Letters to the Editor

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Notes on points in some of this week's letters appear on p. 337.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Disintegration of Heavy Nuclei

THROUGH the kindness of the authors I have been informed of the content of the letters1 recently sent to the Editor of NATURE by Prof. Meitner and Dr. Frisch. In the first letter, these authors propose an interpretation of the remarkable findings of Hahn and Strassmann as indication for a new type of disintegration of heavy nuclei, consisting in a fission of the nucleus into two parts of approximately equal masses and charges with release of enormous energy. In the second letter, Dr. Frisch describes experiments in which these parts are directly detected by the very large ionization they produce. Due to the extreme importance of this discovery, I should be glad to add a few comments on the mechanism of the fission process from the point of view of the general ideas, developed in recent years, to account for the main features of the nuclear reactions hitherto

According to these ideas, any nuclear reaction initiated by collisions or radiation involves as an intermediate stage the formation of a compound nucleus in which the excitation energy is distributed among the various degrees of freedom in a way resembling the thermal agitation of a solid or liquid body. The relative probabilities of the different possible courses of the reaction will therefore depend on the facility with which this energy is either released as radiation or converted into a form suited to produce the disintegration of the compound nucleus. In the case of ordinary reactions, in which the disintegration consists in the escape of a single particle, this conversion means the concentration of a large part of the energy on some particle at the surface of the nucleus, and resembles therefore the evaporation of a molecule from a liquid drop. In the case of disintegrations comparable to the division of such a drop into two droplets, it is evidently necessary, however, that the quasi-thermal distribution of energy be largely converted into some special mode of vibration of the compound nucleus involving a considerable deformation of the nuclear surface.

In both cases, the course of the disintegration may thus be said to result from a fluctuation in the statistical distribution of the energy between the various degrees of freedom of the system, the probability of occurrence of which is essentially determined by the amount of energy to be concentrated on the particular type of motion considered and by the 'temperature' corresponding to the nuclear excitation. Since the effective cross-sections for the fission phenomena for neutrons of different velocities seem to be of about the same order of magnitude as the cross-sections for ordinary nuclear reactions, we may therefore conclude that for the heaviest nuclei the deformation energy sufficient for the fission is of

the same order of magnitude as the energy necessary for the escape of a single nuclear particle. For somewhat lighter nuclei, however, where only evaporationlike disintegrations have so far been observed, the former energy should be considerably larger than the binding energy of a particle.

These circumstances find their straightforward explanation in the fact, stressed by Meitner and Frisch, that the mutual repulsion between the electric charges in a nucleus will for highly charged nuclei counteract to a large extent the effect of the short-range forces between the nuclear particles in opposing a deformation of the nucleus. The nuclear problem concerned reminds us indeed in several ways of the question of the stability of a charged liquid drop, and in particular, any deformation of a nucleus, sufficiently large for its fission, may be treated approximately as a classical mechanical problem, since the corresponding amplitude must evidently be large compared with the quantum mechanical zeropoint oscillations. Just this condition would in fact seem to provide an understanding of the remarkable stability of heavy nuclei in their normal state or in the states of low excitation, in spite of the large amount of energy which would be liberated by an imaginable division of such nuclei.

The continuation of the experiments on the new type of nuclear disintegrations, and above all the closer examination of the conditions for their occurrence, should certainly yield most valuable information as regards the mechanism of nuclear excitation

N. Bohr.

At the Institute for Advanced Study, Princeton, N.J. Jan. 20.

¹ [NATURE, 143, 239 and 275 (1939)].

Photoactivation of Solids and its Effect on Adsorption

Considerable attention has been given recently to chemical processes involving an activating influence of a crystal excited by irradiation1. The mechanism of such photosensitized reactions, although unknown in detail, is generally believed to be a more or less complete transfer of the energy absorbed by the crystal to the reacting components, physically or chemically. Accordingly, the essential difference between photosensitized processes and real photochemical ones is the distance between the place of absorption and the place of reaction. But there must also be another, more general, effect of irradiation on the activity of crystals. Due to the change in the electronic state of the particles in the lattice by the absorption of light (change in charge and degree of polarization, formation of space charges, etc.), the forces between the particles are changed and, consequently, there is also a change in potential of the