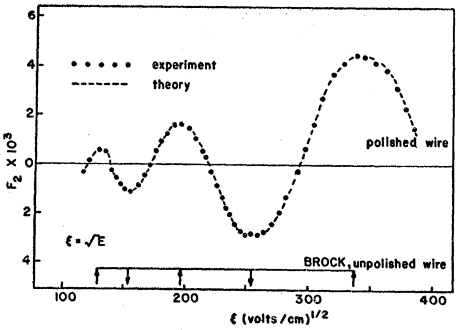

FIG. 1. Periodic deviations in the Schottky effect for a polished molybdenum filament, at 1600°K.

which accurate amplitude determinations could be made, an example of which is given in Fig. 1. In this figure the points are experimental, the dotted curve theoretical,[2] while the arrows along the axis of abscissas mark experimental extrema obtained for unpolished molybdenum filaments.[3] The amplitude maximum taken at $\xi=200$ from deviation curves for various temperatures is plotted against $1/T$ in Fig. 2. While some uncertainty is involved

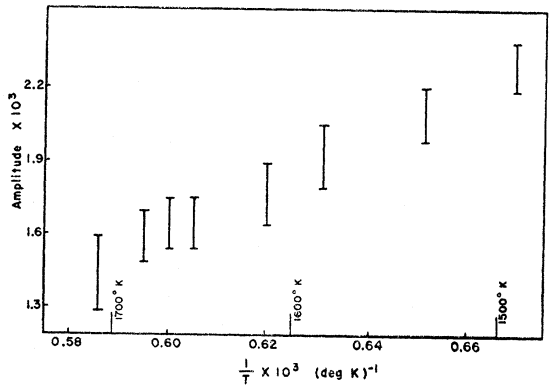

FIG. 2. Periodic deviation amplitude maximum at $\xi=200$, plotted against $1/T$. The range in amplitude indicates uncertainty in locating extrema on the deviation plot. (See Fig. 1.)

in locating the exact maximum of deviations, as indicated by the range at a given temperature, the tendency to increase with $1/T$ seems definitely apparent.

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† Now at the U. S. Naval Research Laboratory, Washington, D.C.
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Radioactive Isotope Separation by Nuclear Recoil*

H. MORINAGA† AND D. J. ZAFFARANO
Institute for Atomic Research and Department of Physics, Iowa State College, Ames, Iowa
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NUCLEAR reactions such as (γ,n), (d,p), and $(\alpha,2p)$ lead to product nuclides with the same atomic number as the initial nuclides. Unless the Szilard-Chalmers process[1] is practicable, it is usually difficult to achieve high specific activity for the product isotope. With light nuclei, however, the recoil momentum of the product nucleus can afford sufficient range to allow physical separation, as is clearly visible in nuclear emulsions.[2] When the ranges of the product nuclei are of the order of a micron, i.e., the size of colloidal particles, one may expect that in a fine powder mixture or in a colloidal suspension one phase or element can act as donor and the other as catcher. If the grain size of the donor is comparable to or smaller than the range of the recoiling product nucleus, the probability of stopping the radioactive nucleus within the "catcher phase" becomes high. Therefore, radioactive atoms will be transferred to the catcher phase from the donor phase.

To verify this experimentally, a preliminary experiment has been done using the $C^{12}(\gamma,n)C^{11}$ reaction in colloidal graphite solution. "Aquadag" solution of about 0.5-percent carbon by weight was bombarded by x-rays from the 70-Mev bremsstrahlung beam from the Iowa State College synchrotron, together with a control sample of powdered carbon. The colloid was precipitated and identical counting samples were prepared from the two target materials. It was found that the carbon bombarded as a colloid lost as much as 80 percent of its activity into the water phase. This result is understandable, since the carbon particles in "Aquadag" consist of small slabs with an approximate diameter of $\frac{1}{10}$ micron and much smaller thickness. The energies of recoiling C^{11} nuclei are expected to be of the order of a fraction of a Mev, corresponding to ranges of a fraction of a micron in carbon.

This method of separating isotopes may have importance in the production of Mg^{28} by $Mg^{26}(\alpha,2p)$.[3] For Mg^{28} production, a compressed powder of mixed Mg and some catcher metal such as tungsten might be used for good heat dissipation and ease of chemical separation. In the case of alpha-particle bombardment, particle sizes need not be less than one micron because of the high recoil momentum available.

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† On leave from the University of Tokyo, Tokyo, Japan.
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Mass Assignments by Isotope Separation*

M. C. MICHEL AND D. H. TEMPLETON
Radiation Laboratory and Department of Chemistry, University of California, Berkeley, California
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A TIME-OF-FLIGHT isotope separator constructed in this laboratory[1] has been used to assign mass numbers to several radioactive isotopes produced in cyclotron bombardments. Atoms of the mass numbers in question have been separated and the corresponding activity observed with a Geiger counter or other counting equipment.

The essential features of the instrument are high transmission (about 20 percent) at a resolution such that the separation factor between adjacent isotopes in the mass range 100–250 is about 100 or larger. In addition, the instrument is calibrated absolutely so that any desired mass number can be selected without the necessity of observing ion currents due either to the isotope being separated or to added stable isotopes.

Several isotopes of cesium (formed by α,xn reactions on iodine) have been separated in the course of work on their decay properties. Chemically separated carrier-free cesium sulfate fractions were ionized from a surface ionization source for this work. The previous assignments[2] of Cs^{127} and Cs^{129} were verified, with sufficient activity separated to establish the half-life of Cs^{127} as 6.1 ± 0.2 hours instead of the previously reported 5.5 hours. In addition, Cs^{130} has been separated and its half-life observed to be 30 minutes, in agreement with the previous result.[2]

A new isotope of cesium found by Mathur and Hyde of this laboratory, has been assigned to mass 125 and its half-life observed (from separated samples) to be 45 ± 1 minutes.

In connection with an investigation of the decay scheme of Cs^{136} by Olsen and O'Kelley[3] a large quantity of this isotope was separated for use in a beta spectrometer study of its decay. On the basis of the decay of part of the separated sample over nine half-