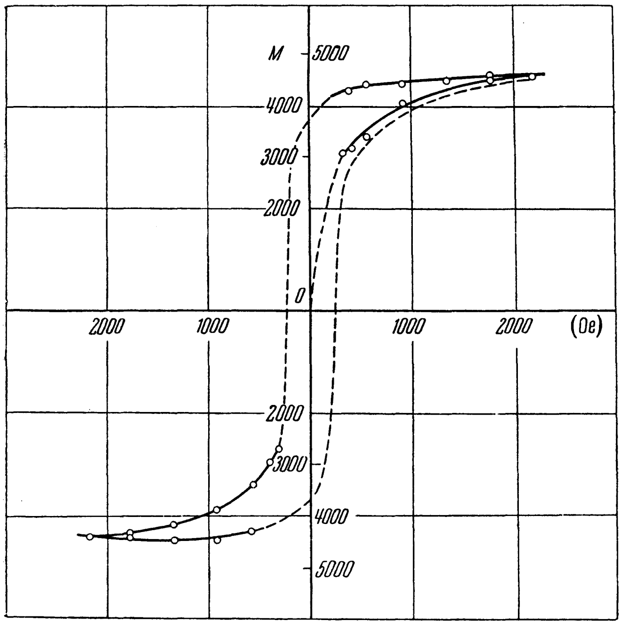

FIG. 2. Dependence of the magnetic moment (molar) of hausmannite on the field ($T = 20.4^\circ$ K).

For comparison, Curve 3 has been drawn in Fig. 1; it corresponds to Curie's law with the constant C_{mol} given above.

Figure 3 shows the curve obtained by us for the temperature dependence of the inverse magnetic susceptibility of braunite (Mn_2O_3). Braunite remains paramagnetic over the whole range of temperatures studied. Below 120° K we observe an anomalous behavior of the susceptibility. The reason for this anomaly is not clear. It may be due to insufficient purity of the sample.

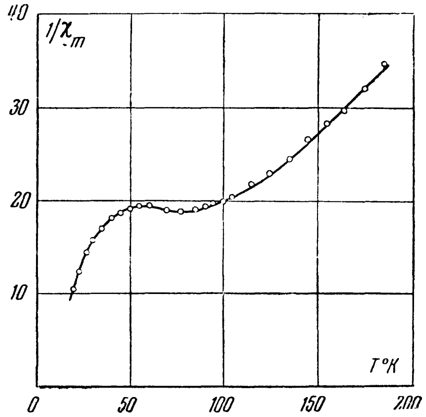

FIG. 3. Temperature dependence of the inverse magnetic susceptibility of braunite (Mn_2O_3).

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Visual Observation of the Stratification of Solutions of He^3-He^4

V. P. PESHKOV AND K. N. ZINOV'EVA
Institute for Physical Problems,
Academy of Sciences, U.S.S.R.

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As WALTERS AND FAIRBANK[1] have recently pointed out, solutions of He^3-He^4 at temperatures below 0.8° K separate into two phases with different concentrations of He^3. Making use of the nuclear resonance technique, these authors carried out measurements of the phase diagram of solutions of He^3-He^4 in the temperature range 0.25–0.85° K.

We have set up experiments on the visual observation of the stratification of solutions of He^3-He To obtain the low temperatures, we pumped vapors of He^3 which were condensed in a small transparent Dewar of volume of about 3 cm^3 (Fig. 1).

A glass ampoule *b* with a volume of about 200 mm^3 (diameter of the ampoule 3.5 mm, height 20 mm) was placed inside the Dewar *a*. The ampoule was joined by the copper link *c* to a thin steel capillary *d*, of internal diameter 0.5 mm, which led out of the Dewar.

The gaseous mixture He^3-He^4 along the capillary was condensed in the ampoule so that the meniscus between the liquid and the vapor remained below the copper connection. A mixture of 51.1% He^3-He^4 concentration was used in the experiment. Condensation took place at 1.1° K. At this temperature, the solution was a homogeneous transparent liquid.

Under a slow decrease of temperature, the solution remained homogeneous down to 0.81° K. The temperature of the solution was determined by the vapor pressure of He^3, measured with a McLeod gauge. Upon reaching a temperature $0.81 \pm 0.01°$ (vapor pressure of $He^3 = p = 3.0 \pm 0.1$ mm Hg), a thin transparent layer appeared on the surface of the liquid. This layer sharply defined the horizontal boundary below.

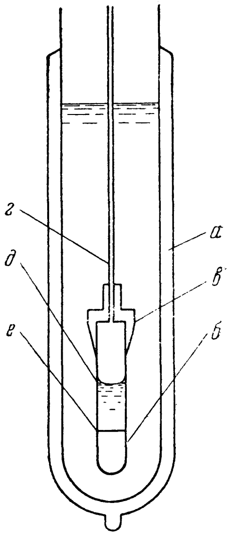

FIG. 1. *a* – Dewar with He^3, *b* – glass ampoule, *c* – copper link, *d* – steel capillary, *e* – liquid-vapor meniscus, *f* – stratification boundary.

As the temperature falls, the boundary dividing the two phases of the solution moves downward; at 0.5° K it occupies a position corresponding to that shown in Fig. 2. Upon increase in the temperature, the dividing boundary slowly rises, and at 0.81° K it combines with the meniscus of the liquid-vapor. In contrast with the concave meniscus of the upper phase, the boundary dividing the two phases has the form of a horizontal line for all temperatures. Shaking and jarring the apparatus has no effect on the position of the boundary.

The temperature of the stratification of the solution with concentration 51.1% was determined by a series of repeated observations of the appearance and disappearance of the boundary on cooling and heating. The value of 0.81° K which we found here agrees well with the measurements of Walters and Fairbank.

FIG. 2. Photograph of stratification of a solution with 51.1% concentration at 0.5° K.

It was of interest to establish whether the liquid in the upper phase was normal or superfluid. Measurements of the λ-transitions in solutions of high concentration, carried out by Daunt and Heer[2], suggest the normal state for this phase; however, their measurements are not sufficiently dependable. In accord with the latest data of Esel'son, Berezniak and Kaganov[3], the curve of the λ-point for solutions with concentrations to 38% is significantly higher than the previous curve[4]. Extrapolation of the data of Esel'son *et al.* in the direction of higher concentrations does not contradict superfluidity of both phases.

We set up an experiment in which a glass test tube, open from above, with inside diameter 1 mm and length 8 mm, was suspended on a wire inside the ampoule. According to the character of the overflow of the stratified liquid, we could say that in all probability, the upper, as well as the lower, phase was superfluid. However, a final conclusion can be made only as a result of a fuller investigation. This investigation of the properties of the solution is continuing at the present time.

The authors express their deep gratitude to Academician P. L. Kapitza for his constant interest and attention to the research.

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Fine Structure of the α-Spectra of U^{234} and U^{238}

B. A. BOCHAGOV, A. P. KOMAR AND
G. E. KOCHAROV
Leningrad Physico-Technical Institute
Academy of Sciences, U.S.S.R.

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FOR THE STUDY OF the fine structure of the α-spectra of long-lived isotopes such as U^{238} and Th^{232}, magnetic spectrometers are practically useless because of their low sensitivity. To solve such problems it is therefore advisable to use pulsed ionization chambers, which exceed the sensitivity of magnetic spectrometers by several orders of magnitude. (The product of source area and solid angle is greater.)

Although they are more sensitive, ionization chambers are somewhat inferior to magnetic spectrometers in resolution. As a rule, the half-width of the lines of the α-spectra of a pulse ionization chamber, which determines its energy resolution, is 50–70 kev. This high value of this quantity is ascribable to circuit noise, in addition to other causes. We were able[1] to reduce the mean square value of the circuit noise to 6.8 kev, which is 3.2 kev less than the best work abroad[2]. In addition, the method of electrical collimation worked out in our laboratory permitted complete utilization of the sensitivity of the apparatus. The resultant apparatus had a line half-width of 30 kev and good sensitivity.

We used this apparatus to study the energy spectra of the α-particles of U^{234} and U^{238}. A natural mixture of uranium isotopes was used as a source of α-particles. The results obtained are shown in Figs. 1 and 2. Figure 1 shows the energy spectrum of the α-particles from U^{234}. Along with the basic group of 4.77 Mev α-particles there is a clearly defined 4.72 Mev group corresponding with the transition to the first rotational level of Th^{230}. The intensities of these two lines are 72 and 28% respectively. These data are in good agreement with the data found by Goldin, Tretyakov and Novikov[3].

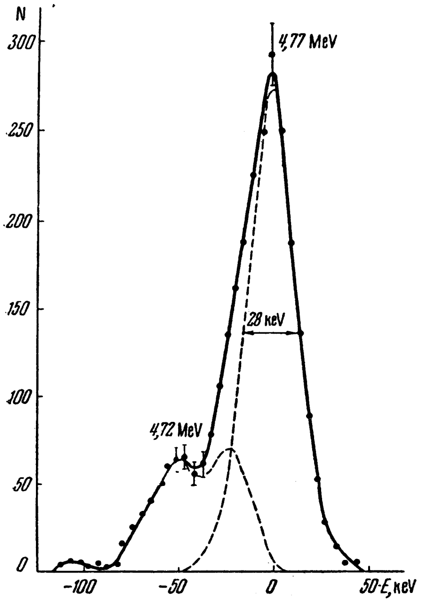

FIG. 1

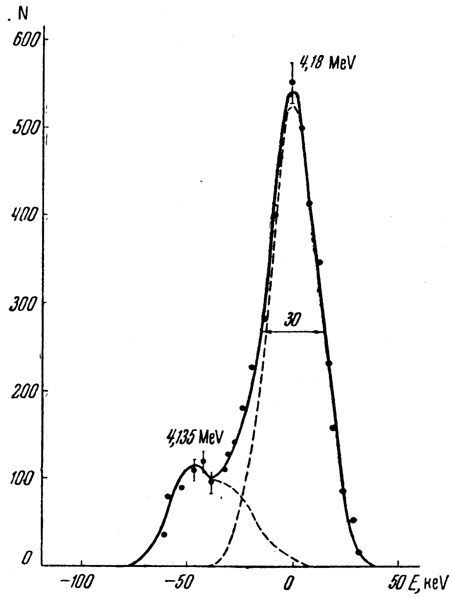

FIG. 2