of the telescope soon made instruments of the type used by Tycho obsolete.

Tycho's greatest heritage was his large stock of observations, and these were fortunately safe in Kepler's keeping. The circumstances which made Tycho decide to leave Hveen proved a blessing in disguise, for otherwise Kepler would never have been given the opportunity his genius demanded. The observations of Tycho provided the material which enabled Kepler to formulate his famous laws of planetary motion. The deduction of these laws was made possible by the care which Tycho had always taken to obtain the greatest accuracy of which his instruments were capable, and by the systematic manner in which his observations were made. The prevailing custom had been to make a few observations near opposition or conjunction, and at other times only when required to supply some particular datum needed for a point of theory. But Tycho observed the moon and planets all round their orbits, both on and off the meridian, and the sun almost daily for many years.

Tycho was a man with many faults. We cannot admire his imperious, overbearing manner, his grasping character, his failure to carry out his obligations, his treatment of his tenants, his quarrelsome disposition. But of his life-long devotion to astronomy there is no question. In practical and spherical astronomy he made the first great advance since the days of the Alexandrian school. He realized that the discovery of the true motions of the heavenly bodies could be achieved only by a large stock of observations made with all possible accuracy; by the construction of improved instruments, by scrupulous care in making his observations, and by his unwearied labours, continued for many years, he opened a new era in astronomy. He is justly regarded as one of the greatest astronomers of all ages.

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## GERMAN PHYSICAL SOCIETY IN THE BRITISH ZONE

### GÖTTINGEN MEETING

THE first meeting of the reconstituted "German Physical Society in the British Zone" took place at Göttingen on October 4, 5 and 6, the new Society actually being founded on October 5.

Because of difficulties of transport and accommodation, only about five people attended from each of the nine universities and technical high schools now operating in the British Zone. A few physicists from Berlin were also present, and the meeting gained a slightly international character through the presence of a few British and Dutch men of science. Altogether, approximately 150 people attended the meetings, which were held in the large lecture hall of the Rockefeller Institute for Applied Mathematics at Göttingen; many lively discussions on a smaller scale took place in the Physics Department of the University.

One could scarcely fail to be impressed by the number of German physicists who had managed to keep their fundamental research work going right through the War, and to maintain it under present conditions. Perhaps this may indicate the failure of the Nazi Government to ensure the collaboration in military research of certain of their most important scientific workers, even under the urgent stress of war. This applies in particular to the physicists now working or residing at Göttingen, which at present is unquestionably the most important centre for physics in the zone, due both to its undamaged condition and the valuable old traditions. Of the well-known physicists now living there and participating in the meetings one might mention Planck, v. Laue, Pohl, Heisenberg, Becker, O. Hahn and Kopfermann.

The foundation meeting of the new Society was not remarkable except for one or two points. It was felt to be essential to make a fresh start rather than to attempt to continue the old German Physical Society, since the latter was taken over (*gleichgeschaltet*) by the Nazis, an event which did not take place, however, until 1938. As an incident illustrating the resistance offered to the Nazis by the Society, the fact was mentioned that when J. Stark insisted in 1933 on becoming president of the Society, no more than two votes were cast in his favour. The president of the new Society is Prof. v. Laue.

It is impossible to attempt to give a complete report of all contributions to the meeting, and some of the more interesting ones will therefore be selected. An essential part of the meeting was felt to consist in the private discussions and demonstrations at the University laboratory.

Lauterjung reported on changes in sensitivity of Geiger–Müller counters to ultra-violet light of wavelength 313 $m\mu$, brought about by illumination with $\gamma$-radiation. The counters consisted of magnesium, filled with a mixture of argon and neon. The $\gamma$-radiation caused an increase in the magnitude of the electric pulses, but no change in the number of pulses for a given ultra-violet illumination. A temporary increase in sensitivity was caused also for $\alpha$-particles which were used as a control in the experiments; the sensitivity towards light, after a slight initial fall from the first high level reached by irradiation with $\gamma$-rays, remained at an increased value of the order of twice the initial sensitivity.

Meyer presented a paper on a proportional Geiger–Müller counter to be used for energy measurements of ionizing particles. The volume of this counter is sufficient to ensure that the particle comes to a complete stop inside the measuring volume. The calibration procedure is ingenious: a window is arranged on the side of the counter, with an electrode outside supplying a field which ensures that the missing part of the wall is at the same potential as the wall itself. In the calibration procedure, $\alpha$-particles are allowed to pass across the gap in the wall, outside the counter; the central part of their path supplies a known number of ions within the counter. The ionization of the particles to be measured is easily determined by an arrangement of two gas-filled relays connected in opposition and working together into a mechanical counter. Particles of low energy will not affect any of the relays. With particles of increasing energy, one of the relays will operate and work the mechanical counter; with even faster particles both relays will operate, and since they are connected in opposition on the output side, the counter will not respond. The combination of relays thus constitutes an 'energy slit' which can be moved through the energy spectrum merely by altering the grid-bias voltages of both relays.

The age of the earth was discussed by Houtermans. His considerations were based on the relative prevalence of various isotopes of lead, with atomic weights of 206, 208 and 209, originating from $U^{238}$, $Th^{232}$, and $U^{235}$ respectively. On this basis, the age of the earth comes to $2 \cdot 9 \times 10^9$ years, with an accuracy of $\pm 0 \cdot 3 \times 10^9$. This is in good agreement with results by Koszy and Wefelmayer based on the total amount of lead present in the earth's crust.

The data underlying these considerations were obtained by means of the semi-routine mass spectrometer developed at Göttingen by Kopfermann. It was claimed that this instrument is much more simple in use and cheaper than any at present available or described. Commercial production of it is contemplated if conditions permit. The success of the instrument is largely due to the principle of producing the ionized particles by electrons oscillating up to a hundred times in the ion gun. In this way a high degree of ionization, often up to 90 per cent, is achieved, and a mass spectrum in the form of a cathode-ray oscillogram can be obtained with very small amounts of substances.

Another instrument demonstrated was a small mass spectrograph used for isotope separation. Amounts up to 0·5 mgm. of certain isotopes can be obtained in twenty-four hours, which is often sufficient for biological experiments with tracer elements. The results of such experiments were investigated by means of the mass spectrometer mentioned above. This collaboration between physicists and biologists is at present impeded by zone boundaries and other difficulties, but is regarded as a very promising line of research.

Similar collaboration between physicists and biologists has centred around the electron miscroscope. This instrument is not fully occupied by problems arising in the physics departments alone, but is now being fully utilized in collaboration of this kind.

From R. W. Pohl's laboratory, Mollwo reported on the density of vacuum-deposited salt layers. An elegant micro-balance was made up from the parts of a moving-coil instrument, the current through this instrument being used to counteract the increase in weight of the support of the salt layer. Precautions are necessary to eliminate the effect of stray electrical charges; when this is done, the sensitivity of the method is considerable. The thickness of the deposited layers is determined by an interference method best described as a reversed Lummer–Gehrke system: the light falls on the layer at glancing incidence, and the interference fringes formed become visible due to any scattering particles present in or on the surface under investigation. All measurements are carried out in the same vessel in which the layer is deposited, without disturbing the vacuum. Applying these methods to layers of magnesium oxide, it was found that the density of the deposited layer is lower than that of the solid. The porosity of such layers was demonstrated by breathing on them, when the interference fringes shift. It was worthy of note that coherent layers of magnesium oxide could not be formed unless a very small amount of a nucleating material was first deposited on to the support. For this purpose, metallic copper was found most useful.

This porosity is of interest in connexion with other investigations on the secondary photo-electric conductivity in magnesium oxide. The permanent secondary conductivity, caused by illumination with light of the appropriate wave-length, is connected with a chemical reaction characterized by the release of oxygen. Mass action considerations apply; that is, the reaction can be impeded by increasing the external oxygen pressure.

König reported on other work on the structure of thin evaporated layers, as investigated by electron and X-ray diffraction. For years now there has been an argument about the lattice constants of the very small crystals first formed on deposition *in vacuo*, various authors reporting differences between small and large crystals of the order of 6 per cent. It was now demonstrated that these discrepancies are due to faulty calibrations of the electron diffraction apparatus, which in many instances was carried out using gold leaf, assuming this to be pure gold. Gold leaf actually contains up to 5 per cent copper, apart from other impurities. Using a twin diffraction camera giving simultaneously the pattern due to a calibration substance and that under test, it was shown that there are no discrepancies between the lattice constants of small and large crystals. Experiments have been done with silver, gold, copper, iron, germanium, zinc oxide, copper oxide, potassium bromide and lithium fluoride; the accuracy of the electron diffraction experiments was stated to be one per mille in terms of the lattice constants.

Another investigation by König dealt with the size of the crystallites necessary for ferro-magnetism. Very small iron crystals were obtained by vacuum deposition on to a cooled surface. The size of the crystals could be controlled by the temperature of the receiving surface. The magnetization was measured in the same apparatus, without disturbing the vacuum, by determining the magnetic Faraday effect of the layer; the size was found by electron diffraction methods. Two results of considerable interest were obtained. The smallest crystal which still exhibits ferro-magnetism consists of about 64 atoms. This is thought to indicate that it is necessary to have one completely 'shielded' unit cell in which the spins can orientate themselves. The other finding concerns the shapes of the smallest crystallites formed by deposition on a surface kept at sufficiently low temperature which appear to consist of unit cells, lying in haphazard orientation in the deposited layer. The process of crystal growth occurring on warming up would then consist in the re-orientation and alignment of unit cells. These results were obtained not only with iron and other metals, but also with ionic crystals.

Justi has made a survey of a large number of elements with respect to their super-conductivity, and has found a few new super-conductors. Superconductivity of sodium and potassium is not certain; rubidium, cæsium, erbium, silicon, tellurium and molybdenum do not exhibit it. Rhenium becomes superconductive at 0·90° K. and uranium at 1·25° K. Ruthenium was also stated to be a super-conductor. Although Justi confined his considerations to elements, an interesting recent finding by the brothers Farkas was mentioned in the discussion, according to which a solution of sodium in ammonia becomes superconductive at −100° C.

Heisenberg reported on a new theory of superconductivity according to which a small proportion of the free electrons in a metal, namely, those near the surface of the Fermi distribution, form below the transition temperature an ordered structure or superlattice. The distance between the electrons forming this super-lattice will amount to many times the lattice spacing. When this lattice is formed, scattering processes are impossible and a lowest state with current can occur. The theory suggests that all metals can become super-conductors, that the low value of the transition temperature is to a certain extent accidental, and that it is not out of the question that materials may exist for which this temperature is much higher than usual.

N. F. Mott