopted Levels dataset has been updated with Q values from [2021Wa16](#). The ²⁴²U β^- decay has been updated with conversion coefficient data from Bricc ([2008Ki07](#)) which leads to slightly different β^- feedings and $\log ft$ values.

Assignment: ²⁴⁴Pu(200-MeV n,n2p)²⁴²U; β^- decay; chem ([1979Ha26](#)).

²⁴²Np Levels

Since the ²⁴²U β^- decay scheme is tentative, all excited levels proposed from this decay work are adopted as questionable.

Cross Reference (XREF) Flags

A ²⁴²U β^- decay

E(level)	J ^{π}	T _{1/2}	XREF	Comments
0.0 [†]	(1 ⁺)	2.2 min 2	A	$\% \beta^- = 100$ J ^{π} : Analogy to lighter Np isotopes and analogy to ²⁴³ Pu and ²⁴⁵ Cm nuclei with 149 neutrons suggest $\pi 5/2[642]$ and $\nu 7/2[624]$ Nilsson states for the ²⁴² Np g.s. $\log ft$ values for β^- decays to low-spin levels in ²⁴² Pu are consistent with J ^{π} =1. The configuration $\pi 5/2[642], \nu 7/2[624]$ was also proposed by 1979Ha26 . T _{1/2} : From 1979Ha26 .
55.58? 6	(1 ⁻ ,0 ⁻) [‡]		A	J ^{π} : E1 transition to (1 ⁺). Probable β^- feeding from 0 ⁺ .
67.60? 5	(1 ⁻ ,0 ⁻) [‡]		A	J ^{π} : E1 transition to (1 ⁺). Probable β^- feeding from 0 ⁺ .
293.9? 1			A	
329.7? 1	(1,0)		A	J ^{π} : γ transitions to (1 ⁺) and (1 ⁻ ,0 ⁻). Probable β^- feeding from 0 ⁺ . 1979Ha26 show (1 ⁻) on their level scheme. If J ^{π} =1 ⁻ , a possible configuration could be 1 ⁻ $\pi 5/2[642], \nu 7/2[743]$. The γ to g.s., assuming it is the 1 ⁺ $(\pi 2/2[642], \nu 7/2[624])$ state, would be allowed; however the γ to the 55.58 level, if it is the 1 ⁻ $(\pi 5/2[523], \nu 7/2[624])$ state, as 1979Ha26 proposed, would not be allowed without introducing considerable amount of configuration admixtures. If J ^{π} =0 ⁺ , the level could be the 0 ⁺ $(\pi 5/2[642], \nu 5/2[622])$ state. γ transitions to the 1 ⁺ $(\pi 5/2[642], \nu 7/2[624])$ g.s. and to the 55.58 level would be consistent with this configuration if the 55.58 level is either the 1 ⁻ $(\pi 5/2[642], \nu 7/2[743])$ or the 1 ⁻ $(\pi 5/2[523], \nu 5/2[622])$ state; however, it would be inconsistent if the 55.58 level has the 1 ⁻ $(\pi 5/2[523], \nu 7/2[624])$ configuration. For J ^{π} =0 ⁺ , the β decay from ²⁴² U would be an isospin-forbidden transition.
598.3? 3	(1,0)		A	J ^{π} : $\log ft=6.9$ 9.
640.6? 2	(1 ⁺ ,0 ⁺)		A	J ^{π} : $\log ft=6.0$ 10 from 0 ⁺ suggests J ^{π} =0 or 1. 1979Ha26 proposed the configuration $\pi 5/2[523], \nu 7/2[743]1^+$ which would account for the feeding to the levels at 56 and 68 and the absence of direct feeding to the g.s., given the proposed configurations for these levels.
0.0+x [†]	(6 ⁺)	5.5 min 1		$\% \beta^- = 100$ Assignment: ²⁴⁴ Pu(30-160 MeV n,p2n); ²⁴² Pu(n,p) chem; activity was not observed in ²³⁵ U(34-MeV α ,pxn) (1981Fr07). Only β^- decay was observed. A possible isomeric transition was searched for by

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

²⁴²Np Levels (continued)

<u>E(level)</u>	<u>J^π</u>	<u>T_{1/2}</u>	<u>XREF</u>	<u>Comments</u>
				1981Fr07 but was not observed. J ^π : Non-observation of β transitions to low-spin states suggests spin higher than that of the 2.2-min state (J ^π =(1 ⁺)). 1981Fr07 proposed the configuration π5/2[642],ν7/2[624]6 ⁺ . T _{1/2} : From 1981Fr07.

† The Gallagher-Moszkowski rule suggests that the 1⁺ coupling of the 5/2[642] proton and 7/2[624] neutron states lies lower in energy than the 6⁺ coupling. If this assumption holds for ²⁴²Np then the 2.2-min state can be taken as the g.s. If this assumption is not valid, then the 2.2-min state might be an isomer and the energies of the levels seen in β⁻ decay would need to be increased by the energy of the isomer.

‡ From the systematics of Nilsson states, 1979Ha26 proposed π5/2[523],ν7/2[624]1⁻ or π5/2[523],ν5/2[622]0⁻ configurations for the 55.58 and 67.6 levels. Another possible configuration for one of these levels could be π5/2[642],ν7/2[743]; however, systematics of Nilsson orbitals suggests that its energy would be higher than 67.6 keV.

γ(²⁴²Np)

<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_γ</u>	<u>I_γ[#]</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.[‡]</u>	<u>α[†]</u>	<u>Comments</u>
55.58?	(1 ⁻ ,0 ⁻)	55.58 6	100	0.0	(1 ⁺)	E1	0.601 9	α(L)=0.451 6; α(M)=0.1120 16 α(N)=0.0298 4; α(O)=0.00690 10; α(P)=0.001126 16; α(Q)=4.16×10 ⁻⁵ 6
67.60?	(1 ⁻ ,0 ⁻)	67.60 5	100	0.0	(1 ⁺)	E1	0.359 5	α(L)=0.269 4; α(M)=0.0666 9 α(N)=0.01774 25; α(O)=0.00414 6; α(P)=0.000692 10; α(Q)=2.76×10 ⁻⁵ 4
293.9?		226.3 1	50 25	67.60?	(1 ⁻ ,0 ⁻)			
		238.2 1	100 50	55.58?	(1 ⁻ ,0 ⁻)			
329.7?	(1,0)	274.2 2	15 6	55.58?	(1 ⁻ ,0 ⁻)			
		329.7 1	100 7	0.0	(1 ⁺)			
598.3?	(1,0)	304.5 2	100 22	293.9?				
		530.6 2	59 30	67.60?	(1 ⁻ ,0 ⁻)			
640.6?	(1 ⁺ ,0 ⁺)	572.9 1	97 6	67.60?	(1 ⁻ ,0 ⁻)			
		585.0 1	100 6	55.58?	(1 ⁻ ,0 ⁻)			

† Additional information 1.

‡ From ²⁴²U β⁻ Decay.

Relative photon intensity de-exciting each level.

Adopted Levels, GammasLevel Scheme

Intensities: Relative photon branching from each level

