^{82}Rb - Comments on evaluation
by M.-M. Bé

This evaluation was completed in January 2015. All literature available by this date was included.

1 Decay Scheme

The decay scheme of Rb-82 is taken from Meyer *et al*. (1983Me08) who observed 46 γ rays in the decay of Rb-82 to Kr-82, whereas only the most intense rays were studied in the other published papers. A statistical analysis process was adopted when several values existed, while all of the other γ rays as given by Meyer *et al.* were accepted.
Rb-82 is produced in the EC decay of Sr-82 ($T_{1/2}$ = 25,347 (17) *d*).

2 Nuclear Data

Q^+ value of 4403 (3) keV is from 2012Wa38.

The following measured values of the half-life of ^{82}Rb have been taken into consideration:

Reference	$T_{1/2}$ (min)	Uc (min)
1953Kr10	1,267	0,083
1953Li27	1,25	0,03
1978Gr17	1,273	0,002
1987Wo01	1,2575	0,0005
Chi2 crit	3,8	
Chi2	10,1	
UWM	1,2618	
LWM	1,2652	
uc(WM)int	0,0014	
uc(WM)ext	0,0045	
Adopted	**1,2652**	**0,0045**

This set of data is discrepant, and the uncertainty in the half-life given by 1987Wo01 has been increased to 0,0020 in order to limit the weight of this particular value to 50 %.

2.1 and 2.2 Electron Capture Transitions and β^+ Emissions

The sums of the EC + β^+ transition probabilities were deduced from the sum of the gamma transition probabilities populating and depopulating each level of the decay scheme. The EC/β^+ ratios were calculated using the Logft program, and a relative uncertainty of 5 % was assumed. Individual EC and β^+ probabilities were derived from these data.

From the values listed below, the sum of P(β^+) amounts to 95,45 (30) %, which corresponds to a 511-keV photon intensity of 190,9 (6) %. This result and the ratio I_{511}/I_{776} can be compared with experimental values.

Reference	$I\beta^+$ (%)	u_c	I_{511}/I_{776}	u_c
1962Sa10	96,1	–	14,3	2,2
1967Vr07	95,4	–	14,52	0,90
1969Ra06	94,6	–	14,13	1,0
1970Gr01	–	–	14,08	0,8
1987Ho06	96,0	0,2	12,886	0,034
1987Ju01	95,87	0,15	12,67	0,15
Adopted	**95,45**	**0,30**	**12,71**	**0,17**

The energies are derived from the *Q* value and the level energies. The fractional probabilities for EC are calculated using the "Tables for Calculation of Electron Capture" (E. Schönfeld, PTB Laboratory report 6.33-95-2 (1995) - 1995ScZY). These values are based on the wave functions determined by J.B. Mann and J.T. Waber (*Atomic Data* **5** (1973) 201), with the exchange and overlap corrections of J.N. Bahcall and E. Vatai (see 1977Ba48; J.N. Bahcall, *Phys. Rev*. **132** (1963) 362; *Nucl. Phys*. **71** (1965) 267; E. Vatai, *Nucl. Phys*. **A156** (1970) 541).

2.3 Gamma Transitions

The transition probabilities were derived from the emission intensities and the conversion coefficients, but in most cases the internal conversions are weak and can be neglected. When given, the conversion coefficients have been interpolated from tables of Band (2002Ba85) by using the BrIcc program with the "frozen orbital approximation" (Kibédi *et al.,* 2008Ki07).

3. Atomic Data

All atomic data are taken from E. Schönfeld and H. Janssen, *Nucl. Instrum. Methods Phys. Res.* A369 (1996)527 (1996Sc06).

4. Electron Emissions

The energies of the conversion electrons are calculated from the energies of the γ rays and the corresponding electron binding energies.
Emission intensities for the Auger electrons and X-rays were derived from the decay scheme parameters by means of the EMISSION program.

5. Photon Emissions

The following data have been considered in the determination of the γ-ray emission intensities relative to a value of 100 % for the intensity of the 776-keV γ ray:

Reference	E (keV)					
	696,86 (5)	**698,37 (5)**	**711,2 (1)**	**1395,14 (3)**	**1474,88 (1)**	**1703,19 (4)**
Vrzal (1967Vr07)	–	1,35 (8)	0,36 (5)	3,98 (15)	0,63 (3)	0,42 (3)
Raman (1969Ra06)	0,430(22)	1,04 (5)	0,35 (9)	3,53 (18)	0,61 (3)	0,37 (9)
Graeffe (1970Gr01)	–	1,28 (10)	0,31 (5)	3,8 (20)	0,89 (10)[(o)]	0,48 (10)
Hrynkiewicz (1970Hr02)	0,22 (7) [(o)]	1,0 (1)	0,23 (6)	3,78 (40)	0,68 (7)[(o)]	0,41 (10)
Meyer (1983Me08)	0,51 (2)	0,99 (3)	0,38 (2)	3,51 (2)	0,59 (2)	0,335 (4)
Hoppes (1987Ho06)	–	1,54 (2) [(o)]	0,470(21)	3,52 (3)	0,601 (14)	0,330 (12)
Chi2	6,9	5,5	4,8	2,4	0,4	2,2
Chi2 crit	6,6	3,3	3,0	3,0	3,8	3,0
UWM	0,470	1,132	0,35	3,687	0,6078	0,3908
WM	0,470	1,062	0,400	3,5212	0,6025	0,3362
uc int	0,015	0,026	0,013	0,0162	0,0100	0,0037
uc ext	0,040	0,062	0,029	0,0251	0,0066	0,0055
LWM	0,47	1,06	0,400	3,521	0,602	0,336
Adopted	**0,47 (4)**	**1,06 (7)**	**0,400 (29)**	**3,521 (25)**	**0,602 (14)[(m)]**	**0,336 (6)**

Reference	E (keV)			
	2167,59 (4)	**2410,26 (5)**	**2479,65 (4)**	**2940,0 (3)**
Vrzal (1967Vr07)	0,34 (3)	0,15 2)	0,22 (5)	–
Raman (1969Ra06)	0,25 (6)	0,12 (3)	0,220 (55)	–
Graeffe (1970Gr01)	0,32 (5)	0,20 (5)	0,28 (6)	0,08 (3)
Hrynkiewicz (1970Hr02)	0,35 (8)	0,17 (4)	0,28 (7)	0,07 (2)
Meyer (1983Me08)	0,28 (1)	0,156 (8)	0,27 (1)	0,021 (4)[(u)]
Hoppes (1987Ho06)	–	–	–	–
Chi2	1,3	0,6	0,4	2,5
Chi2 crit	3,3	3,3	3,3	4,6
UWM	0,308	0,1592	0,254	0,057
WM	0,2872	0,1546	0,2672	0,0470
uc int	0,0092	0,0070	0,0094	0,0118
uc ext	0,0103	0,0054	0,0063	0,0186
LWM	0,287	0,155	0,267	0,047
Adopted	**0,287 (1)**	**0,155 (8)[(m)]**	**0,267 (10) [(m)]**	**0,047 (19)**

[(o)] Omitted from statistical processing.
[(m)] Minimum experimental uncertainty.
[(u)] Uncertainty increased to limit the weighting to 50 %.

All other rays listed in the tables and decay scheme are from Meyer *et al.* (1983Me08). The γ rays with energies of 466,9 and 2508,9 keV given in Meyer are of uncertain origin, and have not been included in the proposed decay scheme.
Two E0 transitions with very weak probabilities of the order of (10^{-5} – 10^{-6}) %, as deduced by 1985Ze03 from the measurement of conversion electrons with a mini-orange spectrometer, were also not included in the tables.

Several measured values of the absolute intensity of the 776 keV γ–ray exist, obtained mainly by means of coincidence techniques:

Reference	Iγ (%)	Uncertainty (%)	
1962Sa10	13	–	Coincidence techniques
1967Vr07	13,2	–	Coincidence techniques
1969Ra06	13,4	–	Coincidence techniques
1987Ho06	14,9	0,4	Coincidence techniques
1987Ju01	15,13	0,27	Original uncertainty = 0,18
2012Gr03	14,93	0,37	Ion implantation of ^{82}Sr
Chi2	0,16		
Chi2 crit	4,61		
UWM	14,987		
WM	15,024		
uc int	0,19		
uc ext	0,08		
LWM	15,02		
Adopted	**15,02**	**0,19**	**WM and internal uncertainty**

There are only three measurements in which the uncertainties are quoted. The uncertainty given by 1987Ju01 was increased to limit the weighting of this value to 50 %.

The absolute emission intensity of the 511-keV annihilation photon has been deduced from the decay scheme data and the theoretical EC/β^+ ratios, as described in Section 2.1

6. References

1953Kr10 P.Kruger, N.Sugarman. Phys. Rev. 90 (1953) 158. Half-life

1953Li27 L.M.Litz, S.A.Ring, W.R.Balkwell. Phys. Rev. 92 (1953) 288. Half-life

1962Sa10 M.Sakai, H.Ikegami, T.Yamazaki. J. Phys. Soc. Japan 17 (1962) 1087. Gamma-ray emission intensities

1967Vr07 J.Vrzal, B.S.Dzhelepov, A.G.Dmitriev, N.N.Zhukovskii, J.Liptak, L.N.Moskvin, J.Urbanets, L.G.Tsaritsyna. Bull. Acad. Sci. USSR, Phys. Ser. 31 (1968) 1701. Gamma-ray emission intensities

1969Ra06 S.Raman, J.J.Pinajian. Nucl. Phys. A125 (1969) 129. Gamma-ray emission intensities

1970Gr01 G.Graeffe, S.Vaisala, J.Heinonen. Nucl. Phys. A140 (1970) 161. Gamma-ray emission intensities

1970Hr02 A.Z.Hrynkiewicz, J.Styczen, W.Walus, R.Broda. Acta Phys. Polonica A38 (1970) 501. Gamma-ray emission intensities

1977Ba48 W. Bambynek, H.Behrens, M.H.Chen, B.Crasemann, M.L.Fitzpatrick, K.W.D.Ledingham, H.Genz, M.Mutterer, R.L.Intemann, Rev. Mod. Phys. 49 (1977) 77 (Erratum. Rev. Mod. Phys. 49 (1977) 961) EC transition probabilities

1978Gr17 P.M.Grant, B.R.Erdal, R.E.Whipple, R.J.Daniels, H.A.O'Brien Jr. Phys. Rev. C18 (1978) 2799. Half-life

1983Me08 R.A.Meyer, J.F.Wild, K.Eskola, M.E.Leino, S.Vaisala, K.Forssten, U.Kaup, A.Gelberg. Phys. Rev. C27 (1983) 2217. Gamma-ray emission intensities

1985Ze03 A.Zemel, T.Hageman, J.J.Hamill, J.van Klinken. Phys. Rev. C31 (1985) 1483. Gamma transitions

1987Ho06 D.D.Hoppes, B.M.Coursey, F.J.Schima, D.Yang. Appl. Radiat. Isotopes 38 (1987) 195. Half-life

1987Ju01 S.M.Judge, M.J.Woods, S.L.Waters, K.R.Butler. Appl. Radiat. Isotopes 38 (1987) 185. Gamma-ray emission intensities

1987Wo01 M.J.Woods, S.M.Judge, S.E.M.Lucas. Appl. Radiat. Isotopes 38 (1987) 191. Gamma-ray emission intensities

1995ScZY E.Schönfeld. PTB Report PTB-6.33-95-2, Braunschweig, Germany (1995). EC transition probabilities

1996Sc06 E.Schönfeld, H.Janssen. Nucl. Instrum. Methods Phys. Res. A369 (1996) 527. Atomic Data

1998Sc28 E.Schönfeld. Appl. Radiat. Isotopes 49 (1998) 1353. Atomic Data

2000Sc47 E.Schönfeld, H.Janssen. Appl. Radiat. Isotopes 52 (2000) 595. Atomic Data

2002Ba85 I.M.Band, M.B.Trzhaskovskaya, C.W.Nestor, Jr., P.O.Tikkanen, S.Raman. At. Data. Nucl. Data Tables 81 (2002) 1. Theoretical ICC

2008Ki07 T.Kibédi, T.W.Burrows, M.B.Trzhaskovskaya, P.M.Davidson, C.W.Nestor Jr. Nucl. Instrum. Methods Phys. Res. A589 (2008) 202. Theoretical ICC

2012Gr03 C.J.Gross, K.P.Rykaczewski, D.W.Stracener, M.Wolinska-Cichocka, R.L.Varner, D.Miller, C.U.Jost, M.Karny, A.Korgul, S.Liu, M.Madurga. Phys. Rev. C85 (2012) 024319. Gamma-ray emission intensities

2012Wa38 M.Wang, G.Audi, A.H.Wapstra, F.G.Kondev, M.MacCormick, X.Xu, B.Pfeiffer. Chin. Phys. C36 (2012) 1603. Q