The assumption on the existence of a long-lived Λ-particle can be verified directly. In particular, such a long-lived particle should have been observed in experiments[5]. The fact that it has not actually been observed is in contradiction with such an assumption.

Therefore, the values R_Λ and R_θ agree most easily with the single K-meson hypothesis, the values of p_θ and p_Λ being $p_\theta = 0.3 - 0.4$, $p_\Lambda = 0.6 - 0.8$.

Let us now investigate the theoretical values of p_θ and p_Λ. In the Gell-Mann scheme, it is assumed that the decay interaction satisfies the selection rule $\Delta T_3 = \frac{1}{2}$ (T is the isotopic spin). One can assume that the decay interaction satisfies a more restricted selection rule $\Delta T = \frac{1}{2}$, which explains by a natural way the longer lifetime of θ^+ with respect to that of θ^0, because, for an interaction with $\Delta T = \frac{1}{2}$, the decay $\theta^+ \to \pi^+ + \pi^0$ is forbidden. For $\Delta T = \frac{1}{2}$, $p_\theta = p_\Lambda = \frac{2}{3} = 0.67$. These values are actually quite indeterminate because a small admixture of interaction with $\Delta T = \frac{3}{2}$ strongly influences p_Λ and p_θ.

In order to explain the decay $\theta^+ \to \pi^+ + \pi^0$, one has to introduce an impurity with $\Delta T = \frac{3}{2}$, the amplitude a_3 of which being $a_3 = 0.07\, a_1$, where a_1 is the amplitude of the transitions with $\Delta T = \frac{1}{2}$. The ratios

$$w(\theta^0 \to \pi^0 + \pi^0)/w(\theta^0 \to \pi^+ + \pi^-)$$

and $$w(\Lambda \to n + \pi^0)/w(\Lambda \to p + \pi^-)$$

vary between the limits

$$\frac{1}{2}\left|\frac{1 \pm \sqrt{2}\, a_3/a_1}{1 \mp a_3/a_1\sqrt{2}}\right|^2,$$

which, for $a_3/a_1 = 0.07$, give $0.62 < p_\Lambda < 0.72$; $0.62 < p_\theta < 0.72$.

In order to obtain $p_\Lambda \sim 0.3 - 0.4$, it is necessary that $a_3/a_1 \approx 0.3$ for the decay interaction of Λ-particles.

Finally, let us emphasize the existing experimental values of p_θ, p_Λ and of R_θ, R_Λ contain large errors which do not allow to draw a unique conclusion. We think therefore that an accurate measurement of these quantities would be very desirable.

[1] T. D. Lee and C. N. Yang, Phys. Rev. **102**, 290 (1956).

[2] Budde, Chretien, Leitner, Samios, Schwarts and Steinberger, Phys. Rev. **103**, 1827 (1956).

[3] Blumenfeld, Booth, Lederman and Chinowsky, Phys. Rev. **102**, 1184 (1956).

[4] R. B. Leighton and G. H. Trilling, Proc. Rochester Conference (1956).

[5] Lande, Booth, Impeduglia and Lederman, Phys. Rev. **103**, 1901 (1956).

[6] Ioffe, Okun, and Rudik, J. Exptl. Theoret. Phys. (U.S.S.R.) **32**, 396 (1957), Soviet Physics JETP **5**, 328 (1957).

Translated by E. S. Troubetzkoy
197

Absorption of Sound in a Phase Change in Rochelle Salt

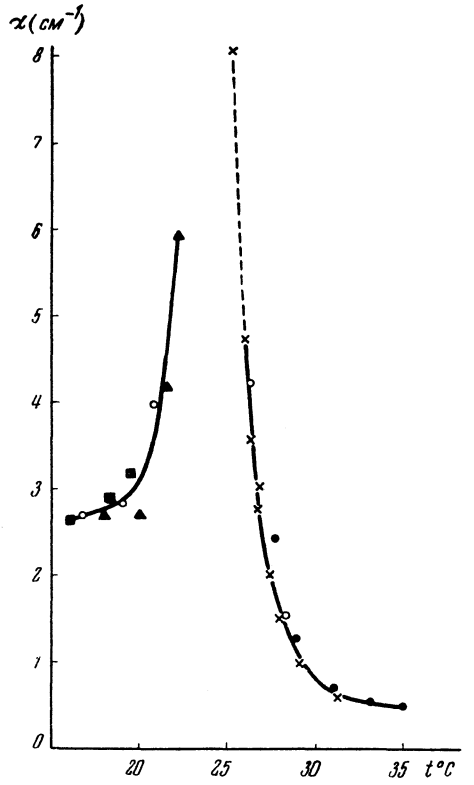
I. A. IAKOVLEV, T. S. VELICHKINA AND K. N. BARANSKII
Moscow State University

(Submitted to JETP editor January 7, 1957)
J. Exptl. Theoret. Phys. (U.S.S.R.) **32**, 935-936 (April, 1957)

SOME TIME AGO Landau and Khalatnikov[1] looked into the problem of the relaxation time necessary for establishing thermodynamical equilibrium in the asymmetric phase of a body undergoing a second-order phase transition. From their calculations it turned out that the relaxation time increases as the temperature of the ordered phase approaches the λ-point. Applying M. A. Leontovich's and L. I. Mandel'shtam's relaxation theory of sound absorption to this problem, Landau and Khalatnikov predicted an increase in the absorption of sound in the absorption of sound in the low-temperature phase near the λ-point.

With the object of observing this phenomenon, we set up an experiment for investigating the absorption of sound in Rochelle salt near its upper Curie point. We used a pulse method for measuring the attenuation of sound in a single crystal of Rochelle salt. Transverse pulses at a frequency of 5 Mcs, 1 to 5 microseconds in length, occurring every 0.002 seconds were introduced into a lamina of Rochelle salt placed in a thermostat. The waves were propagated along the crystallographic z-axis. The oscillations received at the opposite side of the lamina were amplified and fed into cathode-ray oscillograph with a delayed sweep. The attenuation of the sound could be determined from oscillograms of pulses which had passed through different thicknesses of Rochelle salt.

The measured temperature dependence of the amplitude coefficient of absorption of sound α is shown in the Figure. The dotted part of the curve corresponds to a temperature region in which the measurements were only approximate. These results show that the anomalous absorption of sound in a second-order phase transition predicted in a general way by Landau and Khalatnikov does indeed occur in solids,* although the case which we investigated was not specifically taken into account in their work.



It turns out from our experiments that in a ferroelectric substance this phenomenon has its own characteristic features: a transverse sound wave of given polarization undergoes an anomalous absorption; this absorption increases in both phases as their temperatures approach the λ-point. These circumstances have already been explained theoretically by Landau, whose results will, with the permission of the author, be set forth in another more detailed report.

In conclusion it is interesting to note that in a paper (of which Landau and Khalatnikov were unaware) by Huntington[3] devoted to measurements of the elastic constants of various substances by an ultrasonic method, the author describes an observation which now becomes completely understandable. While not citing systematic data for the absorption of sound at different temperatures, Huntington reported, however, that with the apparatus at his disposal it was not possible for him to work with Rochelle salt at temperatures below 26.5°C because of the strong absorption of sound in this crystal. It is now clear that Huntington's observation was related to experimental conditions corresponding to the steep rise of the upper part of the right-hand branch of our curve showing the temperature dependence of α.

Finally, it is perhaps necessary to include within this same set of phenomena the jump in the coefficient of absorption of sound in tin at temperatures near 160°C, observed by Bordoni and Nuovo[4]. Unfortunately the brevity of their report and the absence of quantitative data in it make it difficult to interpret their results, so much more so since the nature of this phase transition in tin is apparently still not completely clear.

The authors are extremely grateful to Academician L. D. Landau for valuable discussions of the results of their experiments.

*This was shown for the phase transition in liquid helium by Pellam and Squire[2].

[1] L. D. Landau and I. M. Khalatnikov, Dokl. Akad. Nauk SSSR 96, 469 (1954).

[2] J. R. Pellam and O. F. Squire, Phys. Rev. 72, 1245 (1947).

[3] H. B. Huntington, Phys. Rev. 72, 321 (1947)

[4] P. G. Bordoni and M. Nuovo cimento 7, Supp. 2, 161 (1950).

Translated by W. M. Whitney
198

Nuclear Interaction in a Photoemulsion at an Energy of 8×10^{13} ev

I. M. GRAMENITSKII, G. B. ZHDANOV, E. A. ZAMCHALOVA AND M. N. SCHERBAKOVA
P. N. Lebedev Physical Institute of the Academy of Sciences of the USSR

(Received by JETP editor January 12, 1957)
J. Exptl. Theoret. Phys. (U.S.S.R.) 32, 936-938 (April 1957)

IN A STACK of unmounted pellicles, Ilford type G-5, 600μ thick (P stack), irradiated in 1955 in