are required to account for these radiations, and the excitations of these states appear abnormally small. It may be that there is some connection between this conclusion and the observation of Waldman and Collins[10] that a metastable level of 1.6 minutes half-value period and about 0.3-Mev energy of excitation can be excited by the action of high energy x-rays on lead.

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High Energy Carbon Nuclei

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$C_6^{12(++++++)}$ AND other nuclei having approximately the same e/m ratio as deuterons can be accelerated in the cyclotron under similar conditions to those required for the deuteron beam.[1] Their kinetic energy will be greater in the ratio of their mass to the mass of the deuteron. By using them, new types of nuclear reactions might be detected, namely, ones involving higher excitation energies than hitherto known. CO_2 was the most satisfactory source of carbon ions. A shallow ionization chamber was used to identify the beam, and to measure its specific ionization and range. Precise measurements cannot be made until the intensity can be increased with the help of a specially built ion source. The Gamow theory of penetration of nuclear barriers has been applied for the case of light bombarding nuclei. Penetration of most nuclei by s waves can be expected even at lower energies than now reached (96 Mev for carbon), although the maximum cross section will be reached only at considerably higher energies, where the contribution of higher incident angular momenta becomes important. The electric moment induced in the bombarding particles at the approach of a nucleus may lead to the splitting off of alpha-particles before the potential barrier can be penetrated. The tracks due to the 96-Mev carbon particles accelerated in the 60″ cyclotron were recorded in photographic emulsions. Their grain density, track length, and the total number of grains have been measured and plotted in relation to the specific ionization and the air equivalent range. Some of the microphotographs taken show elastic collisions with various nuclei. A few cases that may represent inelastic collisions were observed. Two star-shaped inelastic collisions were found and analyzed.

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Assignment of Mass to 46-Hr. Samarium and 9.2-Hr. Europium by a Mass Spectrograph

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A NITRIC acid solution of Sm_2O_3 was irradiated by slow neutrons to produce the 46-hr. samarium activity reported in Seaborg's table.[1] Part of this irradiated sample was placed on the filament source of a mass spectrograph. By operation of the spectrograph the samarium isotopes were separated according to mass on a photographic plate. After removal from the spectrograph, this plate was placed face to face with another photographic plate. With the passage of time the particles emitted from the active isotopes on the first plate gave rise to a developable image on the second plate. After both plates were developed, the original plate showed the normal spectrum of samarium (Sm^+ and SmO^+) while the second plate showed only two lines. These corresponded to masses 153 and 169 on the original plate. Because of the emission of the form SmO^+ the activity at mass 169 was ascribed to the same isotope as was the activity at mass 153. A decay curve of a second portion of the irradiated samarium solution showed that more than 95 percent of the activity was caused by the isotope with 46-hour half-life. Thus we may conclude that the mass of 46-hr. samarium is 153.

A nitric acid solution of Eu_2O_3 was irradiated by slow neutrons to produce the 9.2-hr. europium activity reported in Seaborg's table.[1] The same mass spectrograph technique was applied to this sample as to the samarium sample. In this case the second photographic plate showed a single line corresponding to mass 152 on the original plate. A decay curve of a portion of the irradiated europium solution showed that more than 95 percent of the activity was caused by an isotope with 9.2-hr. half-life. Thus we may conclude that the mass of 9.2-hr. europium is 152.

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Activation of Ag (225 d.) by Resonance Neutrons

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BY activation of Ag in the Argonne heavy water pile it is shown that the Cd filtered neutrons activating the long period of Ag (225 d.) are strongly absorbed in both Ag and Au. As this is also the case for the resonance neutrons leading to Ag^{110} (22 sec.) but not for those leading to Ag^{108} (2.3 min.),[1] it is plausible to assign Ag (225 d.) to an isomeric state of Ag^{110}. Mass assignment of isomers through identification of neutron resonance groups may be a useful method in other cases and is now being applied to Ir.

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