BICENTENARY OF BOSCOVICH'S "THEORIA PHILOSOPHIÆ NATURALIS"

A MEETING was held on June 10 in the Yugoslav Embassy in London, at the invitation of the Ambassador, with Sir Harold Hartley in the chair, to celebrate the bicentenary of the publication in Vienna in 1758 of the "Theoria Philosophiæ Naturalis, redacta ad unicam legem virium in natura existentium" of Roger Joseph Boscovich, *S.J.* (born Ragusa, 1711; died Milan, 1787). The gathering represented many sciences and nationalities, reflecting the wide interests of a great eighteenth century figure.

Sir Harold Hartley opened with a brief sketch of Boscovich's relations with England and the Royal Society, of which he was made a Fellow on January 15, 1761, the same day as Sir Joshua Reynolds. Boscovich paid a visit to England in 1760, meeting many leading personalities, and incidentally served as Ambassador of the Free City of Ragusa, seeking to convince the British Government that Ragusa was not being used as a base by French warships. Sir Harold read a message from Prof. E. N. da C. Andrade describing the warm response of the Royal Society to Boscovich's visit, and of Priestley, Young, Faraday and Kelvin to Boscovich's ideas on the ultimate nature of matter, though the average student to-day may scarcely have heard of him.

Mr. L. L. Whyte then gave an address on Boscovich's theory of fundamental particles. Though Boscovich was recognized by his contemporaries as a distinguished mathematician, astronomer, geodesist, physicist, engineer and architect, as well as poet and diplomatist, his originality and influence were greatest in his "Theoria", where he developed in systematic form his doctrine of the constitution of matter. This was a kinematic theory of point particles[1], in which the traditional dualism (maintained by Newton and all Boscovich's scientific predecessors) of regions of space filled with matter contrasted with empty regions was discarded in favour of the simpler and more powerful 'Pythagorean' conception of spatial patterns of physical points, interacting in pairs in accordance with a single oscillatory law. Boscovich defined the general form of this law of central actions, but left the constants to be determined in the future. His theory was, in effect, a *programme for atomic physics* which a school of physicists has been carrying out since, until de Broglie introduced the wave-particle in 1923. Something might be gained by comparing the complex fields of 1958 with Boscovich's simple particles of 1758. Mr. Whyte showed that the great originality of Boscovich's conception had been recognized, not only by leading British and Continental scientists from 1760 to around 1920, but also by philosophers as varied as Nietzsche, Russell and Cassirer. It was of interest that both Nietzsche and Mendeléeff had put Boscovich with Copernicus as two of the most important and successful challengers of visual appearances.

A series of brief statements were then made on other aspects of Boscovich's work. Prof. Z. Kopal explained that Boscovich's contributions to astronomical science were in keeping with the trend of his times—the main achievements made during his lifetime were not in the field of discovery, but in the application of Newtonian gravitation to the theory of motion of celestial bodies, a work in which Boscovich took a prominent part. He shares honours with Laplace for the development of a method—still in use—for computation of cometary orbits based on three observations. As a professional astronomer for at least a part of his life-time, Boscovich perfected the stellar micrometer and, in 1770, became the founder and first director of the Brera (Milan) Observatory, which has remained in the forefront of Italian astronomical activities ever since.

Mr. C. A. Ronan discussed Boscovich's work in optics. He pointed out that in the eighteenth century corpuscular theories of light were the vogue but that Newton's theory of "easy fits of reflexion and refraction", which had been invoked to explain the partial reflexion and refraction occurring at the boundaries of surfaces of media having different refractive indices, was not fully appreciated. In Boscovich's theory of light the corpuscles were conceived of as rotating and having different polarities on their two sides, one being attracted by matter and the other repelled. Partial reflexion and transmission were thus explained. Moreover, this idea was invoked by others to explain, in conjunction with Boscovich's theory of matter, the penetration of light through solid bodies and the phenomena of astronomical refraction and of phosphorescence. Mr. Ronan also spoke of Boscovich's practical work in the design of an astronomical micrometer, his determination of the instrumental errors of the mural quadrant at Milan, his design of an equilibrium suspension for instruments of this kind, and his discussion of the residual errors inherent in such instruments and their reduction by appropriate design.

Dr. J. F. Scott considered Boscovich's contributions to pure mathematics, passing from his remarkable recognition of the possibility of a non-Euclidean geometry (for example, "these minds . . . would not seek, as our geometricians do, to rectify the parabola; they would endeavour, if one may use the words, to *parabolify* the straight line": "Theoria", § 116) to his advances in trigonometry, his brilliant essay on conic sections, his anticipation of the work of Legendre and Gauss on the calculus of observations, and his importance as one of the earliest foreign scholars to adopt the Newtonian theory of gravitation. Father L. J. Copplestone, *S.J.*, discussed Boscovich's atomism as an illustration of how a theory which is 'philosophical', as possessing wide implications, may provide the basis for a scientific theory which can be put to experimental test.

The Yugoslav Ambassador gave a lively sketch of Ragusa in Boscovich's time, and described how he established the first direct diplomatic relations between the Yugoslav peoples and Great Britain. Prof. I. Supek, president of the Boscovich Institute at Zagreb, brought greetings from the Yugoslav scientific societies and outlined the work of his Institute in research and teaching.

Sir Harold Hartley, in summarizing the contributions, stressed the part that Boscovich had played in establishing relations between the Southern Slavs and the United Kingdom, and the need for a biography of a great scientist recently unduly neglected. A scheme is under consideration for a volume combining a short biography with an extended report of the meeting covering additional aspects of Boscovich's scientific work.

[1] Recent studies of Boscovich's atomism, interpreting it as a kinematic theory, have been made by Whyte, L. L., *Nature*, **179**, 284 (1957), and *Notes and Records of the Royal Society*, **13**, 38 (1958); and by Jammer, M., "Concepts of Force", 170 (Harvard Univ. Press, 1957).

PHOTOCHEMICAL REACTIONS

THE Society of Physical Chemists of France organized a symposium on the transfer of light energy and photosensitization at the Physico-Chemical Laboratory of the University of Paris during May 27–30. In his introductory remarks, Prof. F. Perrin discussed the general principles of light-energy transfer and the life periods of activated molecules, fluorescence, chain reactions and their inhibition. D. Curie (Paris) presented the theoretical aspects of energy transfer and its mechanism in the crystals of luminescent minerals, such as zinc sulphide and potassium chloride. H. Haken (Erlangen) considered the theory of excitons and their role in the transfer of energy in the solid state. S. Nikitine (Strasbourg) described his experiments on the absorption, emission and reflexion spectra of thin layers of Cu_2O, HgI_2, PbI_2, CuBr, CuCl, TlI, TlBr, TlCl, CdS and CdI_2. Some experiments on the transfer of energy by excitons in cadmium sulphide were reported by E. Grillot (Paris), and N. Arpiarian (Paris) discussed the luminescence of zinc sulphide activated by gold and nickel at − 158° C.

A series of papers on the luminescence and energy transfer by organic compounds such as benzene, naphthalene, anthracene, chrysene, pyrene, dihydrodiphosphopyridine nucleotide, etc., were presented by workers from several countries. Other topics included the spectra of silver halides and the phenomena of optical sensitization and desensitization; photo-oxidations and photo-reductions and fluorescence of different organic compounds, colouring matters and their acceleration and inhibition; the transfer of light energy, fluorescence and mechanism of plant and algal photosynthesis. N. R. Dhar and co-workers (Allahabad) discussed their investigations on the increase of nitrogen fixation in soils on incorporating molasses, straw, grass, leaves, etc., by light absorption and calcium phosphates. The mechanism of this nitrogen fixation is based on the decomposition of water molecules into H and OH as in plant photosynthesis. As in animal metabolism and photosynthesis, phosphates are of great importance in nitrogen fixation. A. Szent-Györgyi (Massachusetts) contributed an important paper on the transfer of energy in muscles. This transfer is possible to distances greater than atomic dimensions.

As the world as a whole is short of food, intensive investigations on the acceleration of photosynthesis and soil nitrogen fixation are bound to be of great practical value.

On May 31 the Society celebrated its fiftieth anniversary at the Maison de Chimie, and addresses dealing with the progress of physical chemistry with special reference to France were delivered by Profs. R. Lucas, E. Bauer, R. Wurmser and A. Szent-Györgyi and the representative of the Minister of National Education in France.

THE GERMAN STARCH CONVENTION, 1958

THE International Starch Conference, held at Detmold during April 22–24, was well attended, with some 200 delegates from twenty countries.

In the section covering research and analysis, a paper was read by Dr. G. Gilbert (Birmingham), in which the action of air on aqueous solutions of starch was surveyed. An estimate has been made of the rate of hydrolysis of starch by pure water at 100° and 120° C., and it is found that the molecule of amylopectin is large enough to be affected by such hydrolysis during the dispersion of starch. The molecule of amylose, however, is too small to be affected by such hydrolysis, and it was suggested that oxidation by air contributes to the variation in the published values of the molecular weight of amylose. It was found possible to fractionate starch by dispersing it in cold sodium hydroxide under nitrogen and centrifuging the dispersion. Although sodium hydroxide is usually regarded as a good solvent for starch, the bulk of amylopectin was found to be quite insoluble in it under anaerobic conditions.

The development and present state of the starch industry in the United States was discussed by Dr. G. E. Hilbert (Washington). He reported recent success in growing a variety of maize, the starch from which contains 82 per cent amylose. It is hoped to raise this proportion to more than 90 per cent in the future. Amylose thus produced is cheaper than that obtained by chemical fractionation of starch. It is converted to the acetate, which is similar to cellulose acetate, and, moreover, it can also be digested in the stomach. Amylose acetate is therefore used for the production of such foodstuff adjuncts as sausage skins. Another development in the United States is the electrolytic oxidation of starch with periodic acid; the dialdehyde obtained is a good tanning agent for skins and is also used as a base for plastics.

Prof. M. Samec (Ljubljana) read a paper concerning the degradation of starch by γ-radiation. He reported in particular on the effects of the radiation derived from the betatron, X-rays and cobalt-60 on potato starch. Irradiation by cobalt-60 for 3 hr. was found to cause in starch complete loss of power to adsorb iodine. After 5 hr. the dialysable fraction had risen to 5·2 per cent and the reducing power had increased three-fold. After 7 hr. irradiation by