ever their statistical reliability is not large. At the present time no data are available that either confirm or deny the existence of these maxima.

An indication of the possibility of a resonance in the (KN) system at an energy of 1710 MeV has also been obtained in the work of Barmin et al;[8] the possible existence of a resonance at 1680 MeV in the ($\Lambda\eta$) system has been discussed by Ioffe.[9] Previously[10] it had been discovered that part of the K^0 mesons are secondary, arising from the decays

$$Z^0 \rightarrow K^0 + \Lambda^0 + Q, \qquad (2)$$

where Q, the binding energy, is equal to ~ 40 MeV.

The analysis of the experimental data shows that the K^0 mesons from reaction (2) give values of m^* in the interval 1.8—1.97 BeV and grouped near the maximum possible value $m^* = 1.97$ BeV.

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CURVES OF THE COMMENCEMENT OF SOLIDIFICATION OF HELIUM ISOTOPE SOLUTIONS

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In recent years the thermodynamic properties of solutions of He^3 in He^4 have been investigated in great detail. The exception is the equilibrium diagram of the liquid and solid phases of this solution system for which only limited data are available.[1,2]

To obtain the data necessary for plotting this equilibrium diagram, we carried out experiments to establish the relationship between the solidification pressure and the composition of the liquid phase. Use of the method of thermal analysis allowed us to determine the temperature and pressure at the commencement of solidification of a solution of known composition by recording the kinks on the time dependences of these quantities.

The calorimeter temperature was measured with a carbon resistance thermometer. The pressure inside the calorimeter was found from the elastic deformation of the calorimeter walls. The deformation was deduced from the increase in resistance of a strain gauge in the form of a constantan wire wound on the cylindrical surface of the calorimeter.

Using this method the curves for the initial stage of solidification were obtained for solutions containing 10.3, 24.1, 53.0, and 76.4% He^3, and calibration tests with He^4 were performed at temperatures from 1.5 to 4.2°K at pressures up to 140 atm. The average error in measurement of the temperature did not exceed 0.01 deg K and in determination of the pressure the error was 0.5 atm. The results are given in Fig. 1 which shows that with increase of the light isotope content of the solution the pressure at the commencement of solidification increases monotonically at all test temperatures. For comparison Fig. 1 also includes the solidification curve of pure He^3 obtained by Grilly and Mills.[3]

The results obtained allow us to plot the dependence of the solidification pressure on the composition of the liquid phase for various temperatures (the "liquidus" line) which is shown in Fig. 2.

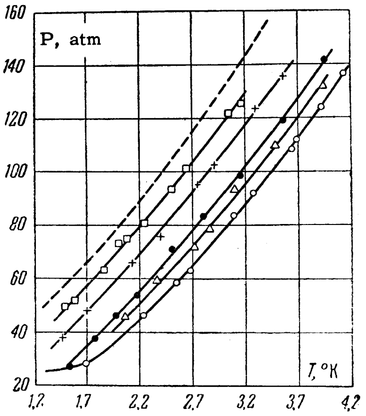

FIG. 1. Temperature dependence of the pressure at the commencement of solidification of helium isotope solutions containing various amounts of He^3. Molar concentrations of He^3 in the solutions were (in %): ○ – zero (continuous line plotted from the data of Swenson;[4] △ – 10.3; ● – 24.1; + – 53.0; □ – 76.4; dashed curve represents pure He^3.[3]

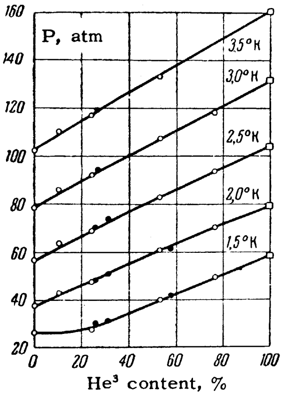

FIG. 2. Dependence of the solidification pressure of helium isotope solutions on the liquid phase composition: ○ – results of the present work; ● – results obtained by the blocked-capillary method; □ – data of Grilly and Mills for pure He^3.

The latter figure also includes the results obtained by the blocked-capillary method.[1]

The form of the isotherms and the good agreement with the results of measurements by the blocked-capillary method allow us to conclude that the equilibrium diagram of the liquid and solid phases probably has a narrow phase separation region.

It is worth noting that the results reported also agree satisfactorily with data obtained recently in the temperature range 1.0—2.1°K,[2] but the absence of a table in this work makes it difficult to carry out a detailed comparison.

Experiments to determine the completion of the solidification of solutions of He^3 in He^4 are being carried out.

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STAR PRODUCTION IN AN EXPANDING UNIVERSE

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EXPANSION of strictly uniform matter, of infinite density at the initial instant of time, is at present the only reasonable explanation for the earlier stage of evolution of the universe. Is it possible for uniform matter to segregate into individual stars and nebulas as a result of gravitational instability in an expanding universe? As will be shown below, to get an affirmative answer it is essential to take account of the phase transition from the solid to the gas during the course of the expansion.

E. Lifshitz[1] has shown that small density perturbations increase with time in proportion to the radius of the world, so that $\delta\rho/\rho \sim R \sim \rho^{-1/3}$. This result holds for the period when the pressure is small compared with the energy density, $p \ll \rho c^2$, that is, starting with nuclear density, $\rho = 10^{14}$ g/cm^3. Since the density now is not less than 10^{-30} g/cm^3, the perturbations increase by not more than $(10^{-30}/10^{14})^{-1/3} = 5 \times 10^{14}$ times. The sun contains about 10^{57} nucleons, and the galaxy about 10^{68}. Regarding the nucleons at the start of the period as independent, we obtain for the density-fluctuation probabilities at the start of the period an estimate $\delta\rho/\rho = \frac{1}{2}\sqrt{N}$, that is, 3×10^{-29} for the sun and 10^{-34} for the galaxy. These fluctuations are so small, that if we increase them by 5×10^{14} we still do not obtain an appreciable quantity.[1)] It is therefore concluded[1] that "it can apparently be assumed that this mechanism cannot cause separation of the matter into individual nebulas."