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Special Review of
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Unclassified TWX P182206Z May 79

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SUMMARY OF THE RESEARCH PROGRESS MEETING

Inez C. O'Brien

December 19, 1947

Special Review of Declassified Reports
Authorized by USDOE JK Bratton
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Radiation Laboratory
University of California
Berkeley, California

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SUMMARY OF THE RESEARCH PROGRESS MEETING

December 11, 1947

Inez C. O'Brien

Linear Accelerator. W. Panofsky. The operation of the Van de Graaff and linear accelerator is quite marginal as yet, although the full 32 Mev energy has been obtained. A beam pattern was taken by exposing a photographic plate to the beam which was first allowed to pass through an aluminum absorber. It gave a well focussed spot about 2 mm in diameter.

The theory of focussing has been reconsidered, including the fact that the Van de Graaff does not give a perfect focus. In the linear accelerator the focal points are shown in Fig. 1.

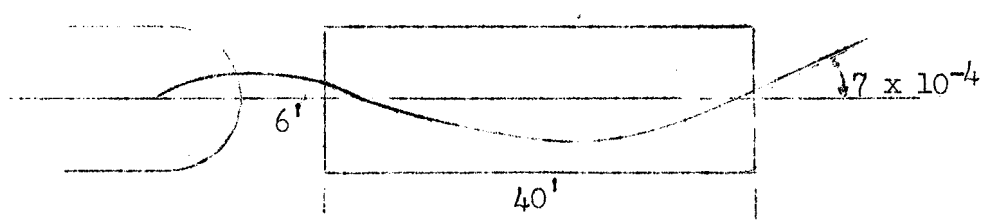

Fig. 1

With the phase angle 20° and 30° from the top of the crest, drift tubes 25 and 46 show focal points. The second focal point is near the end with an exit angle of 7×10^{-4}. The focal length depends upon the phase angle according to the equation $L = L_o \sqrt{1 - \tan \phi}$, where L is the length between the successive nodes and L_o is the length corresponding to acceleration at zero angle.

The phase angle is not constant throughout the machine, since the voltage variation is appreciable. However, the maximum beam half-width is 0.15 inches.

Fission of Bismuth with 200 Mev Deuterons. R. Goeckerman. Bismuth was bombarded with 200 Mev deuterons and the fission yields and cross section determined σ_f = .16 b. A thousand-fold decrease in yield was found in going from Bi to Ta. This fission yield curve for Bi, Fig. 2, was then compared to that obtained from the slow neutron fission of U^{235}. (Fig. 3).

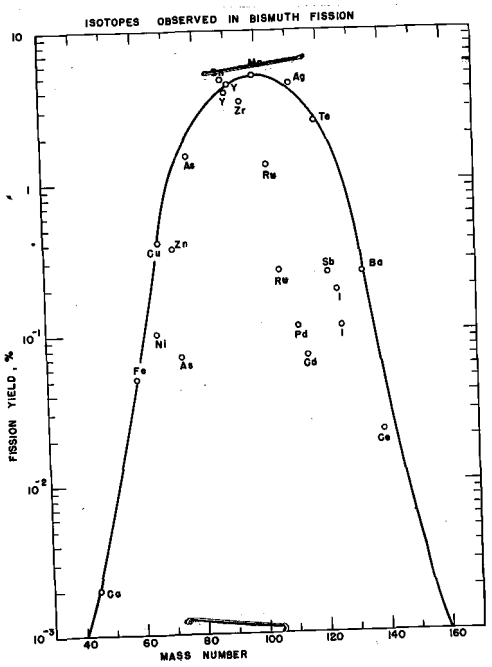

Fig. 2

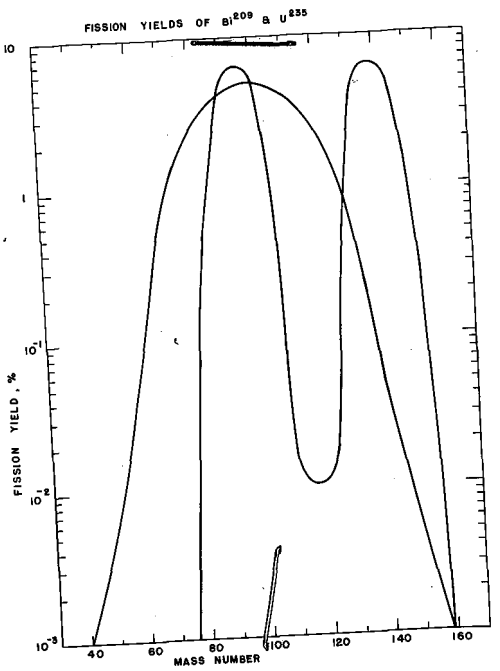

Fig. 3

The left hand member of the bismuth curve contains a number of shielded isotopes with yields as large as the unshielded isotopes. This is not true of uranium fission. The peak of the curve occurs at Mo^{99}. Immediately the right of this peak and along the curve there is a region

having a deficiency of isotopes which indicates that stable isotopes are being produced. The isotopes falling on the right hand part of the curve are neutron deficient, and those falling in the area below the right half of the curve have a neutron excess.

According to the theory, Bi^{209} + 200 Mev deuterons ---→ $[Po^{211}]$ which is a composite nucleus. $[Po^{211}]$ ---→ $[Po^{199}]$ + 12 n. The $[Po^{199}]$ then undergoes fission.

For $[Po^{199}]$, n/p = 1.37, and it is assumed that the fission products will also have an n/p ≐1.37. This was the basis for extending the curve to the right, and it predicts that isotopes like Pd, Ag, Cd, which emit β-radiation will be found in the area below the curve and that Te, I_2, Ba, Cu isotopes of the neutron deficient type will be found on the curve. This was found to be true.

The cross section for spallation reactions in the gold region is .0003 mb and in the osmium region, .005 mb.

Spallation Reactions of Arsenic with 200 Mev Deuterons. H. Hopkins. As^{75} was used since the single isotope is readily available. The arsenic was distilled, placed in an aluminum envelope and bombarded in a 200 Mev deuteron beam for about an hour. The fractions were separated and counted. The types of emission were determined and decay curves followed. In some cases, absorption curves and range measurements were made, and where necessary, the solutions were milked of daughter elements.

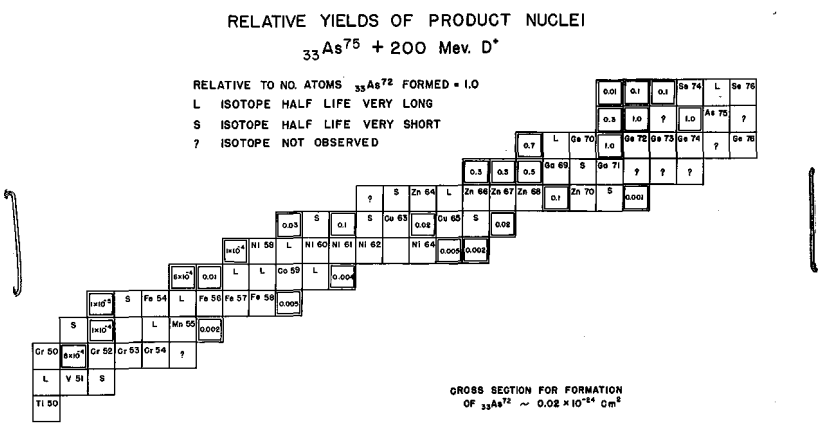

Fig. 4

The yields are relative to As^{72} taken as unity. The cross section for this isotope is 0.02b. Changes in charge of Δ Z = 5,10,15 and changes of mass of Δ A = 5,10,20 and greater were found. In general, the yields decrease as one proceeds from the target nucleus, and the yield of isotopes on the heavy side is greater than on the light side in this direction. This greater production of heavy isotopes indicates that alpha-particles are being emitted in preference to neutrons. In some cases the yield of the upper isotope is a ratio of 10 - 50 less than the lower isotope. In general, when going from Z to Z - 1 the yield is 20 - 30 % less. The blank spaces in the chart given above represent known isotopes not detectable by the techniques used in this experiment.

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