Especially sharp bends of such curves are observed for the heavy isotpes of U and Cf. The maxima of the curves pertaining to single elements all lie almost on a straight line (the dotted line of the figure), and the values of Z^2/A corresponding to these maxima coincide very well with the values of Z^2/A^*. The values of A^* are taken from a stability curve, constructed from data on β-disintegration[6] and correspond to such A's, at which maximum β-stability is obtained for the isotopes of a given element. (The values of A^* are indicated on the figure by little arrows.) Note that in the case of thorium it is difficult to come to a definite conclusion at present, because of insufficient data, one of which is unreliable (Th^{230}).

The dependence of $\lg \tau$ on Z and A can be expressed by an empirical formula:

$$\lg \tau_{\text{years}} = -4.85\,(Z^2/A^*) + 191 - 0.063\,(A - A^*)^2. \quad (1)$$

The last term is added to make the formula applicable for nuclei which are not at the maximum of stability. Let us note that in the interval of mass numbers A under consideration, the values for A^* are given by the approximate relationship:

$$A^* \approx 2.5\ Z + 5. \quad (2)$$

Substitution of Eq. (2) into Eq. (1) shows that when $A \approx A^*$, $\lg \tau$ is approximately proportional to Z ($\lg \tau \sim Z$). This conclusion is confirmed also by a direct examination of the dependence of $\lg \tau$ upon Z.

A possible reason for the considerable deviations from the simple relationship of Seaborg above described is the incorrect form of the formula for the binding energy and hence also for the parameter Z^2/A. One of the most important factors, influencing the above described deviations, is the different susceptibility to deformation of the various nuclei[4]. It appears reasonable to consider that nuclei which are close to the β-stability curve and possess a greater binding energy with respect to other isobars, are less subject to deformation. On the contrary, nuclei which are located far away from the stability curve, and which have a lower binding energy, are more deformed. This deformation makes the crossing of the potential barrier easier. Such an explanation appears the nearer to the truth in view of the fact that the lower excited levels of the nuclei which are near the β-stability curve are elevated with respect to the levels of other isobars.

It is possible that some deviations from the relationship given by formula (1) in special cases are connected with the different deformations of the proton configuration (and also neutron configuration) inside the nuclei. The lower probability of spontaneous fission for uneven nuclei with respect to even-even nuclei[8] can apparently be explained in a similar manner, assuming their lower susceptibility to deformation. An assumption of this kind has already been made for the explanation of the differences in isotopic shifts between even and uneven isotopes.

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On the Paper of G. M. Avak'iants "The Theory of the Transfer Equation in Strong Electric Fields." [1]

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THE necessity for a theoretical investigation of the properties of semi-conductors placed in strong electric fields has existed for a long time. The dependence of the electric conductivity obtained by Davydov[2], as is known, is not confirmed by experiment for many semi-conductors.

G. M. Avak'iants undertook the task of looking into the phenomena of transference in semi-conductors in which the electron gas is strongly heated. It should be noted that while investigation of galvanomagnetic phenomena is undoubtedly of interest, the same cannot be said of thermoelectric and of thermo- and photomagnetic effects. More than that,

the problem of investigation of these phenomena in a strong electric field appears to us one thought up especially for this occasion. In order to heat up the electron gas under conditions when primary current is absent, the author had to introduce artificially a strong electric field perpendicular to the primary temperature gradient (in the presence of a magnetic field in the direction of the latter). This immediately leads to a contradiction in the calculation of the electronic component of thermoconductivity, for instance. The calculation was carried out, as usual, with the assumption of absence of electric current in the specimen ($j = 0$). While doing this, however, the author did not account for the fact that a strong current is required in the semi-conductor in order to heat the electron gas.

Furthermore, in all formulas obtained, there enters a quantity χ^{ν}, which is dependent upon the electric and magnetic fields E and H, and, in the presence of a temperature gradient, also upon the coordinates r. Nevertheless, the calculations of χ^{ν} is carried out under the assumption that the symmetrical part of the distribution function f_0 does not depend on the magnetic field or on the coordinates, and the solution of Davydov is used for this case. We do not agree with Avak'iants, who states that "there is no necessity" for solving the equations of Davydov in the case in which f_0 depends on E, H and r. From the formulas of Davydov[3] it follows that for not very small magnetic fields (or small H at sufficiently low temperatures) the dependence of f_0 upon H cannot be neglected.

In calculating f_0, Avak'iants also neglects a term which accounts for the entrance of electrons into the zone of conductivity (or to local levels). This is justified only in those cases in which the concentration of electrons (holes) differs but little from the equilibrium condition. But, in a kinetic equation, under conditions where the semiconductor is in a strong electric field, not only the usual thermal ionization, but also the ionization by the field must be accounted for. Neglect of the terms expressing the ionization by the field, is, in our opinion, one of the basic causes of the disagreement between theory and experiment.

Thus, the papers of Avak'iants cannot interpret experimental results (for instance, the Pool* effect) and do not contribute, as it appears to us, anything new to the problem of behavior of semiconductors in strong electric fields.

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* *Translator's note:* Probably misprint; correct reference probably is to Suhl effect.

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The Velocity of the Wave Front in Nonlinear Electrodynamics

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IN papers by Blokhintsev[1] and Blokhintsev and Orlov[2], it is shown that for nonlinear electrodynamics and mesodynamics, the propagation of a signal (defined as the surface of a weak discontinuity in the field strength) can take place with a velocity greater than the velocity of light in the vacuum*. Both papers are based on the method of characteristics of systems of partial differential equations, going into detail in the case of plane waves. In view of the importance of this question, it is interesting to investigate it further and to simplify the method.

Sommerfeld[4] has investigated the velocity of the signal and of the wave front (the group and phase velocities**) in Maxwell-Lorentz linear electrodynamics. He showed that, in linear electrodynamics, the velocity of the front is always (independent of the medium) equal to the velocity of light in the vacuum***. This result is particularly easy to get by making use of a method pointed out by Levi-Civita. We shall apply the same method to nonlinear electrodynamics, since the equation for the velocity of the wave front can be derived simply and intuitively****.

As is well known, the equations of electrodynamics are gotten by the use of the variational principle from a Lagrangian depending on the first and second invariants of the field, that is,

$$L = L(K, I^2),$$

where

$$K \equiv \frac{1}{2}(E^2 - H^2),\ I^2 \equiv (\mathbf{E}, \mathbf{H})^2.$$

First let us investigate the use of a plane wave. Let $E = E_x(z, t)$, $H = H_y(z, t)$, $E_y = E_z = H_x = H_z = 0$.