

frequencies all different from each other leads to a totally false picture of the spectroscopic behaviour of crystals, as is shown by several independent methods of experimental investigation. For instance, all crystals usually exhibit at room temperature and always when cooled down to low temperatures the sharply defined shifts of frequency in the spectrum of monochromatic light scattered by them, corresponding to each of the $(3p-3)$ frequencies of the structure active in light-scattering. Significantly also, overtones and combinations of

these $(3p-3)$ frequencies and of the remaining $21p$ frequencies manifest themselves with observable intensity as sharply defined frequency shifts with many crystals.

V. That the identification of the thermal agitation in a crystal with waves traversing the solid is a misconceived idea is also apparent from the complete dissimilarity between heat energy and sound energy in their observable behaviour. The latter travels through a crystal with a velocity of some thousands of metres per second, while heat energy merely diffuses through it.

NOBEL PRIZE FOR PHYSICS, 1955

THE Nobel Prize for Physics has been awarded this year jointly to Prof. W. E. Lamb and Prof. P. Kusch, for studies on the hyperfine structure of hydrogen and other atoms in the radio-frequency region and the precision determination of the magnetic moment of the electron, carried out at the Columbia University, New York.

These studies were initiated by Lamb soon after the close of the war in 1945, utilising the various new techniques developed during the war in the production and measurement of microwaves. It is known that the level $n=2$ of the hydrogen atom has three quantum states $^2S_{1/2}$, $^2P_{1/2}$ and $^2P_{3/2}$. The Dirac theory of the electron requires that the first two of these must correspond to the same energy, while the third, $^2P_{3/2}$, will be different. However, a careful study of the fine-structure of the H_α line ($n=3$ to $n=2$) indicated that the former two may not be identical. Theoretically, such a difference would be expected owing to the interaction of the electron with the electromagnetic field, the so-called radiative correction. Another consequence of this would be that the magnetic moment of the electron due to its spin will differ from its classical value by a small amount of the order of 1.1×10^{-3} .

The H_α fine structure measurements could not give an accurate value of the $^2S_{1/2}-^2P_{1/2}$ separation. In 1947, Lamb and Retherford measured this separation by obtaining metastable atoms of hydrogen in the $^2S_{1/2}$ state and directly inducing transitions in them to the $^2P_{1/2}$ state by means of microwave radiations of the appro-

priate frequency. They obtained a value $1,062 \pm 5$ MC/S with both hydrogen and deuterium.

Kusch and collaborators continued these experiments with various elements, and they were able to show definitely the existence of an anomalous electron spin magnetic moment. In 1952, they made a carefully planned series of experiments to measure this with great precision and obtained a value $g_s/g_p = 658.2288 \pm 0.0006$ for the ratio of the g values of the free electron spin and of the proton. Earlier measurements of Purcell (Nobel Prize winner for 1952) and collaborators had yielded a value 657.475 ± 0.008 for the ratio $2g_l/g_p$, where g_l is the electron orbital g value. Combining the two, the magnetic moment of the electron was calculated to be 1.001146 times the value given by the Dirac theory, in almost perfect agreement with the value 1.0011454 calculated from theory to the fourth order approximation.

The precise studies of Lamb, Kusch and their collaborators have led to valuable data which have helped in giving confidence to the quantum electrodynamists that the rather revolutionary ideas of re-normalisation which they have introduced in their theories are in the right lines.

Prof. Lamb, who is 42, is Professor of Physics of the Stanford University, California, since 1951. Prof. Kusch (44) was associated with research at Columbia University during the war and afterwards joined the Bell Telephone Laboratories. He is now a Professor at Columbia University, New York.