and Lipkin [1], and the corresponding thresholds.

We see from the comparison that only X_1 has a chance of being stable to the strong decay.

Along with the search for X_1 (S = -4), the greatest interest is attached to searches for a baryon with positive strangeness I_4 (S = +1). The expected threshold of the reaction

$$N + N = I_4 + \Sigma$$

in the laboratory system (one of the N is at rest) is of the order of p_N = 4 BeV/c, and for $\pi + N = I_4 + K$ the threshold is p_π = 2.2 BeV/c.

A reaction of particular interest is

$$\pi^+ + p = I_4^{+++} + K^-, \qquad I_4^{+++} = p + \pi^+ + K^+.$$

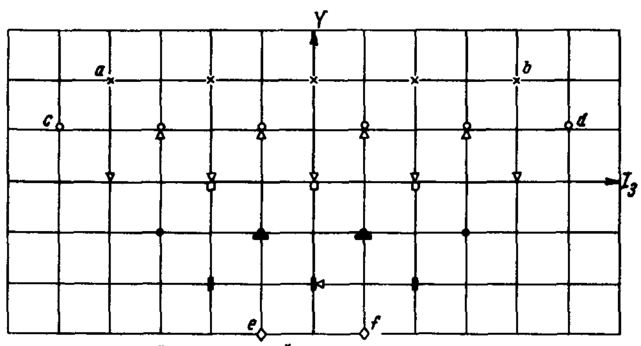
I take the opportunity to thank L. B. Okun' for a discussion.

[1] H. Harari and H. J. Lipkin, Phys. Rev. Lett. 13, 345 (1964).

[2] S. Nikitin, Paper at the 9th Internat. Conf. on High-energy Physics, Dubna, 1964; Alexander, Benary, Reyter, Shapira, Simonpoulou, and Yekutieli, Phys. Rev. Lett. 15, 207 (1965).

1) The index is equal to double the isospin (2I) throughout.

2) The example of an octet with splitting $m(\Sigma) - m(\Lambda)$ = 78 MeV shows that the foregoing assumption is of rather low accuracy; all the mass estimates presented below are quite crude.



× - I_4 (+3 go -1); ○ - N_5^* (+3 go -2); △ - N_3^* (+2 go -1); ▽ - Y_4 (+2 go -2); □ - Y_2 (+1 go -1);
● - Ξ_3^* (+1 go -2); ▬ - Ξ_1^* (0, -1); ▮ - Ω_2 (0 go -2); ◁ - Ω_0 (-1); ◇ - X_1 (-1, -2)
$a = 4n\bar{\lambda}$; $b = 4p\bar{\lambda}$; $c = 4n\bar{p}$; $d = 4p\bar{n}$; $e = 4\lambda\bar{p}$; $f = 4\lambda\bar{n}$

APPENDIX

For reference purposes, we present in coordinates I_3 and Y the 35-plet scheme of [1]. The particle designations and compositions are listed in the caption, where the parentheses contain the electric charges of the particles.

SPLITTING OF EPR LINES OF Cr^{3+} IN $ZnWO_4$ BY AN EXTERNAL ELECTRIC FIELD

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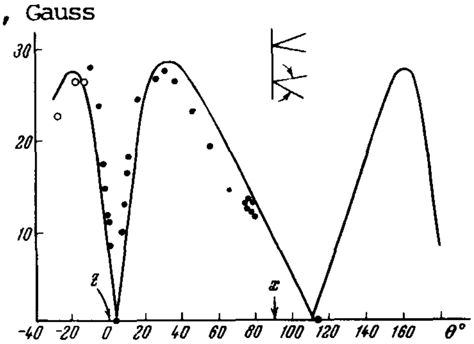
The paramagnetic ion Cr^{3+} in xinc tungstate replaces the Zn^{2+} ion [1]. The position of the Zn^{2+} ion in the crystal [2] is not a symmetry center relative to inversion (point group

C_2). When an external static electric field E is applied, we can therefore expect the EPR lines of Cr^{3+} to shift in proportion to $\vec{E}$. In the $ZnWO_4$ crystal there are two non-equivalent positions of the Zn^{2+} ion, which differ in inversion with respect to the position occupied by the zinc ion. As a result, the shift of the EPR line should manifest itself in the form of its splitting.

We have observed the expected splitting of two lines corresponding to transitions between the sublevels of the Kramers doublets. We investigated also the dependence of the line splitting on the orientation of the external static magnetic field $\vec{H}$. The experiments were made with an EPR spectrometer operating in the 3 cm band (frequency 9,380 Mc) at room temperature.

The Figure shows the angular dependence of the line splitting, corresponding to the transition between the sublevels of the lower Kramers doublet, for the case when the field $\vec{E}$ is directed along the crystallographic axis b (y axis) [1], and the field $\vec{H}$ changes its orientation in the (xz) plane. The experimental points shown on the plot correspond to the directly measured splitting.



Angular dependence of the EPR line splitting at E = 225 kV/cm. Continuous curve - theoretical; points - experimental values obtained with sample no. 1; circles - sample no. 2.

To describe the experimental data, we use a spin Hamiltonian in the form $\hat{W} = \hat{W}_0 + \hat{W}_E$ where $\hat{W}_0$ is the usual spin Hamiltonian [1], including the operator of the Zeeman energy and the energy of the crystalline field. $\hat{W}_E$ is the operator of the energy of interaction with the external electric field $\vec{E}$. It was obtained by a method described in [3], and its form is (I = 3/2):

$$W_E = \sum_i \sum_{j\leq k} \alpha_{ijk} E_i (\hat{J}_j \hat{J}_k + \hat{J}_k \hat{J}_j) + \sum_{ijk} \beta_{ijk} E_i H_j \hat{J}_k . \qquad (1)$$

The possible nonvanishing components are: α_{211}, α_{222}, α_{233}, α_{112}, α_{312}, α_{213}, α_{123}, α_{323}; β_{211}, β_{112}, β_{312}, β_{213}, β_{121}, β_{321}, β_{222}, β_{123}, β_{323}, β_{231}, β_{132}, β_{332}, and β_{233}. The term containing the parameter α_{222} leads to an equal shift of all the levels.

The corrections to the energy levels were calculated by perturbation theory in the presence of degeneracy [4], accurate to second-order terms.

The zeroth-approximation Hamiltonian was chosen to be the operator $D[I_z^2 - (1/3)\, I(I + 1)]$. The terms of the operator $\hat{W}_E$ containing the components α_{ijk} make only a second-order contribution to the line splitting. Therefore, to describe the experimental data obtained by us we can formally confine ourselves to the second term of (1). The theoretically obtained angular dependences of the line splitting coincide with those observed experimentall (see the Figure).

In conclusion we thank M. F. Deigen and V. B. Shteinshleiger for continuous interest in the work, and also L. I. Datsenko and N. F. Kogdenko for help with the measurements.

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1) Our notation coincides with that used in [1].

TOTAL NUCLEAR DECAY REACTIONS

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There are many nuclei (Be^8, C^{12}, O^{16}) whose properties agree well with the assumption that they contain strongly-bound nucleon clusters of the α-particle type. In some nuclei, the α-particle clusters are weakly coupled, so that when such particles collide the emission of α particles, or even complete decay into α particles, has a higher probability than the emission of individual nucleons [1-3].

An investigation of the total decay into α-particle clusters in interactions between α-noncorrelated nuclei (for example, $N^{14} + B^{10} \rightarrow 6\alpha$), and a comparison of these reactions with analogous ones between α-correlated nuclei (for example, $C^{12} + C^{12} \rightarrow 6\alpha$) makes it apparently possible to ascertain whether a regrouping of nucleons with formation of α-particle clusters takes place during the instant of collision, or whether the breakup into α-particle clusters is due only to the α-particle structure of the colliding nuclei.

We have previously measured [3] the cross sections of certain reactions with emission of α particles, due to B^{10} ions interacting with light nuclei in emulsion. In the present paper we report on a more detailed investigation of the reaction

$$N^{14} + B^{10} \rightarrow 6\alpha$$

Type NIKFI-D nuclear emulsions 400 μ thick were bombarded with B^{10}ions accelerated to 100 MeV in the multiply-charged-ion linear accelerator of the Ukrainian Physico-technical Institute. The strictly parallel beam of B^{10} ions entered the emulsion at an angle of 25° to the surface. The emulsions made possible reliable visual discrimination of the tracks of singly-charged or doubly-charged particles, and of heavier nuclei.

From a total of approximately 10,000 stars produced by the interaction between the B^{10} ions and nuclei in the emulsion, we identified, as a result of visual selection, measurement of all the star parameters, and subsequent detailed kinematic analysis, a total of 22 six-pronged stars due to the reaction

$$N^{14} + B^{10} \rightarrow 6\alpha + 0.4 \text{ MeV}, \tag{1}$$