The Indiana University Heavy Particle Spectrometer[1]

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A large magnetic spectrometer, copied after those at the California Institute of Technology (1), has been built. The magnetic field is shaped to give point focusing in the manner introduced by Siegbahn (2). Limiting the magnetic field to π radians instead of $\sqrt{2}\,\pi$ radians puts the source and image outside the field, which is convenient.

This spectrometer is used to measure the energy spectra of the protons, alpha-particles, etc. that result from nuclear reactions induced by the external beam of the Indiana University cyclotron. A target chamber with a sliding O-ring seal allows the spectrometer to be rotated so that all angles with the beam from a minimum of 10° to a maximum of 45° counter clockwise and 145° clockwise are available.

The scattering of 22 Mev alpha-particles by carbon has been investigated. The elastic alphas and groups corresponding to inelastic scattering leaving C^{12} excited to known levels 3 at 4.31, 7.7, and 9.6 Mev are observed. The search for groups corresponding to higher excitations is difficult because of the continuous distribution of alpha's from $C^{12} \rightarrow Be^{8} + \alpha$, $Be^{8} \rightarrow 2\,\alpha$. Some indication of a level around 12.7 Mev is obtained. Any other states between 9.6 Mev and the upper limit of around 16.1 Mev must be excited much less easily than the 9.6 level.

At the forward angles the recoil C^{12} nuclei have enough energy ($>$ 8 Mev) to penetrate the window of the proportional counter used as a detector. Ground state C^{12}'s as well as those that have been excited to the 4.4 Mev level are observed. None corresponding to excitation to the 7.7 or 9.6 Mev levels are observed, indicating that these levels decay to $Be^{8} + \alpha$ (threshold excitation $=$ 7.37 Mev). Additional experiments are required before definite statements as to the competition between this process and decay to the ground state of C^{12} by radiation can be made. It would seem, however, that it is very improbable for the 9.6 Mev level to decay by radiation to the C^{12} ground state (as is expected), and that the 7.7 Mev level decays in this manner less than 50 $\pm$ 50) % of the time.

Literature Cited

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3. F. Ajzenberg and T. Lauritsen, *Rev. Mod. Phys.*, **24**, 321 (1952).

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