PHYSICAL INTERPRETATION OF QUANTUM MECHANICS*

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MODERN developments of atomic theory have required alterations in some of the most fundamental physical ideas. This has resulted in its being usually easier to discover the equations that describe some particular phenomenon than just how the equations are to be interpreted. The quantum mechanics of Heisenberg and Schrödinger was first worked out for a number of simple examples, from which a general mathematical scheme was constructed and afterwards people were led to the general physical principles governing the interpretation, such as the superposition of states and the indeterminacy principle. In this way a satisfactory non-relativistic quantum mechanics was established.

In extending the theory to make it relativistic, the developments needed in the mathematical scheme are easily worked out, but difficulties arise in the interpretation. If one keeps to the same basis of interpretation as in the non-relativistic theory, one finds that particles have states of negative kinetic energy as well as their usual states of positive energy, and, further, for particles the spin of which is an integral number of quanta, there is the added difficulty that states of negative energy occur with a negative probability.

* Substance of the Bakerian Lecture of the Royal Society, delivered on June 19.

With electrons the negative-probability difficulty does not arise, and one can get a sensible interpretation of the negative-energy states by assuming them to be nearly all occupied, and an unoccupied one to be a positron. This model, however, is excessively complicated to work with and one cannot get any results from it without making very crude approximations. The simple accurate calculations that one *can* make would apply to a world which is almost saturated with positrons, and it appears to be a better method of interpretation to make the general assumption that transition probabilities obtained from these calculations for this hypothetical world are the same as those for the actual world.

With photons one can get over the negative-energy difficulty by considering the states of positive and negative energy to be associated with the emission and absorption of a photon respectively, instead of, as previously, with the existence of a photon. The simplest way of developing the theory would make it apply to a hypothetical world in which the initial probability of certain states is negative, but transition probabilities calculated for this hypothetical world are found to be always positive, and it is again reasonable to assume that these transition probabilities are the same as those for the actual world.

OBSERVATIONS MADE AT THE ROYAL OBSERVATORY, GREENWICH

THE observations made during 1936 at the Royal Observatory, Greenwich, have just recently been made available*.

The work is divided into five sections, the first of which, Section A, Meridian Astronomy, contains three subdivisions. Under (1), Transit Circle, 1936, the observed right ascensions, declinations and diameters of the sun, moon and planets are given and compared with the corresponding results as given in the "Nautical Almanac." These tabular places are derived from the well-known tables of Newcomb, Brown and Hill. The mean monthly corrections to Newcomb's place of the sun as given in the "Nautical Almanac" are shown, and also the corrections in longitude and latitude to Brown's "Tables of the Moon". These are deduced from the observed corrections to the right ascension and declination, the mean correction to the former being $0{\cdot}15^s$, corresponding to $2{\cdot}2''$ in mean longitude. Under (2), Time Service, is included a brief description of the reversible Transit "B" which was remounted on January 24, 1935, its place having previously been taken by Transit "D" on April 7, 1933. Collimation is eliminated by reversing the instrument on all stars, and observations are carried up to approximately 20^s of the meridian. Eighteen contacts are observed in each position of the instrument, when possible, and each signal is read to $0{\cdot}01^s$. Table II gives details of observation of clock corrections, and comparisons of Clocks Shortt Nos. 3 and 11 appear in Table V. The Greenwich time determinations are regularly compared with those of other observatories by the reception of wireless signals and the results are given in Table VIII. Under (3), Variation of Latitude, it is pointed out that as the Cookson floating zenith telescope was moved in 1936 to the Christie enclosure and remounted, a new observing programme being introduced at the same time, the results for the latitude variation given by the instrument will not be published for some time. The values of the latitude variation taken from the results of the International Latitude Service are given, and these have been used in the Transit Circle reductions.

Section B, Equatorial Observations, contains the results of the observations of double stars made with the 28-inch refractor. The list deals with the first observations carried out on the programme drawn up in 1936; the pairs were selected from Aitken's "New General Catalogue of Double Stars." These pairs were chosen on the following grounds:

* Observations made at the Royal Observatory, Greenwich, in the Year 1936, in Astronomy, Magnetism and Meteorology, under the direction of Dr. H. Spencer Jones. Pp. viii+A78+B16+Cix+161+D66+E46+38. (London: H.M. Stationery Office, 1939.) 35*s*. net.