Notizen

Energies of Muonic Transitions in Cd and Br and Energies and Intensities of Nuclear Transitions in ^{78}Se and ^{80}Se

A. Brandão d'Oliveira * and T. von Egidy

Physik-Department der Technischen Universität München

(Z. Naturforsch. **31 a**, 211 [1976]; received January 21, 1976)

The energies of the muonic 2—1 and 3—2 transitions in Cd and Br have been measured. The c-parameter of the (c, t) Fermi distribution was determined. Energies and intensities of nuclear gamma rays in Se are given.

From the measured muonic spectra of CdI_2 and $CdBr_2$ [1] the energies of the muonic $2p_{3/2}-1s_{1/2}$ and $3d_{3/2}-2p_{1/2}$ transitions in Cd and Br could be determined. The energies were calibrated with the muonic transitions in iodine [2, 3] ($2p_{3/2}-1s_{1/2}$: 3723.23 ± 0.20 keV; $3d_{3/2}-2p_{1/2}$: $1150{,}42 \pm 0.15$ keV). A linear calibration was applied.

The energies of the muonic transitions in natural Cd and natural Br are:

$2p_{3/2}-1s_{1/2}$ Cd	3268.8 ± 0.6 keV
$2p_{1/2}-1s_{1/2}$ Cd	3229.1 ± 0.6 keV
$3d_{3/2}-2p_{1/2}$ Cd	940.9 ± 0.3 keV
$3d_{5/2}-2p_{3/2}$ Cd	905.9 ± 0.3 keV
$2p_{3/2}-1s_{1/2}$ Br	2053.3 ± 0.4 keV
$2p_{1/2}-1s_{1/2}$ Br	2040.6 ± 0.4 keV
$3d_{3/2}-2p_{1/2}$ Br	494.6 ± 0.5 keV
$3d_{5/2}-2p_{3/2}$ Br	482.4 ± 0.4 keV

Two nuclear gamma rays following the muonic capture in natural Br have been observed and assigned (in parentheses intensities per muon captured in Br, corrected for the $1s_{1/2}$ life-time).

^{78}Se: $2^+ - 0^+$ $E_\gamma = 613.8 \pm 0.4$ keV (0.17 ± 0.05),

^{80}Se: $2^+ - 0^+$ $E_\gamma = 666.3 \pm 0.4$ keV (0.16 ± 0.05).

The gamma energies are in good agreement with previous measurements [4−6].

So far, the nuclear charge distribution in Br^{nat} was not known. We can analyse our data in terms of at two-parameter (c, t) Fermi distribution for the nuclear charge density. Assuming $t = -2.3$ [7], we calculated numerically the energies of the $2p_{2/3}-1s_{1/2}$ muonic transition in Br^{nat} for several values of c. To perform these calculations, we used a computer program [8], and applied all necessary corrections as described in [9].

The final value for c in Br^{nat} is

$$c = 4.7565 \pm 0.0035.$$

Proceeding analogously in the case of Cd^{nat} we obtained the value

$$c = 5.3804 \pm 0.0024.$$

However, we would like to point out that these values are of limited interest, since they describe only the average charge distribution of the natural isotopic mixture in the elements.

Acknowledgement

We would like to thank Prof. H. Daniel for support and many useful discussions, and Mr. H. Hagn and Mr. P. Stoeckel for technical assistance.

1 A. Brandão d'Oliveira, H. Daniel, and T. von Egidy, to be published in Phys. Rev. A.
2 W. Y. Lee, S. Bernow, M. Y. Chen, S. C. Cheng, D. Hitlin, J. W. Kast, E. R. Macagno, A. M. Rushton, and C. S. Wu, Nucl. Phys. A **167**, 652 [1971].
3 J. W. Kast, S. Bernow, S. C. Cheng, D. Hitlin, W. Y. Lee, E. R. Macagno, A. M. Rushton, and C. S. Wu, Nucl. Phys. A **169**, 62 [1971].
4 R. L. Robinson, P. H. Stelson, F. K. McGowan, J. L. C. Ford, and W. T. Milner, Nucl. Phys. **74**, 284 [1965].
5 H. Szichman, Phys. Rev. C **8**, 1429 [1973].
6 P. F. Hinrichsen, G. Kennedy, and T. Paradellis, Nucl. Phys. A **212**, 365 [1973].
7 R. Engfer, H. Schneuwly, J. L. Vuillemier, H. K. Walter, and A. Zehnder, Atomic Data and Nuclear Data Tables **14**, 509 [1974].
8 H. L. Acker, Program Dirac, CERN, Geneva.
9 L. Tauscher, Improved vacuum polarization calculations for mesic atoms and their effect on the π^- mass value, CERN preprint unpublished.

* Now at the University of Basle and at CERN, Geneva, Switzerland.

Reprint requests to Dr. T. v. Egidy, Physik-Department, E 18, Technische Universität München, *D-8046 Garching* bei München.