a more rigorous analysis[4] for nuclear absorption yields results substantiating the simpler assumptions, even though not in agreement with a Lorentz absorption mechanism. On this basis calculated values are

$$(\Delta\nu)\leqq 5000 \text{ mc/sec.},$$
$$(\Delta H)\leqq 1400 \text{ gauss}.$$

μ_i has been taken as 2 Bohr magnetrons, r has been taken as 3A, and a has been taken as 1. These values are rather consistent with the observations in Fig. 1 so that apparently the broad resonance is accounted for. Factors entering a more rigorous analysis would be difficult to examine because of experimental accuracy in measuring μ' and μ''.

Magnetic permeability measurements of gamma-ferric oxide indicates a similar resonance. The magnetic field resulting from anisotropy is found to be smaller, a fact which is consistent with the crystalline structure of this material and the larger separation of iron atoms.

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Cadmium Sulfide as a Crystal Counter*

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AHEARN,[1] Hofstadter,[2] and others[3-5] have recently reported obtaining counts for α- and β-particles and γ-rays with diamonds at room temperature. More recently,[6,7] there have been reported similar results for α- and β-counts with zinc sulfide and with cadmium sulfide. Cadmium sulfide has been investigated in this laboratory, with the following results.

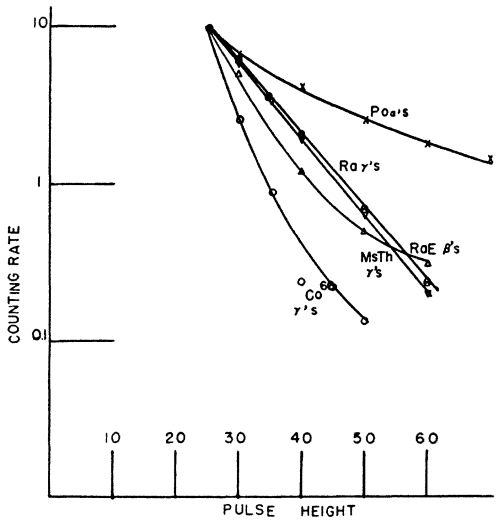

FIG. 1. Pulse heights and counting rates for α-, β-, and γ-rays from various sources.

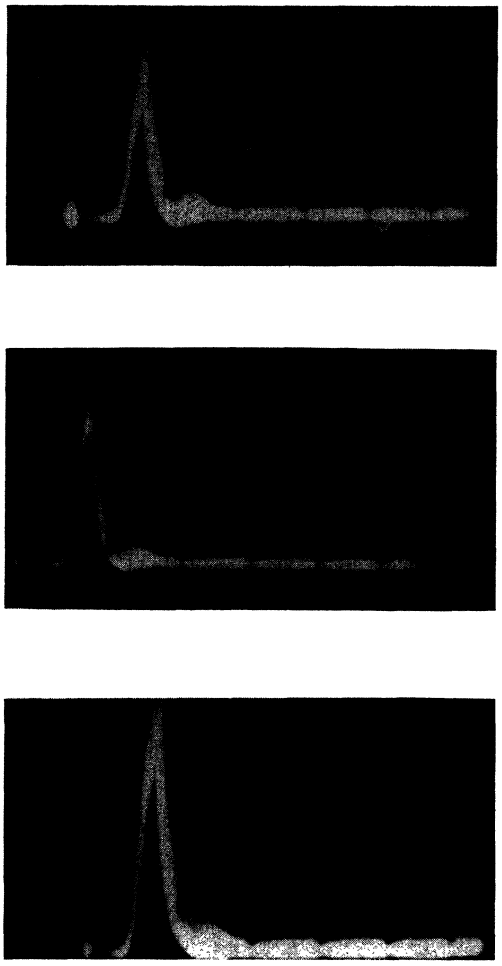

FIG. 2. Top to bottom: Ra γ's, RaE β's, Po α's. Timing markers 1 microsecond. Amplifier gain raised by factor of 2 for γ-ray photo.

The crystals used in the investigations were made by the vapor phase condensation method of Frerichs[8] and supplied by him through the courtesy of the Bureau of Ships.** Of the crystals obtained, only one type was suitable for our purposes. These were irregularly shaped single crystals, as confirmed by Laue x-ray diffraction pattern, about two-millimeters thick and about a half-centimeter on a side. The crystals were cleaved and small portions about 1×2 mm investigated for photo-conductive properties. Crystals which displayed a dark resistance of at least in excess of 10^9 ohms and a light resistance of the order of 10^6 ohms or less were useful as counters.

The electrodes were prepared by evaporating thin gold foils on two opposite faces. They were then mounted on a silver block 2-mm square and clamped with a thin phosphor

bronze spring. The entire assembly was placed in a light-tight copper box, which was in turn mounted directly on the preamplifier. The amplifier is a commercially available linear amplifier having a rise time of 0.2 microsecond and a gain of about 3500 at that rise time.

Plots of pulse height *versus* counting rate have been taken for Po alpha-particles; RaE β's; Ra, MsTh, and Co^{60} γ's (Fig. 1). It was found that the pulse heights observed were a function of the applied voltage from 30 volts to about 200 volts—beyond that value the maximum pulse height remained constant but the crystal background increased considerably. In some crystals surface leakage or other conductive effects limited the voltage to around 300.

At a potential of 70 volts the rise time of the pulse appears to be slightly greater than that of the amplifier, but beyond that value, the recorded pulse rise is equal to or less than the limiting 0.2-microsecond rise time (Fig. 2).

Measurements of maximum pulse heights gave 12 mv for alpha-particles, 6 mv for RaE β's, and about 2.5 mv for Ra γ's.

These experiments are being continued.

* This work was supported in part by the ONR and the Signal Corps.
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** We want to thank Professor R. J. Cashman (Northwestern University), director, Navy Contract NO65 45068, for making the material available to us.

Yields of the Platinum Group Radio-Isotopes in the High Energy Helium-Ion Bombardment of Uranium

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INVESTIGATIONS by O'Connor[1] in 1947 on the radioactive products of the bombardment of uranium with high energy deuterons and helium ions in the Berkeley 184-inch cyclotron indicated the possibility of a continuous yield of products, the isotopes in the heavy region of mass numbers arising from spallation, and those in the middle region of mass numbers arising from fission.

In order to supplement these results, additional experiments were performed at the suggestion of G. T. Seaborg. Determinations were made of the relative yields of the six platinum metals (ruthenium, rhodium, palladium, osmium, iridium, and platinum) when natural uranium is bombarded with 380-Mev helium ions. The reason for interest in the yields of these elements is that the last three lie near the region of mass 180, where the plot of yield *vs.* mass number may change from a fission-yield curve to a spallation-yield curve. In addition, the first three lie in a region from mass 103 to 112, which should indicate whether the center of the curve has a large dip (as does the slow-neutron fission-yield curve), or a single maximum indicating symmetrical fission (as in the case of bismuth[2]), or something intermediate (as in the case of thorium[3,4]).

A new procedure for the radio-chemical analysis of the platinum metals was developed, to which the existing procedures for ruthenium and palladium were adapted as required. Several short bombardments of thin-gauge uranium strips (2 cm×0.5×0.1 cm) were made with 380-Mev helium ions, the target dissolved, the platinum metals isolated, and their chemical yields determined. Yields of activities produced were determined by counting with thin end-window Geiger-Müller counters of the bell jar type, having a known counting efficiency. Direct comparison of samples was made possible by use of identical mountings and shelf geometry throughout. All samples were corrected to 100 percent chemical yield, total sample, and zero absorber. Yield for each isotope was determined relative to the yield of 12.8-day Ba^{140} as a standard of comparison. The cross section for production of the Ba^{140} is estimated as 3×10^{-3} barn.

As was expected, yields of osmium, iridium, and platinum were much lower than those of ruthenium, rhodium, and palladium. The yield of the mass 105 chain was obtained by isolation of both 4.5-hr. Ru^{105} and 36-hr. Rh^{105}. The other isotopes of ruthenium, one of palladium, two of osmium, one of iridium, and one of platinum were identified by decay characteristics and by absorption characteristics were possible. In every case observed values agreed with published data.[5]

The results, plotted as relative yield *vs.* mass number, are shown in Fig. 1. The solid portion of the curve passes through the experimentally determined points; the dashed portion is drawn by analogy to other known fission-yield curves to connect the two experimentally determined sec-

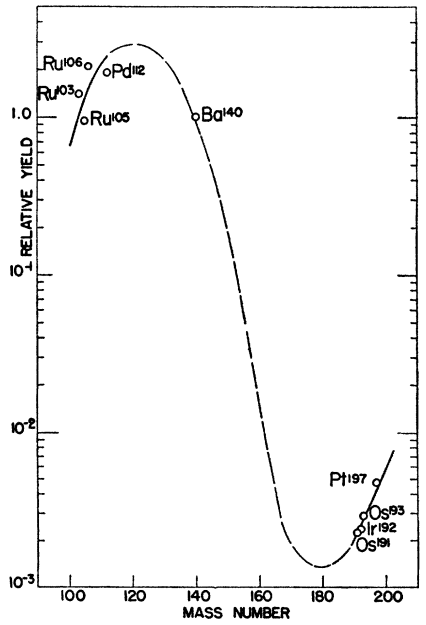

FIG. 1. Relative yield of platinum elements *vs.* mass number for 380-Mev helium ions on uranium.

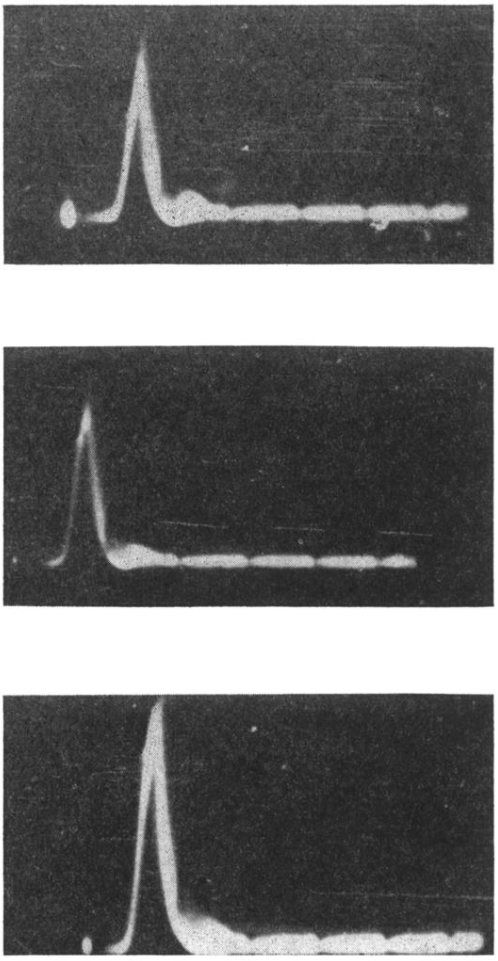

FIG. 2. Top to bottom: Ra γ's, RaE β's, Po α's. Timing markers 1 microsecond. Amplifier gain raised by factor of 2 for γ-ray photo.