because of the interaction between the electrons, there is a finite probability for the energy (and momentum) of an electron in one part of the core to pass directly to another electron in some other part of the core without the intervening process of radiation taking place: that is, in the degenerate core the transfer of energy mostly takes place by the radiationless process and this energy is then converted into radiation in the non-degenerate envelope surrounding the core. Because the energy is transferred by the radiationless process, the 'opacity' may be (as in the case of the radioactive atom) considerably higher than it would be if this transfer of energy took place in the form of radiation. *We may thus connect the discrepancy in stellar opacity to the same cause as that of the internal photoelectric effect in the atom.*

Another interesting point which may be mentioned is that of the emission of high-speed electrons from the white dwarfs, which are almost completely degenerate, and hence the chances of collision for an escaping electron are very small. These high-speed electrons *will in some cases have energies comparable to the cosmic radiation.* In fact, it can be easily seen that due to this electron escape a black dwarf will lose almost all of its mass—*the final state of a black dwarf is a diffuse mass.* These considerations will be published elsewhere in detail.

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April 19.

[1] Ellis: a very lucid account is given in *Science Progress*, April 31, p. 615.
[2] Fowler, *Proc. Roy. Soc.*, vol. 129, p. 1.
[3] Milne, *Mon. Not. Roy. Ast. Soc.*, vol. 91, p. 4.
[4] *Observatory*, Feb. 1931, p. 36.

Coherent Expanded Aerogels and Jellies.

THE continuity of the liquid permeating jellies is demonstrated by diffusion, syneresis, and ultrafiltration, and the fact that the liquid may be replaced by other liquids of very diverse character indicates clearly that the gel structure may be independent of the liquid in which it is bathed. Hitherto the attempt to remove the liquid by evaporation has resulted in shrinkage so great that the effect upon the structure may be profound.

Mr. Charles Learned and I, with the kindly assistance and advice of Prof. J. W. McBain, undertook to test the hypothesis that the liquid in a jelly can be replaced by a gas with little or no shrinkage. Our efforts have met with complete success.

The procedure that we have adopted is as follows: The jelly is first formed in a suitable liquid in dilute form. The liquid is then replaced by another which does not dissolve the structure and has a reasonably low critical temperature. Alcohol has proved quite satisfactory for most of the inorganic gels, ether has advantages in the case of easily reduced substances, and propane was used for all of the organic jellies. In making the replacement, it is necessary that each liquid used be completely miscible with both that which precedes and that which follows it. For example, water may be replaced by alcohol and then by ether. Mere evaporation would inevitably cause shrinkage. However, the jelly is placed in a closed autoclave with an excess of liquid and the temperature is raised above the critical temperature of the liquid, while the pressure is maintained at all times at or above the vapour pressure, so that no evaporation of liquid can occur and consequently no contraction of the gel can be brought about by capillary forces at its surface.

When the critical temperature is passed, the liquid has been converted directly into a permanent gas without discontinuity. The jelly has had no way of 'knowing' that the liquid within its meshes has become a gas. All that remains is to allow the gas to escape, and there is left behind a coherent aerogel of unchanged volume.

Silica aerogel with a density so low as 0·1 is very easy to prepare, and we have prepared some with a density of only 0·02. The silica aerogels are highly opalescent, although quite transparent; they display a glassy fracture and small pieces emit a metallic ring when dropped.

So far, we have prepared silica, alumina, nickel tartarate, stannic oxide, tungstic oxide, gelatine, agar, nitrocellulose, cellulose, and egg albumin aerogels and see no reason why this list may not be extended indefinitely. Apart from the scientific significance of these observations, the new physical properties developed in the materials are of unusual interest.

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Two Modifications of Liquid Nitrobenzene.

THE changes of dielectric constant and density of liquid nitrobenzene with temperature, studied by one of us (J. M.) and described in communications to NATURE, suggest that at 9·5° the liquid undergoes an energy transformation analogous to that found for liquid helium by M. Wolfke and W. H. Keesom,[1] and for liquid ethyl ether by M. Wolfke and J. Mazur.[2]

To confirm this supposition we have made a study of the heating curve of carefully chemically purified nitrobenzene. Nitrobenzene cooled to a temperature lower than the point in question (6° C.) was contained in a Dewar vessel provided with a nickel-plated

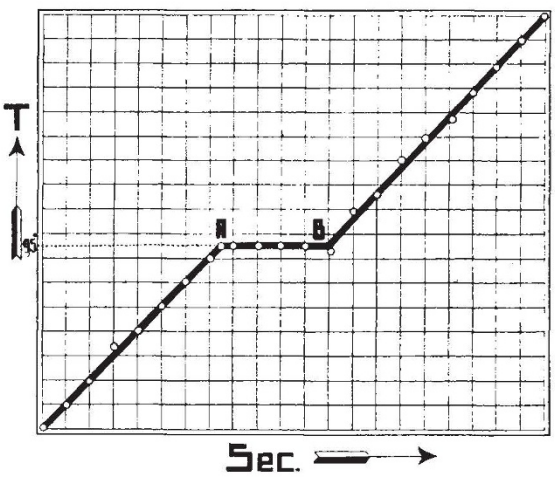

FIG. 1.

refrigerator. We have studied the change with time on gradually increasing the temperature of nitrobenzene which was isolated from all external disturbances.

The platinum resistance thermometer, calibrated with the aid of the standard thermometer of the Cryogenic Laboratory at Leyden, was used as a stirrer.

The experiments were repeated three times and they show that at 9·5° there is a distinct slowing down of the rate of change of temperature (see the part *A B* of the curve, Fig. 1). The parts of the curve above and below the point 9·5° are parallel straight lines, which