interband transitions of electrons, and not transitions inside a single band, since the time for which negative temperatures exist is much shorter in the latter case.

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ON POSSIBLE PROPERTIES OF D^0 MESONS

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In connection with the communication on the D^+ meson,[1] various "peculiar" decays of unstable particles,[2] which were observed in the past, are being reanalyzed.[2] An opinion becoming prevalent is that the D^+ meson, and in accordance with presently popular systematics of elementary particles (e.g., the Gell-Mann-Nishijima scheme[3]) also the D^- meson, exist, have a mass of 742 ± 20 Mev, decay according to the scheme

$$D^{\pm} \rightarrow K + \pi + Q, \quad (1)$$

and are particles of strangeness ± 2. Thus from among all the bosons of the Gell-Mann-Nishijima scheme only the ρ_0 meson has not been detected experimentally.

In the notation of the Salam-Polkinghorne scheme[4]

$$Q/e = \tau_3 + \mu_3 \quad (2)$$

(Q — magnitude of electric charge, τ_3 corresponds to the isospin and μ_3 to the strangeness) the $D^{\pm}$ mesons are described by $\tau_3 = 0$ and $\mu_3 = \pm 1$. If we also include $\tau_3 = 0$ and $\mu_3 = 0$ here, we obtain a triplet D^+, D^0, D^- which may be viewed as a vector in μ-isospace. Consequently the suggestion occurs that this group of isotopic singlets may have similar properties. If such a view were to be accepted then the D^0 meson would also have a mass of the order of the mass of the charged D mesons, and decay according to the scheme

$$D^0 \rightarrow K^{\pm 0} + \pi^{\mp 0}. \quad (3)$$

We wish to call attention to the communications existing in the literature on the decay of neutral particles according to the scheme

$$V_3^0 \rightarrow K^{\pm} + \pi^{\mp} \quad (4)$$

with $m(V_3^0) \approx 650 - 700$ Mev.[5] Thus there are indications that a neutral unstable particle exists with a mass and a mode of decay analogous to the characteristics of the $D^{\pm}$ mesons. If we identify the V_3^0 particle with the above indicated D^0 meson, we come to the conclusion that an isotopic singlet D^0 meson exists with strangeness $S = 0$ which, although it could formally undergo a fast decay into π mesons satisfying the condition $\Delta S = 0$,[6] decays slowly into decay products with strangeness ± 1. However this conclusion contradicts the premises on which the indicated systematics are based unless fast decays of the type $\Sigma^0 \rightarrow \Lambda^0 + \gamma$ and $D^0 \rightarrow n\pi$ are somehow forbidden.

The most convenient method for production of such D^0 mesons would be from reactions of the type

$$\pi^- + p \rightarrow n + D^0, \quad (5)$$

and also from photoproduction of the type studied by Bernardini et al.[7]

We have analyzed over 50 "anomalous" V^0 events detected at various times in cosmic ray experiments.[8] We obtained the following results: 1) no neutral meson exists with a mass of the order of 750 Mev and a decay mode (3); 2) the published anomalous V^0 events are more likely evidence for the existence of two neutral cascade mesons D_1^0 and D_2^0 with the above indicated decay mode (3) with $Q_1 = 38$ Mev and $Q_2 = 63$ Mev; 3) the flux of these mesons amounts to 1 — 2% of the flux of Λ^0 and θ^0 particles (there were approximately 30 of them among the 50 "anomalous" V^0 events); 4) the decays of both D_1^0 and D_2^0 through the two channels $K^+ + \pi^-$ and $K^- + \pi^+$ are in the ratio of 1 : 1.

In connection with the questions discussed here it would be of interest to check the data obtained with bubble chambers irradiated with π-meson beams with momenta in excess of 1 Bev/c. The purpose of this check would be a systematic search for and study of unstable neutral particles with properties different from the Λ^0 and θ^0 particles, since the information on the number of D^0 mesons and their properties is of great importance for the systematics of elementary particles.

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ANGULAR DISTRIBUTION OF DECAY PRODUCTS OF $\Sigma^\pm$-HYPERONS PRODUCED BY PROTONS IN PHOTOEMULSION

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SOLOV'EV[1] stressed the importance of studying the longitudinal asymmetry in the angular distribution of π mesons produced in hyperon decays. During a study of the strange-particle production by 9-Bev protons, Kostanashvili and Shakhulashvili[2] obtained an indication as to the possible existence of such an asymmetry in the decay of $\Sigma^\pm$ hyperons. In view of this, we undertook an experiment to improve the data on the angular distribution of $\pi^\pm$ mesons from the decay of $\Sigma^\pm$ hyperons produced in interactions between 9-Bev protons and photoemulsion nuclei. Our main concern was to choose a method of searching for hyperons free from any experimental bias and to identify carefully the cases of decay that were found.

The search for Σ hyperons was carried out by following the tracks from stars produced by the interaction of the primary protons with emulsion nuclei (NIKFI BR-400 emulsion). Each layer of the emulsion stack was area-scanned for stars with $N_h \geq 10$ in which there was at least one track satisfying the following conditions: a) the particle producing the track is emitted in the direction of the forward hemisphere relative to the motion of the proton beam; b) the line of horizontal projection of the track in one layer of emulsion was ≥ 3 mm; c) the value of the ionization I was within the limits of $1.5\,I_{min} \leq I \leq 7\,I_{min}$. Tracks satisfying these conditions were followed a distance of at least 2 cm or to the end if their length was less than 2 cm. The Σ-hyperon decays in flight via the scheme $\Sigma^\pm \rightarrow \pi^\pm + n$ were selected primarily by inspection. To do this, all points of disappearance of the tracks of particles which clearly did not stop within the layer of emulsion were carefully examined under high magnification ($60 \times 10 \times 1.5$) to seek a secondary relativistic or almost relativistic track. Such cases could represent the decay in flight of $\Sigma^\pm$ hyperons or $K^\pm$ mesons, where it may be expected beforehand that, owing to the great difference in the lifetimes of these two particles, the contamination of K mesons should be extremely slight.

The final identification was made on the basis of multiple scattering and ionization measurements. The values of the velocity (β) of the hyperon and K meson corresponding to the measured value of $p\beta$ and calculated with the tables in reference 3 were compared with the results of the ionization measurement by the method given in reference 4. The statistical error of the measurement of the quantity $p\beta$, as a rule, did not exceed 10 — 15%, and the relative error in the ionization measurement did not exceed 6 — 8%. Measurements to such an accuracy proved to be sufficient for a reliable identification of hyperons. Analogous measurements were made for control purposes on tracks of known K mesons (the K