istic functions which belongs to the Schrödinger equation for the variable in question, each function corresponding to a certain value of the variable; the measurement can then be regarded as consisting in a physical separation of the terms in this expansion, followed by a detection of the system as being in a place or state corresponding to one of them; [2] in other words, as a generalised Stern-Gerlach experiment.

The basic requirement for a characteristic function is accordingly that it shall constitute one of such an orthogonal family in terms of which we can expand any ψ that can occur in Nature. Since it follows from (1) that $\psi\psi^*$ must always be integrable in order that the total probability may be unity, the characteristic functions themselves must be quadratically integrable (or, in the continuous spectrum case, Weyl-normalisable). The customary requirements of continuity and single-valuedness of ψ or its derivatives are unnecessary as an addition to the fundamental requirement that ψ shall satisfy a certain differential equation. The condition that ψ shall be finite everywhere, which serves so well in atomic theory, is in almost all cases equivalent to the requirement that $\psi\psi^*$ shall be integrable. The possibility remains open, however, that in exceptional cases infinities may occur without destroying the integrability, as in the Dirac relativistic hydrogen atom,[3] and on this view such an infinity does not necessarily constitute a 'blemish' on the theory.

The basic postulates of quantum mechanics are necessarily somewhat abstract, but when we have a choice, I feel that the less abstract form has decided advantages from the physical point of view.

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April 27.

[1] Cf. Joffé, *Zeit. f. Physik*, **66**, 770; 1930; Langer and Rosen, *Phys. Rev.*, **37**, 658; 1930.
[2] Cf., for example, *Phys. Rev.*, **31**, 876; 1928.
[3] Darwin, *Roy. Soc. Proc.*, **118**, 673; 1928.

An Apparatus for Recording the Ultra-Violet Light of the Sky.

OBSERVATIONS of ultra-violet light are being made in many towns and seaside resorts by means of Sir Leonard Hill's method of recording the fading of a solution of methylene blue in acetone. For simplicity it would be difficult to improve upon this procedure, but in winter, when the days are short, there are many times when the fading is too small to be observable by this method.

Experiments have been carried on here during the last year or two on an alternative method in which photographic printing paper is used to register the ultra-violet rays.

A strip, 3 in. × 1 in., of 'Ultra-violet Glass', which is opaque to visible light but allows a band of rays beyond the violet from about 3400 to 3700 angstrom units to pass, is fitted into a slot, 3 in. × 1 in., in the lid of a shallow metal box, so that the interior of the box is illuminated only with ultra-violet rays when the lid is closed. To measure the intensity of these rays a stepped 'wedge' is constructed of layers of a fine quality of thin tissue paper which provide ten grades of thicknesses through which the light may pass. A strip of photographic paper receives the ultra-violet rays. This paper is laid on the bottom of the box, the wedge is put over it, the lid of the box closed, and the whole exposed to the light of the sky. At the end of the day the photographic paper is examined, and the greatest number of layers of paper in the wedge which the light has penetrated is read off. According to theory, this number is the logarithm of the intensity of the light. The transmission factor of the paper being known, it is easy to construct an arbitrary scale of light values.

The method is sensitive enough to allow a daily reading to be obtained all through the short days of winter except at such times when fog obscures light of every kind.

As the year advances from winter to summer and the light becomes stronger the wedge scale may need extending, and in that case a further suitable number of layers of the tissue paper may be superimposed on the wedge without detriment to the accuracy of the readings.

If necessary this photographic method could easily be adapted to give a continuous record of ultra-violet rays by wrapping the photographic paper on a rotating drum.

The record of average monthly readings with this apparatus compares very well with the monthly averages of the methylene blue apparatus.

Observations are being carried on in Manchester, Rochdale and Hale (Cheshire), and they show a regular diminution of ultra-violet light as we pass from the open country, through the suburbs, to the centre of a manufacturing town, where the light is found to be about one half of what is received in the country.

This is, no doubt, due to smoke in the atmosphere, for direct experiments in the laboratory demonstrate that smoke is effective in obscuring ultra-violet rays.

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The Change of Density of Nitrobenzene with Temperature.

IN connexion with the study of the dielectric constant of nitrobenzene as a function of temperature,[1] I have measured the density of nitrobenzene in the temperature interval between 5·6° C. and 30° C., using the method described by H. Kamerlingh Onnes and J. D. A. Boks.[2]

I have already used this method in measuring the dependence of the density of ethyl ether upon temperature;[3] there is therefore no need to dwell upon the details. I will mention only that temperatures were determined with an error not greater than 0·003° C.; the changes in the fourth or even fifth decimal of the value of density were still discernible.

The density of chemically specially purified nitrobenzene increases from 1·1916 at 29° C. up to 1·2134 at 9·8°. Beginning from 9·5°, there is a markedly more rapid increase of density with the lowering of temperature; at 5·5°, that is, in the neighbourhood of the freezing point, the value of the density is 1·2569. These changes of density appear distinctly on the accompanying graph (Fig. 1).

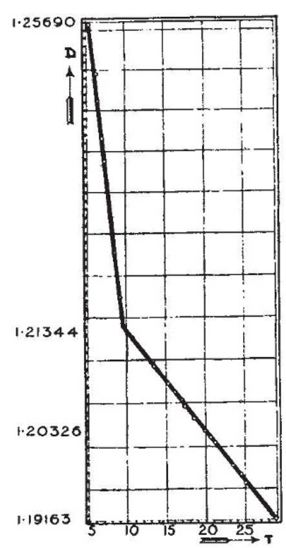

FIG. 1.

In the neighbourhood of 9·5° there is a sharp change