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SCIENCE: A Weekly Journal devoted to the Advance-
ment of Science, edited by J. McKeen Cattell and pub-
lished every Friday by

THE SCIENCE PRESS
Lancaster, Pa.  Garrison, N. Y.
New York City: Grand Central Terminal

Annual Subscription, $6.00  Single Copies, 15 Cts.

SCIENCE is the official organ of the American Associa-
tion for the Advancement of Science. Information regard-
ing membership in the Association may be secured from
the office of the permanent secretary in the Smithsonian
Institution Building, Washington, D. C.

REACTIONS PRODUCED BY NEUTRONS IN
HEAVY ELEMENTS

By Dr. ENRICO FERMI

PROFESSOR OF PHYSICS, COLUMBIA UNIVERSITY

The nuclear reactions produced by neutron bom-
bardment in heavy elements can be conveniently de-
scribed, 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
upon the way in which the compound nucleus further
disintegrates. And this mode of further disintegration
depsends in its turn, for any given nucleus, essen-
tially upon the energy content of the compound
nucleus. When the bombarding neutrons are slow the
energy of the compound nucleus is equal to the bind-
ing 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

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

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*Science* (print ISSN 0036-8075; online ISSN 1095-9203) is published weekly, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. Copyright 2016 by the American Association for the Advancement of Science; all rights reserved. The title *Science* is a registered trademark of AAAS.