perhaps explain the effects attributed in the Press to Ehrenhaft. These may turn out to be no more valid than his previous claims of the existence of charges smaller than the electron (see *Phys. Z.*, 21, 675, 683; 1920). However, we must reserve final judgment until a fuller account of his experiments is available.

Apart from the failure here to confirm some of Ehrenhaft's reported effects, the observation of the movement of the liquid caused by paramagnetic ions in the magnetic field is of some interest. It may possibly form the basis of a method for separating the rare earth elements, the aqueous solutions of which differ markedly in magnetic susceptibility. The modern method of separating gaseous isotopes by thermal diffusion might be paralleled by a method of separating aqueous rare earth ions by 'magnetic diffusion'.

The accompanying diagram, drawn to scale, shows the arrangement of the magnet and soft iron pole-pieces: it should be noted that they are soldered to a brass block. This forms an important feature of the apparatus, and was provided to ensure that the experiments could not be vitiated by the passage of unsuspected leakage currents through the liquid. The average magnetic field between the pole-pieces was measured and found to be 11,000 gauss.

# OBITUARIES

## Prof. Pieter Zeeman, For.Mem.R.S.

PIETER ZEEMAN was born, the son of a clergyman, at Zonnemaire, Holland, on May 25, 1865. In 1885 he went to Leyden, where he became a pupil of H. A. Lorentz and Kamerlingh Onnes, and took his doctor's degree in 1893 with a thesis on measurements of Kerr's magneto-optical phenomenon. He held various positions in the physics department of the University of Leyden between 1890 and about 1900. In that year he was appointed professor of physics in the University of Amsterdam, where he spent the rest of his life.

It was while he was at Leyden, in 1896, that he discovered the effect since known by his name. In a nutshell, this is the fact, hitherto unknown, that the quality (frequency) of light is changed if the light is generated in a magnetic field. This implied an immediate connexion between two great branches of physical knowledge, light and magnetism, previously almost without contact. The mathematical expression of the fundamental effect in its simplest form is $\Delta\nu/H = \frac{1}{2}\, e/mc$, where $\Delta\nu$ is the change in frequency of the radiation, $H$ the strength of the magnetic field, $c$ the velocity of light *in vacuo*, and $e$ and $m$ the charge and mass of the emitting particle. Thus the change of frequency per unit field multiplied by twice the universal constant $c$ is equal simply to the ratio of the charge to the mass of the emitting particles. This result, together with others of interest about the polarization and other details of the radiation, was deduced in 1897 by Lorentz as an inevitable consequence of the assumption that the emission of light was caused by the motion of electrified particles in an electro-magnetic field. While this statement would have been hotly contested in 1896, it is difficult to appreciate now that there was then any reasonable alternative short of the miraculous creation of light.

These considerations—and they could well be amplified—suffice to establish the basic importance of Zeeman's discovery; but in other respects also it was one of the most remarkable discoveries in the history of physics. Historically, it claimed immediate attention as a conspicuous success where Faraday had been baffled half a century earlier. The epoch of its origin was singularly auspicious. In 1897, measurements of $e/m$ for the carriers of the cathode rays by the magnetic deflexion method were published by J. J. Thomson in England and by Wiechert in Germany. Their results were identical within the experimental error with the value found by Zeeman for the particles emitting spectral lines. But all these values were 1,850 times as great as the value of $e/m$ for the lightest charged particle, the hydrogen ion, recognized by electrochemistry. If electricity was essentially atomic, a conclusion almost forced by Faraday's laws of electrolysis, we were here dealing with an apparently ubiquitous particle having a mass $m$ much less than that of the smallest accepted particle, the hydrogen atom. This was settled soon afterwards by direct measurements of $e$ by J. J. Thomson, confirmed by Planck's calculation from the intensity of heat radiation, which showed that their charge was indeed the same as the charge on the hydrogen ion. Thus was the electron born.

Another remarkable, and also perhaps fortunate, circumstance attending Zeeman's great discovery was that it was made at a time when the experimental technique was good enough to reveal the essential foundations, but not good enough to disclose the complicated structures which subsequent technical refinements brought out. Had the discoverer been confronted with all this at the outset, he might have despaired of ever making any sense of it. However, these developments, in which Zeeman himself played a notable part, have proved very important in several directions, and particularly helpful in clarifying and extending the quantum theory.

The Nobel Prizes, which are awarded annually, commenced in 1901. In that year the prize for physics went to Roentgen for his discovery of X-rays. In 1902 this prize was divided between Lorentz and Zeeman for researches on the influence of magnetism on the phenomena of radiation. This is another illustration of the timeliness of the discovery and of the prompt appreciation of its importance.

Zeeman's was a life devoted to increasing and improving our knowledge and understanding of physical phenomena by experimental methods. Much of it was in the field of magneto-optics, in which he was successful so early, and the greater part of it has had some optical connexion. This is not the place to review this in detail, but there is one thing that must be said. It is all characterized by extreme thoroughness and bears the hall-mark of the master of the art of experimental discovery.

Zeeman was elected a foreign member of the Royal Society in 1921 and an honorary fellow of the Physical Society in 1929. He was also a foreign or corresponding member of many other of the world's learned societies and academies. His achievements were recognized by the Dutch Government in creating him a Knight of the Order of the Netherlands Lion and a Commander of the Order of Orange Nassau.

His seventieth birthday, May 25, 1935, was celebrated by the publication in his honour of a volume comprising fifty original papers contributed by friends and admirers representative of the world's leading physicists.

Zeeman had a quiet and peaceful disposition, but he was by no means unforceful. His manner and temperament inspired immediate confidence. He was very genial and likable, and his loss will be mourned by many sincere friends. He died on October 9, 1943, after a short illness and is buried in the Kleverlaan Cemetery at Haarlem. He was a worthy member of that company of great men who have made Holland, despite its handicap of size and population, stand out among the nations in the history of scientific achievement.

OWEN W. RICHARDSON.

## Mr. Edward A. Martin

MR. E. A. MARTIN died at the age of seventy-nine on December 14 at Brighton, where his father had been mayor before him. Mr. Martin was well known as a lecturer on geological subjects, some of which he published in book form. His "Sussex Geology and other Essays" (Archer and Co., London, 1932) includes a chapter on "Clayton Windmills and the Dew-Ponds", among which is mentioned the windmill illustrated in NATURE of February 27, 1932, from the great Chinese Encyclopedia of 750 volumes in the eighteenth century. His researches on dew-ponds appeared in papers for the British Association and Royal Geographical Society. Other essays appeared in the *South-Eastern Naturalist*, of which he was honorary editor from 1916 until 1924.

Mr. Martin was honorary general secretary of the South-Eastern Union of Scientific Societies during 1924–35. To readers of NATURE he will be best remembered as the author, under the initials E. A. M., of the annual reports of Congresses of the South-Eastern Union, many of which he organized personally as well as contributing papers. He edited a bibliography of Gilbert White's writings for the Selborne Society; the geology side of *Knowledge* and the *Journal of the Commons, Open Spaces and Footpaths Society*. He was actively associated with the Croydon Public Library, and while residing in that borough, served during the War of 1914–18 as a commander of the Metropolitan Special Constabulary. On resigning the secretaryship of the South-Eastern Union he became a vice-president of the Union. He retired to Brighton in 1935.

In 1887 Mr. Martin married a daughter of H. T. Carpenter, a Common Councillor of London and then a ward in Chancery. His widow and three children survive and a nephew, Henry Martin, is editor-in-chief of the London Press Association.

T. DANNREUTHER.

WE regret to announce the following deaths:

Major H. J. L. Beadnell, formerly of the Egyptian Geological Survey, on January 2, aged sixty-nine.

Dr. F. D. Chattaway, F.R.S., fellow of Queen's College, Oxford, and formerly a distinguished chemist, on January 26, aged eighty-three.

Sir John Bretland Farmer, F.R.S., emeritus professor of botany in the Imperial College of Science and Technology, on January 26, aged seventy-eight.

Dr. C. B. Kingston, president in 1938–39 of the Institution of Mining and Metallurgy, aged seventy-six.

Dr. H. A. Mess, reader in sociology in the University of London, on January 23, aged fifty-nine.

The Rev. Sir John O'Connell, vice-president of the Statistical and Social Enquiry Society of Ireland, on December 28, aged seventy-five.

Sir Kynaston Studd, Bart., O.B.E., president and honorary chairman of the Polytechnic, London, on January 14, aged eighty-five.

Sir Thomas Ward, C.I.E., M.V.O., formerly inspector-general of irrigation in India, on January 27, aged eighty.

# NEWS and VIEWS

## Functional Collaboration in Colonial Territories

IN the House of Lords on January 26, Lord Listowel asked what action is being taken by the Government to prepare for the organization of security, development and welfare services throughout the British Empire on a regional basis. Lord Cranborne, Secretary of State for Dominion Affairs, replied on behalf of the Government. He said that, while contentious constitutional questions should be put aside for the time being, they must be continually borne in mind. So far as regional international machinery is concerned, the idea is still sufficiently novel to arouse suspicion. Nevertheless, our limited experience of such collaboration in commissions composed of representatives of nations with colonial possessions in the areas concerned has been encouraging. This scheme of constructing machinery to link up certain territories for purposes where common action is desirable has for some time been used in the British Empire as, for example, in the East African Governors' Conference, and regional grouping in the West African Colonies. An example of its extension on an international scale is provided by the Anglo-Caribbean Commission, the working of which has been very satisfactory. The essential point in considering such functional collaboration of neighbouring territories is the realization that it involves joint control, but not joint government. Referring particularly to the recent conference between Australia and New Zealand adumbrating a scheme for such an organization for the South Pacific, Lord Cranborne said that the Government welcomes this movement, and would also welcome the establishment of machinery of a collaborative and consultative nature in other areas in which various nations with colonial interests are concerned.

## European Relief during 1919-20

THE Economic, Financial and Transit Department of the League of Nations, under the title "Europe's Overseas Needs 1919–20 and How they were Met", has issued an account of the failure to face the problem of Europe's post-war requirements of raw materials and essential manufactured goods in those years. The effects of that lack of policy were neither local nor transitory. The penury of European countries induced them to husband their resources by quantitative restrictions on exports and on imports, and the fear of their lowered standard of living induced others to refuse to accept their products. Commercial policy was driven from the very outset down the wrong road and never found another. In 1918 productive capacity in Continental Europe was at an extremely low level; in 1919 industrial production was about one half, agriculture one third, below normal. During 1919 and 1920 Continental