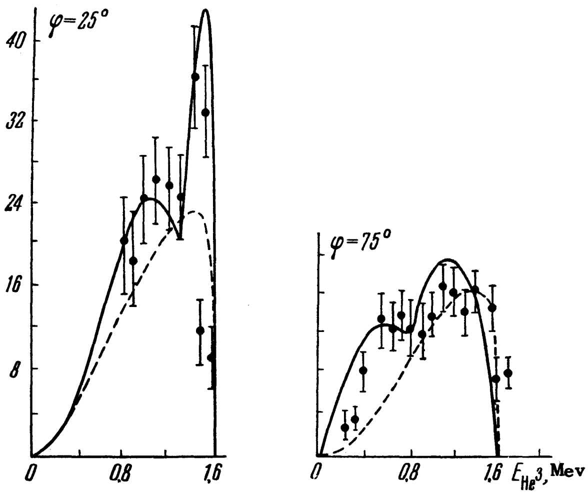

mass system, computed including (solid curve) and omitting (dashed curve) the interaction of the neutrons in the final state, and the experimental energy distribution[4] of the He^3 nuclei (the points on the figure). As one sees from the figure, the energy distributions of He^3 nuclei, computed including the potential scattering of the neutrons in the final state, give a good description of the experimental results.

In conclusion it should be mentioned that, on the basis of these considerations, one can not only explain the energy distributions of products of reactions which lead to emission of several particles, but one also gets a value for the parameters of the interaction of these particles in the final state.

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ISOTHERMAL DISCONTINUITIES IN MAGNETOHYDRODYNAMICS

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IN magnetohydrodynamics, under the condition that

$$\beta_m/\beta_T \ll \gamma M_m^2 u_2 [(1/\gamma M_1^2 + 1/2\, M_m^2 + 1) u_2 + 3/2\, M_m^2]/(\gamma + 1), \qquad (1)$$

the principal role in the diffusion of the shock front is played by thermal conductivity, while magnetic viscosity can be neglected. Here and below we use the dimensionless quantities

$$u = v/v_1, \quad M_1^2 = v_1^2/a_1^2, \quad M_m^2 = v_1^2/a_m^2;$$

$$\beta_m = \nu_m/v_1 l_1, \quad \beta_T = \chi/v_1 l_1$$

where

$$a_m^2 = H_1^2/4\pi\rho_1, \quad a_1^2 = \gamma p_1/\rho_1.$$

Here, $\nu_m = c^2/4\pi\sigma$ is the magnetic viscosity, χ the coefficient of temperature conductivity, and l the mean free path of the ion. The system of coordinates moves with the velocity of the wave in the direction of its propagation (for example, from right to left). The remaining notation is universal in magnetohydrodynamics.

Account of thermal conductivity alone leads to the appearance of an isothermal discontinuity. It is well known that in the absence of a magnetic field, a gradual change in the hydrodynamic quantities takes place only at gas velocities smaller than $u_2 = (\gamma+1)/(3\gamma-1)$ by $+\infty$, whereas in this case $M_1^2 = (3\gamma-1)/\gamma(3-\gamma)$ (see, for example, reference 1). We call the velocity $u_2 = u_l$, for which the isothermal discontinuity appears, the limiting velocity. If the magnetic field is not equal to zero, then the limiting velocity can vary from $u_l = (\gamma+1)/(3\gamma-1)$ to 1, depending on the values of M_1^2 and M_m^2. These three quantities are related in the following fashion:

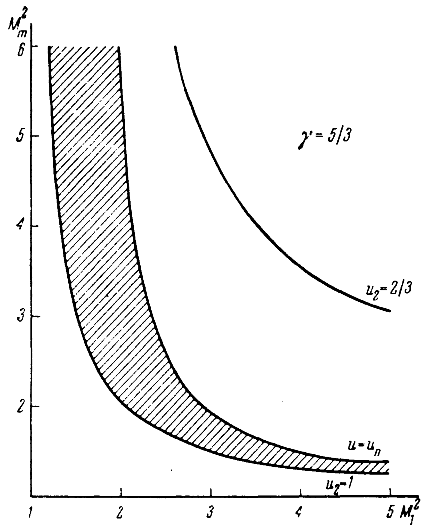
$$M_1^2 = 2[\gamma - (2-\gamma) u_l]/\gamma[(5\gamma-7) u_l^2 + (5-\gamma) u_l - (3\gamma-1) u_l^3 - (\gamma-1)],$$

$$M_m^2 = [\gamma - (2-\gamma) u_l]/u_l^2 [(3\gamma-1) u_l - \gamma - 1]. \qquad (2)$$

The region in front of the isothermal discontinuity is especially clearly seen in the diagram of M_1^2, M_m^2. The connection between u_2, M_1^2 and M_m^2 has the form

$$M_m^2 = (\gamma u_2 + 2 - \gamma)/[(\gamma+1) u_2^2 - (\gamma-1) u_2 - 2u_2/M_1^2]. \qquad (3)$$

In shock waves with parameters taken from the shaded region, the changes of all variables take



place smoothly. The drawing shows that the magnetic field creates more favorable conditions for the formation of an isothermal discontinuity: the isothermal discontinuity appears for smaller amplitudes of the waves the larger the field in the medium.

It is easy to obtain values of quantities characterizing the wave directly in front of the jump. For example, the velocity is

$$u = 1/2\{1/\gamma M_1^2 + 1/2\,M_m^2 + 1 - u_2 + [(1/\gamma M_1^2 + 1/2\,M_m^2 + 1 - u_2)^2 + 2/u_2 M_m^2]^{1/2}\}. \tag{4}$$

I thank K. P. Stanyukovich for discussions.

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NUMBER OF EXTENSIVE ATMOSPHERIC SHOWERS OF COSMIC RAYS NEAR SEA LEVEL

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THE frequency of extensive atmospheric showers with different numbers of charged particles was investigated by many researchers at different altitudes.[1] The most widely used research method consists of measuring the dependence of the number of multiple coincidences of discharges in counters on the effective area of the counters (the so called "density spectrum"). The value spectrum of extensive atmospheric showers can be obtained from the density spectrum by using the well known lateral distribution function of particles in the shower (in the particular case when this function is independent of the number of particles in the shower) and under the assumption that the value spectrum of the showers obeys a power law with a constant or slowly-varying exponent (see the paper by Migdal[2]). The latter assumption is connected with the fact that the axes of the registered showers may pass at varying distances from the particle flux-density detector; when counters are used it is also connected with the random character of the registration of the shower particle flux density.

With the development of methods for the registration and investigation of individual extensive atmospheric showers, direct data have appeared on the value spectrum of showers.[3,5] However, when the number of shower particles is small, it becomes difficult to register individual showers and determine subsequently the number of particles by comparing the particle flux density at certain points at the level of observation. In this connection we used a modification of the method of measuring the density spectrum of extensive atmospheric showers. The modification consisted of registering only the fourfold coincidences of counter discharges which were not accompanied by threefold coincidences in any of the three groups of counters in the same area, located ~ 6 m from the center of the array (Fig. 1). The counter area σ in all the registration channels, including the anticoincidence channels, was changed simultaneously ($\sigma = 0.4\,\mathrm{m}^2$; $0.2\,\mathrm{m}^2$, $990\,\mathrm{cm}^2$, 330 cm^2, and $165\,\mathrm{cm}^2$). This method of registration, while not differing in principle from the measurement of the density spectrum, makes it possible to reduce substantially the difference between the number of particles in the showers causing operation of the setup at a given counter area. This is

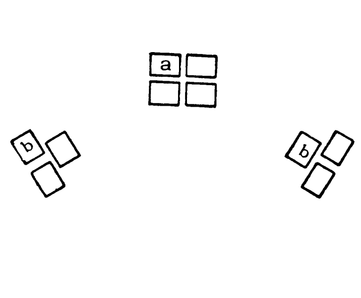

FIG. 1. Plan of the array: a – group of counters connected for fourfold coincidence, b – group of counters connected for threefold coincidence.