

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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