moment states of the first peak. Curve *A* of Fig. 5 represents an *A* state and proves that the nuclear moment is positive. This is verified by the data of curve *B* of Fig. 5 for the selected *B* state.

The foregoing results are in agreement with the findings of the workers using the method of hyperfine structure.[8–10]

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The Radioactive Isotope of Rubidium

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By means of a high intensity mass spectrometer we have separated the isotopes of rubidium. Measurements of the radioactivity of the isotopic samples indicate that Rb^{87} is radioactive and that there is no other isotope with an appreciable activity compared to Rb^{87}.

INTRODUCTION

THE history of the radioactivity problem of rubidium is substantially the same as that of potassium, except that there is no record of an attempt to separate the isotopes of rubidium. The early work on the radioactivity of rubidium is recorded by St. Meyer and Schweidler,[1] and more recent data are collected in a paper by Klemperer.[2] There is some evidence that the beta-particles may lie in two bands. The known isotopes are at mass numbers 85 and 87. The best measurement of the abundance ratio is that of Brewer,[3] which gives $Rb^{85}/Rb^{87}=2.59$. Measurements of Nier[4] place an upper limit of the ratio Rb^{85}/Rb^{86} at 1/13,000 and of Rb^{85}/Rb^{88} at 1/22,000.

Klemperer[2] sets forth theoretical arguments for supposing the activity of rubidium to be due to a rare isotope at 86. v. Hevesy[5] also predicts a radioactive isotope at this point. Sitte[6] argues in favor of 87, as does Nier.[4] Quite recently Hahn, Strassmann and Walling,[7] and Mattauch,[8] have shown that the active isotope is Rb^{87}. Hahn and his collaborators separated the strontium from an old mineral rich in rubidium salts and found the strontium to be 99.7 percent pure Sr^{87}. Mattauch checked their measurements of atomic weight with mass spectroscopic data. This evidence is quite conclusive, but since our own measurements were very nearly completed when papers (7) and (8) appeared, we feel justified in presenting them here.

Using the same technique as in the determination of the radioactivity of potassium,[9] we have separated the isotopes of rubidium and measured their activities.

APPARATUS

The Rb^+ emitter was prepared in the same way as the K^+ emitter. For a single charge we used 150 g $Fe(NO_3)_3\cdot 9H_2O$, 1.5 g RbCl and 1 g Al_2O_3. The fractional difference in atomic weight between the rubidium isotopes is less than half that between the potassium isotopes. To obtain equally accurate results with the former it is necessary therefore to improve the resolving power. Since the entire width of the peaks is due to lack of parallelism of the beam from the source due to the thermal velocity of the ions at right angles to the direction of acceleration, this can be accomplished in two ways, both of which were used. First, the magnet winding was increased from 890 to 2090 turns so that a current of 5 amperes saturated the magnetic circuit with a field of 4200

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gauss between the polepieces, which permitted an accelerating voltage of 4000 for Rb^+ ions. Second, the source was run as cold as possible, making the collecting currents smaller than used for potassium. Since Rb emits fifteen times as many beta-particles as potassium, the 2 mg samples collected in this way in a two-day run were adequate. The resolution maintained throughout is shown in Fig. 1. In this region the dispersion is 2.6 mm per mass unit. All isotopic samples were collected using a 2 mm focal plane slit.

Since the beta-particles from Rb have lower energies than those from potassium we replaced the 0.0245 mm aluminum cylinder of the Geiger-Müller counter by a cylinder of 0.013 mm aluminum foil. The counter had a steady background of approximately 1.5 per minute.

Measurements

In a preliminary set of measurements samples were collected at masses 84, 86, 87, 88, and 90. The first two samples were collected with very broad peaks before the full possibilities of running the source cold were realized and therefore could not be accurately compared with the last three which were collected at excellent resolving power. Before the first two could be repeated it was necessary to rebuild the counter because of an accident thus changing the relative positions of counter and collector and invalidating comparisons with subsequent measurements, except for the sample at 90, which showed no activity. These measurements all indicated, however, that the active isotope was near 87. To verify this we took the data shown in Table I. Samples 86 and 88 were collected with the resolution shown in Fig. 1. The 87 sample was collected on top of the 86 without opening the apparatus, by running the same source at a higher temperature, since it is evident that good resolving power is unnecessary for this sample.

TABLE I. *Beta-particle counts from separated isotopes of Rb*.

Collector Deposit	Counting Ratio R	Activity A	Specific Activity $a\times10^4$
No deposit	1.10±0.05		
86, $Q=140$	1.22±0.06	0.12	8.7±5.7
87, $Q=196$	1.60±0.08	0.38	19.4±5.1
No deposit	0.96±0.04		
88, $Q=180$	1.22±0.06	0.26	14.4±3.9

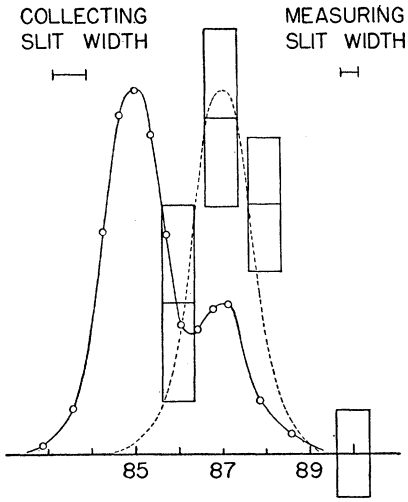

FIG. 1. The solid curve, giving the collecting current plotted against mass, is measured with a 2 mm slit and shows the resolution of the Rb isotopes. The long sides of the rectangles are the two edges of the collecting slit. The ordinates at the centers of the rectangles are proportional to the specific activities, and the lengths of the rectangles are twice the probable errors.

The size, Q, of each sample is given in microampere hours of collecting current measured at mass 85. The quotient, $A/Q=a$, where A is the activity defined in the paper on potassium,[9] is then a measure of the specific activity of a given isotope.

The specific activities are plotted in Fig. 1, showing the width and position of the collecting slit, as well as the probable error due to fluctuations in the counting data. The point from the preliminary measurements showing zero activity at 90 is included.

These measurements show that Rb^{87} is radioactive and that no other isotope of Rb has an appreciable activity compared to Rb^{87}.

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