

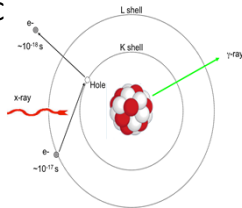
Internal Conversion Coefficient of ^{127m}Te

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What is an ICC?

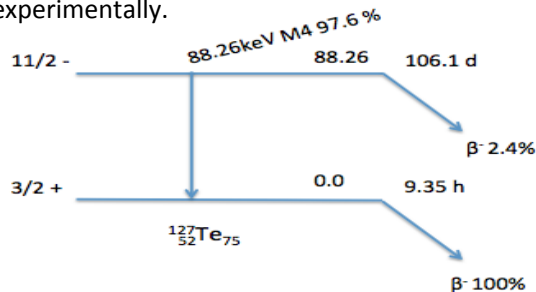
$$\alpha_K \cdot \omega_K = \frac{N_K}{N_\gamma} \cdot \frac{\epsilon_\gamma}{\epsilon_K}$$

An ICC, α_K is the ratio of conversion electrons to the gamma rays produced by an electromagnetic transition from an excited state to a lower energy state in a radiating source. Knowing the ICC is useful in nuclear physics research and has applications in the medical field such as radiation therapies.



A Test of Internal-Conversion Theory

There are two different methods for theoretically calculating an ICC. One includes the hole created by conversion, while the other assumes the hole is filled rapidly. In order to settle the discrepancy, high precision measurements were done to see experimentally whether or not the hole should be included. We used ^{127m}Te because the difference in its ICC values for the two methods of calculation are large enough to distinguish experimentally.



Source Preparation

Our source was activated at the TRIGA reactor by bombarding 98% enriched ^{126}Te with thermal neutrons. We allowed for one month of “cooling down” before collecting data from the source to allow shorter lived radioactive impurities to diminish in the spectrum. We then used a high precision germanium detector to collect data.



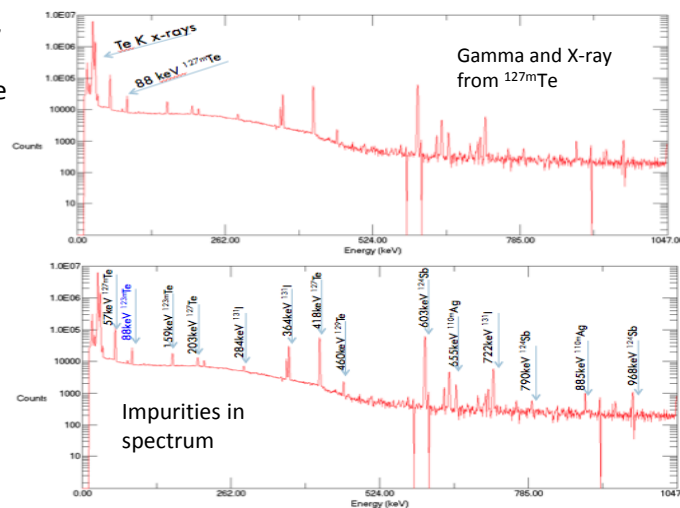
Impurity Correction

Impurity	Contribution to K x-rays	Contribution to 88-keV gamma
^{127m}Te	3.50(63)%	
^{125m}Te	2.83(29)%	
^{129m}Te	0.346(8)%	
^{127}Te	0.23(3)%	
^{129}Te	0.12(3)%	
^{123m}Te	0.104(3)%	0.069(3)%
^{131}I	0.036(10)%	
Total	7.2(6)%	0.069(3)%

Preliminary Results

With hole	Without hole	Experimental
485(2)	468(2)	489(7)

Spectra Analysis



Conclusion

Our experimental value for the ICC of ^{127m}Te agrees with the theoretical calculation that includes the hole created by conversion. This ICC measurement is part of a series that tests internal-conversion theory. Previous measurements by our group have influenced the National Nuclear Data Center (NNDC) to adopt the “frozen orbital” approximation to account for the atomic hole. The experimental value obtained in this measurement provides further evidence that the hole must be included in ICC calculations.