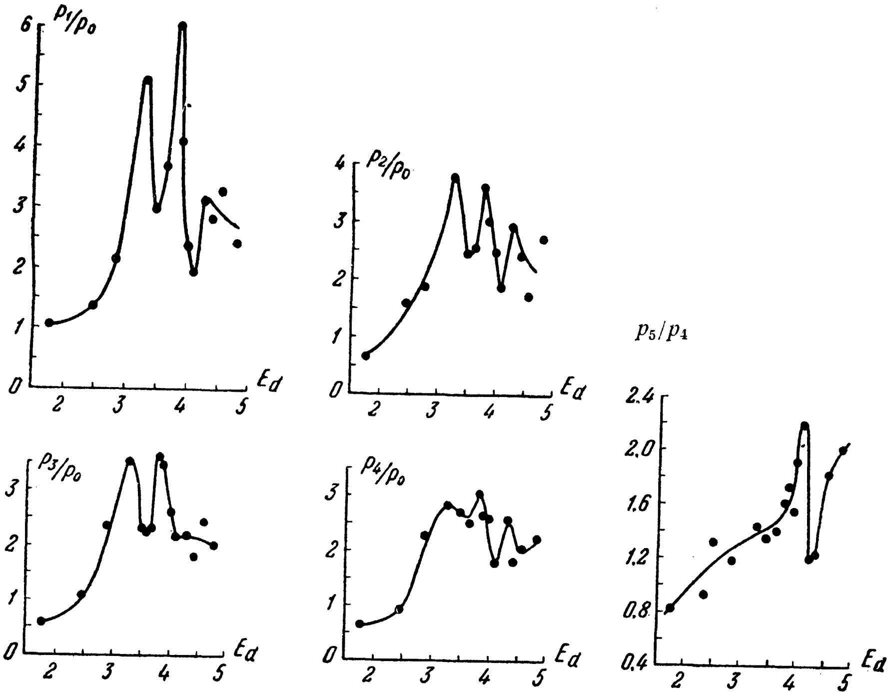

FIG. 2.

4.23 mev, corresponding to the formation of new excited (14.8, 15.3 and 15.7 mev) levels in the P^{30} nucleus. It was observed that these resonances vary with the levels of the final nucleus. The first two ($E_{\text{exc}} = 1.48$ and 15.3 mev) are most clearly pronounced for the ratio p_1 / p_0, and their intensities diminish with diminishing kinetic energy of the proton (i.e., as the ratios p_2/p_0, p_3/p_0, etc., are reached). The third resonance ($E_{\text{exc}} = 15.7$ mev) is most clearly pronounced for the ratios p_5/p_0 or p_5/p_4. Inasmuch as $k_pR \geq 2.5$ (where k_p is the proton wave vector and R the nucleus radius), it is impossible to determine uniquely the spins and parities of the state of the intermediate nucleus from the known spins and parities of the final nucleus.

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152

Measurement of the Saturated Vapor Pressure of a He^3-He^4 Mixture with a High He^3 Concentration

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IN connection with the separation of He^3 from He^4 by rectification, it was necessary to know the phase diagram of the He^3-He^4 mixture at high concentrations of He^3. For this purpose, two series of measurements were carried out for molar concentrations of He^3 in vapor at 97.0 and 94.0%, and in the liquid at about 93.6% in the temperature range from 1.45 to 2.0° K. The separation coefficient was computed from these data.

The saturated vapor pressure was found in the vapor from a known concentration as in the researches of other authors[2,3], by a discontinuity of the pressure composition isotherm, which corresponds to the beginning of condensation. A copper vessel of 31 cm^3 volume was used for the measurement. The thickenss of the walls was 1 mm (Fig. 1*a*). The effective dead volume of the capillaries (internal diameter 1.5 mm) and the manometer was about 150 cm^3. The impurity was introduced into the apparatus in portions from a graduated gas tank. After the introduction of a definite amount, the pressure was established within 0.5-1 mm; it did not change subsequently (in the limits of accuracy of measurement, ± 0.2 mm Hg). The mean error in the determination of the saturated vapor pressure, i.e., the point of onset of condensation, was ± 0.5 mm.

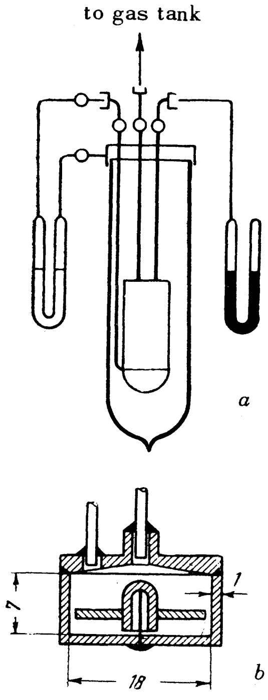

FIG. 1

Control experiments with pure He^4 showed that the isotherms, taken for increase and decrease of the amount of impurity, coincide. For the calculation of the observed difference, the vapor pressure of He^4 in the tank and in the apparatus (of the order of 0.1 mm Hg) a condensation thermometer with liquid He^4 was attached to the lower part of the vessel. Control experiments with pure He^3 gave good agreement (within limits of error) with the data of Abraham, Osborne and Weinstock[4].

The mixtures used in these experiments were prepared by mixing corresponding quantities of pure He^3 and He^4; the concentration $X = N^3/(N^3 + N^4)$ was determined with an accuracy to within ±0.1%.

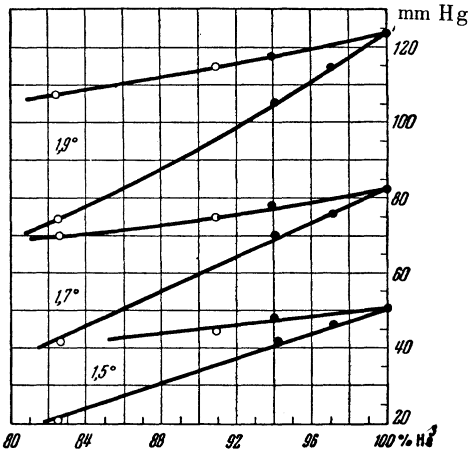

FIG. 2. O—according to Ref. 3; ●—according to the present research.

For the second series of experiments, we used a copper container of diameter 18 mm and height 7 mm (Fig. 1*b*). Slow condensation of the mixture with a concentration of 94.0% He^3 filled the vessel with liquid to about 80-90% of its volume. Before each measurement, the pressure was applied for three minutes at the given temperature. This procedure was sufficient to guarantee that the pressure was established (to within the accuracy of the experiment, ±0.2 mm Hg). A mixer was provided in the apparatus in the form of a magnetized rod that could be set into motion by switching electromagnets. However, it appeared to be unnecessary, since the mixing after the three minute exposure did not change the pressure that had been established. The measurements were taken through the temperature interval from above and below; no hysteresis was observed. The precise value of the concentration in the liquid was determined by the quantity of the mixture in the apparatus, the densiries of the liquid and the vapor, and the concentration in the vapor, which could be determined from

TABLE

in vapor	T°K	P, mm Hg	in liquid	T°K	P, mm Hg
$X_v = 97\%$ He^3	1.497	46	$X_l = 93.6\%$ He^3	1.464	42.4
	1.652	66.7		1.483	45.7
	1.953	127		1.571	57.2
	2.048	151.5		1.657	70
				1.794	94.3
$X_v = 94\%$ He^3	1.509	42		1.861	108.2
	1.648	61		1.915	119.7
	1.963	115		1.975	135.2
	2.048	140			

the pressure on the basis of the results of the first set of experiments. From the relatively weak dependence of the vapor pressure on the concentration in the liquid in the concentration region studied (1 mm at 0.5% He^3 for 2° K), the values of the pressure, obtained from experiments with several different amounts of liquid and, consequently, different concentrations (from 93.8% to 93.4% He^3), lay at the limits of accuracy of the pressure measurement on one curve. For this same reason it was possible to neglect the change in the vapor concentration by diffusion (during the course of the experiment) in the conducting tubes.

The temperature of the apparatus was determined from the vapor pressure of He^4 in the tank (taking into account the corrections mentioned above for the first set of experiments) to within ±0.001° K (the 1949 tables were used).

The results that we obtained are shown in the Table. Phase diagrams were constructed from these for the mixtures of He^3-He^4 for the temperature and concentration region under investigation (Fig. 2). Plotted in the same graph are the data of Esel'son and Beresniak[3]. As is evident from the graphs, our results and those of Ref. 3 are in satisfactory agreement.

The separation coefficient

$$k = X_v(1 - X_l)/(1 - X_v)X_l$$

for the values of concentration studied is equal to 3.0 (±20%) and (with the accuracy pointed out) does not depend on the temperature in the interval 1.5-2.0° K.

The authors take this opportunity to express their thanks to A. I. Filimonov for his help in carrying out the experiments.

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153

Ionizational Slowing Down of High-Energy Electron Positron Pairs

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THE components of a high energy electron-positron pair of energy E separate with the small angle $\theta \sim mc^2/E$. The interference of the electron and positron fields at a small distance from the point of creation leads to a smaller ionization than that which would be caused by two electrons. This phenomenon was theoretically examined by Chudakov.[1] The aim of the present note is to give another derivation of the equations of the ionizational slowing down of a pair and to clarify the limitations of such a development.

We make use of a method first shown by Landau (Ref. 2, p. 145) for the derivation of the equations of ionization loss at high energies (in the region of the polarization effect). If the positron and electron are at a particular moment of time t at