only those functions $F(x, E)$ which yield a V independent of E can be considered as solutions of a wave-equation.

The alternative interpretation suppose that V in Eq. (1) is really independent of E, but dependent on another parameter (call it W) which happens to be numerically equal to E; but then $F(x, E)$ is not in general a solution of (1), but only if $E=W$. The original goal (the construction of a wave-equation, all of whose solutions shall be known) has thus been missed. To put it in another way, $F(x, E_1)$ and $F(x, E_2)$ are solutions of two different wave-equations, corresponding to two physical systems which differ in both their potential and total energies. In order to obtain a complete set of solutions for any one physical problem (single value of the parameter W) it will be necessary to find a function $\phi(x, E, W)$.

This function may satisfy the condition $\phi(x, E, E)=F(x, E)$, but there are other solutions which do not, since electrons may move in either of two directions along the x-axis. The conclusion is that Wilson has not found a complete set of characteristic functions for a given system, but rather one particular function for each of a large number of systems. This seriously restricts the generality of his results.

Turning to these, the only one I shall discuss is the conclusion that electrons are not reflected by a potential barrier if their total energy is greater than the maximum value of the potential energy. From the foregoing remarks it follows that this is true for only one particular value of E, and it becomes of interest to find the physical reason for the distinction enjoyed by this particular value of E. This becomes apparent on an examination of Figs. (2) and (3) reference 1, which represent the potential energy, i.e., qualitatively the index of refraction of the de Broglie waves. It is seen that the optical problem analogous to this dynamical one is that of an etalon consisting of one very thin plate placed at a distance of $\frac{1}{4}$ wave-length in front of a much thicker plate. Elementary optical considerations show that such an etalon will not reflect any light but will transmit all of it. If the wave-length of the incident light be changed (variation of E) keeping the separation between the plates constant (fixed W) this situation will change, and for some other wave-length, the reflection will be complete, the transmission zero.

Carl Eckart

University of Chicago,
April 29, 1930.

Photographic Record of First Order Diffraction of Hydrogen Atoms by a Lithium Fluoride Crystal

I have recently obtained a photographic record of the diffraction pattern resulting from the reflection of a beam of monatomic hydrogen atoms from a crystal of lithium fluoride.

The atom beam, which was of nearly circular cross section, was incident upon the crystal at an angle of 30° from grazing and the plane of incidence made an angle of 45° with the cleaved edges. In this position rows of similar ions run parallel and perpendicular to the plane of incidence with a spacing between two consecutive rows of 2.835A. The reflected atoms were recorded on a plane surface coated with MoO_3 which was placed perpendicular to the plane of incidence and parallel to the incident beam.

The atoms of the beam were moving with the velocities of thermal agitation in equilibrium at a temperature of about 200°C. Their deBroglie wave-length $\lambda=h/mv$ had a distribution corresponding to the Maxwellian velocity distribution with the most probable wave-length equal to 0.89A.

A diffraction pattern appeared on the plate reproduced in the figure which satisfies the cross grating formulae

$$\cos\theta_0-\cos\theta=n\lambda/d$$

$$\cos\phi_0-\cos\phi=m\lambda/d$$

where θ and ϕ are, respectively, the angles between any beam and the parallel and perpendicular rows of ions on the surface of the crystal. The subscript 0 refers to the incident beam. The beams corresponding to $n=0$, $m=\pm 1$ were the most intense and are reproduced quite clearly. They appear in the figure as the parabolic intersection of the detecting plate with the cone $\theta=\theta_0$. The positions of calculated maxima of intensity corresponding to $\lambda=0.89$A are opposite the white-dots and agree well with the observed maxima.

The beams corresponding to $m=0$, $n=\pm 1$ were possibly visible on the original plate but were too faint to reproduce. The maximum corresponding to $n=+1$ is calculated to be at the upper dot but that corresponding to $n=-1$ lies below the plane of the crystal.

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Bartol Research Foundation,
April 23, 1930.