WILLIAM MITCHINSON HICKS

1850—1934

W. M. Hicks

WILLIAM MITCHINSON HICKS 1850–1934

WILLIAM MITCHINSON HICKS was born on September 23, 1850, at Launceston, the elder son of Samuel Hicks, a schoolmaster of that town. He received his earlier education at a private school in Devonport and in 1870 went up to Cambridge after gaining an Exhibition at St. John's College. In the mathematical tripos of 1873 he reached the place of seventh wrangler, and is described in the Calendar then as a Scholar of St. John's. The next year was an important one in the history of Physics in Cambridge. The Cavendish Laboratory was opened, with Clerk Maxwell as first Professor, and a small number of men who had taken the mathematical tripos gathered under him as students there. Sir J. J. Thomson tells us in the Commemoration Volume of Maxwell that Hicks was the first of these students, and that he was followed by Gordon, Chrystal, Saunders, MacAlister, Fleming, Glazebrook, Schuster, Niven, and Poynting—a truly distinguished band. Hicks's close college and lifelong friend, William Garnett, who was fifth wrangler in the same year, was appointed demonstrator.

It is very likely that it was Maxwell's inspiration and the stimulus of the Cavendish Laboratory that turned Hicks's interests from pure mathematics to its application to physics, and it was not many years before he found a subject worthy of his powers. After Helmholtz had discovered the property of permanence of a vortex ring formed in a perfect fluid, Sir William Thomson's suggestion that this feature made feasible a vortex theory of the atom created for this subject a special interest to the mathematical physicist. Hicks had already done work in hydrodynamics ; his earliest paper—*On Two Pulsating Spheres in a Fluid*—a paper containing the elements of a theory of gravitation, appeared in 1879, some three years after he had been made a Fellow of St. John's. He was one of the first to take up the challenge which the difficulties of the further treatment of vortices presented. Inventing, independently of Neumann (who had used them earlier in another connexion), the " toroidal functions " which were necessary to proceed further with the problem, he made a thorough study and application of them. He discovered the possibility of the existence of the hollow vortex ring, that is, one from which the fluid which normally fills the ring-shaped core is absent, and *all* the fluid has no distributed vorticity, but only circulation about the hollow. Another discovery was that of systems containing vorticity, not only about ring but about lines parallel to the axes of these rings. The vortex filaments in

this case are like spirals wound on a ring. As a certain parameter, on which the energy of motion depends, is increased, it is only at certain discrete values of it that rings which are stable make their appearance ; these rings can give rise to complex aggregates of vortices, made up of superimposed shells. This behaviour formed a striking analogy to the periodic classification of the elements, which was highly suggestive of atom-building in those days of classical physics. Although mechanical models of the atom have had to be cast overboard now, Hicks's work was not only a brilliant achievement but it has also been of permanent value in the advance which it made in our knowledge of vortex motion. It was published mostly in four memoirs in the *Philosophical Transactions* between 1881 and 1898, and quickly brought him fame. In 1885, he was elected to the Royal Society, and later he received the award of the Hopkins Prize in Cambridge for the period ending with that year. The Hopkins Prize is a high distinction in the University. It was founded in 1867, and is awarded every three years for the best original memoir or discovery in mathematical physics which has been published by a graduate during the preceding period. The class of men who gained it in the earlier days is brought home to one on reading the names of the first eleven of them, in order—Stokes, Maxwell, Rayleigh, Kelvin, George Darwin, Glazebrook, Hicks, Lamb, J. J. Thomson, Niven, and Larmor.

After gaining the Prize, Hicks became one of the three appointed to award it ; he was also Examiner for the tripos in 1882 and 1883. In this latter year he left Cambridge to go to Sheffield, accepting an invitation to succeed Viriamu Jones as principal and professor of physics and mathematics at the Firth College of that town. From this time onward, the work of a long life was spent in the furtherance of university education in Sheffield and its area. The Firth College was the outcome in Sheffield of the movement, fostered by Cambridge, that had originated some ten years earlier for extending university education into the towns. Founded in 1879 by the gift of a previous mayor, Mr. Mark Firth, the institution, at the time when Hicks arrived on the scene, was having an arduous struggle to keep going. The stage which it had reached may be inferred from the combination of posts he undertook. Its buildings consisted of a few class-rooms and two small laboratories surrounding a central hall used for evening discourses ; the staff numbered half a dozen all told, and the students, mostly teachers in training working for the London External Examinations, were correspondingly few.

That this little place, ever in danger of having to close down for lack of funds, developed into a university was almost entirely due to the far-sighted ideals and work of Principal Hicks. A quotation from his Annual

Report for 1888, which I have discovered accidentally, shows something of the nature of his vision. " For what is the ideal of a local college and technical school? It is to bring into our large towns actual universities with all their advantages ; not as managed by some external body, but as a complete institution itself, forming an organic part of the town. It enters into its needs, is the centre round which local activity circulates. It is the place to which everyone, rich or poor, naturally goes for higher education in all its branches. It stimulates their intellectual interests. The town feels pride in the literary or scientific work done there, as a local product. Its school teachers have received their training there ; its chemists, electricians, and trained foremen are drawn from its students ; its leaders in industry and commerce are former members and present supporters ; the medical profession has its home there ; and in all directions it is inextricably bound up with the daily life of the place . . . It is a worthy ambition for our great towns—these universities of their own . . ." This is remarkable when we consider the date at which it was expressed ; few people then thought anything more was called for than combinations of provincial colleges into universities formed for examining purposes solely.

In his work for this ideal, Hicks was greatly encouraged by Dr. H. C. Sorby, who was a Sheffield citizen, and whose eminence was widely recognized. The two men formed a life-long friendship. The first stage of Hicks's ideal, apart from the extension of the college by building and by new departments, was the union of the Sheffield Medical School, the Technical School, and the Firth College into one University College ; but it was not until 1897 that he succeeded in accomplishing it. In this he was loyally supported by Dr. William Ripper, the principal of the Technical School, who accepted the professorship of engineering in the College. The next opportunity came six years later, when the scheme for union with the Victoria University (no doubt accepted as a practical substitute for the ideal quoted above) was broken up by the collapse of that institution itself. The system by which the Colleges of Liverpool, Manchester, and Leeds were joined into one University was found too cumbersome to work. Liverpool wished to apply for a charter of its own ; and Manchester and Leeds had to follow suit. The opportunity was seized by Hicks in Sheffield also ; it was now or never, and a large sum would have to be raised. His quiet but persistent pressing forward of his ideals, his recognized eminence, and the trust in his judgement which his singlemindedness and sincerity had long inspired, convinced the important citizens and ultimately gave rise to a wave of popular enthusiasm which brought the necessary endowment in its train.

This great work was mostly done behind the scenes, and it is characteristic of the man that he never suggested, or even seemed to think, there was credit attached to it ; but it is safe to say that except for his vision and work the University would not have come into being. The portrait at the beginning of this memoir is reproduced from a painting by Sir Arthur Cope, which was presented to the University as a memorial of this work of his. On its constitution in 1905 the University elected him to be its first Vice-Chancellor, but he held the office only for a few months. As soon as possible he withdrew to become simply Professor of Physics, and apply himself henceforth to the teaching and research work which all his life he had preferred. However, in 1913, he again acted as Vice-Chancellor for a year, stepping into the breach in an emergency.

Not long after he began his work in Sheffield, Hicks took a prominent part in a piece of work of national importance for education. It was he and William Ramsay who, acting on behalf of the principals of local colleges between the years 1886 and 1889, succeeded in obtaining from the Government in the latter year the first grant in aid of University Colleges. The matter is one of some historic interest, but the part played by these two men in it is probably forgotten now. It only came to the writer's knowledge by a number of letters from Ramsay to Hicks coming to light among his effects after Dr. Hicks's death. It appears that at this time some of the provincial colleges were in so bad a way financially that they would have to close down unless something were done soon. Hicks and Ramsay, returning in the same boat from the meeting of the British Association in Montreal in 1884, decided to start a movement for state aid. A body of representatives from the Colleges was formed, of which they acted as the secretaries. After initiating a press campaign, this secured an influential deputation to the Chancellor of the Exchequer, which met with a favourable though non-committal reception. From the letters one gets an idea of the vigorous efforts the two men made first to achieve this and then to ensure that the matter, once raised with the Chancellor, should not be allowed to lapse, as it threatened to again and again. The letters they wrote to influential men, and the interviews they followed them up with, asking them to press the scheme on the attention of the Chancellor, are astonishing in their number. The valiant way in which they pursued their aim led them to ultimate success, and the first Government grant, though disappointingly small, materialized in 1889.

As a Professor, Hicks took a keen and affectionate interest in his students, and was a source of life-long inspiration to many. A friendly simplicity and courtesy of manner, combined with complete sincerity in thought and deed, were qualities that characterized his life in a marked degree—

deviousness was utterly foreign to his nature ; in his dealings with his students these qualities brought him the love and admiration of them all. On the occasions when, after years of retirement, he came as a guest to Old Students' Reunions, the warmth of affectionate welcome which greeted him was eloquent proof of this.

Although his official duties as principal meant the sacrifice of a great deal of time he would have loved to give to research, Hicks carried out much important scientific work in addition to his investigations on vortices. In the 'eighties he was constructing one of the earliest instruments, if not the earliest, for plotting the exact shape of alternating current curves. It consisted of a synchronously driven motor whose rotating part was composed of magnets ; this carried a brush which made a contact at the same phase point in each cycle, thereby charging a condenser to the potential corresponding to the point. It was shown at a Royal Society Evening, and is a beautiful piece of work, still preserved. Some of the earliest investigations on the production of pure iron by electrolytic methods are also due to him. He was never so happy as when he could get a few hours in the laboratory fitting up an experiment.

His main line of work was mathematical, however. In 1880, there was no complete text-book on hydrodynamics—Lamb's treatise had not yet matured—and a very full report by Hicks to the British Association on the progress in this subject (*British Association Reports*, 1881–2) greatly stimulated work in the science, and is of lasting value. The same words might also be used of the well-known text-book on dynamics which he wrote, largely to introduce logical order into the elementary treatment of mass and of force. Hicks was a constant visitor to the British Association, and President of Section A in 1895 ; in the Royal Society he served for three periods on the Council, and was one of the recipients of the Royal Medal.

During the latter half of his life, and right up to his death at the age of 83, Hicks applied himself steadfastly to the elucidation of the structure of spectra. He was filled with a profound admiration for Rydberg's work on the relations between series lines, and proposed to himself the task of extending it. The gradual realization that dynamical theories of the atom, either of the vortex or other types, were doomed to fail in explaining the experimental results, led him to prosecute the search on purely empiric lines. The project was to find out as much as possible about the relations between the frequencies of spectral lines apart from all questions of theory. This produced an extraordinary change in the character of his work from that of his younger days. The difficult mathematics of his earlier papers was replaced by arithmetical calculations, simple in themselves, but

extremely laborious in the immense number of them he carried out. This work gained the distinction of the Adams Prize award in 1921 and was published in a treatise on " The Analysis of Spectra " in the following year. In particular his formula (an extension of Rydberg's) for expressing the frequencies of the lines of a series has been of great value to spectroscopists.

His further work in this field is published in numerous papers in the *Philosophical Transactions* and the *Philosophical Magazine*, and in a book on *The Structure of Spectral Terms*, the proofs of which he was reading when he was seized by the illness which in a few weeks ended his life. The most striking of these empirical relations are those referring to summation series, linked lines, and the " oun." In series of the normal type the frequencies are given by the differences of two terms ; the sums of the terms also give observed lines in many cases—these form " summation series." The " oun " is an apparent unit of term structure which shows itself when the frequencies of the lines of a doublet are compared, and in many other cases of " linked " lines. Hicks's discussions of the evidence for these and other relations are very full and marked by detailed criticism of the data ; they are correspondingly laborious to read, and it must be admitted that the conclusions have not been very favourably received by modern spectroscopists. They tend to be neglected rather than criticized, partly because the results seem to bear little relation to the present theory of the emission of light. Further, without great labour, comparable with that put into the task by Hicks himself, it is very difficult to estimate the extent to which the validity of the relations is affected by the chance coincidences, which admittedly occur in the large number of illustrations presented. Hicks recognized both these difficulties, of course, but was undeterred by them. If they were true, his rules would fit ultimately into a framework of theory. His enthusiasm for the work on the lines he had chosen never flagged. Compeer of Browning's grammarian—

> " He ventured neck or nothing—heaven's success
> Found, or earth's failure :"

—Hicks followed up his search for truth with utter devotion to the last possible moment.

In 1887, Dr. Hicks married Ellen, a daughter of H. S. Perrin. They had two sons, who both served in the War, and one of whom was killed at the Battle of Loos. His memory has been perpetuated by his parents in the foundation of the Basil Hicks Lectureship at the University of Sheffield ; this provides for a series of public lectures by eminent men on subjects connected with the War and the promotion of international peace.

Not very long after his retirement in 1917 from the Chair of Physics at Sheffield, Dr. Hicks's wife died, and he went to live in the little country village of Crowhurst in Sussex, near to the home of his brother and sister. Here he remained until his death, apart from occasional sea voyages which he enjoyed taking to all parts of the world. He lived a quiet and very regular life, working with amazing energy at his calculations every morning, and in the afternoon exploring the countryside by long walks in all weathers. He was a great lover of Nature, especially of trees—each tree that fell to the builder's axe was mourned as a personal friend. As he walked along their country lanes, he became a familiar figure and welcome friend to the village people. It is characteristic of him that until his obituary notice appeared in *The Times*, none of them realized that this friend was a man of great distinction. He enjoyed a very vigorous constitution, and all his life seldom experienced an illness, although in his later years he was hampered somewhat by increasing deafness. Up to a day in June, 1934, in spite of his advanced age, he seemed almost as vigorous as ever ; a sudden attack of illness then brought him to his bed, and he died on August 17. His life of lofty aim has left behind it fruits of enduring value to science and to education, and its own special contribution to the peace of the world.

S. R. Milner.

Reprinted from ' Obituary Notices of the Royal Society of London '
No. 4 pp. 392–393 December 1935

Harrison and Sons, Ltd., Printers, St. Martin's Lane, London, W.C.2