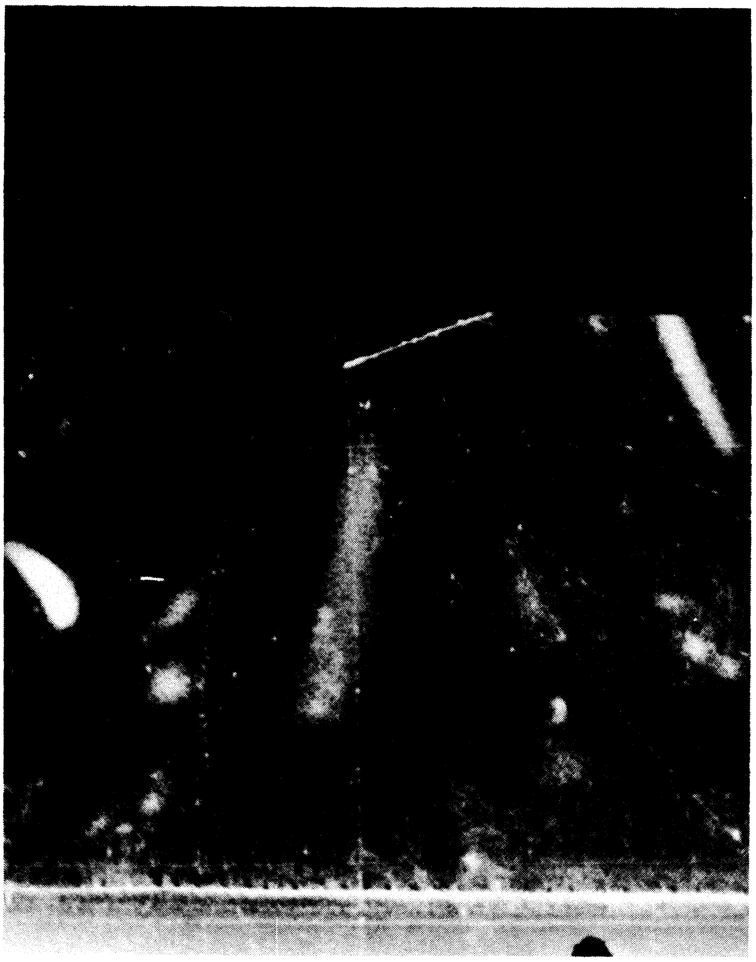

For the article by Mandzhavidze, N. N. Roinishivili and G. E. Chikovani entitled "Anomalous Decay of a Charged Particle Observed in a Cloud Chamber."

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ANOMALOUS DECAY OF A CHARGED PARTICLE OBSERVED IN A CLOUD CHAMBER

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THE unusual event whose photograph is shown in the figure was recorded among the decays of charged hyperons and K-particles observed in a cloud chamber at the El'brus Laboratory.

A slow particle with an ionization multiplicity factor greater than twenty enters the chamber through the front window and decays emitting at an angle of 95° a positive particle with momentum 352^{+94}_{-61} Mev/c and close to minimum ionization. The transverse component of the secondary particle momentum is 351 Mev/c, which is much larger than the maximum momentum of the decay products in the rest system for all known decay schemes of hyperons and K-mesons.

The anomalously large momentum of the secondary particle is hard to explain in terms of experimental error. It is true that the track passes close to a small vapor cloud, but this does not interfere with the measurement of the curvature and does not distort the track. On the other hand, kinematic analysis excludes the possibility of interpreting the given event as the decay of a Λ^0, θ^0, or V_3^0-particle.

All this gives reason to suppose that we have observed the decay of a particle heavier than a K-meson. A detailed analysis of this case will be published later.

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APPLICATION OF THE EINSTEIN-FOKKER EQUATION TO FINDING PARTICLE LOSSES DUE TO GAS SCATTERING IN ACCELERATORS

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THE influence of multiple scattering on betatron oscillations of particles was first investigated by Blachman and Courant,[1] who used the Einstein-Fokker equation to describe the scattering process. Somewhat later, in 1951, one of the present authors[2] used the Einstein-Fokker equation in studying the influence of inelastic scattering of electrons on synchrotron oscillations. This method has also been used by other authors.[3,4]*

Let P (y, t) be the probability that the betraton or synchrotron oscillation amplitude of a particle is y at time t. Without accounting for damping of the oscillations, the Einstein-Fokker equation for P(y, t) is

$$\frac{\partial P(y,t)}{\partial t} = -\frac{\partial}{\partial y}(\overline{\Delta y}P) + \frac{1}{2}\frac{\partial^2}{\partial y^2}(\overline{\Delta y^2}P), \tag{1}$$

where

$$\overline{\Delta y^n} = \lim_{\Delta t \to 0}\frac{1}{\Delta t}\int_{-\infty}^{+\infty} Q(y, \Delta y, \Delta t)(\Delta y)^n d(\Delta y),$$

in which Q(y, Δy, Δt) is the probability that the amplitude y changes by an amount Δy in a time $\Delta t \to 0$. In our case Q is found from the interaction cross section between the accelerated particles and the remaining gas in the chamber. Furthermore, Q(y, Δy, Δt) = Q(y, Δy) Δt. As was shown by Kolmogorov,[5] Eq. (1) is valid if

$$(\overline{\Delta y})^3 \ll (\overline{\Delta y})^2,\ \overline{\Delta y}. \tag{2}$$

Equation (2) means that for large Δy, the probability Q(y, Δy) should rapidly approach zero.

Let us investigate whether this condition is fulfilled by the process of exciting betraton oscillations by elastic scattering. In this case Δy is the increase of the amplitude of free vibrations due to scattering through an angle Θ, and Q is the cross section (up to a proportionality factor) for Rutherford scattering through an angle Θ. Since this cross section is proportional to Θ^{-4}, it is clear that (2) is satisfied and the results of Blachman and Courant[1] are valid

The situation is different if Q(y, Δy) has no sharp maximum at small Δy. As an example, let us consider the excitation of synchrotron oscillations due to inelastic collisions between accelerated particles

*Note made in proof. See also D. G. Koshkareva, Приборы и техника эксперимента, (Instr. and Exptl. Tech.) 2, 15 (1957).