energy should be given as a function of the nuclear temperature Θ by a common expression of the form

$$E = \alpha \cdot \Theta^n. \qquad (2)$$

According to Landau and Weisskopf, $\alpha \cong \alpha_0 \cdot A$ and $n = 2$, while according to Bethe $\alpha = \beta \cdot A^{2/3}$ and $n = 7/3$. It may be shown quite generally that there does not exist any power dependance of E upon Θ which agrees with the non-monotonic variation of D exhibiting a sharp minimum at $A = 160$, at any rate if we assume $\alpha \sim A$ or $\alpha \sim A^{2/3}$. Thus the shift of D shows, either (I) that not all nuclei are in the same thermodynamical state at excitations equal to Q, which excitations for the heavier nuclei correspond to lower temperatures, or (II) that the coefficient α in equation (2) is a complicated and possibly non-monotonic function of A, due perhaps to the variation with A of the relative effects of the electrical and short-range nuclear forces.

The first possibility, which seems to us to be the more likely one, means that the properties of excited nuclear matter change at a certain temperature. So we arrive at the *hypothesis of phase transitions of nuclear matter*. This hypothesis is especially attractive since it makes nuclear matter analogous to two other quantum 'liquids', namely liquid helium and the conductivity electrons which also undergo phase transitions at low temperatures. Perhaps phase transitions are a common property of any liquid exhibiting sharply expressed quantum properties, but only the further experimental study of the structure of the nuclear energy spectrum can ascertain whether nuclear matter really exists in two different phase modifications.

The same hypothesis of phase transitions has also been suggested simultaneously by Dr. I. Pomeranchuk. A more detailed discussion of the problem will be published in a paper to appear in the *Physical Review*.

I. GUREVICH.

Radium Institute,
Academy of Science of the U.S.S.R.,
Leningrad.
July 2.

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Effect of Tube-Length on the Visibility of Dust Particles with an Oil-immersion Objective

WHEN a well-corrected oil-immersion objective is used to examine dust particles mounted in a medium such as Canada balsam, of similar refractive index to the oil, the finer particles will give a very similar image on either side of the correct focus, provided the objective is used at the tube-length for which it is designed. We have found, however, that if the dust deposit is mounted dry on the underside of the microscope cover-glass, the image on either side of the correct focus is not the same at the specified tube-length, and in order to obtain the best images, the tube-length must be reduced.

The dust deposits which are collected on a cover-glass by the thermal precipitator are mounted dry in the above way, and examined with a 2-mm. apochromatic oil-immersion objective, *N.A.* 1·30. In these circumstances a considerable fraction of the finest particles are not visible unless the tube-length is reduced until the images on either side of the focus are similar. The necessary reduction in tube-length is of the order of 2 or 3 cm., an amount which is often beyond the tube-length adjustment of an ordinary microscope. An equally satisfactory correction can, however, be obtained by using the adjustable tube-length corrector designed by the British Scientific Instrument Research Association, at the tube-length specified for the objective.

The details of this investigation and of certain other factors which affect the counting of dust particles will be published elsewhere.

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D. G. BEADLE.
H. S. PATTERSON.

Physico-chemical Investigation Department,
Transvaal Chamber of Mines,
Johannesburg.
June 29.

Electronic Conduction of Magnetite (Fe_3O_4) and its Transition Point at Low Temperatures

WE have measured the electronic conductivity, down to liquid nitrogen temperature, of a number of iron oxides of the homogeneous 'Fe_3O_4' phase, especially as a function of the exact stoichiometric composition of the material. This seemed of theoretical interest for several reasons:

(*a*) Fe_3O_4 is an abnormally good conductor among the semi-conductors with partially filled lattice bands[1].

(*b*) Fe_3O_4 has a very remarkable crystal structure involving a probably statistical distribution of both Fe^{2+} and Fe^{3+} ions at equivalent lattice points[1].

(*c*) There are indications that Fe_3O_4 shows a transition point in the neighbourhood of 120° K. Anomalies in the magnetic behaviour[2] at 120° K., in the specific heat[3] and in the lattice constant[4] at 114° K., have been found. The magnetic anomaly, however, depends on the mode of preparation[5].

We thought it possible that the statistical distribution of Fe^{2+} and Fe^{3+}, which is a statistical distribution of electrons about the double number of lattice points containing Fe^{3+}, and which accounts for the rather high electronic conductivity of magnetite, would lead to some type of order at lower temperatures. A transition of this kind would probably offer an explanation of the anomalies at 120° K. One would expect such a transition to be very sensitive to the ratio Fe : O in the crystal, since an excess of oxygen (solid solutions of Fe_3O_4 and γ-Fe_2O_3) would imply: (*a*) vacant lattice points in the 16-fold position[6] containing, in stoichiometrically pure Fe_3O_4, 8 Fe^{++} + 8 Fe^{+++}, and (*b*) an increase of the ratio $Fe^{3+} : Fe^{2+}$ at this lattice position; both factors would be unfavourable with respect to order. For the irregularities found by Hilpert and Forrer this would supply an explanation more satisfactory than that put forward by these authors.

Furthermore, one would expect that such a transition, involving the conducting electrons, would be accompanied by very pronounced effects in the specific resistance at the transition temperature.

Actually we have found a strong discontinuity in the resistivity curves of some Fe_3O_4 samples, and a considerable influence of the ratio Fe : O.

The main difficulty consists in the preparation of