p-Hydroxybenzil

By oxidizing p-hydroxydeoxybenzoin with chromic anhydride in acetic acid, Weisl[1] obtained a substance, m.p. 175°, which he claimed to be p-hydroxybenzil. He described it as an amorphous powder, crystallizable with difficulty from aqueous ethanol in the form of orange needles; in alcoholic solution, it gave a deep red colour with potassium hydroxide.

Recent work in these Laboratories has shown that p-methoxybenzil[2], when demethylated with hydrobromic acid, gives a p-hydroxybenzil, m.p. 129–130° (found: C, 74·1; H, 4·7. $C_{14}H_{10}O_3$ requires C, 74·3; H, 4·5 per cent) (acetyl derivative, m.p. 67°), which crystallizes readily from benzene or aqueous ethanol in pale yellow needles; with potassium hydroxide its alcoholic solution assumes a deep golden-yellow colour, evidently due to heightened resonance effects in the anionic form of the molecule. The same compound has been obtained almost quantitatively by the oxidation of p-hydroxydeoxybenzoin with selenium dioxide and in a small yield by the application of Weisl's method to p-acetoxydeoxybenzoin with subsequent deacetylation of the product. It seems very probable, therefore, that Weisl, through omitting to protect the hydroxyl group during his oxidation, obtained some product of more complex nature which he wrongly assumed to be p-hydroxybenzil.

The reaction of p-hydroxybenzil, m.p. 129–130°, towards urea and sodium ethoxide in ethanol proceeds in the normal manner to give a mixture of the hydantoin and the glycoluril. 5-Phenyl-5(p-hydroxyphenyl) hydantoin, recently mentioned but not characterized by Melton and Henze[3], has m.p. 311° (decomp.) (found: C, 66·7; H, 4·9. $C_{15}H_{12}O_3N_2$ requires C, 67·2; H, 4·5 per cent); this compound is also produced by the demethylation of 5-phenyl-5(p-methoxyphenyl) hydantoin, m.p. 224–225°, obtained from p-methoxybenzil and urea by the standard method. All melting points are corrected.

Further details of this work will be incorporated in a later publication.

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[2] McKenzie, A., Luis, E. M., Tiffeneau, M., and Weill, P., *Bull. Soc. chim. Fran.*, **45**, 418 (1929).
[3] Melton, J. W., and Henze, H. R., *J. Amer. Chem. Soc.*, **69**, 2018 (1947).

Auroral Activity in Southern Norway from the Middle of August to the Middle of October, 1947

Corresponding to the very high solar activity last autumn, an unusual number of auroras have occurred in southern Norway; I have never before seen so many auroras in so short a time. Thanks to fine weather conditions, all my aurora stations have been in action and a great number of pictures have been obtained for the determination of height and position of the auroras.

Auroras were observed between the following dates and the next one: August 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 28; September 3, 7, 11, 13, 14, 15, 17, 18, 24, 25; October 1, 2, 3, 5, 7, 8, 10, 11, 12, 13, 14, 17, 18. On August 15 and September 3, 7 and 24, auroras formed a corona. On several occasions red rays and red surfaces were seen.

Photographs were taken from my stations on August *13*, *15*, 16, *18*, 19, 21, *22*, 25, 28, September *3*, 7, 11, *15*, *17*, *18*, *24*, *25* and October *2*, *7*, *13*, 17, 18. On the dates printed in italic type, pictures were taken from two, three, four or five stations simultaneously. In all, 1,920 photographs could be used, among which 398 sets were suitable for height determination.

Of special interest were the photographs taken on August 15–16. During that night Lovell, Clegg and Ellyett obtained for the first time radar echoes from the aurora[1], a fact which, if verified, may have the greatest importance for future auroral research. 125 successful pictures were taken that night from my stations, Oslo, Dombås, Holmestrand, Askim and Kongsberg, which gave twenty-eight sets of simultaneous pictures. Of these, eight sets have been measured, giving, among other things, heights of summits of sunlit auroral rays equal to 539, 774, 520, 541, 452, 425, 573, 590, 730 and 657 km., which is of the same order as the heights found by radar.

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[1] *Nature*, **160**, 272 (1947).

Lorentz-like Transformations

The analogy between Dingle's relativistic theory of temperature radiation[1] and the special theory of relativity may be given precise mathematical form by the introduction of a transformation of which those due to Lorentz and Dingle are special cases. This may assist in the further development of the thermal theory.

Consider quantities a and t which transform according to

$$\left.\begin{aligned} da' &= g(b_1)\,(da - b_1 dt), \\ dt' &= g(b_1)\,h(b_1, b)\,dt, \\ b' &= (b - b_1)/h\,(b_1, b), \end{aligned}\right\} \quad (1)$$

g and h being continuous functions of their arguments. The quantity b is defined as da/dt and b_1 is a particular value of b which acts as a parameter of the transformation. With

$$g(0) = 1 \equiv h(0,b) \quad (2)$$

the transformation goes over into the identity as $b_1 \to 0$.

As invariant metrics of the transformation (1) the special forms (i) $da^2 - dt^2$, (ii) $dt(dt - da/k)^3$ are of interest, k being a constant. In case (i) the two-dimensional Lorentz transformation is obtained from (1) in the form

$$\left.\begin{aligned} da' &= \frac{da - b_1 dt}{(1 - b_1^2)^{1/2}}, \\ dt' &= \frac{dt - b_1 da}{(1 - b_1^2)^{1/2}}, \end{aligned}\right\} \quad (3)$$

whereas case (ii) yields Dingle's transformation:

$$\left.\begin{aligned} da' &= \frac{da - b_1 dt}{(1 - b_1/k)^{1/4}}, \\ dt' &= (1 - b_1/k)^{3/4}\,dt. \end{aligned}\right\} \quad (4)$$