Physics. — "*Note on the melting point of palladium and* WIEN'S *constant* c_2." By G. HOLST and E. OOSTERHUIS. (Communicated by H. KAMERLINGH ONNES.)

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1. Recently E. WARBURG [1]) has published new rules for the standardizing of thermometers by the Physikalisch-technische Reichsanstalt at Berlin. In the notes appended, it is stated that the intensities of radiation of the black body at the melting point of palladium and that of gold for $\lambda = 0{,}6563\,\mu$ are in the ratio of 81.5 to 1.

From WIEN'S radiation-formula it follows that:

$$\frac{\lambda}{M} log_{10} \frac{E_{Pd\ mp}}{E_{Au\ mp}} = c_2 \left(\frac{1}{T_{Au\ mp}} - \frac{1}{T_{Pd\ mp}} \right) = L.$$

where $M = log_{10}\, e$ and L is a constant.

It follows from the data given by WARBURG that $L = 2{,}8880$.

This constant may also be derived from measurements of other observers. W. W. COBLENTZ [2]) has made a number of determinations of c_2 which are based on the melting points of palladium (1549), copper (1083), antimony (630.0) and zinc (419.2) as a scale of temperatures. All observers agree that on the scale which is fixed in this manner the melting point of gold lies at 1063°. Calculating L from his value of $c_2 = 14465$ and the melting points of palladium and gold, we find $L = 2\,8880$.

In the Astrophysical Journal, Vol. 42, p. 300, 1915 E. P. HYDE, F. E. CADY, and W. E. FORSYTHE publish some measurements, from which L may again be derived. It follows from their results that at $\lambda = 0{,}6648\,\mu$ $\frac{E_{Pd\ mp}}{E_{Au\ mp}} = 76{,}9$ and therefore $L = 2{,}8869$. The differences between these values for L may be explained by a deviation of the melting of palladium of only $\pm$ 0°.25. A better concordance, therefore, cannot be expected. [3])

Whatever therefore the thermodynamic temperature of the melting point of palladium may be, it will always be necessary to assign a value to c_2 such that

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1) For instance Ann. d. Phys. (48), 1034, 1915.

2) Bull. Bur. of Stand. (10), 76, 1914.

3) Other series of observations (see F. HENNING, Temperaturmessung p. 240), also yield values for L which do not deviate much, with the exception of that of HOLBORN and VALENTINER, which is 2.7 % larger.

$$\left(\frac{1}{1?36} - \frac{1}{T_{Pd\,smp}}\right) c_2 = 2{,}888.$$

Sufficient attention has not always been paid to this relation. For instance in Circular 35 of the Bureau of Standards 2nd edition 1915 side by side with the melting point of palladium 1549° the value $c_2 = 14500$ is found. This would give $L = 2{,}895$, a value which is 0,25 °/₀ too high, whereas the experimental determinations do not differ from each other by more than 0,03 °/₀.

I. LANGMUIR [1]) assumes $c_2 = 14392$. M. PIRANI [2]) $c_2 = 14400$.

In consequence of this greater uncertainties arise than are necessary in view of the good agreement of the most recent measurements.

2. The above discussion naturally leads to a simple method of standardizing optical pyrometers, provided with colour-filters. The ratio v is measured of the intensities transmitted by the filter at the melting points of palladium and of gold. The effective wave-length may then be derived from

$$\lambda = \frac{LM}{\log v} = \frac{1.2542}{\log v}.$$

As an instance, if the red filter N°. F 4512 of SCHOTT and GEN. is taken about 5,8 mm. thick, and the effective wavelength between the two points is determined, the effective wave-length for other ranges of temperature may be derived from HYDE's calculations. In this manner a very simple method of standardising is obtained.

Summary:

To a given value of the melting point of palladium a definite value for c_2 corresponds.

If the melting point of palladium is taken as 1549° (scale of DAY and SOSMAN) c_2 must be taken equal to 14465 ± 5. If on the other hand c_2 is taken 14300 (P.T.R. scale), it follows that the melting point of palladium is 1557°.

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[1]) Phys. Rev. (7) 153, 1915.

[2]) Verh. D. phys. Ges. (17) 226, 1915.