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REACTIONS PRODUCED BY NEUTRONS IN HEAVY ELEMENTS¹

By Dr. ENRICO FERMI

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THE nuclear reactions produced by neutron bombardment in heavy elements can be conveniently described, according to Bohr, with the assumption that, as soon as the bombarding neutron strikes the nucleus, it is incorporated into the nuclear structure with the formation of the so-called compound nucleus. This is a relatively stable system in the sense that its lifetime is very long compared with the frequencies of nuclear particles; in an absolute sense, however, the lifetime is very short, being sometimes of the order of 10^{-12} seconds and sometimes much less.

The ultimate result of the nuclear reaction depends

¹ Presented in a symposium on "Nuclear Physics," at the University of Pennsylvania Bicentennial Conference, September 19.

upon the way in which the compound nucleus further disintegrates. And this mode of further disintegration depends in its turn, for any given nucleus, essentially upon the energy content of the compound nucleus. When the bombarding neutrons are slow the energy of the compound nucleus is equal to the binding energy of the neutron in the nucleus. Apart from irregular fluctuations from nucleus to nucleus, this binding energy has a general variation with the atomic number and is a maximum for elements of atomic weight about 40 where it is in the average about 9 Mev. From there on it decreases more or less regularly up to the heaviest elements where it attains an average value of about 5 Mev. If the bombarding neutrons

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