Every registered curve can serve for the determination of a point of the curve that indicates the relation between rate of crystallisation and boundary temperature. The sum of the temperature of the thermostat and the rise of temperature following from the curve, gives the boundary temperature. The temperature of the thermostat and the dimensions of the tube determine the velocity of crystallisation, which can be derived from the results of the measurements carried out with this purpose (p. 698).

In fig. 4 the abscissa is the temperature of the boundary plane of the phases and the ordinate the velocity of crystallisation. As appears from the figure, the temperature does not reach the melting-point (42°) in any of the measurements, but always remains far below it [1]. The observations yielding temperatures of the boundary above 29° are of no value in consequence of the phenomenon mentioned on p. 698, hence they have not been reproduced in fig. 4. When one wants to determine the portion of the curve above 29°, another experimental method must be followed, in which the process of solidification has a mathematically defined course also near the melting-point, and does not depend on accidental disturbances.

I am greatly indebted to the instrument maker of the Physical Laboratory, Mr. G. KOOLSCHIJN, for the trouble he has taken boring the holes in the tubes used by me.

Institute for Theoretical Physics.

Utrecht, June 1920.

[1]) J. PERRIN, Ann. de Phys. Tome XI, serie 9, p. 96. 1919.

Physiology. — *"On the Observation and Representation of Thin Threads"*. By Prof. W. EINTHOVEN.

(Communicated at the meeting of September 25, 1920).

A full discussion of this subject will be published elsewhere; a few conclusions, however, may be given here.

1. Threads of 0.1 to 0.2 μ can easily be observed with the naked eye as light lines on a dark background. Without difficulty they can be shot or blown, fixed, transferred, put under the microscope, bombarded, and stretched out in the galvanometer.

2. Any thread that can exist, however thin it may be, can be made ultra-microscopically visible, when we are only able to bring it under the microscope in an efficient way. When it is assumed that in case of uniform radiation of a thread the quantity of light reflected by it, decreases in direct ratio to its diameter, the diameter of the thinnest thread visible is calculated at $0{,}2 \times 10^{-6}\,\mu\mu$, By way of comparison it may be said that the diameter of a hydrogen molecule is about a million times larger.

3. The power to see the thinnest *dark thread against a light background* with the unaided eye is not determined by the dimensions of the cones on the retina, but by the power to distinguish two degrees of brightness. Two luminous points or luminous lines which approach each other more and more are still observed separately when they are represented on the retina at a distance apart corresponding to the diameter of a cone at which they appear at a visual angle of 60″; a thread, however, can still be seen at an angle of 2″.

4. Every circumstance which renders the microscopic image of a dark thread against a light background less sharp, increases the apparent diameter of the thread. As no microscope comes up to ideal demands, it may, therefore, be assumed, that the results of the measurements made with this instrument either agree with reality or give too high values, so that the threads mentioned in this paper are really 0,1 or 0,2 μ thick or thinner.

5. The conditions to observe the thinnest dark thread against a light background with the microscope, and represent it, are different from those which hold for seeing two luminous points or lines separate

which approach each other more and more. If the aperture of the projection-objective is N and the wave-length of the light λ, the distance of the still distinguishable points or lines is generally assumed to be:

$$l \geqq \frac{\lambda}{2N},$$

which for $N = 0,95$ and $\lambda = 0,6\,\mu$ yields the value of $0,31\,\mu$ for l. The central diffraction-discs, which are formed in the image of each of the two luminous points, overlap for the distance of the length of the radius of the discs.

On the other hand a thread of $0,2\,\mu$ is represented sharply defined and contrasted with an objective of the same aperture. The edges are so sharply drawn that a number of small unevennesses becomes separately visible.

6. When the same thread is represented with an objective the aperture of which is 0,18, the image becomes, indeed, less sharply contrasted and less definite, but it remains clear enough to be useful for many purposes. In this the central diffraction discs formed of a luminous point on one edge of the thread, and of one of an opposite point on the other edge overlap to an amount of $P = 94\,^0/_0$ of the diameter of the discs.

7. In the direct observation of threads without application of the microscope we found as maximum values of P.... $98,2\,^0/_0$ and $98,5\,^0/_0$. Probably equally great and even greater values of P can be reached in the case of microscopic representation.

8. There is every reason to assume that with commercial objectives a serviceable image may still be obtained of a thread of $0,04\,\mu$.

At the meeting photos were, in fact, exhibited of a bombarded quartz thread, the diameter of which was to all probability of the said order of magnitude.

Astronomy. — *"The Distance of the Dark Nebulae in Taurus"*. By Dr. A. PANNEKOEK. (Communicated by Prof. J. C. KAPTEYN).

(Communicated at the meeting of Sept. 25, 1920).

§ 1. Various investigations made in recent years, have demonstrated ever more clearly the existence of dark cosmic nebulae, that aborb and weaken the light of the stars behind them. Between the luminous patches and streams in the Galaxy, dark spots and cavities are seen, which were originally considered as empty spaces in the star-filled galactic system. The improbability of these empty spaces extending as conic tubes through HERSCHEL's lenticular star-system, with our sun as vertex, constituted one of the main arguments for the conception of the Galaxy as a ring of no great extension in depth. For a long time the possibility that they should originate by means of absorption has played no part in the theories concerning the structure of the universe.

It is through the photographs of MAX WOLF and BARNARD that we first have become acquainted with numerous details scarcely allowing of any other interpretation. Small dark spots are to be seen in the midst of the luminous star clouds; long, dark, fantastically shaped lanes intersect the luminous parts, and are evidently connected with faintly luminous nebulae. MAX WOLF has repeatedly pointed out the existence of extensive absorbing nebulous masses, as one of the main causes that determine the aspect of the Galaxy. The galactic system is then to be considered as a mixture of dense starclouds, luminous nebulae and dark nebulous masses.

In an investigation of some star-photographs in Aquila [1]), comprising the densest parts of a starcloud and also a black spot therein, the author of the present article found that in the black spot the densities of the stars from the 11^{th} to the 15^{th} magnitude were all smaller in the same proportion, compared with the cloud besides it; if the spot were caused by absorption, the absorbing substance should therefore not lie in the far depths of the starcloud, but a great deal nearer by, so that it was only accidentally projected against this luminous background.

1) A. PANNEKOEK. Investigation of a galactic cloud in Aquila. Proceedings R. A. of S. Amsterdam, Vol. XXI, Nr. 10. (March 1919).