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Office Bearers : 1994 - 1997

Updated by S McKeown

OFFICE BEARERS : 1994 - 1997

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J.H. Hubbell **C-312 Radiation Physics NIST, Gaithersburg, MD 20899 USA Tel: (301) 975-5550** **Fax: (301) 869-7682**	***North America:*** D. Nagel (USA)	D.A. Bradley (Malaysia)
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R.H. Pratt **Dept. of Physics** **Univ Pittsburgh, PA 15260 USA** **Tel: (412) 624-9052** **Fax: (412) 624-9163**	***Africa and Middle East:*** M. Berrada (Morocco)	L. Gerward (Denmark)
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Main

From the Editor *Dudley Creagh*

The IRPS Bulletin is moving with the times ... or rather .. is trying to catch up with the times. From the next issue our Society will have a site on the World Wide Web. It will contain information on our Society, office bearers, an application form, perhaps a registry of members' e-mail addresses, and ... very important ... the current newsletter, with a link to preceding newsletters which have been produced in electronic form.

This move will, I hope, help to raise the profile of our Society. As well, there should be some savings to be made with respect to postage, and members with WWW access may like to choose to take their copy of the Bulletin off the web. As you know, our Society has very finite resources, and every economy which can be made in this area releases funds to support our conferences.

Our Society, as I have said many times, is unique in its coverage of radiation physics. We should use this feature to attract members.

I again draw members' attention to the Jaipur Meeting which is further advertised in this edition of the Bulletin. We have had many successful meetings in interesting places, and the Jaipur Meeting promises to eclipse former meetings. Be there!!!

Notice of how to access the web site will be given in the next edition of the IRPS Bulletin.

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President's Column *John Hubbell*

Contents:

THE IRPS AND ITS OVERT AND HIDDEN AGENDAS

Most of us do not operate at a single level of motivation, but at several levels, some open and overt to our families, to our work partners and to the public at large. There are also deeper levels of motivation which we develop as we travel our individual paths from birth to death, which we often feel inhibited from sharing with the outside world. These secret and deeper levels of motivation are our "hidden agendas." Although many of these hidden agendas remain hidden because we are not particularly proud of them, I think there are also many hidden agendas which are too noble to share with other persons, yet result in lives and actions of enormous benefit to the global human family. Similarly, I think the International Radiation Physics Society, as it travels its path from its conception in Calcutta in 1974 and its birth in Ferrara in 1985, to its ultimate demise(?) in the uncertain and shadowy future, has both overt and hidden agendas, both of the noble character.

THE OVERT AGENDA OF THE IRPS

The overt agenda of the IRPS is of course the promotion of Radiation Physics and the facilitation of communication between researchers as well as users in the general cross-disciplinary area of radiation physics. These researchers and users are drawn from a great variety of normally compartmentalized disciplines, such as medical physics, crystallography, nuclear power, industrial irradiation processing, industrial radiation imaging and gauging, x-ray astronomy, physics teachers, and the list goes on and on. For all, radiation physics (radiation sources, radiation detectors, radiation interactions: theory and measurements) is the common thread which has brought us together to form the International Radiation Physics Society.

With our triennial International Symposia on Radiation Physics (ISRP's) and our quarterly IRPS Bulletin newsletter, I think we are fulfilling our overt agenda. Our numbers are gradually increasing, as more and more researchers are finding out about us and realizing the benefits of the cross-fertilizations between otherwise isolated disciplines, uniquely provided by our Society. Our membership has now passed the 500 mark, drawn from over 60 countries scattered over the entire globe.

Our innovative and unique tiered dues structure encourages membership from developing countries and also from developed but economically depressed countries. Russia and other Former Soviet Union countries, also South Africa, have recently been added to the latter category for our IRPS dues assessment purposes. For the above countries, the annual dues are only $5, or discounted even further to $12.50 for three years [the preferred mode of payment]. Even for the developed countries, such as the U.S., Western Europe, Japan and Australia, the annual dues are only $15, discounted to $40 for three years [the preferred schedule, matching the interval between our triennial Symposia]. For students the dues are reduced even more. What other national or international professional society is less demanding of its members, financially?

Typical of our triennial Symposia, our next one, ISRP-7 in Jaipur, India February 24-28, 1997 offers cutting-edge invited oral papers by leaders in their fields, grouped under the topics:

Fundamental Processes in Radiation Physics
Radiation Sources and Detectors
Applications of Radiations in Fundamental Research
Radiation in Technology, and
Radiation in Archeometry, Earth and Space Sciences and Cosmology

Contributed papers on these and all other topics related to our common thread of radiation physics are warmly invited. Besides the technical aspects of the Symposium, Jaipur and its surroundings are richly picturesque, including an exposure to the history and culture of the host country.

Registration materials and further information on ISRP-7 may be obtained from the Chairman of the ISRP-7 National Organizing Committee:

Prof. **Bikash Sinha**, Director,
Saha Institute of Nuclear Physics
1/AF Bidhan Nagar, Calcutta 700 064, INDIA
Phone: +91-33-337-0313
Fax: +91-33-337-4637
email: bikash@saha.ernet.in

Following ISRP-7 in Jaipur in 1997, our next triennial Symposium ISRP-8 in the year 2000 will be in Prague in the Czech Republic, another attractive venue typical of our Symposia. Previous venues, in addition to the above mentioned Calcutta (ISRP-1, 1974) and Ferrara (ISRP-3, 1985), have included Penang (ISRP-2, 1982), São Paulo (ISRP-4, 1988), Dubrovnik (ISRP-5, 1991) and Rabat (ISRP-6, 1994)

For those of you reading this column who are not already members of the IRPS, further information may be obtained from

IRPS Secretariat
C/- Prof. **Richard H. Pratt**,
Department of Physics and Astronomy
University of Pittsburgh
Pittsburgh, PA 15260 USA
Phone: +1-412-624-9052
Fax: +1-412-624-9163
email: rpratt@vms.cis.pitt.edu

IRPS membership inquiries may also be directed to

Prof. **S.C. Roy**
IRPS Membership Coordinator
Department of Physics
Bose Institute
93/1 Acharya Prafulla Chandra Road
Calcutta 700 054, India
Fax: +91-33-350-6790
email: scroy@boseinst.ernet.in

THE NOOSPHERE, GORILLAS, PEN-PALS, TUNNELS AND A HIDDEN AGENDA

The "Noosphere":

As many of you know from previous readings of this Column, I have been influenced by the writings of the Jesuit paleontologist **Pierre Teilhard de Chardin** (1881-1955). In addition to his fossil expeditions into the Gobi Desert and his participation in the discovery of the "Peking Man" fossil remains in Choukoutien (the famous cave is very near the China Institute of Atomic Energy, southwest of Beijing), Chardin wrote a number of books interpreting his views of the past, present and future of mankind's niche in the cosmos. His most well known book is The Phenomenon of Man (Le Phenomene Humain) in which he mentions the "spheres" associated with our planet earth: the "barysphere" the heavy core of the earth, outside which lies the "lithosphere" outer rocky layer, outside which lies the "hydrosphere" (the oceans) and the "atmosphere" the upper portion of which is the "stratosphere" and so on.

Mainly occupying the earth's hydrosphere and atmosphere is the "biosphere," the totality of the myriad varieties of the amazing self-replicating arrangements of atoms to which we attribute "life," whatever that is. According to recent news reports, based on microscopic examination of a meteorite found in Antarctica, our neighbor planet Mars also once possessed a biosphere, suggesting that due to the benign and/or fortuitous nature of inter-atomic forces and the available mix of elements throughout the cosmos, "life" is ever and everywhere poised to spring into reality.

Through aeons of the evolutionary process (or whatever) the biosphere produced a life form sufficiently complex to enjoy reflective thought, and to preserve and exchange these thoughts, and so here we are. Teilhard de Chardin envisioned these exchanges of thoughts not just within clans and nations, but as a "thinking skin" covering the entire planet earth, adding one more sphere the "noosphere" ("noo-" for mind). During Chardin's lifetime these exchanges were mostly by postal mail, and to some extent by telephone, and face-to-face at conferences and other travel situations. In 1996 the noosphere, with the available new electronic networks, is functioning more and more like a global "brain of brains."

Barriers and Gorillas:

On the other hand, unfortunately, the global human family is still partitioned by age-old hatreds and mistrust, often erupting in downright barbarism, arising from ethnic, religious (sectarian rigidities, not the deeper personal religious aspirations), nationalistic/territorial, economic and other barriers. These barriers inhibit the full realization of the loving, caring noosphere envisioned by Chardin, serving the "global human family". In Bosnia, Rwanda, Chechniya, Ireland and elsewhere around the globe including in my own country the United States, repulsive forces seem to be at work between fellow human beings, rather than attraction.

The behavior of some humans is sometimes put to shame even by the gorilla, to whom we tend to think ourselves superior and less "beastly." According to another recent news report, a very young boy visiting an American zoo managed to climb into the gorilla enclosure and fall into a deep concrete pit, rendering him unconscious, and difficult to be retrieved. A mother gorilla, noticing the boy's predicament, dropped herself down into the pit, tenderly picked up the boy in her arms, and brought him to a door of the enclosure where human aid could take over. Barriers, even between species, can apparently be "tunneled through."

What can we do, as members of the IRPS "global radiation physics family," to move the human race, at least a little, toward the ideal of a seamless caring, loving "noosphere"?

Pen-Pals and Tunnels:

I think all international Societies, particularly in the physical sciences, eventually come to realize that, in addition to their topical focus, their individual members have unique access to individual fellow researchers on the opposite sides of such barriers as are mentioned above. The IRPS, with its conscious effort to be truly global with respect to developing as well as developed countries, provides such access between very-different cultures and political systems, unparalleled among scientific and other international Societies, in my opinion.

When I was a child in my home town of Manistee, Michigan, our Methodist church-school newsletter promoted the idea of "pen-pals" with children in foreign countries, and provided the go-between for getting such correspondences started. I think my pen-pal (I can't remember whether male or female) was from Europe, perhaps Denmark, so the barriers between us were minimal. Nevertheless, the seed was planted for a hunger to communicate with persons outside my normal sphere. In establishing my career in radiation physics, it was a great joy to realize that barriers much more formidable than geography could be "tunneled through" via scientific exchanges. For example, I now find myself to be "honorary grandfather" to **Tran Vuong Tung** ("King of Pine's Tree"), age 7 as of August 20 in Ho Chi Minh City, Viet Nam, son of my radiation physics colleague **Tran Van Luyen**.

A Hidden Agenda for the IRPS:

The mother gorilla has raised our consciousness as humans about the fundamental nature of the goodness of life and loving and caring, as she tunneled through the species barrier and rescued the little boy. I think we as individual members of the IRPS have an enormous and unique opportunity to take on as a worthy and noble "hidden agenda" for the IRPS --- "tunneling through" the political, cultural, religious and other barriers besetting our tiny spinning island in space, moving us at least a little toward Chardin's loving, caring "noosphere." The IRPS *overt agenda*, with its above-listed benefits, is what has brought us together. This *overt agenda* may serve also as the foundation for an IRPS *hidden agenda* of even greater benefit to the general global human family.

Reports from Vice Presidents and Councillors

From Vice President Denes Berenyi (East Europe and FSU) : There seems to be a new possibility for the utilization of ESRF (European Synchrotron Radiation Facility) in Grenoble - associated membership. Some Central European countries (Czech Republic, Hungary, Poland, Slovenia) are interested in this and they are trying to form a consortium to have one associated membership. In Debrecen, an international meeting was held on the utilization of PET (Positron Emission Tomograph) at the end of May. In the whole region of Central and East Europe there are two PET Laboratories, one in Debrecen, Hungary and another in St Petersburg, Russia.

From Councillor Lief Gerward (Denmark) :

ELECTION TIME

Election of Executives and Officers of IRPS

The triennial election of IRPS office bearers is now taking place. The candidates suggested by the Nominations/Elections Committee were presented in the March/April 1996 issue of the Bulletin (Vol. 10, No. 1). Inside this issue of the Bulletin you will find a copy of the ballot paper. We ask that you complete the ballot paper and return it to the Elections Committee, following the instructions that accompany the ballot paper. The Elections Committee will announce the results of the election at the ISRP-7 in Jaipur, 24 - 28 February 1997. The present Council has decided that all IRPS members who receive this Bulletin are eligible for voting.

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SECOND ANNOUNCEMENT and CALL FOR PAPERS

7th International Symposium on Radiation Physics

(ISRP-7)

February 24-28, 1997
Jaipur, India

IRPS

Organised by
INTERNATIONAL RADIATION PHYSICS SOCIETY
in collaboration with
UNIVERSITY OF RAJASTHAN
and
SAHA INSTITUTE OF NUCLEAR PHYSICS

Paper

A STUDY OF THE RELATION BETWEEN APPLIED STRAIN AND STRUCTURE IN ELASTOMERS

P. **M. O'Neill*, D.C. Creagh** and S.A. Holt***

** School of Physics, University College, The University of New South Wales, CANBERRA ACT 2600 Australia*

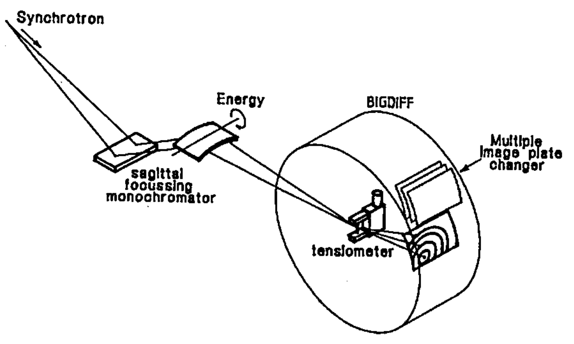
** * Faculty of Information Science and Engineering, University of Canberra, BELCONNEN ACT 2616 Australia*

Introduction

Elastomers form a significant proportion of materials used in everyday life. They are used in footware, cables and hoses, belts and tyres, engineering components, automobiles, biomedicine, et cetara. Their strength, deformability, fracture toughness are created through the interconnection of polymer chains selected so as to produce the desired mechanical behaviour. It is essential to know how the structure of the elastomer olumchanges as a function of applied stress, so as to select the best polymeric mix for the desired mechanical properties. One class of elastomers are those based on the poly-urethanes. The samples used in this study were manufactured by DJ Martin, University of Technology, Sydney[1].

Experiment

The experiments were undertaken at BL20B using the sagittal focussing monochromator[1] and beam dimensions typically 35 x 35 um2... The mono-chromator was tuned to 1.739 A and the detuned to eliminate harmonics. A tensometer based on a linear slide and a dc motor encoder was devised to be mounted on the theta-axis of the vacuum diffractometer [2]. The samples were mounted strain- free normal to the incident beam and 303 mm from an imaging plate which was mounted in a new imaging plate changer [3]. See Figure 1.



An imaging plate was moved into position, and a 2 min exposure taken. The plate was then changed, a known strain applied to the elastomer, and another exposure taken. Up to ten diffraction patterns can be acquired before it was necessary to break the vacuum in the diffractometer.

Discussion and Results

Figure 2 shows part of a sequence taken with one of the elastomers. In Figure 2a the zero-strain diffraction pattern indicates that the elastomer is highly crystalline, abd quite highly oriented. As stress is gradually applied the long range order is gradually lost, and the outermost Debye rings become diffuse at about 80% strain.

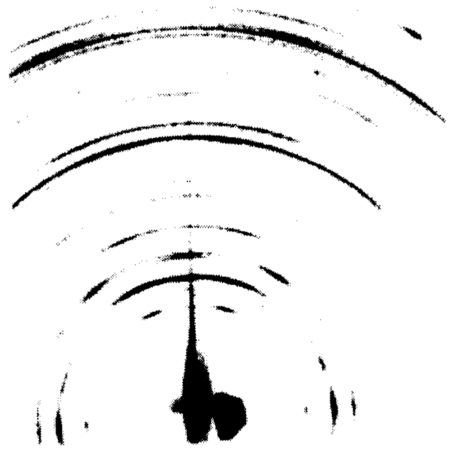


Figure 2 : Diffraction patterns from stressed elastomers
(a) Diffraction Pattern with 0% strain

The loss of order is gradual, and at 320% strain (Figure 2b) all order has been lost in the elastomer. On relaxing the stress the diffraction patterns retrace the path they followed on loading, but the strain is different, and the sample now has acquired a permanent set.

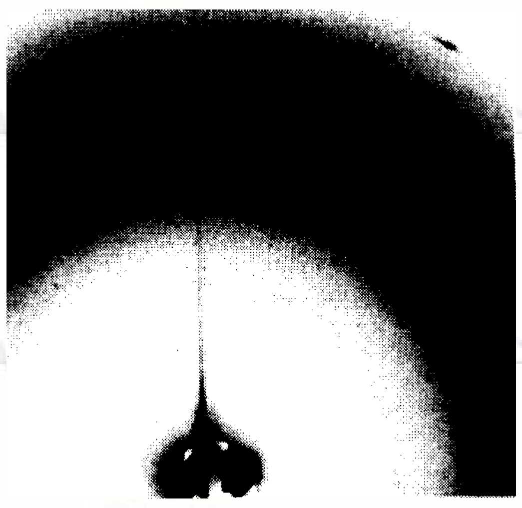


Figure 2 : Diffraction patterns from stressed elastomers (b) Fully loaded .. 320% strain

We have demonstrated a new technique for examining the relation between structure and strain in elastomeric materials. The progression of the structural change from an ordered to a disordered state is the opposite to that commonly encountered in polymer systems.

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Paper

ONE HUNDRED YEARS OF ELECTRONS

Leif Gerward[a] and Christopher Cousins[b]

a. Department of Physics, Technical University of Denmark, Lyngby, Denmark

b. Department of Physics, University of Exeter, Exeter, UK

The search for the true nature of electricity led to the discovery of the electron and the proof that it is a constituent of all atoms. These achievements gave the scientists the first definite line of attack on the constitution of the atom and on the structure of matter.

In a lecture on 'The Stability of Atoms' given to the Royal Society of Arts in 1924, Ernest Rutherford said:

The trend of physics during the past twenty-five years has been largely influenced by three fundamental discoveries made in the closing years of the nineteenth century. I refer to the discovery of X-rays in 1895, of radioactivity in 1896 and the proof of the independent existence of the negative electron of small mass in 1897.

The first two of these discoveries were revelations of totally unsuspected phenomena, rare events in the progress of science. The third was quite different - it was a watershed in the long quest to understand the nature of electricity. In the present paper we focus on the period of activity concerned with discharge in gases and cathode rays which culminated in the discovery of the electron. Finally and briefly we comment on some of the developments of the concept during the following hundred years.

Already in 1874, at the British Association meeting in Belfast, the Irish physicist George Johnstone Stoney had pointed out that, on the basis of Faraday's law of electricity, an absolute unit of quantity of electricity exists in that amount of it which attends each chemical bond or valency. This talk was later published (Stoney 1881). Stoney subsequently suggested the name *electron* for this small unit quantity of electricity (J.J. 1911/12). Hermann von Helmholtz (1881), independently, drew similar conclusions. In the Faraday lecture delivered before the Chemical Society in 1881 he declared:

If we accept the hypothesis that the elementary substances are composed of atoms, we cannot avoid concluding that electricity also, positive as well as negative, is divided into definite elementary portions which behave like atoms of electricity.

The discovery of the cathode rays by Wilhelm Hittorf in 1869 forms the first link in a chain of events that leads not only to the triumphant confirmation of the above hypothesis but also to the brilliant discoveries made in the closing years of the 19th century: that of X-rays by Wilhelm Conrad Röntgen in 1895 and that of radioactivity by Henri Becquerel in 1896.

Cathode rays occurs when electricity is discharged in a rarefied gas. At a given low pressure of the gas, rays are emitted from the negative pole, the cathode. The cathode rays themselves are invisible, but they can be observed by the phosphorescence that they induce at the walls of the glass tube and by the shadows from objects placed in their path. The cathode rays propagate in straight lines, but unlike ordinary light rays they can be deflected by a magnetic field.

The phenomena exhibited by the electric discharge in rarefied gas had long been familiar from studies by Julius Plücker, Wilhelm Hittorf, Eugen Goldstein and other physicists. In a lecture delivered before the British Association at the Sheffield Meeting in 1879, William Crookes first used the expression *radiant matter* or matter in the ultra-gaseous state, to explain the phenomena of phosphorescence, trajectory, shadows, mechanical action, magnetisation and heat associated with the cathode rays (Crookes 1901/02). Crookes considered the ultra-gaseous state a 'fourth state of matter'. In the Bakerian Lecture for 1883, speaking of radiant matter, he considered that the particles flying from the the cathode were of the dimensions of molecules (W.A.T. 1919/20). Following Crookes many British physicists held that the cathode rays were particles. In contrast, the majority of the German physicists maintained that the cathode rays were analogous to electric waves. They were inspired by Heinrich Hertz (1892) who, in 1892, had shown that the cathode rays could pass through thin sheets of metal. At Hertz' suggestion, Philipp Lenard made a kind of discharge tubes equipped with a thin aluminium window, allowing the cathode rays to enter the open air outside the tube.

At the end of 1884, when the English physicist Joseph John (J.J.) Thomson was not quite 28 years old, he succeeded Lord Rayleigh as professor and director of the Cavendish Laboratory in Cambridge. He immediately began experiments on the passage of electricity through gases. He was convinced, he later said, that "whenever a gas conducts electricity, some of its molecules must split up and that it is these particles which carry electricity" (Thomson 1926). Originally, he thought that the molecule was split up into two atoms. It was not until 1897 that he was to realize that the decomposition of the molecules was quite different from ordinary atomic dissociation.

At the beginning of 1897 Thomson made some experiments to clarify the nature of the cathode rays, in particular to test some consequences of the particle theory (Thomson 1897). He first repeated, in a modified form, the experiment of Jean Perrin of Lille, France, to show that the cathode rays carry a negative charge. Next, he measured the deflection of the cathode rays under an electrostatic force, the rays travelling between two parallel and electrically charged aluminium plates. Hertz had been unable to detect any deflection in a similar experiment, but Thomson showed that this was due to the conductivity conferred on the rarefied gas by the cathode rays. The deflection could indeed be detected, even in a weak electric field, provided that the vacuum was good enough. Moreover, he found that the deflection was proportional to the potential difference between the plates. Finally he measured the deflection of the cathode rays under a magnetic field. He concluded (Thomson 1897):

As the cathode rays carry a charge of negative electricity, are deflected by an electrostatic force as if they were negatively electrified, and are acted on by a magnetic force in just the way in which this force would act on a negatively electrified body moving along the path of these rays, I can see no escape from the conclusion that they are charges of negative electricity carried by particles of matter.

To find out whether these particles are molecules, atoms, or matter in a still finer division, Thomson further made a series of measurements of the ratio of the mass, m, of each of these particles to the charge, e, carried by it. He devised two methods for deflecting the cathode rays, one in a magnetic field, the other in an electric field. In both cases he found that the value of m/e is independent of the nature of the gas in the discharge tube, and its value is of the order 1/1000 of the smallest value known at that time, namely the value for the hydrogen ion in electrolysis. Thomson speculated that the smallness of m/e might be due to the smallness of m, or the largeness of e, or to a combination of these two. A support for the smallness of m was delivered by Lenard, who had measured the absorption of the cathode rays by various media. From Lenard's result the mean free path in air at atmospheric pressure could be estimated to be 0.5 cm. This value is far larger than the value for the mean free path of the air molecules themselves, showing that the cathode ray particles must be small compared with ordinary molecules.

From his experiments Thomson concluded that, in the intense electric field near the cathode, the molecules of the gas are split up, not into ordinary atoms but into particles of a primordinal element, which he called *corpuscles*. These corpuscles, which are charged with negative electricity and projected from the cathode by the electric field, constitute the cathode rays. According to Thomson (1897) cathode rays represent matter in a new state, a state in which the subdivision of matter is carried very much further than in the ordinary gaseous state: a state in which all matter - that is, matter derived from different sources such as hydrogen, oxygen, &c. - is of one and the same kind; this matter being the substance from which all the chemical elements are built up.

Thomson gave his first public account of his discovery that in cathode rays there are particles far more minute than anything previously recognized at the Friday meeting of the Royal Institution on 30th April 1897. Commenting on his talk not three weeks later George Francis FitzGerald (1897) suggested that

We are dealing with free electrons in these cathode rays.

There is a delightful aptness in this identification, for FitzGerald was related to Stoney, being both his nephew and his cousin! Though Thomson was the undisputed discoverer of the electron, there were others in the hunt who came close to the prize. In particular, Perrin (1965) relates in his 1926 Nobel lecture how he had already begun work involving electric and magnetic deflection of cathode rays when Thomson's 1897 paper appeared.

In his 1897 paper, Thomson tended to consider the smallness of m/e as due to a combination of the smallness of m and the largeness of e. In subsequent work (Thomson 1899) he devised a method for direct measurements of e as well as m/e, thus allowing the mass of the particles to be determined. The measurements showed that e is the same in magnitude as the charge carried by the hydrogen ion in the electrolysis of solutions. Thus Thomson had proved that the mass of the carriers of negative electricity is of the order of 1/1000 of that of the hydrogen atom, the smallest mass known at that time. This numerical result was perfectly adequate for the interpretation adopted and, if not at first very accurate, was soon improved by later experiments. By way of contrast, it followed from experiments by Wilhelm Wien on the ratio of the mass to the electric charge for carriers of positive electrification that these masses were comparable with those of ordinary atoms.

The method for measuring the charge of the ion was based on the discovery by Charles Thomson Rees (C.T.R.) Wilson that the ions form nuclei around which water will condense from dust-free air at a certain supersaturation. The problem of finding the number of ions per volume was now reduced to find the number of drops per volume in the cloud. This was done by observing the velocity with which the drops fall under gravity and by deducing the radius of each drop from a formula containing the viscosity of the gas through which the drop falls. Finally, it was necessary to know the velocity with which the ion moves under a known electric force. This parameter was determined by the New Zealand-born English physicist Ernest Rutherford, who had arrived at Cambridge in October 1895 to carry out research at Cavendish Laboratory under Thomson's guidance.

Thomson concluded that the negative charge carrier, its mass and charge being invariable, must represent a fundamental conception in electricity, or indeed in matter in any state. He proposed to regard the atom as containing a large number of smaller bodies, which he called corpuscles. With regard to their size he estimated what would come to be known as the 'classical electron radius' to be of the order of 10-13 cm. In the normal atom, the assembly of corpuscles forms a system which is electical neutral. Detached corpuscles behave like negative ions, each carrying a constant negative charge and having a very small mass. The atom left behind behaves like a positive ion with a mass much larger than the negative ion. In short, the corpuscles are the vehicles by which electricity is carried from one atom to another. Thomson was convinced that there are more corpuscles in the atom than the one or two that could be torn off by processes known at that time. A strong support for this hypothesis was afforded by the Zeeman effect, which accordingly affects a large number of lines in the spectrum from a given atom.

Through Thomson's discovery of the electron, numerous strange effects observed in the past got their natural explanation. In a paper read before the Royal Society on 6th February 1902, Sir William Crookes (1901/02) summarized:

Nearly twenty-five years ago I was led by experiments in highly rarefied tubes to assume the existence of matter in an *ultra-gaseous* state. /.../ What I then called "Radiant Matter" now passes as "Electrons", a term coined by Dr. Johnstone Stoney, to represent the separate units of electricity, which is as atomic as matter. What was puzzling and unexplained on the "Radiant Matter" theory is now precise and luminous on the "Electron Theory". /.../ The electrons are the same as the "satellites" of Lord Kelvin and the "corpuscles" of J.J. Thomson.

J.J. Thomson received the Nobel Prize in physics in 1906 in recognition of the great merits of his theoretical and experimental investigations on the conductivity of electricity by gases, and he was knighted in 1908. At his seventieth birthday, 18th December 1926, he received numerous messages of congratulation from abroad. Niels Bohr, professor of the Institute of Theoretical Physics in Copenhagen wrote (Bohr 1926):

Guided by his wonderful imagination and leaning on the new discoveries of the cathode rays, Röntgen rays and radioactivity, he opened up an unknown land to science. Indeed, it is difficult for scientists of the younger generation, who are working on the new land to which Thomson has opened the gates, fully to realize the magnitude of the task with which the pioneers were confronted.

The growth in the understanding of the nature of electricity was a triumph of human curiosity, competition and cooperation. In the electron we recognize the very first of the many fundamental particles that have been proposed during this last hundred years, and it has survived where others have perished.

Advances continue, and the electron of today is not the simple entity it was: it has acquired angular momentum; it has been drawn into the quantum world where its behaviour is brilliantly captured, first by the Schrödinger and Dirac equations and later by quantum electrodynamics; it has been joined by a positive counterpart, the positron. Beams of electrons possess wavelike properties, and electron diffraction joins X-ray diffraction as a powerful probe of the structure of matter. Through the Pauli exclusion principle we understand the Periodic Table and make sense of atomic and molecular spectra, and the characteristic X-radiation. The same principle drove the development of Fermi-Dirac statistics to the puzzling shortfall in the thermal capacity of metals.

The early years of the century brought the discovery of superconductivity in metals, more recently that of high-Tc superconductivity in certain cuprates. In the closing years we find that technology has reached such a pitch of delicacy that 'artificial atoms' can be constructed: nanometer-sized metal or semiconductor systems with a few electrons designed to function as transistors or other devices.

Thus Thomson's discovery of the electron not only produced the explanation of a number of puzzling observations in the past but also opened up new fields of science. Of these the richest is surely that of the electronic structure of matter, a field of unceasing development, which has given us, amongst many other things, the electronic chip, the computer, and, ultimately, an unprecedented power of global intercommunication.

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NEWS ITEMS

From "Physics World", August 1996,
Vol. 9, No. 8, page 12

Big thinking on nuclear physics

Opportunities for international collaboration in nuclear physics are to be explored by a new working group which was approved by the Megascience Forum at a meeting in June. The new working group wants to select the best opportunities for cooperation. It will analyse plans for new nuclear physics facilities in different parts of the world, including the proposed Electron Laboratory for Europe *(Physics World* October 1995 p5). The group will also be looking at plans for radioactive beam facilities, *such* as those at ie Oak Ridge and Argonne National Laboratories in the US, and the Japanese Hadron Project JHP). The JHP is a multipurpose facility that would also be used by high-energy physicists and neutron scatterers *(Physics World* May p 13) .

Nuclear physics is the fourth topic to be chosen for a Megascience Forum working group since the forum's remit was strengthened early this year. Another working group on neutron sources - has divided its work into three sub-groups. The first will examine how to upgrade existing neutron sources, while ie other two will look at international co-operation on novel neutron instrumentation and the development of new neutron sources. The latter will also explore opportunities for collaboration on outstanding technical questions to do with building the next generation of neutron sources, such as ie Europe Spallation Source and the US Pulsed Spallation Neutron Source *(Physics World* June p8).

Two other topics are to be discussed at workshops early next year. Italy and Greece are to organize a workshop on a proposal for a deep-sea neutrino laboratory, while Japan is arranging a meeting on population growth, food production and energy generation. The workshops will look at how much international interest there is in co-ordinating research on the topics and whether a Megascience Forum working group should be set up.

Energy boost for Russia

Russia is planning major developments in nuclear energy. A new public company is being set up to manage the nuclear fuel industry, and a new safety programme for the remaining graphite-moderated RBMK reactors, similar to those at Chernobyl, is being implemented. Meanwhile, the nuclear equipment manufacturers, *Rosenergoatom*, has announced the imminent completion of the first of 20 floating nuclear power stations. These are scheduled to come on-stream in the year 2000, using two 35 MW light water reactors. They are intended for the far north and east of Russia, which can only be reached by sea or river.

But not all is well with the Russian nuclear industry. Last month, Russian radio reported that criminal proceedings had been brought against the Sosnovy Bor nuclear power station near St Petersburg regarding its failure to pay the staffs wages. Delays of several months are common in the Russian state sector, and the power station is being investigated by the prosecutor-general, the state tax service, and the department for combating economic crime.

First results from CERN upgrade

CERN, the European laboratory for particle physics, has produced its first pairs of W+ and W- particles. These fundamental particles, along with the Z°, carry the weak nuclear force that is responsible for b-decay. The particles were produced at the upgraded large electron-positron collider (LEP).

According to Wilbur Venus, a senior physicist on the DEPHI collaboration at CERN, the mass of the particles is likely to be about 81 GeV. He adds, however, that it is too soon to be any more certain, as only about 20 pairs have so far been detected. The precise value will depend on the outcome of a calibration that was being carried out as *Physics World* went to press. Researchers also hope to have a better idea once the current run, which lasts until the middle of August, is over.

The upgrade puts LEP in the energy range where supersymmetry theory - an extension of the Standard Model of particle physics - can be tested. Further upgrades will eventually reach collision energies of almost 200 GeV.

Safety worry at Texas plutonium plant

A series of incidents at a plant in Texas that salvages plutonium from ageing nuclear weapons has raised concern about safety. The plant's owners, the US Department of Energy (DoE), reacted by bringing forward an inspection that was originally planned for late 1997. The Pantex plant in Amarillo employs about 300 technicians to strip plutonium from ageing conventional explosives that might detonate by accident. Security is high and safety procedures are tough. But recent inspections by the DoE have shown serious lapses, including improper storage of radioactive materials, wrongly labelled containers of explosives, and failure to check barrels of old explosives regularly.

Managers at the plant have conceded that workers failed to follow a rule that weapons must never be left under the control of a single individual. They have also admitted other lapses in safety regulations. However, they argue that nuclear weapons are fundamentally designed for safety in handling, and that there was no chance of any explosion from ie accidents. DoE officials, meanwhile, countered that low-level, low-hazard accidents can easily escalate into more serious incidents which could threaten real damage.

Another peek in the future

The UK is to undertake another Technology Foresight exercise in l999, it was announced last month by Ian Taylor, the minister for science and technology. The Foresight process was launched by the UK government in its 1993 white paper "Realizing Our Potential". It took off the following year when 15 panels of experts from industry, academia and government worked out which marked and technology opportunities were most likely to promote wealth creation and enhance quality of life in the UK over the next 10-15 years. Since then, the UK government has launched a number of opportunities to promote research in the areas recommended by the panels, including the Foresight Challenge competition. The research councils - and now the funding councils - have also started to steer public fundsinto these areas. Taylor hopes that the new exercise will "continue to promote partnerships between business, government and the science base".

SCUBA

The first results from SCUBA - the sub-millimetre common-user bolometer array - are due early this month. Astronomers will use the instrument to image primordial galaxies, the most distant objects in the galaxy, and the cosmic background radiation, which contains tiny fluctuations corresponding to the formation of large-scale structures in the early Universe. SCUBA is mounted on the James Clerk Maxwell telescope in Hawaii.

New Members, Address Changes etc.

Welcome to New Members :

Dr Joseph C McDonald 07/96-07/97
K3-53, Pacific Northwest National Laboratory
PO Box 99
Richland
WASHINGTON 99352 USA

Address Changes

Dr David Jette
The Lanzl Institute
3600 15th Ave. W., Suite 205
Seattle, WA 98115-1330 U.S.A

Returned Mail

Can anyone assist with new address?

Dr Margarita Herranz
Manzarragena
C. Uresaranses
Gorliz, Vizcaya SPAIN

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Calendar

1996

September

9-11 *Second International Workshop on the Industrial, Medical and Military Applications of Radionuclides*, Salzburg, Austria. Workshop Secretariat, Institute of Physics and Biophysics, Hellbrunnerstr. 24, A-5020 Salzburg, Austria.
Fax : 43 662 8044 5704;
Phone : 43 662 8044 5700;
e-mail : physik@edvz.sbg.ac.at

18-20 *International Symposium on In Vivo Body Composition Studies*, Malmö, Sweden; Symposium Secretariat, Department of Radiation Physics, Malmö University Hospital, S-205 02 Malmö, Sweden.
Fax : 46 40 963185; Phone : 46 40 331235

October

6-9 *3rd Topical Meeting on Industrial Radiation and Radioisotope Measurements and Applications (IRRMA'96)*, Raleigh, USA; W.F. Troxler, IRRMA'96 Conference General Chairman, Troxler Electronic Laboratories, PO Box 12057, Research Triangle Park, NC 27709, USA. Phone : 1 919 549 8661

14-16 *International Symposium on Nuclear Energy and the Environment*, Beijing, China; Leng Ruiping, Wang Hengde, Chinese Society of Radiation Protection, PO Box 2102-14, Beijing 100822, China. Fax : 86 10 8539375; Phone : 86 10 8510370

21-25 *4th International Conference on High Levels of Natural Radiation*, Beijing, China; Prof. Tao Zufan, Secretary General of 4th ICHLNR, Laboratory of Industrial Hygiene, Ministry of Health, 2 Xinkang Street, Deshengmenwai, Beijing 100088, China.
Fax : 86 10 2012501
Phone : 86 10 2021166 ext. 378

November

3-7 *International Conference on Radiation and Health in Israel*, Ben Gurion University of the Negev, GBeer Sheva, Israel; International Conference on Radiation and Health, Ortra Ltd., 2 Kaufman Street, Textile Center, POB 50432, Tel Aviv 61500, Israel.
Fax : 972 3 5174433; Phone : 972 3 5177888
e-mail : ortra@trendline.co.il

3-8 *2nd International Symposium on Ionizing Radiation and Polymers*, Guadeloupe, France. Natacha Betz, IRaP96, CEA/Saclay, DSM/DRECAM/SRSIM, 91191 Gif sur Yvette Cedex, France.
Phone : 33-1 69 08 48 34 Fax : 33-1 69 08 96 00
e-mail : irap@drecam.cea.fr

1997

February

24-28 *7th International Syumposium on Radiation Physics (SIRP-7), Triennial Meeting of the International Radiation Physics Society (IRPS)*, Jaipur, India; B. Sinha, Director, Variable Energy Cyclotron Centre, 1 A/F, Bidhan Nagar, Calcutta 700 064, India
Fax : 91 33 346781; Phone : 91 33 370032

March

15-20 *Sixth Conference of Nuclear Sciences and Applications*, Cairo, Egypt; Prof Dr A I Helal, Atomic Energy Authority (ESNSAS) 101 Kasr El-Eini Street, Cairo, Egypt, Fax : +20 2 3543451

May

19-23 *ICRM'97*, Gaithersburg, Maryland, USA; Dr J.M.R. Hutchinson, Radioactivity Group, NIST, Gaithersburg, MD20899, USA
Telefax : +1-301-926-7416; e-mail : jmrh@micf.nist.gov

June

2-5 *2nd International Workshop on Electron and Photon Transport Theory Applied to Radiation Dose Calculation*, Seattle, Washington, USA. David Jette, Lanzl Institute, 3600 15th Ave.W., Suite 205, Seattle, WA, USA 98119
Phone : 1-206-286-0241; Fax : 1-206-286-0231
e-mail : dave@meihua.lanzl.com

July

21-25 *X International Conference on Small-Angle Scattering*, Campinas, Brazil; Prof. Aldo Craievich, LNLS, Cx Postal 6192, 13081-970 Campinas, SP, Brazil