

Precision Measurements of the Lead K_{α_1} and K_{α_2} X-ray Energies

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The energies of the K_{α_1} and K_{α_2} X-ray lines in lead have been measured with a curved crystal spectrometer. The values of 74.9720 ± 0.0010 keV (K_{α_1}) and 72.8077 ± 0.0010 keV (K_{α_2}) are compared to recent theoretical estimates and previous experimental results.

During the course of an investigation into the nuclear structure of light nuclei [1] a mixed target of natural lead fluoride, aluminium and potassium chloride was inserted into the High Flux Reactor of the Institute Laue-Langevin at Grenoble. The thermal neutron flux at this position was 5.5×10^{14} n/cm² s. Selected gamma lines in potassium,

Table 1. Comparison of the present results with previous experimental results of Bearden [6] and theoretical estimates of Huang et al. [5], all energies in keV.

| Line | Present Results | Bearden | Huang |
|----------------|-----------------|--------------|---------|
| K_{α_1} | 74.9720 (10) | 74.9694 (12) | 74.9607 |
| K_{α_2} | 72.8077 (10) | 72.8042 (12) | 72.7977 |

chlorine and aluminium in addition to the X-rays were repeatedly scanned using the curved crystal spectrometer Gams 1 [2]. The gamma ray data obtained were fitted using a Gaussian function, while the X-rays were fitted with a convolution of a Gaussian which represented the instrumental broadening and a Lorentzian line shape. The width of the Gaussian which was fixed was obtained from neighbouring gamma lines. To obtain an absolute energy the 517.0771 ± 0.0009 keV line in ³⁶Cl [3] was used. This line in turn was previously measured relative to the 411 keV transition in Hg [4].

The results can be seen compared to theoretical values of Huang et al. [5] and previous experimental values of Bearden [6] in Table 1. It should be noted that the theoretical results are in the process of being revised [4] and that the previous experimental results were based on an older energy scale.

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- [1] H. H. Schmidt, P. Hungerford, H. Daniel, T. von Egidy, R. Brissot, G. Barreau, S. Kerr, C. Hofmeyr, and K. P. Lieb, I.L.L. Internal Scientific Report 80SC35S and to be published.
[2] H. R. Koch, H. G. Börner, J. A. Pinston, W. F. Davidson, J. Faudou, R. Roussille, and O. W. B. Schult, Nucl. Inst. Meth. **175**, 401 (1980).

- [3] R. Rascher, K. P. Lieb, G. Barreau, R. Brissot, H. G. Börner, H. Daniel, and T. von Egidy, to be published.
[4] R. Deslattes, E. Kessler, W. Sander, and A. Henins, Ann. Physics **129**, 378 (1980).
[5] K. Huang, M. Aoyagi, M. Chen, B. Crasemann, and H. Mark, Atomic and Nucl. Data Tables **18**, 243 (1976).
[6] J. Bearden, Rev. Mod. Phys. **39**, 78 (1967).