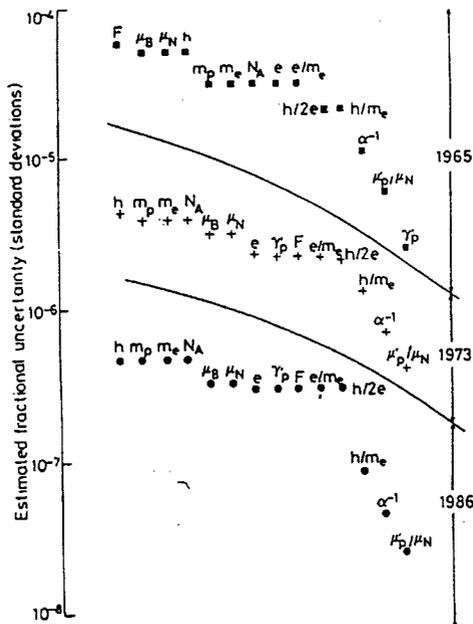


## HISTORY OF PHYSICS GROUP



APRIL VISIT TO THE NPL

NEWSLETTER NO. 11

SPRING 1998

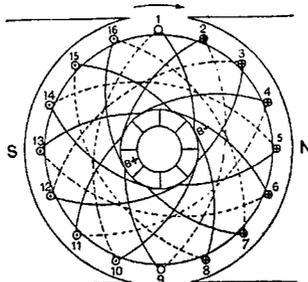
## Secretary's Report

The Group has held four meetings since the last report was printed. A meeting on "100 Years of the Electron" was held on 25 March 1997, at the Institute of Physics Annual Congress in Leeds. It was well supported from among those attending the Congress, which suggests there is interest in historical meeting, at least for the more important events and provided the meeting is easily accessible. On 12 April 1997 there was another meeting on "Vectors in Physics: Origins and Significance" at the James Clerk Maxwell Institute in Edinburgh. This was mostly a repeat of the meeting held in London in October 1996, but with some different speakers. It was arguably more successful - the total number attending was about the same, but fewer of them were committee members. Credit for the success goes to Stuart Leadstone, and his sterling efforts to ensure that anyone who might be interested knew about the meeting. An innovation for the group was an evening lecture in London on 9 July 1997, at which Sir Brian Pippard spoke about his work during the war at what became the Radar Research and Defence Establishment, at Malvern. A July evening is perhaps not the best time for a lecture, but the audience of about fifteen generated a lively discussion. The experiment of an evening lecture in which the speaker is encouraged to give a personal view will be repeated. Lastly, there was a meeting on "Entropy: Origins, Significance and Applications" at the University of Manchester on 18 October 1997, the occasion of the annual General Meeting. It was a lively and tolerably well attended meeting, but what History Group objectives it achieved is open to question. Most of those who present were from the Manchester and District Branch, which co-sponsored the meeting, not from the History Group, and as a consequence the meeting did not concentrate on matters historical as much as it could have done.

Meetings are the major activity of the group and it is of great concern to the committee that they attract only a small proportion of the membership. We have tried to hold one meeting on a physical concept and one other meeting each year. Speaking personally, I do not feel the last two concept meetings, on vectors and on entropy, have been outstandingly successful. If such meetings are not attractive to members the committee needs to know, and to have suggestions for topics that would be of more interest.

The running of the group continues to give cause for concern. If we operated precisely as the constitution suggests we should, most members of the committee would have stood down long ago and there would be no workable committee. The same small group of people cannot, and certainly should not, continue to run the group indefinitely, but the attendance at recent Annual General Meetings has been poor, and, with the exception of Lucy Hudson whom we welcomed on to the committee last October, we have found no-one able or willing to join the committee. Even though some members may continue to pay the subscription through inertia rather than continuing interest, the size of the group suggests a substantial interest in historical matters. For many, perhaps most, it is a secondary interest, but the group cannot continue indefinitely unless there are people prepared to take over, and to bring in new ideas.

Neil Brown.



## **Future Meetings**

### **The Evolution of Medical Imaging. A Personal Odyssey from Geiger counters to MRI**

Saturday 14 September 1998, 18.30-19.30 (provisional)  
Institute of Physics, London

This evening lecture will be given by Professor John Mallard, who has first-hand knowledge of many of the developments he will be talking about.

The meeting is open to all. There will be no charge.

### **The Origins and Development of the Electromagnetic Field Concept**

Saturday 17 October 1998  
London

This will be an afternoon meeting, with four or five speakers. All details are provisional at this stage, and suggestions are welcome. The meeting will be followed by the Annual General Meeting of the Group.

The meeting is open to all.

## **Meetings in 1999**

The Group is proposing to hold three meetings in 1999.

There will be an evening lecture at the IOP, probably early in the year, at which an eminent speaker will give a personal view of some relatively recent developments.

The subject of "Physics and Religion" has been suggested for a half-day meeting in April - from a historical viewpoint, not looking at any current controversy.

1999 marks the bi-centenary of Volta's pile, the first electric battery, and the subject for a half day meeting in October 1999 is likely to be "Two hundred years of the Electric Current." This will also be the occasion for the Annual General Meeting.

## **Contact**

For details of any of these meetings, or if you have any suggestions about them, contact Neil Brown, Honorary Secretary, History of Physics Group, by post at the Science Museum, South Kensington, London, SW7 2DD, by fax to 0171 938 9736, by e-mail to [n.brown@nmsi.ac.uk](mailto:n.brown@nmsi.ac.uk), or by telephone to 0171 938 8046.



# Institute of Physics

## Half Day Meeting Programme

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### Aspects of the History of Measurement

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Saturday 25 April 1998  
National Physical Laboratory, Teddington,  
Middlesex

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### Organised by the History of Physics Group

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One of the objectives of the History of Physics Group is to put on record the story of some of the more recent developments in the subject - to go beyond the published papers recording the formal results to study the processes and interactions which led up to them. Measurement has been one of the central purposes of the National Physical Laboratory ever since its foundation in 1900. Thus the Laboratory is a highly appropriate venue for a meeting about the history of measurement. Three of the speakers have been involved in developing techniques of measurement throughout their careers and therefore speak with particular insight. The fourth speaker has great experience in the history of scientific instrumentation, and has been compiling a catalogue of the artifacts in the historic collection at the Laboratory. The meeting will also include a tour of the historic collection.

There will be no charge for the meeting. Advance booking is essential so that names can be given to the security staff at the Laboratory. If you wish to attend please complete the slip below and return it to *C. N. Brown, Honorary Secretary, History of Physics Group, Science Museum, South Kensington, London, SW7 2DD*, by post, or by fax to 0171 938 9736, or by e-mail to [n.brown@nmsi.ac.uk](mailto:n.brown@nmsi.ac.uk), or telephone 0171 938 8046.

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## Institute of Physics

I expect to attend the meeting "Aspects of the History of Measurement" at the National Physical Laboratory, Teddington, Middlesex, at 1400h on Saturday, 25 April 1998.

Name and Address: \_\_\_\_\_

\_\_\_\_\_

Telephone/E-mail \_\_\_\_\_

*Return form to: C. N. Brown, Honorary Secretary, History of Physics Group, Science Museum, South Kensington, London, SW7 2DD, or e-mail [n.brown@nmsi.ac.uk](mailto:n.brown@nmsi.ac.uk)*

# Institute *of* Physics

cont.../

## **Aspects of the History of Measurement**

*Chairman: Dr John Roche, Centre for Medieval and Renaissance Studies, Oxford*

13.45 - 14.00 Registration

14.00 "Measuring archaeological time."

*Professor Robert Hedges, Archaeology Research Laboratory, Oxford*

14.35 "Chemists make measurements too."

*Dr Douglas Ambrose, formerly of the Chemical Standards Division, National Physical Laboratory*

15.10 "A hundred and fifty years or so of the electrical units."

*Dr Brian Petley, Basic Metrology Group, National Physical Laboratory*

15.45 Tea

16.00 "To begin at the beginning: standards of length and mass."

*Dr. Anita McConnell, Oxford University Press*

16.35 General discussion

16.45 Tour of the historic collection

*Dr. Anita McConnell*

17.15 Close of meeting

**How to get there.** The entrance to the National Physical Laboratory is on Queen's Road, Teddington. It is less than half a mile from Teddington railway station and is signposted from the station. There are trains to Teddington from London Waterloo every 15 minutes, and the journey takes half an hour.

**"100 Years of the Electron"**  
**University of Leeds, 25 March 1997**  
**Institute of Physics Annual Congress**

1997 marked the centenary of the "discovery of the electron" by J. J. Thomson, and to celebrate the event the Institute of Physics encouraged the History of Physics Group to organise a meeting on the subject, as part of the Annual Congress.

What constitutes the "discovery" of something as elusive as the first sub-atomic particle is an interesting question in its own right. The speakers very quickly made it clear that the usual brief account is simplified to the extent of being misleading. The full story is much more complex, sometimes uncertain, and always more interesting. There is a prehistory to almost every discovery: it was nearly made by someone else years before, or it was made but ignored by the rest of the world. This does not detract from the achievement of the recognised discoverer, and usually throws light on the ways science progress of science. The electron is no exception and the first speaker, Dr Grahame Gooday, contrasted Thomson's work with that of Professor Frederick Guthrie, who might have discovered the electron a few years earlier, had circumstances been different and the climate of opinion more favourable. Thomson, like most men of his standing, was deeply involved in all aspects of science and in the next paper Dr. Alan Morton described Thomson's involvement with the IOP and with the development of scientific research.

Dr. Isobel Falconer has studied J. J. Thomson's work on the electron for many years, and gave what must be the definitive account of it in a paper entitled "From Smoke Rings to Electrons". The smoke rings are a reference to Thomson's early, vortex theory of the atom. Thomson did propose the existence of a very tiny particle, but for many years he referred to it as a "corpuscle". The term "electron" had been coined a few years earlier, but it described something rather different from what Thomson envisaged. More surprisingly, when he first suggested in public the existence of this "corpuscle", at the Royal Institution in April 1897, he had not performed the famous experiment traditionally regarded as marking the discovery of the electron. That experiment, in which he balanced the electric and magnetic forces of a beam of cathode rays and calculated their charge-to-mass ratio, was not performed until some months later. Thomson's did have an estimate of the charge to mass ratio, but from a less reliable experiment.

The discovery of the electron seemed to settle the old argument as to whether cathode rays were particles or waves. It is ironic that the nature of the electron was to come into question a few years later with the concept of wave-particle duality, and that J. J. Thomson's son G. P. Thomson should have so much to do with this. The last two speakers looked at this aspect of the electron, Dr. Jeff. Hughes discussed instruments, theories, and the origins of electron diffraction, and Dr. Arnold Lynch concentrated on the "Half the Electron" Thomson discovered. Dr Lynch preceded his paper by showing a short film of J. J. Thomson made for the Institution of Electrical Engineers in about 1931, and gave his recollections of hearing Thomson lecture at about that time.

Few, if any, History Group members went to the annual Congress primarily to attend this electron meeting. It was much more a service for the wider Institute membership, as many historical meetings could be if the mechanism were there to publicise them more widely. As always at Congress with its parallel sessions, the audience fluctuated, but there was a substantial audience for all the papers and the great interest there is in this particular bit of history was evident.

Neil Brown.

## BLUE PLAQUES FOR PHYSICISTS

Ken Barritt's article on Sir James Jeans has stimulated interest in the scheme. One of our members, Kenneth Herbert, has written in giving some details of the events surrounding the unveiling of the plaque to John Canton in Stroud. He has also written an interesting article giving much detail and background to the life of one of our earliest experimenters in electro-statics.

The plaque scheme was originally set up by the Director of the Institute, Brian Davies, some years ago as a result of his concern that so few scientists were being honoured. We have included up to date details of the plaques that have been erected later on in the newsletter. Clive Jones supplied the details and Lucy Hudson extended the biographical information.

Readers may wish to follow up the blue plaques in their areas and write in giving further information about the activities of the personalities in their neighbourhood.

## APPEAL

Donations to the group are not required, however literary contributions are welcome. These can range from short pieces such as in 'Snippets', anecdotes, museum visits, uses of apparatus, etc., to larger articles on an area of interest to the author.

The running illustrations in the newsletter are designed to draw attention to the artistic dimension of some scientific diagrams. If readers know of drawings that display a similar effect, perhaps they would like to send them in, quoting the source for possible inclusion in a later newsletter.

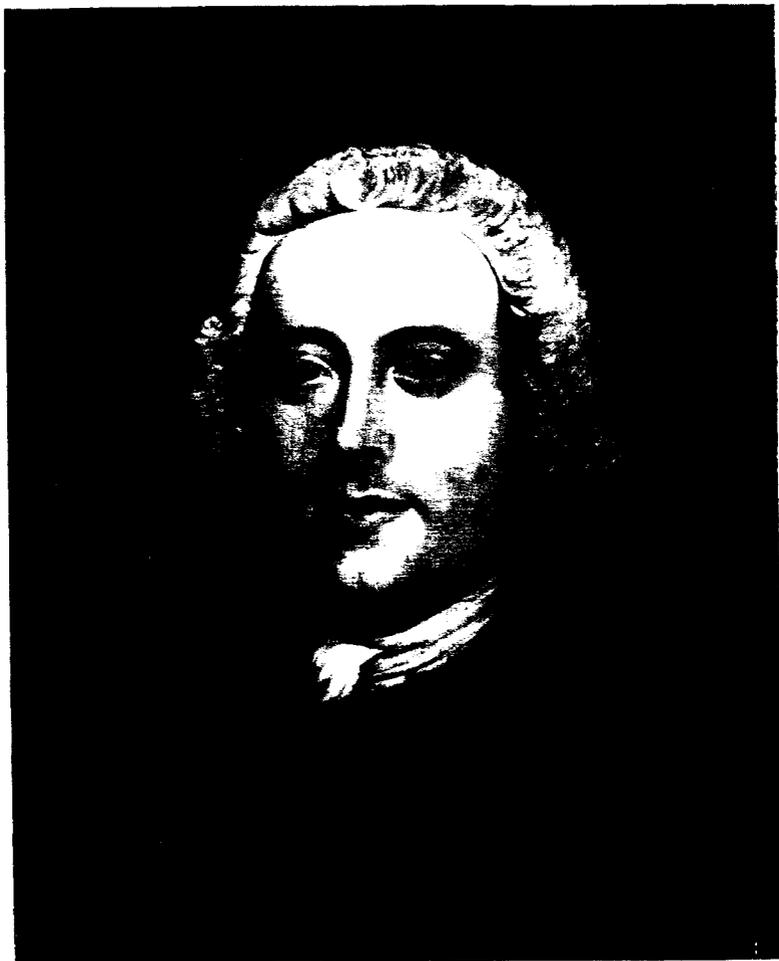
## APPRECIATION

I would like to thank all the contributors, members of the committee and various other people who have helped me in compiling the newsletter over the past few years. Without them it would have been a less interesting and informative publication.

David Hooper was our first editor and laid secure foundations for its composition and development. It is now time to hand over to a new editor who will add to and extend its variety. I wish good luck to Lucy for the succeeding issues and trust that members will support her with a good selection of copy that will interest our readers.

Bob Joyce

JOHN CANTON M.A. F.R.S.



On May 22nd, Professor Butterfield, Vice President of the Institute, unveiled a Blue Plaque on the wall of the Old Town Hall, Stroud, Gloucestershire, commemorating the eighteenth century physicist John Canton (1718-72). Canton had attended the charity school which was held in the building at that time. The plaque was a joint venture sponsored by the South West branch of the Institute and the Friends of Stroud Museum. The ceremony was attended by over 40 guests, and received quite wide coverage in the local press and on local radio. Following the ceremony, a reception was held in the building, at which there was a display of documents relating to Canton, replicas of some of his apparatus, and a kit of experiments in electricity and magnetism related to Canton's work, available for loan to local junior schools, and for which the Institute's education department had made a grant in 1994.

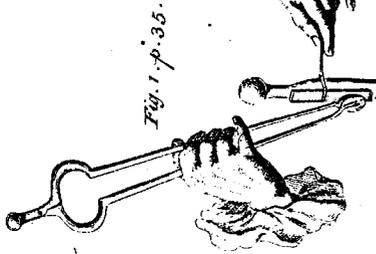
K.B.H.Herbert

John Canton was born in Stroud the son of a broadloom weaver. Through sheer ability and determination, he rose to become a Fellow of the Royal Society, a member of its Council, twice winner of the Copley Medal, and one of the most respected physicists of his generation, a close friend of, and correspondent with such figures as Joseph Priestley and Benjamin Franklin.

Canton's parents were dissenters; he was baptised at the nearby non-conformist chapel, and remained a committed member of the dissenting community all his life. Sent to the local charity school, he quickly distinguished himself by his academic prowess, particularly in mathematics. When aged about nine, his father decided that the boy had received sufficient education for a future weaver, removed him from school and took him as his apprentice. The young John was not to be so easily deterred, however; he took every opportunity to continue his studies, working so late into the night that his father feared for the boy's health. During this time he calculated and carved in stone a sundial, which, in addition to time of day, provided various other astronomical information such as time of sunrise, and the position of the sun in the ecliptic. His father proudly displayed the dial in front of his cottage, where it attracted the attention of passing gentry, some of whom encouraged him in his studies and permitted him the use of their libraries. When about 18, the Rev. Dr. Henry Miles, a native of Stroud, but then the minister at dissenting chapels in Tooting and Old Jewry, London, persuaded Canton senior that his son's abilities were being wasted in Stroud, and the father agreed that the boy should accompany Miles to the capital, and stay with him while he sought suitable employment. Accordingly, Canton stayed with Miles for three months, after which he articulated himself as a Clerk, or pupil teacher, to the Master of the Academy in Spital Square. The Spital Academy seems to have been a school for the sons of wealthy non-conformists, although pupils from other backgrounds also attended. So impressed was the Master with his young assistant that on completion of the five years articles, he took the Canton into partnership. On Christmas day 1744, Canton married Penelope Colebrooke, a member of the wealthy banking family, and his climb up the social ladder was crowned the following year when, aged 27, he became Master of the Academy, a position he was to hold for the remainder of his life.

Soon after arriving in London, Miles, who became a F.R.S. in 1743, was able to introduce Canton to the scientific circles in which he moved, and so for the first time, Canton was able to meet and socialize with people having similar interests and abilities, and to become aware of contemporary issues, ideas, and questions. Miles owned a collection of "philosophical instruments", and no doubt Canton had the use of these, which were bequeathed to him on Miles' death.

Canton's first publications were routine calculations of



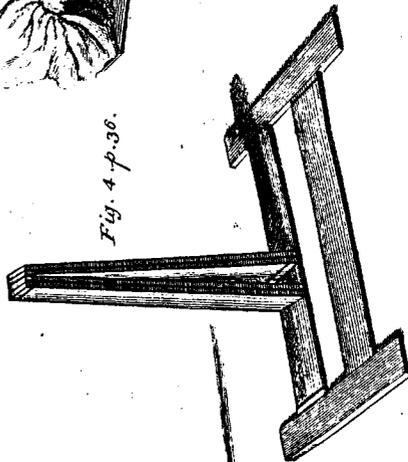
*Fig. 1. p. 35.*



*Fig. 2. p. 35.*



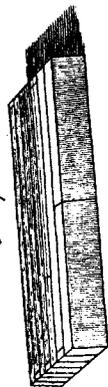
*Fig. 3. p. 36.*



*Fig. 5. p. 37.*



*Fig. 6. p. 38.*



eclipses, and electrical queries which appeared in the "Ladies' Diary" and the "Gentleman's Magazine" but the first mention of his name in "Philosophical Transactions" occurs in a paper by William Watson in 1746 (1) where reference is made to an experiment

"by Mr Canton, to determine the quantity of electricity accumulated in the Leyden phial. Taking the charged phial in one hand, he made it give a spark to an insulated conductor, which spark he took off with his other hand. This operation he repeated till the whole was discharged; and by the number of sparks, he estimated the charge."

It is of interest that Canton was experimenting with a Leyden jar as early as 1746; its invention, usually attributed to Musschenbroek or von Kleist, did not occur until 1745 or 46.

By the late 1740's, Canton had achieved a considerable reputation as a skilled experimenter, and in 1749 was elected a Fellow of the Royal Society, his sponsors including the Astronomer Royal James Bradley, Benjamin Robins, the ballistics expert, and Gowin Knight, first librarian of the British Museum, and experimenter in magnetism. Knight had devised a method of making strong magnets, which he kept secret, only divulged after his death, since he was making a considerable sum of money supplying compass needles to the Admiralty. During the 1740's, Canton had also found a method of making strong magnets, but had not disclosed his method for fear it might prove injurious to Knight's business. He did, however, demonstrate the method to his friends, who urged him to publicize it. It should be remembered that the only way of making strong magnets at this time was by the use of a lodestone, which was not required in Canton's method. Accordingly, in 1751, with some nervousness and trepidation, Canton demonstrated his method to the Royal Society, subsequently published in *Philosophical Transactions* (2). Four bars of soft steel were magnetized by stroking them against an iron poker which had become magnetized by being left in its customary position, which happened to coincide approximately with the direction of the earth's field. Two unmagnetized bars were placed between two short bars of iron, so as to form a rectangle. The magnetized bars were then placed in pairs and used to stroke the unmagnetized bars. By a complicated sequence of interchanging the bars, and then using these to magnetize similar bars of hard steel, Canton was able to produce what were for the time, very strong magnets. The demonstration was a great success, and Canton was awarded the Copley Medal of the Society, which was at this period awarded for the best experiment demonstrated to the Society during the year. The same year, Canton was awarded the honorary degree of M.A. by the University of Aberdeen.

Unfortunately, the demonstration provoked a bitter controversy which troubled Canton for the remainder of his life. The Rev. John Michell had, early in 1750, published "A Treatise on Artificial Magnets" in which he described a method of making strong magnets very similar to that of Canton, and he claimed that the latter had appropriated his method. The essential difference between Canton's and Michell's methods was that the former had the bars arranged in a rectangle, thereby forming a magnetic circuit, whereas Michell had his bars in a straight

line, Canton's method should thus result in a stronger magnetization. The Royal Society investigated, and found in favour of Canton, and this was supported by the overwhelming opinion of the scientific community in London. Nevertheless, the controversy continued, and even on his deathbed, Canton was imploring his friend Joseph Priestley to make efforts to clear his name in this affair, and as late as 1785, thirteen years after Canton's death, Michell was still making his claim.

Canton's reputation rests mainly for his work in electrostatics. In 1753 and 1754 he published two papers in *Philosophical Transactions* (3,4) the results of his investigations into electrostatic induction. Canton was a friend and close associate of Benjamin Franklin, and his experiments were made in the context of the latter's "single fluid" theory. In order to account for the then known facts of electricity, particularly the action of the Leyden Jar, Franklin proposed the existence of a "subtle weightless fluid" which pervaded all bodies in the spaces between the particles of which the body was assumed to be made. A body was electrically neutral when the fluid within and without it were in equilibrium. Excess of the fluid resulted in a positive charge, a deficiency in a negative charge. The particles of electric fluid were assumed to repel each other, but to be attracted by the particles of "common matter" of which the body was composed. Excess fluid resulted in the formation of an "electrical atmosphere" surrounding the body. Canton invented the well known "pith ball electroscope"; two small balls of elder pith or cork suspended from a common support by threads of linen or silk. These would diverge when charged or in the neighbourhood of a charged body. Using this simple apparatus, Canton investigated the charges induced in the balls, and in tin tubes, when electrified glass tubes and sealing wax were brought close to them. His explanations for the observed effects were in terms of the single fluid theory, which was largely replaced towards the end of the century by a two fluid theory, but Canton's experiments and observations provided a body of empirical knowledge which formed a cornerstone for the subsequent development of electrical theory. The experiments were refined and developed by Franklin and Aepinus. Joseph Priestley, in his *History and Present State of Electricity* (5) wrote;

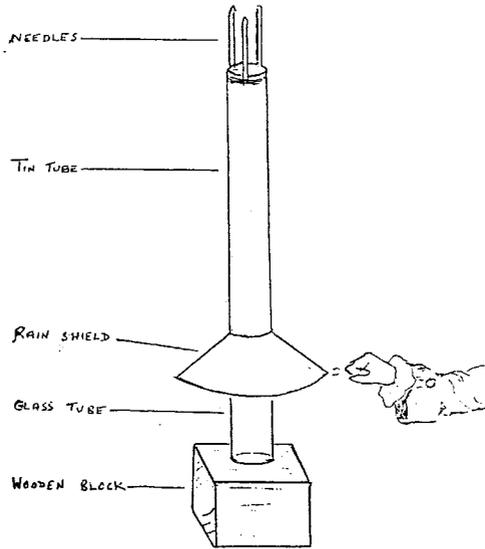
"I shall present ...the finest series of experiments that the whole history of electricity can exhibit, and in which we shall see the genius and address of four of the most eminent electricians in this whole period; namely, Mr.Canton and Dr.Franklin, Englishmen, and Messrs. Wilke and Aepinus, foreigners. Mr.Canton had the honour to take the lead, and made all the essential experiments."

Canton also made the significant discovery that the sign of the charge acquired by a body when electrified by friction depended on the state of its surface and not just the material from which it was composed, as had formerly been believed. For example, a polished glass rod becomes positively charged, whereas roughened glass becomes negatively charged.

Another area of important work by Canton, was in the field of

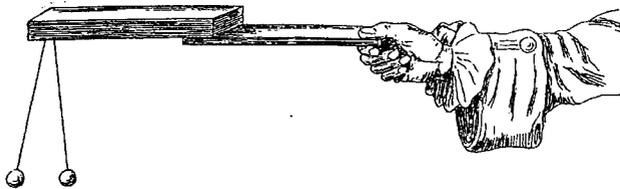
### CANTON'S THUNDERSTORM APPARATUS (CONJECTURAL)

Canton did not provide a diagram of his apparatus for demonstrating the electrical nature of thunderstorms, but from his description it must have looked something like this:



### CANTON'S PITH BALL ELECTROSCOPE

from Philosophical Transactions Vol.48.2 (1754)



atmospheric electricity. Although the idea that thunderstorms were electrical in nature had been suggested by many, there was no direct evidence in support of the theory until Benjamin Franklin proposed setting up vertical iron rods, pointed at the upper end, and terminating at the lower end in an insulated stand protected from the weather by a kind of "sentry box". Franklin believed that, if thunderstorms were electrical, sparks should be obtainable from the lower end of the rod. The experiment was first performed, not by Franklin himself, but set up by d'Alibard at Marly, near Paris, in May 1752. Franklin's prediction was indeed correct; sparks were obtained from the rod, thus confirming the electrical nature of thunderstorms. In July of the same year, Franklin performed his famous experiment with the kite. The Marly experiment was soon repeated at several places on the continent, but attempts in Britain met with failure, until Canton, working independently, and with an apparatus substantially different from Franklin's, succeeded in obtaining electricity from thunderstorms on July 20th 1752. Canton described his experiment in a letter to William Watson, subsequently published in *Philosophical Transactions* (6);

"...a tin tube, between three and four feet in length, (was) fixed to the top of a glass one, of about eighteen inches. To the upper end of the tin tube, which was not so high as a stack of chimnies on the same house, I fastened three needles with some wire; and to the lower end was solder'd a tin cover to keep the rain from the glass tube, which was set upright in a block of wood...."

Canton found that when he applied his knuckle to the edge of the tin cover during a thunderstorm, sparks were obtained. The reason why Canton succeeded whilst others failed was apparently because his apparatus was the only one in which the insulation was protected from the short-circuiting effect of rain.

By using a portable version of his pith ball electroscope, in which the balls and thread were contained in a sliding box with a wooden cover, Canton investigated the electrification of clouds, and found that the clouds were sometimes in a positive, sometimes in a negative, state. Franklin had made the same discovery in Philadelphia shortly before (although this was unknown to Canton at the time) and was greatly surprised, since he, at first, found the negative electrification difficult to reconcile with his single fluid theory, and was therefore delighted to hear of the confirmation by Canton.

Canton also found that rain, hail, and thawing snow were charged, and that the air outdoors was sometimes electrified in clear weather, but never at night, unless there was a display of aurora borealis, which seems to have been observed more frequently in London than at present, due in part, no doubt, to the darker skies at the time. He also appears to have been the first to notice the disturbance of the earth's magnetic field when the aurora was visible.

Canton's second Copley Medal, awarded in 1765, was for his demonstration of the compressibility of water. In his paper (7) Canton refers to the "famous Florentine experiment" which had led to the general belief that water was incompressible. The

experiment he is referring to was conducted by the "Academia del Cimento" established in 1657 under the patronage of the Medici family. The Academy only existed for ten years, and its report, published in English translation in 1684 describes three experiments to detect the compressibility of water, none of which was successful. Canton performed two experiments to detect the compressibility; one qualitative, one quantitative. In the latter experiment, he used a hollow glass sphere 1.6" in diameter, to which was attached a calibrated capillary tube 0.01" internal diameter, open at its end. The sphere and capillary were filled with air free water, so that the water level was part of the way up the capillary. The apparatus was placed under the receiver of a pump, the air pressure reduced, and the water was observed to rise up the capillary. The pressure was then increased above atmospheric pressure, and the water level was depressed. Canton performed several subsidiary experiments to establish that the change in level was not due to distortion of the glass, or the presence of air in the water, and he ensured that temperature remained constant by placing the sphere and tube in a water bath. Canton assumed that the pressure was reduced to zero in the first part of the experiment, and increased to two atmospheres in the second part. The typical vacuum pump of the mid-eighteenth century is said to have been only capable of reducing the pressure to about 1/50 At. at best, (8) and so one can assume that the pressure was reduced to about 15mm Hg. Since the experiment was conducted at 50°F, at which temperature the S.V.P. of water is about 9mm Hg, the water would not have boiled. Canton concludes that a pressure change of 1 At. results in a change in volume of one part in 10870. He also measured the compressibility of other liquids, such as spirit of wine, olive oil, mercury, and sea water, and found that the compressibility decreased as the density increased. For these experiments, Canton was nominated for a second Copley Medal in 1764. However, several Fellows were not convinced that the decrease in volume was really due to compressibility, and suspected some spurious effect. The Royal Society therefore appointed a committee of 12 Fellows, chaired by the President, the Earl of Morton, to investigate the matter. After much deliberation, the committee were able to raise no objections, and Canton was awarded the medal. Had Canton really detected the compressibility of water? Taking Canton's results at their face value, we can calculate a figure for the Bulk Modulus of water, which comes to about 2 GPa. This compares well with the currently accepted value of 2.05 GPa (Kaye and Laby), so we can safely conclude that Canton deserved his medal!

The above represents Canton's major achievements, but in addition he investigated the electrical properties of tourmaline; he kept a daily record of the variation of the earth's magnetic field, and, as mentioned, detected the disturbance at the time of the aurora borealis; he made a phosphor from calcined oyster shells and sulphur, known today as "Canton's Phosphor", and investigated its properties; he participated in the worldwide observations of the transits of Venus in 1761 and 1769, and, by a classic demonstration of scientific method, he showed that the phosphorescence of sea water was due to the decomposition of organic matter, a question which had been in dispute since

antiquity.

John Canton died on 22nd March 1772, aged 54. Professor Heilbron, in his entry on Canton in the Dictionary of Scientific Biography, concludes with a fitting tribute;

"..schoolmaster Canton was one of the most distinguished of the group of self-made, self-educated men who were the best representatives of English physics in the mid-eighteenth century".

#### References

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2. Canton, J. "A Method of making Artificial Magnets..." *ibid* vol.47 (1751-52) p.31-38
3. Canton, J. "Electrical Experiments...with some Observations on Thunderclouds". *ibid* vol.48.1 (1753) p.350-58
4. Canton, J. "A Letter...concerning some new Electrical Experiments" *ibid* vol.48.2 (1754) p.780-84
5. Priestley, J. "History and Present State of Electricity" 3rd. ed.vol.I p.388 (London 1775)
6. Watson, W. "A Letter...concerning the Electrical Experiments upon Thunderclouds" *Philosophical Transactions* vol.47 (1751-52) p.568-69
7. Canton, J. "Experiments to prove that water is not Incompressible" *ibid* vol.52 (1763) p.640-43
8. Heilbron, J. "Electricity and Magnetism in the 17th and 18th centuries" University of California Press (1979)

## LECTURES AND MEETINGS

This information has kindly been supplied by the BSHS and is their copyright. Nearly all these meetings are open to people who are not members of the society concerned, sometimes at a slightly higher cost. We remind readers to check before departure that the event has not been cancelled .

### **British Society for the History of Science**

\*P M S Blackett: Science and Politics in Twentieth Century Britain

at Clore Theatre, Imperial College

on 16-17 April 1998

This meeting is organised jointly with the Royal Society, Imperial College, Manchester University, and the Operational Research Society. The British physicist P M S Blackett was born in 1897, and received the Nobel Prize in 1948. As well as making important contributions to particle physics and geophysics, Blackett was an important figure in a number of British universities (including Manchester and Imperial College). He was also very well known for his singular contributions to operational research in the second world war, his opposition to a British nuclear programme, for his writing on military strategy, and his involvement in policy making in science and technology in the 1960s. This conference brings together not only scientists and politicians who worked with Blackett, but also historians of science and military strategy, to reflect on the place of Blackett not only in the history of British science, but in the history of British strategy and politics. Speakers include: Sir Ronald Oxburgh, David Edgerton, Sir Bernard Lovell, Jeff Hughes, Jonathan Rosenhead, Harry Elliott, Sir Arnold Wolfendale, Sir Clifford Butler, Mary-Jo Nye, Ted Irving, Jonathan Rosenhead, Sir Michael Howard and Tony Benn. Further details and registration form from BSHS Executive Secretary, 31 High Street, Stanford in the Vale, Faringdon, Oxfordshire, SN7 8LH. E-mail: bshs@hidex.demon.co.uk

\*New Directions in the History of British Computing

at Manchester University

on 16-17 June 1998

In June 1998, Manchester is celebrating fifty years since the building of the first electronic stored-program computer. This conference will consider the history of computing in a broader sense, including such subjects as diverse as mechanical practices of calculation, the construction of mathematical tables, the historiography of computing, the application of computers by British scientists, and the history of computer games. The meeting will incorporate the Society's EGM for 1998. Further details from Dr Jon Agar, CHSTM, Mathematics Tower, Manchester University, M13 9PL. E-mail: agar@fs4.ma.man.ac.uk

\*Gender and Science

at St Edmund Hall, Oxford

on 11 July 1998

Speakers include: Alison Winter, Alison Morrison-Low, Sophie Forgan, Graeme Gooday, Janet Browne, and Michael Roper. Further details from Professor Ludmilla Jordanova, Word Art Studies and Museology, University of East Anglia, Norwich. E-mail: l.jordanova@uea.ac.uk, or Dr Katherine Watson, Wellcome Institute for History of Medicine, 183 Euston Road, London. E-mail: ucgakdw@ucl.ac.uk

## Wellcome Institute for the History of Medicine

\*Symposium on the History of Botany and Medicine

at Wellcome Institute for the History of Medicine

on 17 April 1998

Speakers will be A Cunningham, A Touwaide, L Brockliss, D Allen, L Cunliffe-Lister, D Harley, M Dobson, N Towers, J Goodman and V Walsh. Further details from Ms F Houser, Wellcome Institute for the History of Medicine, 183 Euston Road, London, NW1 2BE.

\*Symposium on 'Consuming Blood'

at Wellcome Institute for the History of Medicine

on 15 May 1998

Speakers will be K Pelis, A Cunningham, A Goldbloom, M Gosbee, N Hattori, R Porter, M Thomas, S E Lederer, W Schneider, H Dodsworth, A M Moulin and K Crocker. Further details from Ms F Houser, Wellcome Institute for the History of Medicine, 183 Euston Road, London, NW1 2BE.

\*Symposium on the National Health Service: Its Past, Present and Future

at Wellcome Institute for the History of Medicine

on 3 July 1998

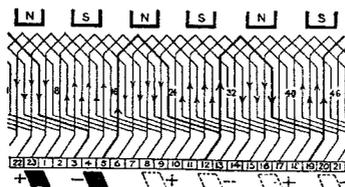
Speakers will be A Hardy, C Webster, G Rivett, R Stevens, J Lewis, D Brady, N Timmins, M Neve. Further details from Ms F Houser, Wellcome Institute for the History of Medicine, 183 Euston Road, London, NW1 2BE.

\*Anthropology and Psychology: the Legacy of Torres Straits, 1898-1998

at St Johns College, Cambridge University

on 10-12 August 1998

This conference is supported jointly with British Psychological Society and the Royal Anthropological Institute. The 1898 Cambridge expedition to the Torres Straits is widely recognised as having been formative in the development of anthropology and psychology in Britain. It was a turning-point in the careers of several participants who went on to found what have become highly specialised disciplines in the twentieth century. The aim of the conference is to look forward by reflecting on the past, to ask whether the dynamic interaction of embryonic disciplines a century ago offers a useful framework for thinking about the possibilities for intellectual synthesis today. Provisional speakers include: Keith Hart and Graham Richards on reevaluating the TSE today, Sandra Rouse and Elizabeth Edwards on Haddon, Henrika Kuklick on Rivers, Anita Herle and Jude Philp on the Torres Strait today, Simon Schaffer on measurement, Barbara Saunders on colour classification. Further details from: Paul Caldwell, Department of Social Anthropology, Free School Lane, Cambridge CB2 3RF. Tel: +44-1223-334586. E-mail: pfc21@hermes.cam.ac.uk



\*The Political and Moral Economy of Standards

at City University

on 24 October 1998

Further details from Dr Arne Hessenbruch, Department of History & Sociology of Science, University of Pennsylvania, Logan Hall 249 S. 36th Street, Philadelphia, PA 19104-6304, USA (until 1 July 1998). E-mail: arne@sas.upenn.edu

### **Royal Society of Arts**

The Society's History Study Group Programme

at Royal Society of Arts

on 16 March, 20 April, 29 June 1998

Speakers will be respectively J Insley, D Allan, G Seidmann. Further details (including timings) from Susan Bennett, Archivist, Royal Society of Arts, 8 John Adam Street, London, WC2N 6EZ.

\*The Spirit of Improvement

at the Royal Society of Arts

on 8 May 1998 This all day meeting will discuss the role of technology and science in improving various aspects of society during the eighteenth and nineteenth centuries.

Speakers will be F Foden, D Allen, E Evans, I Whyte, B Pace, J V Beckett, J Tann and F A J L James. Further details from Susan Bennett, Royal Society of Arts, 8 John Adam Street, London, WC2N 6EZ.

### **Royal Institution Centre for the History of Science and Technology**

\*RICHST Research Seminar

at The Royal Institution

on 24 March, 28 April, 26 May, 23 June, 22 September, 27 October 1998 at 5.30 pm.

Speakers will be respectively Frank A J L James (Faraday and Lighthouses), James Hamilton (Fields of influence: Artists, Scientists and Events), Arthur Lucas (Ferdinand von Mueller and Science Education in Victorian Victoria), Nancy Cartwright (The Limits of Causal Order from Economics to Physics), Joe Cain (Their Honeymoon Spent Caked in Mud: Collaboration as Courtship in the Careers of Anne Roe and George Gaylord Simpson) and Sophie Forgan (Science and the projection of England: concepts of national identity in the Festival of Britain 1951)

\*Science and Art in Britain, 1800-1860

at The Royal Institution

on 28 April 1998

This afternoon meeting, held during the showing of the exhibition 'Turner and the Scientists' at the Tate Gallery, will comprise short presentations by historians of science and of art which will examine the various interactions between artists and scientists during this period. Historical figures who will be examined include J M W Turner, John Constable, Humphry Davy, Cornelius Varley, Michael Faraday and Harriet Moore. Plenty of time will be allowed for general discussion of the issues raised. Further details (available at the end of March) from Dr Frank James, Royal Institution, 21 Albemarle Street, London, W1X 4BS.

## **American Association for the History of Medicine**

Annual Meeting

at Toronto

on 7-10 May 1998

Offers of papers on any topic in the history of medicine. by 30 September 1997, to J H Warner, Section of the History of Medicine, Yale University School of Medicine, L132 SHM, PO Box 208015, New Haven, CT 06520-8015, USA.

## **Society for the History of Alchemy and Chemistry**

\*H E Armstrong: A Sesquicentennial Celebration

at Science Museum and Imperial College Library

on 20 May 1998

Speakers will include William H Brock, Richard Rice, Joan Mason and Mick Nott. Further details from John Hudson, Applied Sciences, Anglia Polytechnic University, East Road, Cambridge, CB1 1PT.

## **CHEIRON:**

### **The International Society for the History of the Behavioral and Social Sciences**

Annual Meeting

at University of San Diego

on 18-21 June 1998

Further details from Leila Zenderland, Cheiron Program Chair, Department of American Studies, California State University, Fullerton, CA 92834-6868. E-mail: lzenderland@fullerton.edu

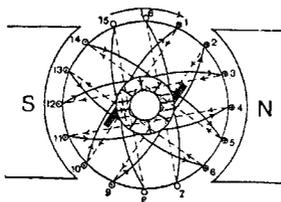
## **Royal Meteorological Society History Group**

\*London weather through the centuries.

at Kew area

on 20 June 1998

The effects of London's growth on its weather and climate; the Royal Society and the setting-up of Kew Observatory. Climate issues now faced by Kew Gardens. Further details in due course from the Group Secretary, M E Crewe, National Meteorological Library, London Road, Bracknell, RG12 2SZ.



**\*Meeting to Celebrate the Society's 150th Anniversary**

**at the Royal Society**

**on 3-4 April 2000**

This meeting, which is co-sponsored by the Institution of Civil Engineers, Royal Astronomical Society and Royal Geographical Society will cover the history of the Society, its antecedents, its contemporaries – the Scottish Meteorological Society and the British Rainfall Organisation, and the Societies with whom it shared many interests and members – the Royal Society, Royal Astronomical Society, the Royal Geographical Society and the Institution of Civil Engineers. Themes will include: Formation of the early English meteorological societies, from 1823, the Society's administration, premises, membership and publications, G J Symons and the *Meteorological Magazine*, the Society's relations with instrument makers, and its exhibitions, the Society's connections with medicine and the natural sciences, with astronomy and upper air, with technology, and with education, the Scottish Meteorological Society, 1855-1921, with Ben Nevis Observatory, English and Scottish Met. Societies' interests in maritime meteorology, British Rainfall Organisation, 1860-1919, and the work of H R Mill, the Society and the Royal Geographical Society, the Society's activities during the past fifty years. Further information will be available later from The History Group Hon Sec, Royal Meteorological Society, 104 Oxford Road, Reading, RG1 7LL.

**University of Manchester**

**\*After the Body: An International Conference on Religion, Culture and Gender**

**at University of Manchester**

**on 22-25 June 1998**

The keynote speakers will be Talal Asad, Mary Douglas, Page du Bois, Thomas Laqueur, Roy Porter and Bryan Turner. Further details from the Centre for Religion, Culture and Gender, Department of Religions and Theology, University of Manchester, M13 9PL; e-mail: [crcg@man.ac.uk](mailto:crcg@man.ac.uk). WWW: <http://www.art.man.ac.uk/reltheol/crcg/body.htm>

**All European Academies**

**History of Science and Technology in Education and Training in Europe**

**at University Louis Pasteur Strasbourg**

**on 25-6 June 1998**

Further details from Claude Debru, Centre Européen d'Histoire de la Médecine, Faculté de Médecine, Université Louis Pasteur, 4 rue Kirschleger, 67085 Strasbourg, France.

**University of Southampton**

**\*Darwin's Millennium**

**at University of Southampton**

**on 3-5 July 1998**

This conference will inquire into the processes and effects of Darwin's 'dangerous' ideas from the mid-eighteenth century onwards. Further details from Lucy Hartley, Department of English, University of Southampton, Southampton, SO17 1BJ; e-mail: [lh2@soton.ac.uk](mailto:lh2@soton.ac.uk)

## **Society for Hellenic Cartography**

\*18th International Conference On The History Of Cartography  
at Athens

on 11-16 July 1999

This meeting is organised with the National Hellenic Research Foundation, in collaboration with Imago Mundi Ltd. The theme of the conference is 'The Cartography of the Mediterranean World'. Offers of papers to and further information from Dr George Tolias, 18th International Conference on the History of Cartography, The National Hellenic Research Foundation, 48 Vassileos Konstantinou Avenue, GR-116 35, Athens, Greece. E-mail: gtolias@cie.gr

## **Society for the Social History of Medicine**

Summer Meeting: Medicine and the Public Sphere

at University of Edinburgh

on 17-19 July 1998

The history of medicine provides a useful lens through which to view shifting boundary between the public and private spheres, and the constitution of the public sphere. This conference will examine such issues by looking at the development of medical care and medical administration in Britain from the late eighteenth century to the present day. Topics will include the growth of public health, the development of the hospital services, the organisation and status of medical research, and the recent privatisation of the NHS. Further details from Steve Sturdy, Science Studies Unit, University of Edinburgh, 21 Buccleuch Place, Edinburgh EH8 9LN. E-Mail s.sturdy@ed.ac.uk

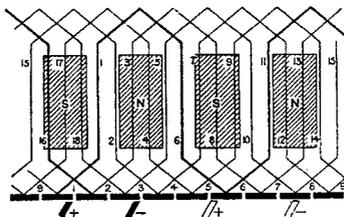
## **International Union of the History and Philosophy of Science**

\*XVII International Scientific Instrument Symposium

at Sorø

on 20-25 July 1998

Offers of papers to and further information from the XVII International Scientific Instrument Symposium, Sorø Academy, Postbox 37, DK-4180 Sorø, Denmark.



## **Pascal Centre**

Science in Theistic Contexts  
at Redeemer College  
on 21-25 July 1998

This conference will be an exploration of the internal role of theistic religious beliefs in mathematics and the natural science through contextualised case studies. Speakers will include J H Brooke, I Grattan-Guinness, M Osler, N A Rupke, C A Russell and P Sloan. Further details from The Pascal Centre, Redeemer College, 777 Hwy 53E, Ancaster, Ontario, L9K 1J4, Canada, e-mail: pascalcentre@redeemer.on.ca or www.redeemer.on.ca/pascal/

## **University of Plymouth**

ECLIPSE 99: Navigational Stimulus to the History of Science  
at University of Plymouth  
on 9-12 August 1999

This conference, which coincides with the next total eclipse of the Sun to be visible from England, will explore the impact of navigation on the history of science. Offers of papers to and further information from P A H Seymour, Institute of Marine Studies, University of Plymouth, Drake Circus, Plymouth, Devon, PL4 8AA.

## **University of Edinburgh**

Medicine, Science, and Enlightenment, 1685-1789  
at Edinburgh  
on 11-14 August 1998

This conference which is sponsored by the Institute for Advanced Studies in the Humanities, University of Edinburgh. The programme co-ordinators are Professor Roger Emerson, Department of History, Social Sciences Centre, University of Western Ontario, London, Ontario, Canada, N6A 5C2 (e-mail: emerson@sscl.uwo.ca) and Professor Paul Wood, Department of History, University of Victoria, P.O. Box 3045, Victoria, BC, Canada, V8W 3P4 (e-mail: pbwood@uvvm.uvic.ca). Conference participants are encouraged to take part in the Institute Project: European Enlightenment, sponsored by the Institute for Advanced Studies in the Humanities. Information regarding the Institute Project and the Fellowship programme administered by the Institute can be obtained by writing to Professor Peter Jones, Institute for Advanced Studies in the Humanities, University of Edinburgh, Hope Park Square, Edinburgh, EH8 9NW, Scotland.

## **International Society for the study of European Ideas**

Engineering Stories: Texts, Pictures and Myths in the History of Engineering  
at Haifa University  
on 16-21 August 1998

The aims of the workshop are to explore how texts, pictures and myths have been used to create (or sustain) particular versions of technological history. Further details from Stuart Bennett, Department of Automatic Control & Systems Engineering, The University of Sheffield, Mappin Street, Sheffield, S1 3JD, UK. email: s.bennett@sheffield.ac.uk

## **University of Roskilde**

Problems in the Historiography of Recent Science, Technology and Medicine  
at University of Roskilde  
on 19-23 August 1998

This will be the second international conference devoted to problems in the historiography of recent science, technology and medicine. The number of participants is limited to around 35. There will be time for 15-20 paper presentations. Further details from Thomas Söderqvist, Division of Philosophy and Theory of Science, Department of Communication, Roskilde University, P.O.Box 260, DK-4000 Roskilde, Denmark. E-mail: thomass@ruc.dk

## **8th International Conference on the History of Science in China**

\*China and the West

at Technische Universität Berlin  
on 23 - 28 August 1988

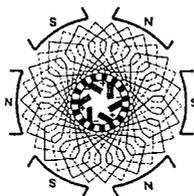
This meeting will also include the 2nd International Symposium on Ancient Chinese Books and Records on Science and Technology. The themes of the main meeting will be Transmission and Diffusion of Technology between China and the West, Cross-cultural Comparisons in Technology, Science and Bureaucracy and New Research Areas in the History of Chinese Science, Technology and Medicine. Offers of papers, by 31 March 1998, and further information from Weif H Schnell, Technische Universität Berlin, Institut für Philosophie, Sekr: 14 - 7, Ernst-Reuter-Platz 7, 10587 Berlin, Germany. E-mail: 8thichsc@server.kgw.tu-berlin.de. WWW address: <http://station4.kgw.tu-berlin.de>

## **International Commission on the History of Geological Sciences**

\*Advancing Geological Knowledge of the Carpathian-Balkan Region in the Nineteenth and Twentieth Centuries

at Geocenter, University of Vienna  
on 30 August -2 September 1998

This symposium will form part of the activities of the XVth Congress of the Carpathian-Balkan Geological Association. For further information, contact the Organizing Committee, XVI Congress of the CBGA, Geological Survey of Austria, Rasumofskygasse 23, PO Box 127, Vienna, Austria-1031; Fax: 431 712567456; e-mail: wjanoschek@cc.geolba.ac.at or Dr Endre Dudich, Geological Institute of Hungary, PO Box 106, Budapest, Hungary-1142; Fax: 361 2510703; e-mail: geo@mafi.hu



**\*From Folds to Nappes to Plates, The History of Ideas about Glaciation  
at Neuchâtel**

on 7-14 September 1998

For further information, contact Professor Jean-Paul Schaer, Université de Neuchâtel,  
Institut de Géologie, Emile-Argand 11, 2007 Neuchâtel, Switzerland; Fax: 41 32 7182601;  
e-mail: sabine.robert@geol.unine.ch

**International History, Philosophy and Science Teaching Group**

\*5th International Conference

at Pavia University

on 15-19 September 1999

This conference will bring together scientists, teachers, historians, philosophers,  
mathematicians and educators. The meeting will also contribute to the local celebrations  
of the bicentenary of Alessandro Volta's creation of the battery in 1799. Further details  
from Dr E A Giannetto, Dipartimento di Fisica 'A Volta', Università di Pavia, Via A Bassi  
6, 27100 Pavia, Italy; e-mail: volta99@pv.infn.it; WWW: www.cilea.it/volta99

**American Society for Information Science**

\*History and Heritage of Science Information Systems

at Pittsburgh

on 23-25 October 1998

The conference, which is co-sponsored by a number of other groups, will explore the  
history and heritage of the nature, development and influence of all types of science  
information systems. Offers of papers, by 1 April 1998, to and further details from  
Professor R V Williams, College of Library and Information Science, University of South  
Carolina, Columbia, SC 29208, USA; e-mail: bobwill@sc.edu

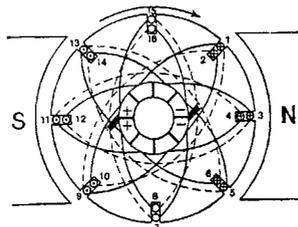
**International Association of Geomagnetism and Aeronomy**

\*Long- and Short Term Variability in Sun's History and Global Change

at Birmingham

on July 1999

Topics will include papers from history, archaeology, solar physics, astrophysics among  
other subjects dealing with historically observed minima in the sun's activities. Offers of  
papers, by 15 January 1999, to and further details from Dr Wilfried Schröder,  
Hechelstrasse 8, D-28777 Bremen-Roennebeck, Germany.



# New Exhibitions

*You won't feel a thing: Needles in medical history*

at The Wellcome Building, 183 Euston Road, London, NW1 2BE  
from 17 April - 29 August 1998

This exhibition will explore the various ways in which needles have come to be used in medicine and the role they have acquired in the popular culture of medicine.

*Humphrey Cole - Mint, Measurement and Maps in Elizabethan England*

at The British Museum  
from 3 March - 6 May 1998

Most of the instruments made by Humphrey Cole, the map engraved for Richard Jugge's Bible and objects from the mint will be on display. Further details from Silke Ackermann, Department of Medieval and Late Antiquities, British Museum, London, WC1B 3DG.

*The Garden, the Ark, the Tower, the Temple: Biblical metaphors of knowledge in early modern Europe*

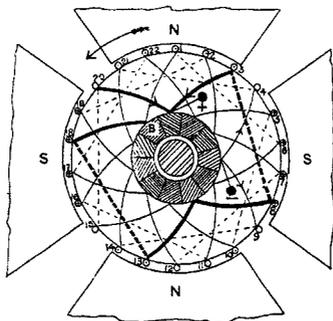
at the Bodleian Library, Oxford  
from 2 February to 2 May 1998 (Weekdays 9.30-4.45, Saturdays 9.30-12.30)

This exhibition is organised with the Museum of the History of Science in Oxford. On Thursday evenings in February there will be an associated series of lectures in the Museum at 6.00 pm. Further details from Dr J A Bennett, Museum of the History of Science, Broad Street, Oxford, OX1 3AZ.

*Line of Faith*

at the Museum of the History of Science, Oxford  
from 10 March to 30 May 1998 (Tuesday to Saturday, 12.00-4.00)

This is an exhibition of Islamic mathematical instruments. Further details from Dr J A Bennett, Museum of the History of Science, Broad Street, Oxford, OX1 3AZ.



## LECTURES AND MEETINGS

This information has kindly been supplied by the BSHM and is their copyright. We remind readers to check before departure that the event has not been cancelled.

### *Tuesday 7 April 1998*

#### HIMED 98

Our annual meeting on the uses of history in mathematics education will be held at the University of Warwick on Tuesday 7 April 1998. This is the day after the 1998 Mathematical Association Annual Conference ends, which is also being held at the University of Warwick. Topics to be covered at HIMED 98 range from *Mathematics master classes* (Professor Sir Christopher Zeeman, FRS) to *The history of  $\pi$*  (Dr Roger Webster). Members are invited to offer contributions for workshop sessions (deadline 16 March).

The cost will be £19, including coffee, lunch and tea. Overnight accommodation (6/7 April) will be available on the University campus for £23.05. Deadline for bookings is 31 March 1998.

Further details from J V Field, *Department of History of Art, Birkbeck College, 43 Gordon Square, London WC1H 0PD*. Fax 0171-631-8107; Tel & Fax 0171-736-9198 << jv.field@hart.bbk.ac.uk >>

### *Thursday 21 May 1998*

#### HISTORY OF COMBINATORICS

A meeting on the history of combinatorics to be held on 21 May at the Open University, Milton Keynes. Speakers include Eberhard Knobloch, Anthony Edwards, Keith Lloyd, Terry Griggs, Ian Anderson, Harald Gropp, Norman Biggs and David Singmaster.

Details from Robin Wilson, *Mathematics Faculty, Open University, Milton Keynes MK7 6AA*. << r.j.wilson@open.ac.uk >>

### *Saturday 20 June 1998*

#### HISTORY OF CRYPTOGRAPHY AT BLETCHLEY PARK

A meeting on aspects of the history of cryptography in the twentieth century will be held on 20 June at Bletchley Park, Milton Keynes. Speakers include Clifford Cocks (GCHQ): *The invention of non-secret encryption*, Donald Davies, Whitfield Diffie (Sun Micro Systems): *Technology and cryptography in the 20th century*, and Jim Reeds (AT&T): *Error detection: mutilation tables in early 20th-century telegraphic code books*.

There will be a guided tour of the collections held at Bletchley Park, including the reconstruction of Colossus. The fee (which includes coffee, lunch with wine, and tea) will be £27 for members of the BSHM, £32 for non-members, and £17 for students. Further details from J V Field, *Department of History of Art, Birkbeck College, 43 Gordon Square, London WC1H 0PD*. Fax 0171-631-8107; Tel & Fax 0171-736-9198 << jv.field@hart.bbk.ac.uk >>

# BLUE PLAQUE INFORMATION

LUCY HUDSON

CLIVE JONES

## 1. John Canton, FRS (1718 - 1772)

*Location:* near the main door of the Old Town Hall in the Shambles, Stroud. This building used to house the school which he attended.

*Unveiled:* 22.05.97

Canton was born and spent his formative years in Stroud, Gloucestershire. Although he left school early in order to go into the family business, Canton continued to study in his own time. A Dissenting preacher from Stroud, Dr. Henry Miles, noticed his talent, and arranged for him to leave home, and eventually to become articled to Samuel Watkins, master of a school near to what is now Liverpool Street Station in London. Having served his apprenticeship from 1738-1745, Canton succeeded Watkins and kept the school until his death 27 years later. Henry Miles became FRS in 1743, and through him, Canton was able to mix in natural philosophical circles, and by the late 1740s, had acquired a reputation as an experimentalist. He was made FRS in 1749, despite being involved in a priority dispute over a novel method of making artificial magnets. His main field, however, was electrostatics. He was the first person in England to repeat the French experiments confirming Franklin's theories of lightning, and whilst doing this, became drawn to the mystery of the polarity of the charge on a cloud. He invented a portable electroscope to detect charge present in a system, and it is for experiments on electrostatic induction that Canton remains well-known. "Liberal in politics, latitudinarian in religion, devoted to his profession, schoolmaster Canton was one of the most distinguished of the group of self-made, self-educated men who were the best representatives of English physics in the mid-eighteenth century."<sup>1</sup>

## 2. Joseph Priestly, FRS (1733 - 1804)

*Location:* on the Warrington Salvation Army Citadel which stands on a site once occupied by a school in Cheshire, where he gained such a good reputation that he was invited to become a tutor at the Dissenting Academy at Warrington. He took up this post in 1761, and taught many things including languages, history, law and oratory, but not natural philosophy! He became a prolific writer, with publications ranging from The Rudiments of English Grammar to Essay on the First Principles of Government, which was said to have influenced Jeremy Bentham. He also began writing on scientific matters, though, and completed his History of Electricity in 1767. Whilst researching this book, he had met up with Benjamin Franklin and John Canton (see above) in London, and had been elected FRS at their suggestion. Priestly and his family (he had married in 1762) moved to Leeds in 1767, where he took up a Presbyterian ministry, and also began his

<sup>1</sup> J.L. Heilbron, Dictionary of Scientific Biography "Canton" p.52

researches into the nature and properties of gases for which he is now famous. In 1773, he entered the service of the Earl of Shelburne, as librarian and advisor to the household tutor, and continued to study gases under his patronage, in the family homes in Wiltshire and London. In 1780, he moved his family to Birmingham, where he took up another preaching post, and became involved with the famous Lunar Society (which counted amongst its members at that time Erasmus Darwin and James Watt). The society supported his researches into gases, and his opposition to the new chemistry of Lavoisier. In 1791, he spoke out in favour of the initial phases of the French Revolution. This, together with his continued vocal opposition to sectarian intolerance within England led to his property being burnt by a "Church-and-King" mob, and his life being endangered. For a while he lived in Hackney, teaching natural philosophy and preaching at the Dissenting Academy there, but in 1794, he felt it necessary to emigrate to the United States. When he arrived, he was well-received, and offered a position as Professor of Chemistry at the University of Pennsylvania. He turned this down, however, in favour of settling in an area reserved for British people fleeing persecution. This settlement never really took off, but the Priestleys elected to remain there. Priestley became very unhappy after his wife and one of his sons died in the mid-1790s, but his grief was tempered slightly in his latter years when Thomas Jefferson was elected President in 1800. He had supported Jefferson's cause throughout, and Jefferson personally befriended him, and at last he felt as if he were in a country where the political authorities were not going to persecute him. He died in 1804, and was buried in Northumberland, Pennsylvania.

### 3. James Clerk Maxwell, FRS (1831 - 1879)

*Location:* on the Strand Building of King's College, London

*Unveiled:* 24.06.96 jointly by Professor Mike Westbrook (Vice-President of the IOP) and Professor Cyril Domb (first Clerk Maxwell Professor of Physics at King's College, London, 1954 - 1981)

Maxwell was one of the most eminent theoretical physicists of the nineteenth century. He was educated in Edinburgh, and entered the University at 16, having had a paper published the previous year by the Royal Society of Edinburgh on a method of drawing ellipses using pins and thread. After becoming Second Wrangler at Trinity College, Cambridge, he obtained a chair at Aberdeen, but moved down to the Strand in 1860 when he was made redundant in an administrative reorganisation. His legacy to electromagnetism, the Maxwell Equations, were put forward in 1864. He worked for five years at King's College, on the British Association project to measure electrical standards, but resigned and returned to Scotland on the death of his father (his mother having died when he was still a child). He returned to Cambridge in the early 1870s, to set up the Cavendish Laboratory from scratch, but tragically died of cancer at the age of 48. He was succeeded in his post by Lord Rayleigh.

### 4. Sir Charles Parsons [Pres. of RS, so presumably FRS?] (1854 - 1931)

*Location:* in the main entrance to the Turbinia Gallery of the Newcastle-upon-Tyne Museum of Discovery

*Unveiled:* 20.05.97 by Sir Arnold Wolfendale (Immediate Past-President of the IOP)

Parsons, a physicist and engineer, was President of the Institute from 1923-25. His father was an astronomer and maker of outstanding telescopes, and eventually became President of the Royal Society. After studying in Dublin and Cambridge, Parsons undertook an apprenticeship in engineering, and throughout his life, he continued to combine his knowledge of theory and practice, in the tradition of Kelvin and Watt, to produce original work in the fields of power generation and marine propulsion. He designed and patented a multistage, high- pressure steam turbine for use in the firm where he worked, and by the end of the nineteenth century, had set up his own company to make turbo-generators, especially for use in marine power. He displayed his 48 m craft, *Turbina*, at the 1897 naval celebrations of Victoria's jubilee, where its capacity to travel at over 34 knots so impressed the Navy that *HMS Dreadnought* was fitted with his turbines. Later on in the early years of the twentieth century, Cunard used the turbines in their liners. Later work included the construction of searchlights, also for use by the Navy, and large telescopes, following in the footsteps of his father.

## 5. Sir William Bragg, FRS, Nobel Laureate (1862 - 1942)

*Location:* the Parkinson Building of the University of Leeds

*Unveiled:* 18.03.96 by Sir Arnold Wolfendale (President of the IOP)

Having been brought up in his uncle's house after the death of his mother, Bragg went on to study mathematics at Cambridge. He was an assiduous worker, and graduated with first class honours. Soon after, he became professor of mathematics and physics at the University of Adelaide, where he published very little, but was very involved with the public understanding of science, science education and university administration. He married an astronomer's daughter, had a family, and took up golf. As part of his 1904 presidential address to a section of the Australian Association for the Advancement of Science, however, he gave a highly critical talk on current work in the field of the ionisation of gases, especially the scattering of  $\alpha$ ,  $\beta$  and  $\gamma$  rays by matter. Later on that year, at the age of 41, he began the work that was to bring him wider recognition. He did experiments into the absorption of  $\alpha$ -particles, leading to the development of a method of identifying radioactive substances. His next field of research was into the nature of X-rays and  $\gamma$ -rays, advocating a "quantised" view of X-rays. His controversial view that ionisation of matter by these rays is a secondary process involving a high speed electron was eventually confirmed by C.T.R. Wilson's cloud chamber (see below). He became Cavendish professor of physics at the University of Leeds in 1908, and together with his son (who was working at the Cavendish) worked on the recently-discovered von-Laue phenomenon. They became convinced that a theory of X-rays should take account of both waves and corpuscles. The Braggs then became interested in the inversion of the relation they had earlier discovered,  $n\lambda = 2d\sin\theta$ , to obtain the distances between atomic planes in a crystal using a ray of known wavelength, thus transforming the analysis of crystal structures into a straightforward procedure. During the First World War, he did some research into crystals, but most of his time was spent in positions of management and as an advisor. He worked on submarine detection, and was knighted in 1920. During the war, Britain fell behind in X-ray spectroscopy, but in 1923, Bragg became head of the Royal Institution, and set up a research group to work on the analysis of organic crystals, a field in which Britain was then able to excel. Bragg was President of the Royal Society from 1935-1940. He had been a member of the Deutsche Physikalische Gesellschaft since before the First World War, and at the outbreak of the Second, tried

unsuccessfully to further understanding between British and German scientists. The last two years of his life were taken up with scientific administration in the war effort.

## 6. Charles Thomson Rees (C.T.R.) Wilson, Nobel Laureate (1869 - 1959)

*Location:* on a specially-built cairn at Flotterstone in the Pentland Hills, south of Edinburgh, a short distance from his birthplace

*Unveiled:* 10.04.96 jointly by Dr. Lesley Glasser (Chairman of the Institute's Scottish Branch), and a Vice-President of the Royal Meteorological Society

As Wilson was a Scottish scientist born in the nineteenth century, he had to have "Thomson" in his name. For variety, however, he chose to use it as a middle name. Although born in Scotland, he moved to Manchester when he was four years old. His immediate family was not well off, and his education was paid for by his businessman step-brother, William, based in Calcutta. After starting off as a medical student, he changed to physics, following a BSc at Owens College, Manchester, with a period at Sidney Sussex College, Cambridge. In order to support his mother after the death of his Calcutta step-brother in 1892, he took a teaching job at Bradford Grammar School, but after a short while, he returned to Cambridge, where he managed to support himself by being a demonstrator for medical students. It was at this time that Rutherford and his contemporaries started research in the department, and Wilson often took part in their discussions. He was awarded the Clerk Maxwell scholarship (less than twenty years after Maxwell had died) for three years, then went on to hold posts as demonstrator, lecturer, and finally Jacksonian professor of natural philosophy. Many honours were bestowed upon him, including FRS in 1900 and a Nobel prize shared with A. H. Compton in 1927, for their work on high-energy photon scattering.

The reason why Wilson's blue plaque is on a cairn in the hills is that he was profoundly influenced by the beauty and truth of Nature. He spent much of his life walking and climbing in Scotland, and used to spend time on Ben Nevis, observing natural phenomena such as coronas, and electric storms. His invention of the cloud chamber, an invaluable piece of apparatus in the physicist's armoury, was inspired by his wish to emulate the stunning cloud formations that he witnessed whilst on the mountains; and his research into atmospheric electricity was stirred by experiencing his hair standing on end when he was once caught in a storm. This gave him a glimpse of the magnitude of the forces and fields he was investigating. His work on the conductivity of air later inspired Victor Hess, who subsequently postulated the existence of "cosmic radiation".

## 7. John Logie Baird (1888 - 1946)

*Location:* the house in Hastings where Baird carries out his experiments and demonstrated the first radio transmission of images (television)

*Unveiled:* 12.03.97 by Dr. Brian Manley, President of the IOP

Educated in Glasgow, Baird's initial studies were in electrical engineering. He began serious experiment, however, in the early 1920s, after a serious illness. His previous record of poor health had meant that his earlier attempts to earn a living selling household goods were unsuccessful. His first television apparatus was able to transmit and receive pictures over a range of a few feet, and

the first demonstration took place in two attic rooms in Soho in 1926. In the following years, the range of his apparatus increased rapidly, transmitting via telephone line from London to Glasgow in 1927, and to New York in 1928. The first BBC television pictures were transmitted by Baird's company in 1929, but the system that the BBC eventually adopted was that of Marconi-EMI. Although his particular methods have now largely been superseded, he also experimented with stereo and large-screen formats, and UHF transmission, pioneering techniques which are often considered nowadays to be modern developments.

## 8. Sir Edward Appleton, FRS, Nobel Laureate (1892 - 1965)

*Location:* the Old Building of the Bradford and Ilkley Community College, Bradford

*Unveiled:* January 1998 by Sir Bernard Lovell

Appleton studied at what is now the Bradford and Ilkley Community College from 1911 to 1913. He studied physics at Cambridge, but his interest in radio waves stemmed from his time as a signals officer in the First World War. After Kennelly and Heaviside had proposed the existence of a layer of charged particles in the atmosphere, to explain the observation that it was possible to send radio waves around the world, despite the propensity of electromagnetic radiation to travel in straight lines, Appleton was the first to demonstrate conclusively the existence of such a layer. By measuring the interference between initial and reflected waves sent between Bournemouth and Cambridge, he was able to calculate the height of this layer to be 70 km above the Earth's surface. Although this first layer was named after Heaviside, a second, slightly higher, layer was subsequently discovered, and named after Appleton. He received the Nobel Prize for physics in 1947.

## 9. Edmund Stoner, FRS (1899 - 1968)

*Location:* the Physics Building (now known as the Stoner Building) of the University of Leeds

*Unveiled:* 18.03.96 by Edmund Stoner's widow

In 1939 Edmund Stoner was appointed as the first Professor of Theoretical Physics at Leeds. In 1951 he was given the post of Cavendish Professor of Physics, the chair accepted by Bragg in 1908. His research included the structure of atoms, "white dwarfs" in the far reaches of outer space and the theory of ferromagnetic materials.

## 10. Evan James Williams, FRS (1903 - 1945)

*Location:* the house where Williams lived as a child, and where he died

*Unveiled:* 12.05.95 by Professor Vernon Morgan (Vice-President of the IOP)

At the early age of 27, Williams had obtained an MSc, a DSc and two PhDs and at 36 was elected a Fellow of the Royal Society. During the Second World War he worked in the Department of Naval

Operational Research where it is recorded of him that, “no individual contributed more to the defeat of the U-Boat.”

## 11. **Ernest Walton**, Nobel Laureate (1904 - 1995)

*Location:* Trinity College, Dublin

*Unveiled:* 09.09.97 by Mary Robinson, President of Ireland, in the presence of Tom Mitchell (Provost of Trinity College), Brian Manley (President of the IOP) and Alun Jones (Chief Executive of the IOP)

Walton undertook undergraduate and postgraduate studies at Trinity College, Dublin, before going up to Cambridge University. Whilst there, he worked with John Cockcroft on the first ever nuclear accelerator experiment, using protons accelerated to 700 keV. (They were jointly awarded the 1951 Nobel prize for physics for this work on splitting the atom). Two years after this collaboration, in 1934, he returned to Trinity college, and remained there until his retirement in 1974. Walton lived until the age of 91, having presented his Nobel citation and medal to his college on his 90<sup>th</sup> birthday. One of the reasons that Mary Robinson agreed to unveil this plaque at the very end of her term of office was that he was one of her sponsors when she stood for election to the Irish Senate.

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### *Further proposals ...*

## 1. **Frederick Soddy**, Nobel Laureate (1877 - 1956)

As an Oxford Chemistry graduate, Soddy went to work as a demonstrator in Montreal. There, he collaborated with Rutherford at the start of this century on an explanation of the nature of radioactivity. In their disintegration theory, they proposed that heavy atoms are unstable, and that changes in their mass and charge cause the formation of new elements. In 1913, he was among those who formulated the radioactive displacement law of emission of alpha and beta particles, and he gave us the word “isotopes”. Having gained a chair at Oxford, he became more involved with politics and administration after his efforts to reform the teaching of chemistry went unheeded. He was awarded the Nobel Prize in 1921.

## 2. **Dame Kathleen Lonsdale**, FRS (1903 - 1971)

Dame Kathleen was one of the first women physicists to be elected to Fellowship of the Royal Society. Although born in Ireland, Lonsdale moved to London when she was a child, where she graduated in Physics in the early 1920s. After working at the Royal Institution for twenty years, she moved to University college, London. It was there that she did her major work on the structure of organic crystals, using X-ray diffraction. Having disclosed the structure of hexamethylbenzene with this method, she went on to pioneer the technique of using Fourier analysis to solve the structure of her next organic compound, hexachlorobenzene. As a pacifist and Quaker, Lonsdale spent a month in prison during the Second World War for failing to pay a fine charged to her for not enrolling for

any form of national service. Two years later, however, in 1945, she and Marjory Stephenson (a Cambridge biochemist and microbiologist) were elected as the first two female Fellows of the Royal Society. The Lonsdale Building of University College, London, is named in her honour.

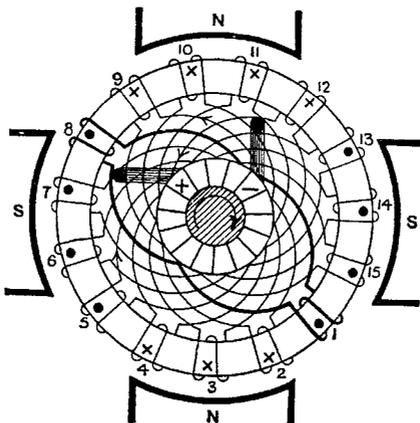
### 3. **Sir Harrie Massey** (1908 - 1983)

Born and educated in Australia, Massey took his first three degrees at the University of Melbourne. After gaining his doctorate from Cambridge in 1932, he became a lecturer in Mathematical Physics at the Queens University, Belfast. He then moved to University College, London, where he remained until his retirement, starting as Goldsmid Professor of Mathematics in 1938, and ending as head of the Department of Physics and Astronomy. Towards the end of his career, he also spent four years as Vice-Provost of the college. He was heavily involved in scientific administration, becoming President of the Atomic Scientists Association in 1953, President of the Physical Society in 1954, and Chairman of the Council of Science Policy in 1965. As well as gaining many prestigious medals from the Royal Society and the Royal Astronomical Society during his lifetime, a building at the Anglo-Australian base laboratory was named in honour of him in 1984, the year after his death.

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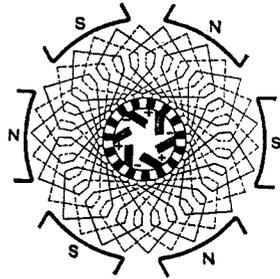


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Dynamo diagrams from Ch. XVIII 'Technical Electricity' by H. T. Davidge and R. W. Hutchinson, 4th Edition, pub. University Tutorial Press, London, 1931

Portrait of John Canton by an unknown artist, in the National Portrait Gallery.