The Nuclear Magnetic Moment of Scandium[45]

ROBERT E. SHERIFF* AND DUDLEY WILLIAMS
Ohio State University, Columbus, Ohio
May 8, 1950

THE nuclear magnetic resonance due to Sc^{45} has been located in a magnetic field of 5000 gauss at 5.14 Mc/sec. by means of the super-regenerative detection method.[1,2] A strong signal of the same order of intensity as for the Br^{79} signal in saturated aqueous NaBr was found in a saturated aqueous solution of $ScCl_3$. Our preliminary value of the ratio of the resonance frequency of the Sc^{45} signal to that of the Br^{79} signal in the same magnetic field is:

$$\nu(Sc^{45})/\nu(Br^{79}) = 0.96954 \pm 0.00006.$$

Using Zimmerman and Williams' value[1] for the ratio of the Br^{79} and proton resonance frequencies in the same magnetic field, we find:

$$\nu(Sc^{45})/\nu(H^1) = 0.24296 \pm 0.00005.$$

Making a diamagnetic correction[3] of 0.260 percent and using the value 2.79255 nuclear magnetons for the proton's magnetic moment[4] we find for the nuclear g-value of Sc^{45}:

$$g(Sc^{45}) = 1.3605 \pm 0.0003.$$

The spin of Sc^{45} is known to be 7/2 from hyperfine structure studies.[5,6] Thus the magnetic moment is:

$$\mu(Sc^{45}) = 4.7617 \pm 0.0010 \text{ nuclear magnetons.}$$

This value agrees very closely with the best spectroscopic value[7] of 4.8 nuclear magnetons.

* AEC Research Fellow.
[1] J. R. Zimmerman and D. Williams, Phys. Rev. **76**, 350 (1949).
[2] W. H. Chambers and D. Williams, Phys. Rev. **76**, 638 (1949).
[3] W. E. Lamb, Phys. Rev. **60**, 817 (1941).
[4] Hipple, Sommer, and Thomas, Phys. Rev. **76**, 1877 (1949).
[5] H. Schuler and T. Schmidt, Naturwiss. **22**, 758 (1934).
[6] H. Kopfermann and E. Rasmussen, Zeits. f. Physik **92**, 82 (1934).
[7] H. Kopfermann and H. Wittke, Zeits. f. Physik **105**, 16 (1937).

The Half-Life of Strontium[90]*

RUTH I. POWERS AND A. F. VOIGT
Institute for Atomic Research and Chemistry Department, Iowa State College, Ames, Iowa
May 11, 1950

THE long-lived strontium isotope, Sr^{90}, one of the nuclides resulting from uranium fission, is important because of its high yield in fission, about five percent, as well as its long half-life. In any fission product mixture more than a few years old, this nuclide and its daughter, the 62-hr. Y^{90}, together constitute a large fraction of the total activity. Consequently the half-life of the parent Sr^{90} assumes some importance in calculations dealing with long term use or storage of the fission products.

This nuclide was first reported in this country by Nottorf,[1] of this laboratory,[2] in 1943. The decay of several samples which he prepared have now been followed for seven years, by means of a Lauritsen electroscope, and the half-life resulting from these measurements is sufficiently different from that currently used to warrant its publication at this time. The currently accepted value of 25 yr. is an average between the 23±3-yr. value reported by Nottorf[3] as a result of measurements over two and one-half years, and the value of 24 to 30 yr. estimated by Glendennin,[4] and Coryell[5] from fission yield data.

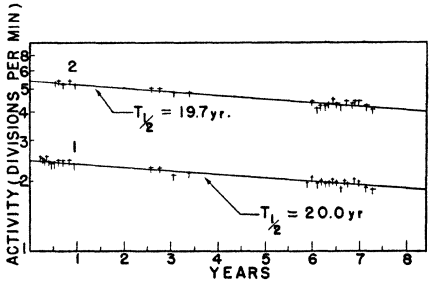

FIG. 1. Decay curve of Sr^{90}.

The original samples, after separation from cyclotron bombarded uranyl nitrate, were purified by repeated carbonate precipitations, and mounted as strontium carbonate.

In order not to measure any of the 55-day Sr^{89}, which was originally present, sample 1 was read with 746 mg/cm² of aluminum absorber, while sample 2 was read with 714 mg/cm². The beta-ray from Sr^{89} has an energy of 1.5 Mev and a range of 680 mg/cm² of aluminum. Before each reading the stability of the electroscope was checked with a uranium standard. Noteworthy is the fact that the Lauritsen electroscope has remained stable over this period of seven years.

The method of least squares[6] was used to draw the best possible straight line through each set of data (Fig. 1). From this, a half-life of 20.0 yr. was obtained with sample 1, while sample 2 gave 19.7 yr. Therefore the half-life of Sr^{90} may be taken as 19.9±0.3 yr.

* This work was performed at the Ames Laboratory of the U. S. AEC.
[1] R. W. Nottorf, Metallurgical Project Report, CC-521 (March 15, 1950).
[2] Present address, E. I. du Pont de Nemours and Company, Parlin, New Jersey.
[3] R. W. Nottorf, National Nuclear Energy Series, M.P.T.S., Div. IV, Vol. 9, Paper No. 77.
[4] L. E. Glendennin and C. D. Coryell, National Nuclear Energy Series, M.P.T.S., Div. IV, Vol. 9, Paper No. 78.
[5] C. D. Coryell, Metallurgical Project Report, CC-1112 (December, 1943).
[6] A. G. Worthing, and J. Geffner, *Treatment of Experimental Data* (John Wiley and Son Inc., New York, 1946), Chapter XI.

The Angular Distribution of Protons from the $B(\alpha, p)C$, C^* Reaction

J. L. PERKIN
Wheatstone Laboratory, King's College, London, England
May 8, 1950

USING a 5-mc polonium α-particle source and a cloud chamber, Roy[1] examined the angular distribution of protons from the reaction $B(\alpha, p)C$, C^*. The angular distributions of the two groups with Q-values of 0.42 and 0.09 Mev were found to be roughly isotropic within the wide limits of statistical fluctuation imposed by the small number of protons recorded.

Creagan[2] examining the emission of protons at 0° and 90° found the intensity of protons from transitions to the ground state (Q=4.07 Mev) in the forward direction to be small compared with that observed at 90°.

The present experiments were performed using a 1.4-mc polonium α-particle source, unbacked boron targets, and Ilford C2 photographic plates to record the emitted protons.

The photographic plates were held in a frame by retaining screws such that the plane of the emulsion lay 3 mm below the line joining the source and target.

Boron targets were made by smearing a suspension of boron powder in a collodion-ether solution on glass plates. In this way unbacked and fairly uniform tagets could be obtained with thicknesses as low as 0.2 mg/cm². Microscopic examination showed that the relative amount of collodion in the film could be reduced to quite small proportions before the target became too fragile.

The source holder and collimating arrangement were designed so that the spread of the α-beam at the target was ±10°, and so that the maximum angle at which the plate could see all the target was as much as 170° in one case.

Non-resonance experiment. For the first exposure (14 days) the energy of the α-particles at the target was set at 4.3 Mev. This corresponded to the top of the potential barrier of the B^{10} nucleus. A target of thickness 0.35 mg/cm² was used.

About 4000 proton tracks were measured and groups corresponding to Q-values of 4.08±0.12, 3.35±0.25, 0.65±0.15, 0.15±0.15, and −0.57±0.15 Mev, were observed. The over-all intensities of the first four of these groups were in the ratio 10:1:100:50. Comparison of the Q-values found with the more precise ones obtained by Creagan[3] since this work was completed,