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of Physicists

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Physics in Canada

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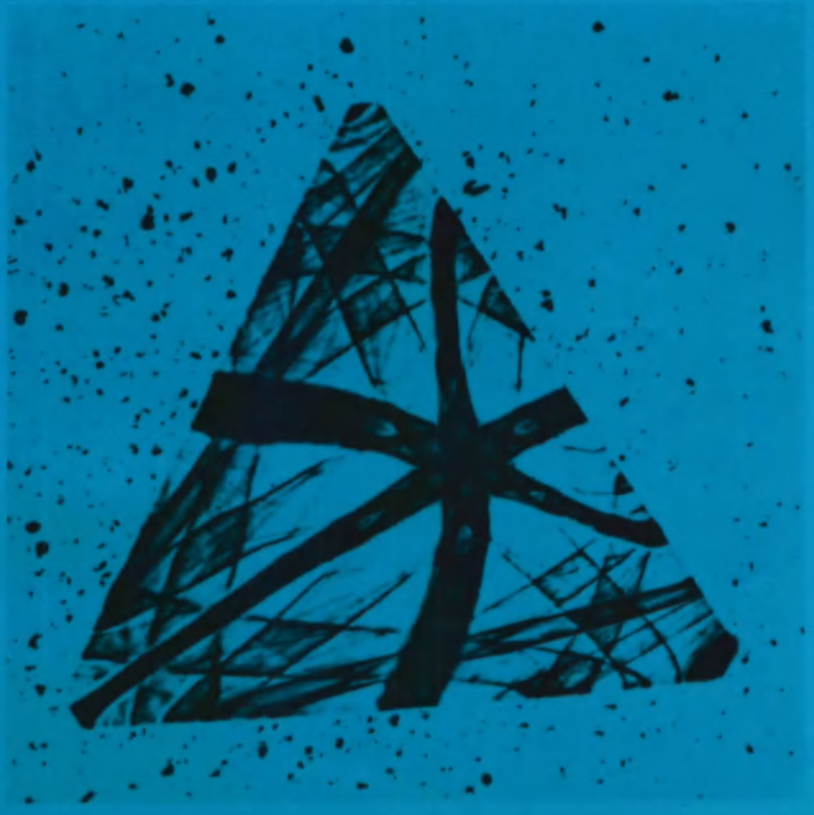
La Physique au Canada



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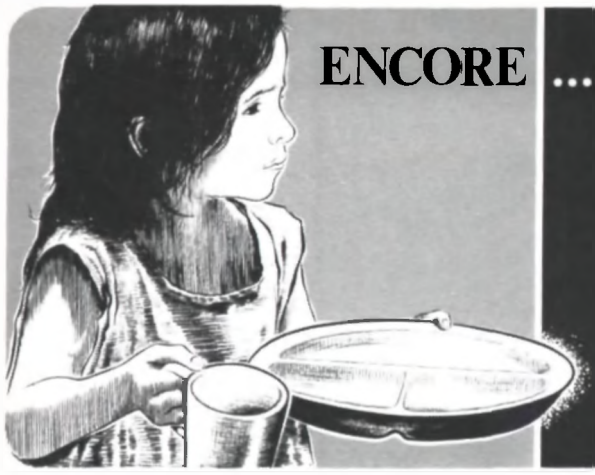

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La Physique au Canada

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FRONT COVER: Electron micrograph showing bend extinction contours in a thin gold platelet; × 75,000. (Courtesy F. W. Boswell).

Letters

Dear Sir:

I am pleased that "Physics in Canada" has published (September, 1970) an account of the discussion that took place at the C.A.P. Congress in Winnipeg on the Employment Situation for Physicists with Higher Degrees.

The situation is distressing enough in all conscience, but the thing that I personally found particularly distressing about the whole discussion on that occasion was the almost clinical impersonality of it all. The idiom of the discussion represented graduate students as statistics, or as commodities in a pipeline. There was even a suggestion that a little overproduction was a good thing. It was not until Dr. Purcell, President of the American Physical Society, raised the issue indirectly, that there was any real recognition in the discussion of the fact that graduate students are people and not things. I think it was Dr. G. C. Neilson who pointed out, from the audience, that, in the circumstances we may well be better off to spend a little less money on that new piece of fancy equipment and a little more on people.

We are, after all, the Canadian Association of Physicists rather than just the Canadian Association of Physics.

Yours sincerely,

J. R. Prescott
The University of Calgary

Dear Sir:

While attending the Canadian Undergraduate Physics Conference in Edmonton recently, I made some observations which I believe pertain to every member of the CAP.

As an undergraduate, I found the conference valuable in an academic way, but I believe the conference failed organizationally. This organizational problem could have been eliminated through greater guidance and personal aid, other than financial, from the members of the CAP. I was quite disheartened to learn that the only member of the CAP who participated in an official capacity was the President.

The workshops or discussion periods failed because there was no professional guidance there, which I believe could have been used in a strictly guidance fashion. Students find it very difficult to talk intelligently about a certain phase of "Science and its Inter-relationship to Society" with limited experience or knowledge.

I believe that members of the CAP, if only those at the University of Alberta, could have been invaluable in assisting the students in the preliminary organization, as well as in the functioning of the conference. Some feel that the people in the CUPA should be left on their own and should learn from their own mistakes, but a physics conference is a mammoth task which must be well organized to be successful. Nothing can ruin a conference more quickly than poor organization.

The lack of guidance became particularly evident at the General Meeting and in the drafting of the Constitution. The Constitution was drawn up hastily, and the General Meeting, as a result, approached the farsical.

In the future, I would suggest that the members of the CAP take an earnest interest in the activities of the CUPA, for herein lies the future of physics in Canada. Whether the interest be local or national, the CUPA as well as the CAP would benefit.

I am looking forward to an excellent conference next year.

Yours sincerely,

D. G. Stephenson
Officer Cadet
Royal Military College

Dear Sir:

I am distressed by the tendency amongst younger scientists towards clarity of thought and expression engendered by an avoidance of convolution of verbal expression. Have they no respect for the pedestrian platitudes of their elders?

Recently, I came across the technical description of the catastrophic failure of an avian generated, byosythesized oblate spheroid structure at the termination of a graviational descent. The verbal description was positively succinct. I present my alternate detailed account of the event in order to demonstrate the elegance of verbosity.

"The object of our prognostication formerly balanced in unstable equilibrium at the top of an array of refractory particles held in a matrix by silaceous cement. One day there was a catastrophic failure of equilibrium which resulted in a conversion of potential into kinetic energy. Eventually a collision (non-elastic) occurred and there was a complete destruction of the original shell structure. The Army Engineers (aided by the Equestrian division), failed to achieve reassembly of the original structure."

This, sir, I claim is a more obtuse, scientific version of the original version of H.D. as reported by M. Goose *et alia*.

Yours sincerely,

Howard O'Brian

Research in Physics at Simon Fraser University, Burnaby, B.C.

R. R. HAERING

Simon Fraser University first opened its doors to students in 1965, and research in physics started at that time. The Physics Department then consisted of nine faculty members, one post-doctoral fellow and 13 Ph.D. graduate students. At the present time, the Department consists of 19 faculty members, 13 post-doctoral fellows and 24 graduate students. Since 1965, the Department has graduated eight Ph.D. students, six of whom are now working in industrial research positions, mostly in the U. S. The initial period of rapid departmental growth is now over and we expect only a modest expansion during the next few years.

The research activity in the Physics Department was initially concentrated in the area of Solid State Physics. The decision to concentrate on one area of research was made because of our belief in the "critical mass" theory of research and because concentration on one area would allow us to achieve economies through the sharing of back-up facilities required for various research projects. Today, our facilities for solid state research are among the finest in Canada. The Department is still primarily solid state oriented, although our interests have widened to include studies of liquid metals, liquid crystals and chemical physics. The Department is also involved in the TRIUMF project and has the responsibility (through A.S.Arrott) of designing the neutron target. This target will make TRIUMF, which was initially conceived as a nuclear physics facility, a significant tool for solid state research.

Our Department takes great pride in the extensive program of seminars and lectures which it has implemented during the past years. This program has brought many distinguished visiting scientists to SFU and has made a large contribution to our research program. For example, a recent series of lectures by Prof. P.G. de Gennes of the University of Paris has heightened our interest in liquid crystals and has provided impetus for several new experiments in this field. A similar earlier visit by Prof. A.B. Pippard of Cambridge University has resulted in a major departmental effort to measure the optical properties of metals in the 10 μ - 1000 μ wavelength range. The "Pippard experiment" will be discussed a little more fully below, together with two other projects which are currently in progress.

The "Pippard Experiment"

Although the optical properties of metals have been extensively studied at microwave and optical frequencies, no systematic study has to date been possible in the experimentally difficult region between 10 μ and 1000 μ. The chief difficulty has been the lack of suitable monochromatic sources of radiation of adequate strength. This situation has changed with the advent of lasers and strong laser lines are now available at 10 μ (CO_2), 28 μ and 118 μ (H_2O), 200 μ (DCN), 330 μ (HCN) and 700 μ (ICN). These laser lines will be used to measure the optical properties of single crystal metals, initially of copper. One anticipates that somewhere in the above frequency range the effective mass of electrons should change as a result of the diminishing role of lattice polarization, but there may well be surprises. The experiment involves a joint effort by several faculty members (B.P. Clayman, J. F. Cochran, J. D. Irwin and L. H. Palmer). The lasers have been built and are operating and the required Helium-3 cryostat is nearing completion.

The Thin Film Squid

Our laboratory was first introduced to the remarkable properties of squids (superconducting quantum interference detectors) by Dr. J. E. Zimmerman, then of the Ford Motor Company Labs., who pioneered the squid in 1965. In essence, a squid consists of a superconducting loop containing a weak link. This system is able to detect individual quanta of magnetic flux and is therefore an extremely sensitive magnetometer. Squids are normally fabricated by machining a block of niobium metal, the weak link being formed by an adjustable point contact. Such units often lack mechanical stability and can fail on recycling between Helium temperature and room temperature. Members of our Department (F. Consadori, A. Fife, R. F. Frindt, S. Gygax) have recently succeeded in fabricating squids from $NbSe_2$. This material is a layer structure with a superconducting transition temperature of 7.0°K. With careful preparation, it is possible to fabricate squids in the form of thin platelets. The weak link in these units is a single crystal section whose thickness is of the order of 100 Å. $NbSe_2$ squids look extremely attractive as magnetometer sensing elements. They are mechanically rugged, can be encapsulated and are insensitive to thermal cycling.

The Phonon Maser

During the past two years we have studied ultrasonic phenomena in piezoelectric semiconductors. In these materials the electron-phonon interaction is particularly large and dominates the ultrasonic behaviour under suitable conditions. Normally, the electron-phonon interaction results in ultrasonic attenuation but in the presence of a D.C. electric field of sufficient magnitude the interaction may produce ultrasonic amplification. We have recently achieved phonon maser action ueing this effect. The phonon maser produces highly monochromatic sound waves in the frequency range 50-500 MHz. Strain amplitudes are very large (10^{-4}) and line widths are less than 100 Hz. The phonon maser is easily tunable and should prove to be of great value as a source of ultrasonic waves. Because of the acousto-electric effect the device also has an electrical output which can be used as an F.M. transmitter. Up to 4% of the D.C. power is converted to the maser frequency, usually into a single mode. We have demonstrated that such a unit will transmit audio signals which

can be picked up with a conventional F.M. receiver. F.M. transmission of video signals also appears possible.

A more complete list of experimental and theoretical research projects is described in our graduate studies pamphlet which is available from the Department on request.

The Support of High Energy Physics Research by NRC*

J. M. ROBSON

Physics Department, McGill University;
Chairman, Physics Advisory Committee of NRC.

There seem to be some strange misconceptions about the recent attempts by the National Research Council to aid research in high energy physics by Canadian scientists. Perhaps the following chronological and factual account of the developments in this field may help to clarify the situation:

In the Fall of 1967 a group of Canadian High Energy Physicists applied to NRC for a grant "to study in detail the feasibility of Canadian participation in the 200 GeV accelerator project of the National Accelerator Laboratory (NAL) at Batavia, Illinois, and the most desirable form for that participation, if feasible". A grant was awarded in the Spring of 1968 and the group submitted their report to NRC in March 1969. The report entitled, "A Particle Physics Programme for Canada", recommended:

1. That the Government of Canada join that of the United States in funding the 200 GeV accelerator.

2. That the Canadian expenditure on a total particle physics programme starting in 1970 comprise an investment of $4 million annually for the next five years in the 200 GeV accelerator laboratory and continued support for the Canadian user groups at the yearly level of $1 million rising to approximately $2 million by 1974.

3. That the Canadian funds for the Accelerator Laboratory be administered by a Canadian Universities Research Association (initially composed of those Canadian universities which wish to be actively associated with particle physics research).

4. That the Canadian contribution to the Accelerator Laboratory be held in Canada and be placed at the disposal of the Director of the Laboratory, who will be responsible to the officers of CURA for its proper use.

The Council referred this report to its newly formed Advisory Committee on Physics for comment. This Advisory Committee had been formed in the late Summer of 1968 to advise Council on matters concerning physics and was in the early stages of getting its thoughts straight when Council asked it to look at this specific proposal. It therefore had to discuss it as an isolated proposal and did so on several occasions in the Summer and Fall of 1969. It received both unsolicited and solicited expressions of opinion on the subject and also commissioned the Canadian Association of Physicists to survey its membership on the question. It concluded that the participation proposal in the form suggested by the High Energy Physicists did not receive support by a sufficient majority of its (the Advisory Committee's) members to warrant a supporting recommendation to Council at the time. The Advisory Committee on Physics did, however, agree with the following basic ideas:

1. that High Energy Physics is a stimulating and fundamental branch of physics in which Canada should be involved on a long term basis;

2. that this involvement should not be done by constructing an accelerator in Canada but should be done by international collaboration;

3. that Canadian funds for Particle Physics Research be administered by a Consortium or Association of Canadian Universities and Institutions and that it has freedom to use these funds in any way it sees fit consistent with normal NRC grant regulations and provided they are not used towards capital construction of an accelerator;

4. that the Canadian expenditure for the support of High Energy Physics be increased gradually by a factor of two over the next five years, provided this increase is not at the expense of other fields of physics.

The NRC Advisory Committee on Physics submitted the following recommendation to Council:

We recommend that Canadian Elementary Particle Physicists be encouraged to form a Consortium or Association to administer all funds for Elementary Particle Experimental Physics available from the Canadian Government. This Consortium or Association should be empowered to use the funds in any way it sees fit to further research in Elementary Particle Physics provided this does not involve capital expenditure in a basic accelerator. The funds made available to this Consortium or Association should be provided by the National Research Council after a review of the past and proposed programmes of operation. The National Research Council should impose minor administrative requirements on the use of these funds in accordance with its general practice.

Provided the programme warrants it, and provided the funds are available, the amounts should be at least as great as the following:

1970/71:	$0.75 M
1971/72:	$0.9 M
1972/73:	$1.2 M
1973/74:	$1.4 M
1974/75:	$1.6 M

* This article appeared in the Dec. 1970 issue of Science Forum. Because of its interest to the Physics community, it is reproduced here with the permission of the author and the Editor of Science Forum. The Editor.

> We further recommend that, if the present accessibility of U.S. facilities changes, the Government should give serious consideration to a closer participation with the U.S. in meeting the operating costs and/or the capital costs of the 200 GeV accelerator.

The Council considered the report of its Advisory Committee on Physics in November 1969 and agreed that it could not accept the High Energy Physicists' recommendation that Canada participate in the construction of the accelerator at Batavia. However, if the future of Canadian high energy physics research was to be by international collaboration (i.e., essentially by the use of U.S. accelerators including the 200 GeV machine), Council wished to be assured that these facilities would really be accessible. It therefore appointed an ad hoc committee to explore this further with the Director of the National Accelerator Laboratory (Dr. R. R. Wilson) and with the President of the University Research Association (Dr. N. Ramsey).

This ad hoc committee consisted of three Council members (D. Le Roy, J. M. Robson and G. Volkoff) and two other members (J. Daniels and E. P. Hincks); it visited NAL on December 2, 1969, and met with Dr. Ramsey, Dr. Wilson and Mr. J. A. Erlewine, Assistant Manager of the Atomic Energy Commission. A number of other Americans were also present from the NAL and AEC.

The ad hoc Committee proposed for discussion three possible methods of participation:

1. Free access to the accelerator by Canadian scientists without any direct contribution to NAL,
2. Use of the accelerator by the payment of fees based on the amount of time used,
3. Participation through contributions to the development of experimental facilities following the actual construction of the basic machine.

The last will be referred to as Post Construction Participation (PCP). In discussing the first possibility, Dr. Wilson confirmed the statements attributed to him in the CERN Courier of September, 1968, in reply to the following question: "If the worst came to the worst, could the American project in fact accommodate a significant overseas participation?" The answer was: "With money, yes. Without money, no." "Without money we cannot even accommodate our own regional interests. We could increase the intensity of the machine, I suppose, but there is always a problem of so many hours, so many square feet, and you just cannot do everything. I suspect that we are going to have to expand to meet the needs already foreseen in our own country. We should, of course, try to accommodate people from Europe, if the worst came to the worst, but we would regard this as a pretty desperate circumstance." Confirmation of this made it quite evident to the ad hoc Committee that an unlimited free-loading type of participation would not be possible.

In discussing the second possibility, Mr. Erlewine of AEC provided the answer: this would require adherence to AEC policy which would entail payments based on the original capital expenditure on the facility, amortization costs, overhead, etc. Such charges would probably be very much larger than the annual contribution of $4 million proposed by the Study Group.

It was made quite clear to the ad hoc Committee that the only reasonable method of participation in the facility was by PCP. The remainder of the discussion centered around the various aspects of this method. It became apparent that a contribution of the order of $1 million a year for a period of two years followed by an escalation to a larger annual contribution was probably necessary.

The Americans felt that the funds so allocated should be held in Canada until called for by the Director of NAL. All three of the American groups pointed out that the availability of funds in Canada would be of great benefit to the project. They also thought that it would provide a better mechanism by which Canadian firms could compete for contracts.

Dr. Ramsey and his colleagues pointed out that Canadian participation in the PCP form would benefit Canadian scientists in ways which would not be possible under any other scheme. He pointed out that brilliant experiments are not devised in isolation, and that interactions between Canadian scientists and all other users of the facility would provide the stimulation and free exchange of ideas so necessary in this field of research.

The Executive Committee of the National Research Council heard a report on this visit on December 12 and instructed me to prepare a full report for the March 1970 meeting of Council.

My Brief to Council, dated February 1970, was based on three beliefs: First, that in the foreseeable future no Canadian accelerator was likely to offer facilities for elementary particle physics which were at all competitive with those expected at Batavia (TRIUMF is not, and has never claimed to be, a high energy accelerator); secondly, that use of the Batavia accelerator can only be expected with some form of participation which includes a modest sharing of the financial burden of NAL and thirdly, that competition for other American facilities will get increasingly strong as some of them are phased out. The Brief read, in part, as follows:

> It is proposed that High Energy Physics should be supported at a level which will provide opportunities for Canadian scientists to participate meaningfully in its development.
>
> It is proposed that this should be done by their active participation in the programme of the National Accelerator Laboratory at Batavia, Illinois; it is now known that this can only be effective if it involves financial contributions to help defray the operational expenses and the cost of major scientific equipment during the post construction period.
>
> It is proposed that this participation, and all other research in High Energy Physics, should be coordinated by an Institute of Particle Physics, and that all funds from the National Research Council should be handled by this Institute. Any Canadian research laboratory should have right of membership in this Institute. This Institute should manage funds associated with participation in the National Accelerator Laboratory and should coordinate and disburse funds for

research in High Energy Physics to its member groups and to individuals. It should apply annually to the Negotiated Grants Committee of Council for that part of its income which comes from the Council.

It is proposed that the Institute should be established during 1970 and should become fully effective by 1 April, 1971. It should apply in November 1970 for funds to the Negotiated Grants Committee of the Council. It should put some funds at the disposal of the Director, NAL, on 1 April, 1971.

It is proposed that Council make available to the Institute for the grant year 1971-72, $1,000,000. (U.S.) for participation, plus approximately $700,000. for experimental programmes, plus approximately $130,000. for theoreticians, plus approximately $90,000. for organizational expenses, summer schools, and orientation programmes, a total of about $2,000,000. (Canadian). This sum would be documented and applied for by the Institute in its application in November 1970.

I expressed my own personal conviction, shared by many high energy physicists, that if participation was not possible, Canadian research in this field was likely to become second rate and should perhaps be phased out. The Council discussed this in some detail. After its deliberations it agreed that the following account could be released to the High Energy Physics community.

At its March meeting, the National Research Council discussed the proposal that Canada participate with the United States in the operation and use of the 200 GeV accelerator at Batavia, Illinois. The proposal recommended the expenditure of 1 million U.S. dollars in 1971 and again in 1972 followed by an annual amount escalating at about 20% per year with a full review after about five years. It also proposed the creation of an Institute of Particle Physics to handle these funds and also to allocate operative funds for the experimentalists and theoreticians. Council recognized that this was a progressive and practical way for Canadian High Energy research to develop and were impressed by the approach.

However, Council felt that it did not have sufficient data at its disposal to see where it could find the additional funds,especially in 1971-72. If Council should receive a reasonable increase in 1971, the problem would be alleviated. It could not, however, bank on this; in fact, present indications were that it would not. In view of this, the members felt that a way of providing it out of existing funds would have to be found in order to give approval this year.

It therefore tabled the recommendation for reconsideration at the June meeting, with the intention of critically examining its whole budget to see where funds could be found. It also requested the Physics Advisory Committee to recommend if funds could be pared from existing physics programmes, but at the same time realized that it would be difficult to extract all the funds from existing physics support. It agreed to rediscuss this in June in the light of this additional data and to reach a definite decision one way or the other at that time.

The Advisory Committee on Physics considered Council's request at two meetings in April and May. At the first it recognized that Nuclear Physics was relatively rather well supported in Canada and at the second identified two facilities which had reached stages in their development which perhaps warranted a reduction in support. On the invitation of the committee the Nuclear Physics Division of the CAP had nominated a representative to participate in the discussion at this second meeting. The committee realized that to go much further it needed a lot more advice and information and recommended to the Council that a grant be awarded to the CAP to undertake a survey of goals and priorities in physics (this was subsequently awarded by Council). Nevertheless, taking into account the two identified soft spots in Nuclear Physics and one other soft spot unrelated to Nuclear Physics, it felt that Council could find about $150,000. next year from these areas if it urgently needed money for emerging programmes in other areas.

At the Council meeting in June 1970 the Chairman of the Advisory Committee on Physics was very careful to point out that this sum was not earmarked for High Energy Physics. It was an earnest attempt on the part of the Advisory Committee on Physics to locate quickly, and put dollar values on, areas which could be squeezed if Council absolutely had to do so in the best interests of Canadian University support. It hoped that other sectors would also make such searches.

Council went on to consider the participation proposal tabled at its March meeting. After taking a careful look at its overall budget, it concluded that it would probably be unable to find the $1 million needed for support of participation in 1971. After further discussion it passed the following motion:

Council accepts the principle of participation in the operation of the Batavia accelerator and undertakes to implement this as soon as its financial situation permits.

In the meantime, it authorized the Vice-President (University Support Programme) to put a sum of up to $200,000. annually at the disposal of the Director, National Accelerator Laboratory, as a retainer to keep the participation offer open.

In passing the motion Council affirms its support of Canadian research in high energy physics and agrees with the concept of this being done by international collaboration. Though not explicitly stated in the motion, it hopes that the Institute of Particle Physics, or some equivalent, will be set up and will undertake the functions outlined in the Robson brief of February 1970.

Before closing I would like to outline Council's action on another grant request which has some significance for High Energy Physics. It concerns an application from the University of Toronto for funds for "Computer controlled measurements of scientific photographs". The device is often referred to as "Polly". This was a joint application from some High Energy Physicists, Chemical Engineers, Electrical Engineers and a

Biologist. It was an unexpected example of how a technological development in High Energy Physics could have very considerable significance in the applied sciences. Council's Negotiated Grants Committee was impressed by these applications and awarded a grant to help in the construction of "Polly".

My own personal research has been associated with very low energy particles. In fact, I am presently planning experiments at energies which will be about a factor of 10^{18} less than those which are expected to be available at Batavia next year. Nevertheless, I am excited at the prospect of Canadian Physicists perhaps being able to participate in this new frontier field of High Energy Physics; I consider that Council acted in a far-sighted manner in trying to make this possible.

Note from the Physics Education Division

The following note from Dr. Walter Thumm will, I hope, stimulate other members of the CAP, particularly members of the Physics Education Division to contribute items of general or specific interest in the field of physics education.

It may be that

> In matters pedagogical
> and things philological
> this note quantumalogical
> be not escatalogical.
>
> L. R. McNarry, Chairman
> Physics Education Division.

One-week Summer Courses in Physics for High School Teachers.

Walter Thumm
McArthur College of Education
Queen's University

Sometime during the Fall of 1969 at a gathering of the executive of the Physics Education Division of the CAP, various possibilities relating to the interaction between university physicists and high school physics teachers were discussed. It seemed to the executive that some venture which provided a more or less total immersion in a relatively restricted topic area for a period of one week might be worth trying.

On the basis of these preliminary discussions McArthur College of Education (the Faculty of Education at Queen's University) approached the Department of Physics of the Faculty of Arts and Science with a view to providing instructors and facilities for a limited number of one-week courses in the Summer of 1970. It was proposed that the courses be offered for the two weeks immediately following the termination of the school year so that teachers might participate without decimating their holiday period. The response of the Physics Department to these ideas was enthusiastic and on the basis of that response preliminary data of the following type was sent to teachers.

"Objective: to provide a short, concentrated look at certain topics of interest, with the opportunity to work with related equipment where relevant.

Size of classes: 10 - 15 students.

Length: One week per topic. Candidates could enroll in one or two one-week sessions.

Prerequisite: Interest in topic of the one-week session of concern.

Tentative format: Two-hour lecture each morning (five days) - informal contact with instructor at coffee and/or lunch - afternoon free to do experimental work and/or library research - no exams.

Instructor: A member of the Queen's Physics Department with a particular interest and competence in the subject concerned as well as an interest in physics education.

Endorsement: Such a program has the full support of the Physics Education Division of the Canadian Association of Physicists.

Level: Starting point would be about the "Scientific American" level and progress from there would be by mutual arrangement between students and instructor."

This information was sent to secondary schools and to community colleges. A number of possible topics were also suggested and an indication of topic preference was solicited.

On the basis of the response received it was decided to go ahead with the venture and four classes were mounted, one on "Lasers", one on "Radio Astronomy", one entitled "Some Solid State Physics", and the other on "The Physics of Cathode Ray Tubes". Here is a typical example of the kind of information subsequently placed in the publicity and registration brochures.

"1. Lasers (June 29th - July 3rd)

The theory of laser action will be discussed in a qualitative way based on elementary quantum physics. The properties of laser light will be illustrated by demonstration experiments and also by direct experimentation in the laboratory with He-Ne gas lasers.

Such topics as spatial coherence, temporal coherence and peak power will be treated.

Text: Lasers and Light, Readings from Scientific American, W.H. Freeman, San Francisco, 1969.

Instructors: Professor X and Professor Y.

Dr. X, a graduate of Queen's and of Cambridge, is one of the Physics Department's most experienced lecturers. He has taught courses in optics many years and is intensely interested in lasers. Dr. Y is a graduate of McMaster and of the University of British Columbia. His special field of interest is in microwaves and magnetic susceptibilities. Dr. Y has had wide first-hand experience with lasers. He is keenly interested in educational matters and is Chairman of the Physics Department's Undergraduate Curriculum Committee."

While the final enrolment in the four courses was only of the order of ten physics teachers per course, involving some 30 different teachers, the venture appears, on the basis of information gathered from both the physics teachers and their instructors, to have been a pronounced success. Asked the question, "Do you think these courses serve a useful purpose?", the teachers who took the courses answered in the affirmative with a unanimous and resounding enthusiasm. Here are examples of some typical replies to this question: (1) "Yes, it is one of the few chances a teacher has to come to grips with a professional physicist without being under the gun for examinations." (2) "Yes, small groups are ideal and lectures as interesting as those of our instructor are greatly appreciated." (3) "Yes, they give one, at least, a perfunctory knowledge of the current state of physics in a specific area. Personally I found the course stimulating and a distinct change from the average summer course."

Reaction from the instructors who participated was similarly enthusiastic about the program and certainly appeared to indicate that this approach should be continued. Some typical instructors' responses were: (1) I am heartily enthusiastic about the summer courses for teachers. I would consider it very useful if they continued in their present format and possibly in an expanded range of offerings." (2) "The public relations aspect of the courses was very good. We were put in touch with some high school teachers whom we would not have met and they, in turn, had a chance to see us at work. I enjoyed teaching my particular subject." (3) "My view is that as long as the teachers keep coming then we are performing a useful service."

In general it seems safe to conclude that physicists can well perform a useful role vis a vis the high school teachers of physics by offering to devote one to two weeks of their summer research time (not every year, of course) for this kind of effort in which they lecture to and talk with a small group of teachers about a subject of mutual interest and provide these teachers with some access to directed laboratory work. The word "directed" was inserted purposely because whereas the program and the general format on the whole received enthusiastic support, it has come through on the teachers' critiques that a certain degree of direction in the afternoon laboratory work is desirable. This was particularly the case because for an appreciable number of teachers the topics were sufficiently unfamiliar that there was merit in a short one-week course, to borrow a phrase from one of the participants, in "Do this" type of laboratory work rather than only in "What would you like to do today?" type labs.

In providing this information above for readers of Physics in Canada I lay no claim to originality on the part of Queen's University. Similar projects have no doubt taken place elsewhere. The objective is purely and simply to indicate one apparently possible successful avenue in helping to close the vertical gap in physics education. The author would, as I am sure would also the participating instructors, Dr.'s A. T. Stewart, H. M. Cave, W. Y. Chau, D. B. McLay, M. Sayer and H. J. Wintle, be more than pleased to correspond directly with any reader who wishes more details or who has suggestions to offer in regard to this type of undertaking.

Pictorial Facteria

A short course intended to familiarize science students with LITEROSCIENTIA MICROCOSOMES known to infect scientists.

Beast No. 5: The Glamour Bug.

S.E.X 482636.

A voluptuous parasitic electronic bug which infests modern equipment. When bitten by this creature the scientist gradually sinks into a stupor which is related to sleeping sickness and ultimately leads to the suspension of all critical faculties when in the presence of flashing electronic indicators and visual displays of collected data. Medically this trance state is known as the Vinkenblinken Syndrome. Scientists are particularly prone to attack from this bug when preparing NRC grant requests and an early symptom is a compulsive desire to collect and hoard glossy brochures provided by manufacturing agencies. When in a secondary phase of the illness the scientist tends to regurgitate endlessly the commercial blurbia and imprecise terminology of the brochures. At this stage of the illness the scientist suffers from acute depression in which he is tormented by delusions that research is only possible at a threshold grant level of $50,000. Treatment of the illness usually requires shock treatment which can be induced by severe throttling of funds; play therapy with string and sealing wax usually helps.

Howard O'Brian
Ornery Lecturer in
Nomotony Physics Dept.

In Memoriam, Dr. Lloyd George Elliott

by W. B. Lewis

LLOYD ELLIOTT, 1919-1970

Physics, and more than physics in Canada, has suffered a grievous loss by the sudden death of Lloyd George Elliott from a heart attack. Dr. Elliott was Director of Research at the Chalk River Nuclear Laboratories and at the time of his death was carrying great responsibilities. He had supported the growth of the CAP from its inception and became its President for 1959. His contributions to the growth and strength of physics are well known to many. A profile of his life and work, written by Dr. A. T. Stewart, was published in Physics in Canada in the fall of 1959 (Vol. 15, #3). This memoir will not review the course of his early life but will attempt to appraise the wisdom he developed that made his counsel so valuable to many, both at Chalk River and in world-wide circles.

The relatively small group of basic research scientists at the Chalk River Nuclear Laboratories repeatedly demanded and received wise decisions from Lloyd Elliott that account in large measure for their continued success. He created conditions, appropriate for change, that sustained and renewed their leading position in a developing pattern of research, first in nuclear and neutron physics and more recently also in the complex science of solids, liquids, gases and their interfaces. He was also studying the fourth state of matter, plasma, serving on the National Research Council's Associate Committee for Plasma Physics.

Lloyd Elliott helped ensure CRNL's international reputation in many ways. He was able to do so because his own study and experience developed a deep understanding of the whole range of scientific activity. He valued the work in depth of theoreticians and always ensured that the experimental physicists had strong theoretical support. He had a remarkable intuition for future experiments that would obtain maximum results, and he took a close interest in the choice and detailed design of equipment. Thus, during the conception of the NRU reactor, he gave personal attention to the design of the beam tubes and thermal neutron column. The two high-voltage tandem ion accelerators were, through his foresight, obtained early and enabled CRNL to increase its research productivity. He obtained the support of the International Union of Pure and Applied Physics for the two major international conferences on nuclear structure held in Canada, in Kingston in 1960 and in Montreal in 1969. The published records of these conferences constitute a momument of his achievement through the CRNL group.

From that firm base his guidance extended to other circles. Following his term as President of the CAP he served on the Council of the American Physical Society (1960-1964). From 1962 to 1968 he was Editor of the Canadian Journal of Physics. He was a member of the Visiting Committee of the Bartol Research Foundation of the Franklin Institute from 1965. Lloyd Elliott was elected to these positions because he was found to possess a remarkable sense of the nature of truth in science, and could discuss both the unknown and new knowledge with singular competence.

But he was also a leader with a flair. He could recognize scientific talent and encourage its development. His judgment of people was repeatedly confirmed as scientists moved out of Chalk River -- mainly to universities -- and spread their strength to scientific work throughout Canada and beyond.

Lloyd Elliott will be sadly missed as Chairman of the National Research Council and Atomic Energy Control Board Visiting Committee for research grants to universities in nuclear and high energy physics. This committee under his chairmanship has reviewed the work of many laboratories linked by these grants. Times have not been easy in recent years when the number of university scientists has outrun the funds made available for research grants, so that cuts have been the rule. Despite the cuts, Chalk River has been able to expand its cooperative researches with universities whose staff and students make increasing use of the CRNL facilities under the guidance of the Experiments Advisory Committee chaired by Lloyd Elliott.

L. G. Elliott was born on a farm in Clarence, Nova Scotia, and took his first degree at Dalhousie University in 1938 followed by a M.Sc. in 1940. He went on to take a Ph.D. at the Massachusetts Institute of Technology in Nuclear Physics in 1943. He then joined the National Research Council which was at that time establishing the Montreal Laboratories for Atomic Energy Research and moved with these laboratories to Chalk River in 1946. His own research with beta-ray spectrometers led to measurements of very short nuclear lifetimes and of reaction energies of importance to basic constants, such as the exact mass of the neutron, and to a better understanding of the structure of nuclei. He became Assistant Director in the Physics Division in 1951, and was its Director from 1952 to 1967 when he became Director of Research, embracing the whole range of basic science at CRNL. He was elected a Fellow of the Royal Society of Canada in 1949, and received the honorary degree of D.Sc. from Carleton University in 1967.

Lloyd Elliott maintained a strong interest in education and was a member of the board that established the High School in Deep River. His other participation in community affairs included the founding of the local Community Skiways of which he became President. His recreational interests were extensive. He and his wife in recent years not only became first-rate skiers but also swimmers and scuba divers. He enjoyed canoeing holidays with his family.

Our sense of loss is felt most intimately by his wife and three sons of whom George, the eldest, is pursuing post-doctoral studies in mathematics having returned to Queen's after a year at U.B.C., the second, Bruce, is in his first post-graduate year studying immunology also at Queen's, while Martin, the youngest, has reached Grade 13 at C. J. Mackenzie High School.

We shall no longer see Lloyd Elliott striding on skis on the frozen river, but he will survive with gratitude in the memories of the many who have witnessed or participated in the growing strength of basic science in Canada throughout the last 25 years.

News/Nouvelles

Second Canadian Conference on Micrometeorology

The Second Canadian Conference on Micrometeorology will be held at Macdonald College, P.Q., May 10 - 12, 1971. On May 12, there will be a joint session with the Fifth Annual Congress of the Canadian Meteorological Society, which is to be held at the same location, May 12 - 14, 1971. The theme of the joint session is "Meteorology and the City". Other sessions are planned on the topics: Methods of Measurement, Air/Water Interactions, Micrometeorology over Snow and Ice, Agrometeorology, Forest Meteorology, Topoclimatology, Mesometeorology, and Theoretical Aspects of Micrometeorology.

Anyone wishing to present a paper should send title and definitive abstract (preferably less than 300 words) to the Chairman of the Planning Committee, Dr. R. E. Munn, Canadian Meteorological Servide, 315 Bloor St. West, Toronto, no later than February 15, 1971. Alternatively, titles and abstracts for the joint session on May 12 may be sent to Dr. C. L. Mateer, Program Chairman for the Canadian Meteorological Society Congress (at the same address as Dr. Munn). Authors whose papers have been accepted for presentation at the Congress will be notified by April 1, 1971.

Information on registration, accommodation, etc., will be provided in due course. Prof. R.H. Douglas of Macdonald College is Arrangements Chairman for the Congress.

Queen's Nuclear Theory Summer Seminar

More than seventy nuclear physicists met at Queen's University of August 26 and 27 to attend the second Queen's University Summer Seminar in Nuclear Theory, organized and supported by the Nuclear Physics Group and the Physics Department at Queen's. The conference was sponsored by the CAP.

As well as representatives from Canadian universities and research institutions, the meeting brought together physicists from the United States and Europe. The subjects discussed provided a survey of recent research developments in nuclear structure physics. Topics included:

Shell Model Calculations
(F. C. Barker, B. Castel, W. Davies, P. Federman, J. Kitching, J.C. Parikh, B. H. Wildenthal)

Effective Operators and Coulomb Displacement Effects
(M. Harvey, J. Janecke, S. Kahana, F. Kahana, B. West, L. Zamick)

Hartree-Fock Fields
(R. Y. Cusson, I. P. Johnstone, J. Le Tourneux, R. Padjen, G. Struble)

and Heavy Nuclei Studies
(G. T. Ewan, A. Jensen, J.O. Rasmussen, A. Volkov, C. Y. Wong).

International Union of Pure and Applied Physics

World-System for Abstracting

The ICSU Abstracting Board, of which Prof. H. W. Koch (USA) is IUPAP's representative, has announced its plans to go ahead with the first stage of a world-system for abstracting and indexing services for science and technology.

The stage will be planned by eleven of the world's major abstracting services from France, Germany, U.S.A., U.S.S.R., and the United Kingdom. Each of these will be responsible for abstracting journals in a certain area and contributing the abstracts to a pool. This will greatly reduce the duplication of work and reduce the number of articles processed by each service.

Subsequent stages will consolidate and meld the pool interchanges. Scientists will greatly benefit by being assured that each service gives complete coverage of his area, thus reducing his search time.

Bulletin Distribution

Copies of the IUPAP News Bulletin are distributed to all IUPAP international Commissions and National Committees. In addition, 23 member countries either distribute copies to individual physicists or reproduce it in their Physics journal.

We still await the answer of 15 member countries to our questionnaire concerning the distribution of the News-Bulletin.

The History of Physics

Growing interest in the history of physics, particularly its spectacular developments in the 20th Century, was underlined at the recent IUPAP-sponsored Conference on the Role of History of PHysics in Physics Education held at M.I.T., July 13 - 17. Consideration was given to the need for preserving archival materials, and for publications in this field. Co-operation with the International Union of History and Philosophy of Science was also discussed. Formal proposals will soon be made to the IUPAP Executive for action.

Conferences in 1971

Requests for sponsorship from IUPAP have been received from over 20 organizations planning international conferences in 1971. This number is at variance with the opinion widely held last year that the current austerity felt in most physics communities would result in a decreased number of meetings. It upholds the opinion that more frequent meetings ensure less duplication of work and more efficient use of research funds.

Fifth European Congress on Electron Microscopy

The fifth in the series of European Congresses on Electron Microscopy is to be held at the University of Manchester, England, from 5 - 12 September, 1972.

The organization of the Congress is being undertaken jointly by The Institute of Physics and the Physical Society and The Royal Microscopical Society, on behalf of The British Joint Committee for Electron Microscopy and under the auspices of The International Federation of Electron Microscope Societies.

The object of the Congress is the presentation and discussion of papers concerned with the electron microscope as an instrument and electron microscopy as a physical technique. Papers considering developments in the design, operation and the general physics of the electron microscope and related electron optical instruments will be relevant and so will a discussion in specimen preparation techniques, image recording, analysis, resolution and contrast and the general physical interpretation of results.

Papers on the applications of electron microscopy to specific problems in science and technology will be confined to specialist symposia on the last two days of the Congress.

The Congress will also include a Trade Exhibition of electron optical instruments and ancillary equipment.

Anyone wishing to be placed on the mailing list for further details should ask for the First Circular which is now available from

Mr. L. Lawrence, The Administrative Secretary
EMCON 72
The Institute of Physics and
the Physical Society
47 Belgrave Square
London, SW1
England.

Science Council of Canada, Special Study Report

On the 15th of October, 1970, at 11:00 a.m. in the Conference Room of the Science Council, 150 Kent St., Ottawa, Mr. Andrew H. Wilson presented a report published by the Science Council entitled "Background to Invention".

Based upon material gathered in 1967-68 by Mr. Wilson when he was working for the Economic Council of Canada, this study is subdivided in two parts:

First, an assessment of the effectiveness of the Canadian patent system.

Second, an examination of the effectiveness of industrial research and development activities in Canada. The majority of the material was obtained through interviews with senior research and technical managers of eighty companies across Canada and some thirty agencies, institutes and individuals.

Contents of the Study:

The study has identified a number of principles and ideas on which future revisions to the Canadian patent system should be made. For example:

- The system should be administratively simple, page 72.
- The Patent Act should be amended to ensure that more Canadian residents apply for patents of invention, page 73.
- The standard of examination and quality of Canadian patents should improve, page 72.
- The average period of pendency should be reduced, page 72.
- The Canadian system should be integrated internationally, page 71.
- The link between industrial research and development activities and the patent system is usually made indirectly, page 70.
- The course of development work may be influenced more by the existence of a patent system than the course of research work, page 70.
- As far as most industrial R & D laboratories are concerned, the value of the patent system is that it exists to be used after R & D work has been completed and before additional resources are committed to design, production, marketing and sales activities related to specific inventions, page 70.
- The author also found that industry tended to prefer the general incentive program and the fully funded contract to the cost-shared special assistance programs which are currently available, page 73.
- Governments alone cannot be responsible for all the measures defined to support R & D and innovative activities in Canadian industry. The public sector shares this responsibility. Nevertheless, federal assistance might be more effective if both the research and development activities were supported by the same department or agency and if the follow-on, or innovative, support is closely linked to the R & D. This may mean, for example, combining the administration of the present general incentive and special assistance programs, the industrial research institutes and Canadian Patents and Development Limited

in a single independent agency; giving this agency the authority and the resources to enter into development, procurement and other innovation-support contracts, page 74.

Queen's University

A contribution of $225,000. has been made to Queen's University, Kingston, Ontario, by The International Nickel Company of Canada, Limited.

The grant, which is payable in five annual installments of $45,000., is a contribution to the University's current capital campaign and will be applied to promote the fields of science and engineering in the construction of a new Mining Building complex and the extension of the University's geological facilities.

The grant is part of the Company's enlarged program of continuing aid to education which was initiated in 1956. Since that time, donations in Canada by International Nickel have totalled more than $11,000,000.

From British Information Services:

TV System Aids Surgeons

Doctors at Leeds General Infirmary, north-east England, are using television to watch the progress of instruments inside the blood vessels of the human body. And on the same screen they can simultaneously see the effects on the patient's heart.

The system, developed at Leeds University, has already been used to find the best position in the heart for the electrodes of a pace-making device and to pin-point a dangerous tumour. The prototype has cost less than $5,140. to develop.

Previously, doctors have had to watch the instruments in the body and be given a running commentary on the heart's condition by someone else. Now the picture of the blood vessels and the progress of the instrument -- for example, a catheter -- are displayed on the same screen together with traces showing heart rate and blood pressure.

The doctor can absorb all the relative information as he performs his delicate task. He can also have instant playback so that cause and effect can be linked at once with much greater safety to the patient.

The value of the new system showed up particularly in dealing with the tumour. This was invisible to X-rays, but it was located by gradually manoeuvring a probe and watching the effect on the heart and blood supply. Doctors gradually narrowed down the search until they found the exact blood vessel supplying the tumour.

Other work for which the system will be used includes investigation of the bladder and heart pressure tests.

Laser "Knife" Vapourizes Tissue

A laser beam "knife" to be used like a scalpel is undergoing laboratory tests at the Royal College of Surgeons in London.

In experiments with a prototype intended not for surgical use but to prove the design principles, a carbon dioxide laser is used to produce 60 watts. Focused on a spot less than one millimetre across, the power density is 180 kW per square inch. Few materials can survive this. Tissues, with a high water content, vapourize into steam.

Moving the laser spot produces a narrow cut with cauterized edges that do not bleed, as long as no large blood vessels are involved.

The laser is a cumbersome unit, so the beam from it is sent by mirrors to a manipulator held by the surgeon. Special linkage devices have been designed for the manipulator, with mirrors at the elbow joints, by the Aldermaston Research Establishment of the United Kingdom Atomic Energy Authority, who are carrying out the development work in collaboration with the College of Surgeons. The manipulator can be steered precisely by the surgeon and is easy to control.

Lighter and slimmer models of the prototype manipulator will follow.

New Plastics "Sandwich" Competes with Metals

A prototype car hood three times stiffer and less than half the weight of a traditional steel one gives promise of a major use of plastics in motor manufacture.

The hood was shown by Imperial Chemical Industries (ICI) to demonstrate the potential of a new plastics manufacturing process which they have invented and patented.

The process allows a plastic "sandwich" -- one of the strongest structures known -- to be made in a single high-speed manufacturing operation. Moulding can be produced in which plastics containing expensive ingredients are distributed only where they are essential -- in the skin -- and cheaper ones used in the core.

ICI believe the process will enable plastics to compete more effectively with metals, particularly in applications where rigidity and good surface finish are required. With the car industry a major potential user, other likely applications are in domestic applicances; in building products like washbasins, baths, sinks and partitions; packaging products; and in engineering for gear wheels and other components.

Various combinations of thermoplastics can be used to give either a hard and glossy surface with a core of foam, or a soft-to-the-touch surface with a rigid core.

Department of Communications Extramural Research Program

The Department of Communications has received approval to fund a program of extramural research at Canadian universities and institutes beginning April 1, 1971.

The content of the program will be oriented towards applied research in the broad technical areas of communications science, systems engineering, radar, and space mechanics and to the socio-economic aspects of the modern communications environment.

Instead of grants, research agreements will be negotiated with interested groups. The objective is to build a broader base of research that can be used in preparing long-range plans. It is felt a research partnership will be a key factor in keeping all interested groups better aware of

national goals and related departmental objectives and will enable independent research groups to assist in formulating those goals. Agreements will be negotiated with institutions or groups wishing to develop a unified set of projects. Individual researchers will not be excluded in instances where a unique expertise exists that fills an obvious gap in the total research picture. In all instances the agreements are aimed at creating ensembles of researchers that could respond to the need for R and D during the planning and development of large technically advanced systems.

Western Regional Nuclear Physics Conference Eighth Annual Meeting, 1971

This is to announce that the Conference will be held on Friday, February 19th, through Sunday, February 21st, 1971, at the Banff School of Fine Arts. No scientific sessions are planned for Sunday, February 21, but it is anticipated that the Conference will disperse on Sunday rather than Saturday. The exact timing of the Conference activities will depend on the transport schedules then in force and there will be more precise details in the second circular which will be sent out in January.

While in past conferences we have heard a number of interesting half-hour invited papers from the different laboratories, a variation might be to have one (or more) speaker(s) devote a total time of two to three hours on one specific topic of general interest to the participating groups. The level of these talks should be aimed particularly at the graduate students. This is put forward as a suggestion and any ideas and opinions on this point, or on the program in general, would be most appreciated.

Since Calgary is hosting the Conference this year, part of a session will be devoted to Cosmic Ray Physics, and papers will be invited in this area.

Communications concerning the scientific program should be sent to W. Falk, Physics Dept., The University of Manitoba, Winnipeg 19.

For other information regarding the Conference, contact J. R. Prescott, Physics Department, The University of Calgary, Calgary 44.

N.R.C. ad hoc Committee on Plasma Science and its Application

An ad hoc Committee on Plasma Science and its Application was established by the National Research Council of Canada with the following mandate:

(a) "to report to NRC on the status of research and development in plasma science and technology in Canadian universities, government and industrial laboratories;

(b) to identify with priorities aspects of research and development in plasma science and technology which, bearing in mind Canadian and technical limitations, it would be appropriate to encourage."

The Committee comprises the following:

H.E. Duckworth	University of Manitoba, Chairman
A.J. Alcock	National Research Council of Canada, Secretary
M.P. Bachynski	RCA Limited
W.J. Cheesman	Canadian Westinghouse
G.G. Cloutier	Hydro-Québec
J. Convey	Canada Department of Energy, Mines & Resources
J.H. DeLeeuw	University of Toronto
D.G. Hurst	Atomic Energy Control Board
W.B. Lewis	Atomic Energy of Canada Limited
J.R. Parent	Université du Quebec

The Committee hopes fully to take advantage of the work of other groups; in particular the Canadian Association of Physicists Division of Plasma Physics, the N.R.C. Associate Committee on Plasma Physics, and the (Laurence) Study Group of the C.A.P. which is preparing "to make recommendations concerning the allocation of N.R.C. and A.E.C.B. support to university research in physics". Both the Science Council and the Chief Science Adviser to the Cabinet will also be kept informed on the activities of the Committee. The Committee intends to seek the advice of those doing research and/or development in Plasma Science in Canada. Amongst other things, this should ensure that the purview is broader than physics alone and is in fact representative of the broad field of Plasma Science and its applications.

As a necessary step in the edification of some of the Committee members, and also to provide those actively involved in the subject with an early opportunity to describe their own work and make recommendations for future priorities, the Committee is organizing a two-day symposium in Ottawa on January 13 and 14, 1971. It is hoped that each research and/or development group whose annual budget exceeds $10,000. will be represented at the symposium. The Committee will arrange for travel expenses of one representative from each such group.

Any communication to the Committee should be made through the Secretary, Dr. A.J. Alcock, Physics Division, National Research Council of Canada, 100 Sussex Drive, Ottawa.

Canadian Physicists/ Physiciens canadiens

At THE UNIVERSITY OF WESTERN ONTARIO ... After forty-two years Professor A.M.I.A.W. DURNFORD has retired. Although no longer teaching, he plans to continue his research with the Dept. of Physics. Professor A.C. BURTON, the retired head and founder of the Department of Biophysics will also be continuing his research here.

DR. G. S. ROSE is currently on leave of absence with the Canadian International Development Agency as Professor of Physics at University College, Cape Coast, Ghana, where he is teaching physics and advising on an undergraduate curriculum for the education of high school teachers in basic science. On his return to Western he will

assume duties as Assistant Dean, Faculty of Arts. Dr. Rose has also recently been elected a Fellow of the Royal Society of Arts, London, England. Dr. D. R. MOORCROFT is on sabbatical leave at the Department of Applied Physics and Information Science, University of California, San Diego. Dr. P. A. FRASER, retiring Chairman of Physics, has been appointed Professor in the Department of Applied Mathematics at this University.

New appointments to the Department of Physics at the Assistant Professor level include Dr. D. GAILY (Washington) in the area of Atomic Collision Physics, having recently completed a two-year stay in the Culham Laboratories, Dr. S. D. ROSNER (Harvard), will be joining the Atomic Collision Physics group in December after a two-year stay in the Clarendon Laboratory, Oxford; Dr. J.K.E. TUNALEY (Sheffield), who has been three years with the European Space Research Organization in Holland, will strengthen the Upper Atmospheric Group. Mrs. P. CHEFURKA (Montana State), who has been Senior Demonstrator and Tutor, is now an Instructor in the Department in charge of first year teaching laboratories.

Dr. J. WILLIAM McGOWAN, Chairman of the Department, has recently been elected a Fellow of the American Physical Society.

Dr. P. A. FORSYTH, Director of the Centre for Radio Science, participated in a lecture series sponsored by the Advisory Group for Aerospace Research and Development of NATO. In order to reach an international audience the lectures were delivered once in Europe and again in North America. The sites chosen for the series which dealt with propagational effects relating to communication and navigational satellites were Eindhoven, The Netherlands, June 25-26, and Ottawa, June 29-30.

Dr. D. R. HAY attended a meeting of the NATO Advisory Panel on Radio Meteorology in Rome, October 25-27, to assist in the preparation of an Advanced Study Institute on the measurement of atmospheric turbulence. The latter will be held in Oslo in 1971.

Event "Dial Pack" was the name given to the second 500 ton TNT detonation held on July 23 at the Defence Research Establishment, Suffield, Alberta. Dr. D. R. LANE-SMITH headed one team from Western, which made electrical field measurements when the TNT was exploded; a second team headed by Dr. D. R. HAY began experimenting after the blast on the same site, working with a special meteorological tower, taking measurements with rockets and other equipment.

"Positron Summer Seminar" organized by the Department of Physics and the Department of Extension and Summer School was held in Owen Sound from June 26-28. The meeting was attended by more than 30 research workers from Canada and the United States. Interest centered around the use of positrons and basic and applied research and included informal discussions on the behaviour of positrons in gases, liquids and solids. Attending from Western were J. Wm. McGOWAN, P.A. FRASER, R. ORTH, G. CATLOW, E. CHANEY, Y. F. CHAN, C.Y. LEUNG, B. A. PAGE, S. PENDYALA and N. A. YOUNG from the Department of Physics and T. M. LUKE from the Department of Applied Mathematics.

The newest research laboratories in the Department of Physics, centered around a 400 keV Van de Graaff, several positron experiments, and laser studies, were officially dedicated on June 29, 1970. These laboratories will contain the atomic and molecular physics work of Professor J. Wm. McGOWAN and his associates, Drs. E. CHANEY, R. CACAK, C. Y. LEUNG, R. CAUDANO, R. ORTH and P. ZITZEWITZ and Mr. J. PALMER and Mr. S. PENDYALA.

As part of the ceremonies there was a morning symposium dealing with some of the related theoretical and experimental work which is being done in the Department of Physics, and in the afternoon Professor B. P. STOICHEFF of the Department of Physics, University of Toronto, presented a seminar entitled "Light Scattering with Lasers", and Professor R. W. NICHOLLS, Director of the Centre for Research in Experimental Space Science, York University, officiated at the dedication ceremonies.

A program was introduced at Western in 1969 for Ontario Indian high school students, employing them on research projects during their summer holidays. It was initiated by the Physics Dept., and supported by the University Senate and the Federal Department of Indian Affairs. During the summer of 1970, twenty-five such students from all parts of Ontario were placed in ten different departments of the University for a period of eight weeks. Professors and students are happy with the program, so hopefully it will expand here, and to other universities.

Among the visitors in the department this past year were Professor S. LUNDQUIST, Director of the Uppsala Research Institute, and Dr. VIKTOR from the Institute of High Voltage Research, Uppsala, Sweden. Arrangements for these visits were made by Dr. R. C. MURTHY when he visited Uppsala in February last. A collaborative research program between Dr. Murthy's lightning research group and the Uppsala High Voltage Institute was set up during these visit. Other visiting professors in the Department last year included J. D. BESSIS, Saclay; W. CHUPKA, Argonne National Laboratories; D. GROCE, Science Applications, Inc.; G. A. WOONTON, Director, Centre de Recherches sur les Atomes et les Molecules, Quebec; S. V. VENKATESWARAN, U.C.L.A.; and D. EDMONDS, Boston University, who spent the summer in conjunction with the Racetrack Microtron electron accelerator program under the direction of Professor H. R. FROELICH of this Department.

Among the post-doctoral fellows, Dr. Roland CAUDANO has left the Atomic Collisions group to become Associate Professor at the University of Louvain; Dr. Niall YOUNG has left the Atomic Theory group to join the Computer Sciences Department at the University of Aberdeen. This month, Dr. M. A. ABDU accepts a post with McKenzie University, Sao Paulo, Brazil, after two years' association with the Centre for Radio Science. Joining the Atomic Collisions group is Dr. P. ZITZEWITZ, Harvard, who delivered a paper this summer at the 2nd International Conference on Atomic Physics in Oxford; Dr. W. C. FON has come to the Atomic Theory group from Manchester, while Dr. A. WEBSTER has come from the University of the West Indies, to join the Centre for Radio Science.

At LAURENTIAN, Dr. J. HOFSTEE, from the Centre for Radio Science and Department of Physics of the University of Western Ontario, has joined Laurentian's Physics Department. At Laurentian, Dr. Hofstee will continue his Ionospheric Research related to auroral scatter.

A l'UNIVERSITÉ DE MONTRÉAL, le Dr. Roland FIVAZ, Ph.D. (Genève) a été nommé professeur agrege. Il se joint à l'équipe de physique du solide, portant à 4 le nombre de professeurs au sien de ce groupe. Depuis 1968, le Dr. Fivaz occupait un poste de "Senior Research Associate" en physique du solide a l'Université de Virginie.

Le Dr. Hendrikus VAN ANDEL, Ph.D. (British Columbia) a été nommé professeur adjoint. En 1969-70, le Dr. Van Andel poursuivait des recherches à l'Universite de la Saskatchewan, à titre de "Resesearch Associate" au sein du groupe de physique des plasmas.

At the UNIVERSITY OF TORONTO, at the Fourth Annual Congress of the Canadian Meteorological Society, Winnipeg, May 27, 1970, Mr. Tom AGNEW, now a graduate student in Meteorology, was awarded the Dr. A. Thomson Undergraduate Student Prize for his report, "Terrain induced vertical velocities obtained using a direct method of stream function computation".

The Australian Academy of Science has awarded its Pawsey Medal, for distinguished research in physics, to Dr. R. A. CHALLINOR, of the aeronomy group.-

Dr. H. C. HALLS has been appointed as a lecturer at Erindale College. He will be assisting Professor J. T. WILSON with the Earth and Planetary Science course at the college as well as conducting research into paleomagnetism of Precambrian rocks.

For the fourth year in succession a weekend conference was held on photonuclear reactions in Muskoka, Ontario. Seventeen scientists were present from the University of Toronto, Trent University, National Research Council of Canada and from Rensselaer Polytechnic Institute.

Calendar / Calendrier

February (1971); Ontario Research Foundation, Sheridan Park. Material Preparation and Analysis, a one-day symposium sponsored by the Solid State Division of CAP. Further details will be sent by Dr. F. T. Hedgcock, McGill University.

February 19 - 21 (1971); Banff School of Fine Arts. Eighth Annual Western Regional Nuclear Physics Conference. Contact Dr. J.R. Prescott, Department of Physics, The University of Calgary, Calgary 44.

April 5 - 7 (1971); University of Lancaster. Conference on Elementary Particle Physics arranged by the Nuclear Physics Sub-Committee of the Institute of Physics and the Physical Society.

April 16 - 17 (1971); A.E.C.L. Laboratories, Chalk River, Ont. Eastern Regional Nuclear Physics Conference. It is expected that there will be invited speakers, contributed papers, and a visit to some of the nuclear physics facilities at Chalk River.

June 21 - 24 (1971); Carleton University. Annual CAP Congress. The Chairman of the Local Organizing Committee is Dr. R. L. Clarke, Department of Physics, Carleton University, Ottawa.

July 5 - 7 (1971); University of Durham. Rare Earths and Actinides, arranged by the Solid State Physics Sub-Committee of the Institute of Physics and the Physical Society.

EXCERPTS FROM I.U.P.A.P. BULLETIN No. 19

At the meeting of the Executive Committee of I.U.P.A.P. held in Copenhagen in October 1970, the patronage of the Union was extended to the following international conferences to be held in 1971.

Inquiries should be directed to the Secretary of the appropriate International Commission.

I.U.P.A.P. Categories for International Conferences:

A - Large (500 - 2000) full-fledged meetings where all or most aspects of a Commission's field are examined and reviewed. Most Commissions will only sponsor one such major meeting every three years.

B - Medium (100 - 500) sized conferences at which a particular aspect of a Commission's area of responsibility is examined in detail. A Commission might sponsor one such meeting a year.

C - Small (40 - 100) sized meetings, often by invitation only, where specialists gather to assess progress in a very limited field. Such meetings might be satellite conferences, preceeding or following a Category A meeting.

Commission on Thermodynamics and Statistical Mechanics

1. Int. Conf. on Statistical Mechanics, [Category A], Chicago, U.S.A., March 29- April 2.
2. Conf. on Theoretical Physics and Biology, [Category C], Versailles, France, June 21 - 26.

Commission on Solid State

3. Int. Conf. on Crystal Growth, [Category B], Marseille, France, July 5 - 9.
4. Int. Conf. on Light Scattering in Solids, [Category B], Paris, France, July 19 - 23.

Commission on Particles and Fields

5. Int. Conf. on Duality and Symmetry in Hadron Physics [Category B], Tel-Aviv, Israel, April 5 - 7.

Commission on Plasma Physics

6. Int. Symposium on Plasma Physics, [Category C], Canada, July.

Commission on Atomic and Molecular Physics and Spectroscopy

7. VIIth Int. Conf. on the Physics of Electronic and Atomic Collisions, [Category A], Amsterdam, The Netherlands, July 26 - 31.

Relativity

8. Seventh Int. Conf. on General Relativity and Gravitation [Category A], Copenhagen, Denmark, July.

Books Received

The following books have been received recently for review. Space will not permit reviews of all these to be published. Anyone interested in having a particular book reviewed, or in writing a review, please communicate with the Book Review Editor, G. E. Reesor, University of Waterloo.

La Théorie de la Relativité. A. Einstein, Gauthier-Villars, 1969, p.p. 179, Price; $3.65.

Physics and Chemistry in Space, Vol. 2 - Dynamics of Geomagnetically Trapped Radiation. J. G. Roederer, Springer-Verlag, 1970, p.p. 166, Price: $9.90.

Vector Spaces and Algebras. F. A. Matsen, Holt, Rinehart and Winston, 1970, p.p. 292, Price: $12.05.

Springer Tracts in Modern Physics, No. 54. G. Hohler, ed., Springer-Verlag, 1970, p.p. 176, Price: $15.40.

Photophysics of Aromatic Molecules. J. B. Birks, John Wiley, 1970, p.p. 704, Price: $29.00.

Direct Nuclear Reaction Theories. N. Austern, John Wiley, 1970, p.p. 390, Price: $19.95.

Sigma Molecular Orbital Theory. Oktay Sinanoglu and Kenneth Wiberg, McGill University Press, 1970, p.p. 455, Price: $19.25.

Symmetry Principles and Atomic Spectroscopy. B. G. Wybourne, John Wiley & Sons, 1970, p.p. 219, Price: $17.50.

Optics. M. V. Klein, John Wiley & Sons, 1970, p.p. 647, Price: $14.95.

Proceedings of the International Conference on Organic Superconductors. William Little, ed., Wiley Interscience, p.p. 224, Price: $11.50.

A Quantum Approach to the Solid State. Philip L. Taylor, Prentice-Hall, 1970, p.p. 322, Price: $13.95.

Proceedings of the Symposium on Turbulence of Fluids and Plasmas, Vol. 18. J. Fox, ed. John Wiley & Sons, 1969, p.p. 511, Price: $17.00.

The Applications of Holography. Henry Caulfield, John Wiley & Sons, 1970, p.p. 138, Price: $9.95.

The Spiral Structure of our Galaxy, Symposium 38, International Astronomical Union. W. Becker and G. Contopoulos, Springer-Verlag, 1970, p.p. 478, Price: $24.40.

Ultra-Violet Stellar Spectra and Related Ground-Based Observations, Symposium 36, International Astronomical Union. L. Houziaux and H. E. Butler, Springer-Verlag, 1970, p.p. 361, Price: $19.80.

Non-Solar X- and Gamma-Ray Astronomy, Symposium 37, International Astronomical Union. L. Gratton, Springer-Verlag, 1970, p.p. 425, Price: $23.10.

Global Effect of Environmental Pollution. S. F. Singer, ed.,[Symposium, American Association for the Advancement of Science, Dallas, Texas, 1968]. Springer-Verlag, 1970, p.p. 218, Price: $12.00.

Dealing with Data. Arthur Lyon, Pergamon, 1970, p.p. 392, Price: $8.00 [Hard-cover], $5.50 [Soft-cover].

Surfaces and Interiors of Planets and Satellites. A. Dollfus, ed., Academic Press, 1970, p.p. 569, $9.00.

Molecular Radiation Biology, Heidelberg Science Library, Vol. 12. H. Dertinger and H. Jung, Springer-Verlag, 1970, p.p. 250, Price: $6.40.

The Lunar Rocks. M. Mason and W. G. Melson, John Wiley & Sons, 1970, p.p. 179, Price: $8.95.

An Introduction to Quantum Physics. G. Sposito, John Wiley & Sons, 1970, p.p. 426, Price: $13.95.

Dynamics of Satellites [COSPAR-IAU-IAG/IUGG-IUTAM Symposium, Prague, 1969]. Bruno Morando, ed., Springer-Verlag, 1969, p.p. 312, Price: $23.10.

Physics of Nuclei and Particles, Vol. II. P. Marmier and E. Sheldon, Academic Press, 1970, p.p. 671, Price: $19.50.

Underwater Acoustics. L. Camp, John Wiley & Sons, 1970, p.p. 308, Price: $17.50.

Reference Systems and Inertia: The Nature of Space. B. E. Clotfelter, Iowa State Univ. Press, 1970, p.p. 116, Price: $3.50.

Book Reviews

GAS LASER TECHNOLOGY, by Douglas C. Sinclair and W. Earl Bell. Holt Rinehart and Winston, Inc., Toronto, 1969, p.p. xiii + 161, Price: $7.70.

The authors aim this relatively short monograph at the scientist or engineer who uses gas lasers, but is not a laser specialist. In less than 150 pages of text, the authors successfully describe Lamb's semi-classical theory of gas lasers, transverse and longitudinal mode structure, and finally construction of gas laser tubes, mirrors, windows and power supplies.

The chapter on Lamb's theory is preceded by a discussion of semi-classical radiation theory; these chapters are inherently fairly heavy reading, and in the end the authors must settle for a certain amount of descriptive material. I think the well-illustrated sixty pages on mode structure, gaussian beams and output power are probably the most useful to the habitual user, and the final chapter on construction of gas

lasers is a good introduction to anyone who wants to build his own laser.

If anything is missing, it is a more detailed chapter on specific gas lasers. Such material can date a book rather quickly, and most readers can be expected to be reasonably "up" on current developments. References are deliberately scarce and point primarily to "standard references" and review papers that would be most useful to the non-specialist.

M. YOUNG,
RENSSELAER POLYTECHNIC INSTITUTE

THERMAL PHYSICS (Second Edition), by Philip M. Morse. W. A. Benjamin, Inc., New York, 1969, p.p. 431, Price: $17.50.

This is a revised edition of a book, first published in 1964, designed for the senior undergraduate students majoring in physics or engineering. In keeping with its title, the book attempts to cover the complementary areas of thermodynamics, kinetic theory and statistical mechanics in a unified manner. The level of presentation is very well suited for pedagogy at the undergraduate level; at the same time, it is sufficiently advanced to prepare the student for a strictly graduate course in statistical physics. The choice of material is fairly representative, which shows that the author has restrained himself from imposing his personal preferences on the student. The subject matter is strengthened by a selection of 126 problems, most of which are fortunately on the physical rather than on the mathematical side. However, no answers are provided, which can at times become annoying to the student as well as to the instructor.

In view of the fact that more and more instructors are now becoming convinced of the usefulness of treating thermodynamics, kinetic theory and statistical mechanics as a single discipline, which may be given the name "thermal physics" or "statistical physics", Professor Morse's book should be of considerable interest. No doubt, the book will meet some competition in the market but, in the opinion of the reviewer, we do not have many books available at the moment which provide the same scope and possess the same style as this one.

R. K. PATHRIA
UNIVERSITY OF WATERLOO

PHYSICS IN MY GENERATION. A SELECTION OF PAPERS, by Max Born. Springer-Verlag New York Inc. (Heidelberg Science Library Series), 2nd edition, 1969, p.p. 172 + viii, Price: $3.80.

Max Born's life, intimately linked with this century's revolution in physics, exemplifies also the tragic turbulence of the times we live in. In 1901, at the age of 19, he began his studies, first in his native Breslau (since 1945, Wroclaw, Poland), continuing at the Universities of Heidelberg and Zurich, and obtaining the degree of Dr. Phil. in 1907 at Gottingen. In 1915, Max Planck invited Born to become Professor of Theoretical Physics at the University of Berlin where Einstein had been since 1913. Four years later, Born became M. v. Laue's successor at Frankfurt -- O. Stern and W. Gerlach carried out their experiment in Born's department -- and in 1921 he was called to Gottingen by H. Minkowski to succeed P. Debye. His co-workers there included J. Franck, P. Jordan and W. Heisenberg. In 1933, Born left Germany as a refugee, first taking a post as lecturer in mathematics at Cambridge, and in 1936, becoming Tait Professor of Natural Philosophy at the University of Edinburgh. He was awarded the 1954 Nobel Prize in Physics, in recognition of his work as a co-founder (with Heisenberg and Jordan) of quantum mechanics, their first papers dating back to the Gottingen period (1925).

Born's published work, in addition to something like 300 scientific articles, includes books on the dynamics of crystal lattices, relativity theory, solid state, quantum mechanics, optics, etc., and semi-popular writings such as "The Restless Universe", "Natural Philosophy of Cause and Chance", "Physics and Politics", and the present volume of 16 articles.

Anyone who is at all interested in the present history of physics, the views of the men who made this history, and a glimpse of their persional lives, should read this attractive collection of lectures and essays. Max Born writes simply, in conversational style, and always gives a personal point to his remarks. Many of these articles, including among them Born's Nobel lecture, are concerned with the probabilistic nature of physics and reluctance (or refusal) of determinists such as Planck, Einstein, L. de Broglie, Schrodinger, Bohm, etc., to come to terms with these disturbing ideas. In one of the essays, Born undermines the popular view of classical mechanics as necessarily deterministic.

The articles span the period from 1921 to 1966. Born's mounting concern over the moral and political implications of modern technology becomes increasingly apparent. Knowledge has finally lost its innocence even for physicists, as facts and values are forced to a confrontation:

> "In 1921, I believed that science produced an objective knowledge of the world which is governed by deterministic laws. The scientific method seemed to me superior to other, more subjective ways of forming a picture of the world ... and I even thought the unambiguous language of science to be a step toward a better understanding between human beings. In 1951, I believed in none of these things. The border between object and subject had been blurred, deterministic laws had been replaced by statistical ones, and although physicists understood one another well enough across all national frontiers, they had contributed nothing to a better understanding of nations but had helped in inventing and applying the most horrible weapons of destruction.... Still, I believe that the rapid change of fundamental concepts and the failure to improve the moral standards of human society are no demonstration of the uselessness of science in the search for truth and for a better life."

There is a refreshing modesty and candour in these remarks, characteristic of Max Born, a great physicist and also a great man.

P. M. PFALZNER, O.F.C., OTTAWA

INSTITUTE OF PARTICLE PHYSICS

L'INSTITUT DE LA PHYSIQUE DES PARTICULES

The Institute of Particle Physics is now being incorporated. It will be an organization to coordinate research in high energy physics in Canada, to administer research funds in high energy physics, and to effect liaison with the National Accelerator Laboratory, Batavia, Illinois.

Applications are now solicited for individual membership in the Institute. The qualifications for membership are training and competence sufficient to enable the applicant to play a significant role in the activities of the Institute. The standard expected is approximately that which would qualify the applicant for a university staff position. In addition, the applicant should be free to devote at least half of his time to research connected with the field of high energy physics.

Further information, and application forms, can be obtained from The Secretary, Institute of Particle Physics, c/o Department of Physics, University of Toronto, Toronto 181, Ontario. The first meeting of the Trustees of the Institute to admit members will take place on 10 February 1971, and all applications received up to that date will be considered at that meeting.

Simon Fraser University

FACULTY OF SCIENCE

APPLICATIONS are invited from scientists of established reputation with administrative experience and ability for the position of Dean of the Faculty of Science. An appointment as Dean normally carries faculty rank and, while the position is full-time, reasonable contact with teaching and research activities appropriate to his discipline should be anticipated. *Letters, including a curriculum vitae, should be addressed to* Dr. B. G. Wilson, Vice-President, Academic, from whom further details may be obtained.

University of Waterloo

Department of Physics

APPLICATIONS are invited for an additional post in BIOPHYSICS at the Assistant Professor level. Principal research interests lie in the fields of radiobiology, microwave physics, various aspects of solid state physics, and in astronomy. The successful candidate will be expected to join in the general teaching programme.

Applications should be sent to Professor J. W. Leech, Chairman, Department of Physics, University of Waterloo, Waterloo, Ontario. Closing date is February 15, 1971. Further details available on request.

ANNUAL CONGRESS
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OF PHYSICISTS
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LES 22, 23, 24 et 25 JUIN 1971

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le 1er avril 1971

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Details of the financial assistance and the fields of research may be obtained from PROFESSOR H. W. DOSSO, Head, Department of Physics, University of Victoria, Victoria, British Columbia.

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