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OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

No. 20-5
24 May 1966

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OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

Edited by Bernard Epstein and Victoria S. Hewitson

24 May 1966 ESN-20-5

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EARTH SCIENCES

Astrophysics at Queen Mary College

According to Dr. John A. Bastin, head of the Astrophysics Group at Queen Mary College, measurements are now being made on the absolute attenuation of the earth's atmosphere for the 750-μ and 850-μ "windows" with a radio telescope in London. Observations are made possible by using a Putley-type detector cooled with liquid helium. Initial signals were obtained with the sun as a source during late March, and measurements and calculations are now being made in the course of preparing a paper on this subject for Nature.

The antenna is a 5-ft diameter Cassegrainian type, and frequency resolution is obtained with a Fabry-Perot interferometer. This interferometer is motor-driven so that it takes about 20 minutes to make a wavelength scan from 1.8 mm to 200 μ. As operated, the fractional resolution of the interferometer is about 12:1 for the 850-μ and 750-μ windows under investigation. Radiation from the 850-μ window is reasonably strong, and radiation from the 750-μ window appears adequately strong to allow reliable measurements. Bastin believes that he may also be able to obtain absolute attenuation data from the weak signals being received at approximately 350 μ and 200 μ.

Some months ago J.N. Gaitskell and A.E. Gear of the Astrophysics Group made atmospheric measurements in the 1-mm to 200-μ wavelength range at Pic-du-Midi, the well-known optical observatory in the French Pyrenees. The instrumentation for those measurements was essentially the same as that described above except for the fact that the detector was a Golay cell, which is less sensitive. It was possible to use the Golay cell at Pic-du-Midi because the telescope was mounted 9000 ft above sea level, where the relative lack of water vapor makes astronomical observations easier. Gaitskell and Gear have prepared a paper on the relative attenuation data and have compared these results with radio-sonde data obtained at nearby stations; the paper will appear in the June 1966 issue of ICARUS, a journal devoted to the solar system.

Bastin's work on tracking the sun will permit calculating total atmospheric attenuation between the earth and the sun. Results on atmospheric measurements made for absolute attenuation near sea level in the 600-μ to 200-μ region have been reported ("Atmospheric Attenuation at Submillimeter Wavelengths" by K.H. Breeden, W.K. Rivers, and A.P. Sheppard) in the March 1966 issue of the new British IEE publication Electronics Letters. These measurements were made with a high resolution interference spectrometer recently developed at the Georgia Institute of Technology.

Measurements are also currently in progress at Queen Mary College on the water vapor absorption line at 784 μ. The output of a 25-w, 35 gc, CW klystron is being used to drive a Froome-type plasma harmonic generator to obtain the 11th harmonic signal at 770-μ to 810-μ. The water vapor line is measured by comparing the signal in an evacuated 20-ft tube with the signal from a similar 20-ft tube containing water vapor. The 770-μ - 810-μ tuning range does not permit covering the line at atmospheric pressure, but the results should provide interesting details on line shape and the dependence of line width at reduced pressures.

Previously, personnel of the Astrophysics Group have measured equivalent black body temperature of the sun in the millimeter wavelength region (Proceedings of the Royal Society, A, 278, pp. 543-573, 1964), and various aspects of the lunar surface (Nature, 203, No. 4948, pp. 960-961, 29 August 1964; 207, No. 5004, p. 1381, 25 September 1965; and The Astrophysical Journal, 141, No. 3, 1 April 1965.)

In September 1966 Bastin will go on leave of absence to the University of Colorado, Boulder. During his one-year leave, Dr. Peter E. Clegg will oversee the activities of the Astrophysics Group.

An ONR London technical report on Physics at Queen Mary College (Technical Report ONRL-58-62 by J. de Launay, 24 July 1962) has been previously issued, but at that time the far-infrared astrophysical measurements program had just begun.
(M.W. Long)

Ocean Optics from Copenhagen

On 8 April Prof. Nils G. Jerlov, Head of the Oceanography Department at the Oersted Institute, Univ. of Copenhagen, returned from an extensive cruise on the Danish research vessel DANA. We were delighted to have the opportunity of chatting with him in his office almost immediately upon his return and to learn of his recent unpublished work in underwater optics.

En route from Bermuda to the Sargasso Sea one of the chief objectives was to measure attenuation as a function of wavelength and depth of open sea water. Of particular interest on this occasion was the use of a 6943-Å ruby laser and a 4800-Å argon laser. Delays are always anticipated on such ventures, but about one week was lost for a most unexpected reason. The ship's wireless operator died on board, and it became necessary to return to port. During the return, considerable anxiety developed about the weather -- a worry that could not be resolved since no one else could operate the wireless, and they were too far from shore for any other communication.

In any case, the trip was extended an additional week or two, and, as often happens, most of the data were taken in the last couple of days. In situ forward scattering measurements with the ruby laser were made in the region from 1° to 3°, at depths as far down as 400 m. Similar measurements were attempted with the argon laser, but continual technical difficulties prevented its optimal use. Although Jerlov's associate, Dr. Kullenberg, is more intimately acquainted with the laser work, he was still on board ship at the time we spoke with Jerlov.

Worthy of special note is Jerlov's report that in measuring the transmittance of sea water he found that in a sea which had been very calm for a number of days the transmittance was actually higher near the surface than farther down. This transmittance inversion layer, which existed from the surface down to about 100 m with an unusually clear layer occupying the top 10 m, has not been reported before, according to Jerlov. Quite probably it simply reflects the long condition of calm which permits particulate matter to sink.

Author of a forthcoming text, Optical Oceanography, to be published by Elsevier Press in about a year, Jerlov formerly headed the Oceanography Institutes at both Gothenburg and Copenhagen. He finds it quite a bit less harrowing to tend to just one institute, and he thus manages to carry on research, direct some 12 oceanography students and several doctoral candidates, and to write a text. Those who know him only through his professional publications in recent years may be surprised to hear that he published a good bit under the name of Jensen prior to 20 years ago. At that time, as is quite common in Sweden, he officially adopted another family name -- perhaps to avoid the difficult postal problems in a country where so many Jensens (English equivalent-Johnson) exist. Jerlov recalled having been re-christened at sea -- in what he describes as a "very wet" ceremony.

His group is not very large; there is really only one faculty member in addition to Jerlov and Kullenberg. Two fellowships are currently occupied, one by a Japanese student and the other by a Norwegian. One research associate is also employed by the Institute and is presently studying the polarization of scattered Sargasso sea water, with a view to determining the types of scattering particles present.

While no one can fail to enjoy the famous open-faced sandwiches called Smørrebrød, Danish pastry (known in Denmark as Wienerbrod and in Vienna as Copenhagenerkuchen), and the many esthetic delights of this charming and friendly city, we had nevertheless been scheduled to push on shortly after our visit with Jerlov. Unfortunately (or otherwise, depending on one's point of view) a most unexpected snowstorm tied up the city for about a day, forcing us to remain a little longer. Obviously one should spend his extra time in the pursuit of science, and what better place to visit than that foundation, famous for its support of scientific research, known as the Carlsberg Breweries. As is quite well known, the profit from these breweries is devoted to scientific and cultural works, and it supports, for instance, the Biological Institute, the National Historical Museum at Frederiksberg Castle and the Carlsberg Glyptothek with its unique collections of classic and modern art. Thus, Danes quite often describe their evening activities as being devoted in cultural improvement, since some fraction of the purchase price of every glass or bottle of Carlsberg goes to educational institutes. Those concerned with a possible shortage of beer will be pleased to know that Carlsberg now fills three million bottles per day and keeps stored in its cellars the equivalent of 25 million bottles.

While much of the plant is fully automated, it is interesting to see women workers employed to scan each bottle visually for defects or dirt. Apparently decisions here are qualitative, and machinery has not yet been designed for this purpose. The job is so taxing that each scanner is employed at this task for only two 40-minute periods per day. In general, the workers at the Brewery seemed an industrious and happy group -- and this may be related to the Carlsberg policy of providing up to six free bottles per day to be drunk on the premises (the bottles, not the workers!).
(E.H. Weinberg)

NATO Conference at Newcastle

A conference on the subject "The Mantles of the Earth and Terrestrial Planets," sponsored by NATO, was held at the University of Newcastle upon Tyne, 30 March to 7 April. One hundred and sixty participants, from twelve countries ranging as far afield as Australia, were registered.

During the twelve half-day sessions sixty papers were delivered arranged under the following general headings: evidence from meteorites and cosmochemistry; determination of basic physical constants of the planets; radial variation of physical properties in planetary interiors; the origin of the moon; physical evidence for non-hydrostatic conditions in the planets; planetary rotation; geochemical evidence on the nature of the earth's mantle; surface evidence relating to planetary evolution; and thermal convection in planets.

It would be impossible to report the substance of the Conference in any detail, for although its subject was fairly definite, the discussions in fact roamed widely over the fields of geophysics and planetary physics, from the origin of the moon to the evidence for continental drift. There was no indication as to when or whether the proceedings would be published.

Since the moon, the planets and the earth's mantle are all areas in which we are limited -- for the moment at least -- to long-range observations, there are few other fields of scientific discussion so dominated by theories and models -- often highly imaginative. However, the fact that we may soon have the opportunity for on-the-spot observation heightens an interest which might otherwise lag. When a conference such as this is enlivened by the sometimes sparkling and sometimes disparaging comments of a highly respected actor such as Harold Urey, nothing more is necessary to make it a successful occasion -- and it was.
(N.W. Rakestraw)

MATHEMATICAL SCIENCES

Centre de Recherches Physiques, Marseille

The Centre Nationale de la Recherche Scientifique (CNRS) is an agency of the French government which maintains an extensive complex of research institutes and laboratories which engage in research in the physical, biological, and social sciences. A central "Comité" determines overall policy, allocates funds, and appoints 32 sectional panels of 22 members each which concern themselves with supervising particular fields of activity. Some 4500 scientifically trained workers, together with supporting staff, are employed in the various installations of CNRS, which are widely scattered throughout the nation. The total annual budget currently stands at some $70 million.

A beautiful campus-like development near the southern edge of Marseille accommodates the "Centre de Recherches Physiques" (CRP) and the "Laboratoire de Chimie Bactérienne." The former organization is divided into four departments: Mécanique Physique et Acoustique, Visualisation des Ondes, Automatique et Electro-acoustique, and Structures Cristallines. A brief visit to the first of these was for this writer a most impressive and stimulating experience. This Department is under the supervision of Dr. Th. Vogel, who also serves as director of the entire CRP.

Vogel, who appears to combine administrative ability with a high degree of mathematical competence and a flair for effective application of mathematics to engineering problems, leads a rather sizeable group of young mathematicians, some of whom are combining their work at CRP with their studies for higher degrees at the University of Aix-Marseille. Those mathematicians whom I visited are concerned principally with studies in the difficult and vitally important theory of non-linear ordinary differential equations. Particularly impressive is the effective use that is made of mechanical devices which are built to simulate the behavior of solutions of the mathematical problems under investigation. Both a digital and analogue computer are also in use; some limited success has even been obtained in employing the latter in studying solutions of partial differential equations.

Contrary to what this writer expected, the mathematicians at CRP seem to be almost completely free to pursue topics of their own choosing; while Vogel must justify his organization's activities, it appears that CNRS maintains an enlightened attitude which refrains from demanding short-term "payoffs" on the work which receives its support.

An annual report, including an extensive list of publications -- both internal reports and papers appearing in journals -- is issued by CRP, whose address is 31, Chemin Joseph Aiguier, Marseille 9e, France.

Some information on the acoustical research activities of CRP appears in Technical Report ONRL-44-65 by D. Ross.
(B. Epstein)

MATERIAL SCIENCES

Conference on the Application of Physical Chemical Methods in Chemical Analysis

This Conference, held in Budapest 19-23 April 1966, took place under the auspices of the Analytical Chemistry Division of the IUPAC and was organized by the Hungarian Chemical Society. In some ways it could be considered a prelude

for the IUPAC conference to be held in Prague in 1967. Although it was definitely international in scope (scientists representing 18 different nations read 186 papers), it is interesting to note that the number of Western contributions was very small (32 out of 186). As such the conference presented a very good cross section of analytical research in Eastern Europe, particularly in instrumental methods.

In connection with this Conference, the Hungarian Trading Company for Instruments (Metrimpex) had arranged an exhibition of instruments to run concurrently with a lecture series. Among flame photometers, titrimeters, pH-meters, polarographs, etc., which looked fairly modern and well constructed, were a type OD-102 Derivatograph and an OU-102 Ultracentrifuge that could be of interest to Western scientists.

The Derivatograph actually combines three units: a differential thermoanalysis unit (DTA), a thermo-balance (TG), and a derivative thermo-balance (DTG). The ultracentrifuge is laid out for the determination of molecular weights up to 10^8 and operates over a range of 6000 to 60,000 rpm with a maximum error of $\pm$ 0.1%. The temperature range is 0 - 150° C with a maximum error of $\pm$ 0.2° C, and a vacuum of up to 10^{-6} mm Hg can be maintained. A preparative rotor for the centrifuge is also made, and it is equipped with various cells and recording devices.

For a country as small as Hungary, such developments are impressive and perhaps commendable. These instruments are designed for the purpose of obtaining hard currencies, but will encounter difficulties on the Western market as they are not really that competitive as far as price is concerned, and in addition very little is known about their reliability. Some of the users that I talked with (mainly from East Germany and Czechoslovakia) were rather critical in their evaluation and complained about costs, service, and spare parts.

Currently, more than 50% of Hungary's imports from the West are paid for by exporting food products. This method of obtaining foreign currencies is reflected in the very high prices of articles that are exported and also sold on the domestic market, as, for example, salami, which is a major export item. In order to improve its standard of living, Hungary is compelled to seek new sources of hard currencies. In all Iron Curtain countries, the export industry already receives high priority for the delivery of raw materials, the planning schedules, and other reasons, but because of the Comecon policies for the distribution of hard currencies, of which the Soviet Union receives the major share regardless of who has contributed to the pool, and because of the rather inflexible internal trade agreements which involve planned economic growth rates, these countries are faced with the necessity of trying to find new products to sell to the Western world, in order to increase their own holdings of foreign exchange. Barter is becoming an increasingly difficult form of trade, and there is a limit to the extent that foreign markets can absorb small arms, ammunition, and guns, as the Czechoslovakians have found.

Thus, new initiatives such as the development of analytical instruments are a "must," but it remains to be seen if such excursions into the highly competitive structure of Western markets really pay off for newcomers like Hungary.

The meeting itself took place in the "House of Engineering" at the Szabadsag Ter. (This name, meaning Freedom Square, commemorates the liberation of Hungary in 1945. There is also Szabadsag Hotel, Szabadsag Bridge, street, etc., too much of it in fact. Motto: They who need it most scream loudest.) However, the opening and the plenary sessions were held elsewhere.

Though some colleagues may object to a statistical or numerical evaluation of scientific achievements, Prof. L. Erdey (member of the Hungarian Academy of Science and Director of the Institute for General Chemistry of the Technical University, Budapest) attempted to do just that. While acknowledging that many analytical chemists complain that their discipline does not receive the attention it warrants, he asserted that the recent remarkable increase in the number of papers on analytical chemistry testifies to the immense development of this discipline during the past two decades. Progress in the development of analytical methods having a purely chemical basis has been astonishing, but the development of analytical procedures using physical methods has been even more dramatic (see Tables I and II). Erdey went on to say that Hungary occupies a much better place with respect to the number of publications than could be expected from its population (15th in 1955 and 10th in 1965 among the European nations). A comparison of publication rates of various countries is given in Table III. One could, of course, also conclude from this Table that the Communist world revolution is marching irrestistably forward and that the bourgeois countries are on the decline, since the US has just lost its leadership in the output of analytical publications. Another Socialist triumph! Analytical chemists of the US unite! (How about forming a National Analytical Chemical Agency -- NACA? I know we have had that acronym before, but then Ben Akiba has already defended that point.)

TABLE I

Change in Analytical Methods

	1946	1955	1965
Chemical methods	34%	26%	14.2%
Physical methods	60%	71.8%	81.5%

TABLE II

Percentage of instrumental methods used

	1955	1965
Optical methods	43.2%	40.5%
Electrometric titrations	4.8%	4.5%
Other Electrometric methods	6.2%	10.2%
Radiochemical methods	2.0%	7.4%
Gas chromatography	-	9.5%
Thermoanalysis	-	1.9%

TABLE III

Percentage of papers published in analytical chemistry

	1965	1961
USSR	21.5%	19.1%
USA	20.2%	27.1%
Germany	10.0%	7.8%
Japan	6.8%	7.8%
Poland	5.1%	1.5%
U.K.	4.3%	?
Commonwealth	-	13.8%
France	4.2%	5.0%
CSSR	3.6%	2.0%
Italy	3.0%	3.2%
Hungary	2.6%	1.2%
Switzerland	1.1%	1.3%

Erdey continued that analytical chemistry is not a stepchild, but is of major importance in its own right. After all, analytical chemists have been publishing their own journal for over 100 years, and their field of endeavor forms a link to all other disciplines. New analytical methods invariably lead to new discoveries. Remarkable results were attained in the field of instrumental analysis during the last century. Spectrographic analyses were already being carried out in the late 1860's and electrometric experiments were being conducted by the end of the century. Hungarian research workers contributed to the development of instrumental analysis with such important discoveries as the buffer solutions (Szily, 1903), activation and dilution methods with radioactive indication (Hevessy, 1913-1925), coulometric titration (Szebelledy and Somogyi, 1939), and contributions to the fields of chromatography (Zechmeister and Cholnoky) and chromometric analysis (Szebelledy and Ajtay).

Instrumental analysis has grown immensely since World War II. Hungarian research workers have succeeded not only in keeping abreast of the new developments, but also in going in the forefront of research in some fields. They have attained remarkable results in various fields of electrometric analysis, and their thermoanalytical studies are also of great importance. Critical surveys of gravimetry are being made on the basis of new aspects that are in close connection with the results of the former. One must also mention here their very good work in the fields of emission and absorption spectroscopy, flame photometry, atomic absorption spectrophotometry, indicator research, mass spectrometry, radioactive analysis and separation methods. The first comprehensive historical survey of analytical chemistry is another significant accomplishment. The quality and results of all of their work have a very good reputation, which is further illustrated by the ever-increasing number of Hungarian textbooks and monographs on analytical chemistry appearing in foreign languages. So much for Erdey's Hungarian rhapsody on some trends in the development of instrumental analysis.

Prof. F. Cuta (Institute of Chemical Technology, Prague, Czechoslovakia) elaborated on a unified method of teaching chemical and instrumental analytical methods. He suggested that physical chemical analytical methods (instrumental analysis), as a teaching subject,should be treated in very close connection with chemical analytical methods. Chemical properties of substances form the basis for chemical methods; physical properties for the physical ones. The latter must be explained more clearly, not only in terms of their measurements, but also with regard to the relative value of properties in question for a given analytical method. For the application of physical methods in analytical chemistry a mere description is not adequate. One should also discuss the properties in question from the standpoint of analytical effectiveness. By this one means the sensitivity of the determinations, the ease of separations based on physical properties, the number of operations required to obtain reproducible results, etc. Estimating the value of physical properties in their relation to applicability to analytical methods, we can assign first importance to methods of emission and absorption spectral analysis in its broad sense, as they permit the determination of a considerable number of components in a single operation. Polarographic methods, which feature this advantage to a somewhat lower extent and potentiometric methods of still more restricted scope follow after. Other physical properties appear to be of lesser effectiveness. While we find them to be somewhat inefficient in selectivity, they are, however, sometimes of remarkable sensitivity, as, for instance, in determinations utilizing such properties as electrical conductivity, optical refractivity, electrical capacity, and others. Following the ideas outlined above, one can work out an approach to the teaching of instrumental analysis on the same basis and in the same way as chemical analysis is taught, resulting in a deeper understanding and knowledge of a broader range of its applications.

The full texts of the plenary lectures, ten in all, will be published by Butterworth and Company, Ltd., London, W.C. 2, the official publishers of the IUPAC.

During the course of the Conference, the Hungarian Chemical Society had also arranged visits to a number of institutes. I went to the Institute of Inorganic and Analytical Chemistry of the Eötvös Lorand University and the Institute for General Chemistry of the Technical University, both in Budapest. The L. Eötvös University is the older of the two, as is its Chemistry Department, which was founded by Karl Thau, a student of Bunsen. He was followed by J. Winkler, and today Prof. Z. Szabo is the Director. The Institute for General Chemistry of the Technical University was founded in 1845. Its first professor was C.H. Nendtwich, and he was followed by L. Ilosvay, who served from 1882 to 1934 (sic! 52 years). Today, it is headed by Prof. L. Erdey. Both Szabo and Erdey are members of the Hungarian Academy of Sciences.

About 500 students are taking chemistry at the Eötvös University and some 750 at the Technical University. The teacher-to-student ratio is approximately 1:25. According to official statistics, student numbers are evenly divided between the sexes, but this observer

detected a slight preponderance of women students, somewhere between 50% and 60%.

The buildings which we saw were very old indeed, and appeared to be more than inadequate for the task at hand. It was mentioned that new laboratories will be constructed during the coming decade if all goes well. We were shown mainly research and teaching laboratories in which analytical studies are performed; they had obviously been cleaned and prepared for our visit. They were adequately equipped, but certainly not too opulent. Instrumentation was humble, and the usual conglomeration of new and old ranged from an old Beckman DK2 and Zeiss spectrometer (Stufo, from the 30's) to a new Czech electron microscope (type TBS 242) which looked very compact (I don't know how good it was) and an Italian C. Erba gas chromatograph with hot wire and flame ionization detector. Also in evidence were quite a number of Hungarian-built instruments of varying designs, all bearing the "Metrimpex" label and English terminology on the controls, and so well kept and brand-new looking that one wondered whether they had been placed there for exhibition. In the radiochemistry laboratories US and Russian equipment including counters were side-by-side. Despite the fact that there were quite a number of Soviet scientists with us during the tour, the guide spoke quite freely about the poor quality of the Russian instruments. The tour languages, by the way, were German first and English second -- no Russian or French.

In general, the scientists guiding us or presenting short descriptions of their research or instrumentation made an effort to be very objective -- to the point of being self-critical. Two things, however, stick in my mind for whatever merit they may have: (1) The door to every laboratory that we entered was closed and locked, sometimes twice, although people were working inside; furthermore, there were locked partitions at the beginning of the staircase on each floor, similar to those found in some old-fashion apartment houses with bells which have to be rung by anyone who does not belong or has no key. The research described to us (spectrometric analysis of trace elements in various Hungarian wines for correlation with soil analysis, etc., etc.) surely did not sound like a defense program that had to be protected. (2) That among all the UV spectrometers, photometers, and emission spectrographs in evidence, not a single infrared instrument was to be seen. Even if one argues that an NaCl instrument might not be of too much use in an inorganic laboratory, the importance of an IR spectrometer with extended range for research purposes hardly needs emphasis. The papers presented indicate that there is one somewhere in the Technical University (a Zeiss UR-10) and another one at the Central Research Institute for Chemistry at the Hungarian Academy of Sciences (a Unicam SP200), but the absolute unfamiliarity with infrared methods of all persons whom I encountered seemed strange. Perhaps the IR-spectrometers are unavailable or too expensive, and so Metrimpex showed their own brand-new development, the Model 2000, which looks like a crossbreed of the Intracord and the IR-5, and is purported to have solid state electronics. No technical data were available, and unfortunately Metrimpex has also developed its own new system of cell supports in which none of the other holders will fit.

Of course, another reason for not seeing any of the IR instruments -- and this is by no means pure speculation without background -- could be that the instruments available are being intensely used for something that they did not want to show us.

Having ventured into other somewhat remote areas of Europe before, we had decided to go to Budapest by car. Border crossing formalities were easy enough: passport with visa and the "green card" (international certificate) are all that is needed. Money counting and registration have been dispensed with, and the only other question was "Do you have Hungarian money with you?" (the importation of which is forbidden). The drive to Budapest was very pleasant indeed, although somewhat slowed by numerous horse-drawn carts, even more than we have observed in Czechoslovakia and Poland, and many, many stretches of road that were being repaired or improved. Hungary is still missing from the handbooks of practically all of the European Automobile Clubs, and so map materials and other helps for the motorized traveler are scarce or inadequate, although Hungarian road maps can be obtained at the border. We saw only two or three foreign cars on the 130-mile trip from the Austrian border to Budapest, and, if I remember correctly, they were all Austrian. The vicinity of a center of population always makes itself felt by the increase of trucks that are on the road, in at least a 30:1 ratio with cars. Observing traffic policemen when entering Budapest, one quickly discovers that they are rather impolite, superstrict and unconciliatory, not to say outright mean. So one drives with extra care. Now, certainly not all of our own traffic laws appear to be logical, but those of the Eastern countries got stuck somewhere when motorization started, and the only reason why the traffic still rolls is that it is not as dense as in the Western world. Most dangerous, however, and very irritating, is the night-driving habit of "glow worming" one's way through dimly lit streets with only parking lights on. This is bad enough in London, but outright criminal in poorly-lighted places like Wroclaw, Budapest, and Prague -- not to mention the smaller towns. If you hit somebody, you go to jail. If you drive with low beam,

first, everybody will blind you in turn with his high beam to indicate your offense, and secondly, you are liable to be fined heavily by a policeman because you break the law. Well, maybe they are so advanced technologically as to have built-in IR-scopes or perhaps they receive shots of vitamin A, but I certainly could not see a darn thing. Advice: do not drive after dark in Iron Curtain countries if you can avoid it.

We stayed in the Szabadsag Hotel, a modern building with nice rooms, but altogether too-thin walls. The cuisine was excellent, although you do not see too much beef on the menu. Veal, pork, and chicken, as well as vegetables, are plentiful. The beer is excellent. Hotel service is good when you pay for it directly, but slows to a crawl when included in the overall price. The price difference between hotel service and the outside consumer market appeared to be extraordinarily high and amounted to a luxury taxation, so we went out and bought our own bread and salami -- of excellent quality, by the way -- so as not to have to resort to restaurant eating all the time.

The language of commerce in Hungary is German. Russian is understood, but not used, and speaking Rumanian creates the same effect as one might get when singing "Deutschland, Deutschland über Alles" in the center of Tel Aviv. It is deeply resented, since Hungary lost quite a bit of its territory to the Rumanians after WWII, who in turn had to give some of theirs to the Soviet Union. Anyway, in Italy or Germany you will find the menu printed in the local language plus French and sometimes English; here German is used for communication with foreigners. Hungarian is spoken by only about 12 million people; and it is not at all related to any of the Germanic or Slavic languages, but belongs to the Finno-Ugric group that branched from the Uralic languages. It has borrowed terms from the Iranians, the Romans, the Turks, and every other surrounding nationality, and is reportedly a grammatical monstrosity. Because of this and because Hungary has been connected with Austria for so long, it is not too hard to understand why German has become the second language. Soviet influence and Hungary's membership in the Communist bloc has had very little effect in this respect.

The city of Budapest is a modern one, and its people appear to be better dressed and more cheerful than the population of other Eastern capitals, but a deacription of the sights to be seen and the views to be admired is better left to more qualified authors.

Our visit was certainly pleasant enough, and our memories are marred only by the border-crossing delays when going from Hungary to Yugoslavia. To clear the Hungarian side took more than an hour, with practically no traffic our way and was pure chicanery. Well, there is absolutely nothing one can do in such cases. Better to keep quiet so as not to be delayed even longer; or even better, stay away from these totalitarian countries altogether. Summing it all up, the meeting must be viewed as a very successful attempt of one of the smaller Eastern European nations to be heard and noted in the scientific and cultural struggle between East and West and in terms of the country's own striving to advance from a wholly agricultural society to a technological one.
(B. Bartocha)

Chemistry Changes at Reading

The Chemistry Department at Reading University, England, has occupied a handsome new building on the new campus which is being developed on the edge of the city of Reading on an old estate known as Whiteknight's Park. The building is modern in design and contains adequate space and equipment for an up-to-date department granting both BSc and graduate degrees. It is fortunate that the building was completed last year, because the British government's financial position is such that a moratorium on construction of all academic facilities has been declared.

The Chemistry Department is simultaneously being reorganized. Prof. E.A. Guggenheim, who for many years held Reading's sole chair of chemistry, will retire at the end of the current academic year. Four new professors, Drs. Bryce-Smith, I.M. Mills, H.M. Frey and G.W.A. Fowles, have been appointed. Bryce-Smith, who has been at Reading, has been appointed Professor of Organic Chemistry, with P.F. Holt as reader, and A. Gilbert and A.C. Richardson as lecturers. One additional lecturer is to be appointed in this group. Mills, who also has been at Reading, has been appointed Professor of Chemical Physics. Associated with him will be two lecturers, J.M. Hollas and a second person to be appointed. Frey, formerly at Southampton, has been appointed Prof[illegible] of Physical Chemistry. He has a s[illegible]f two lecturers, A.D. Pethybrid[illegible] T.M. Hardman. Fowles, also for[illegible]y of Southampton, has been appointed Professor of Inorganic Chemistry. He will be assisted by J.E. Prue as reader, and three lecturers, P.C.H. Mitchell, H.J.M. Bowen, and E.S. Halberstadt, as well as by a fourth to be appointed.

Bryce-Smith's interests are in organic metallic chemistry and in photochemistry. Mills works in high resolution infrared spectroscopy. Frey specializes in gas-phase kinetics.

Fowles continues his work in the halogen compounds of the IV, V, and VI group transition metals. He will assume the duties of Department Chairman for a period of four years beginning in fall 1966.
(S.Y. Tyree)

MISCELLANEOUS

New Curriculum at Sandhurst

Sandhurst, the British military academy, is introducing a new emphasis into its training. In the past, the Sandhurst product has been criticized for his inadequate knowledge of basic soldiering. In the new curriculum the emphasis will be less on the schoolroom, less on producing potential divisional leaders, and more on turning out platoon officers. In the future the Army hopes to send more of its active officers to the universities for the elements of higher education and also to recruit more of its officers from the universities.
(N.W. Rakestraw)

Following the Norseman's Trail

The route of Columbus across the Atlantic has been followed -- several times, I think, even in a replica of his flagship. Now it is proposed to follow the route of Leif Ericsson in the original discovery of America. Mr. John Anderson, yachting editor of The Guardian, will set sail in a 45-ft cutter with five shipmates, sailing to the west coast of Greenland and then following the currents which he thinks must have carried Ericsson on to America. This trip doesn't seem to have the publicity and the glamour of the visit of the Kon-Tiki to Polynesia.
(N.W. Rakestraw)

Who Wants to be a Camel?

A note in the public press tells how agricultural researchers in Adelaide, Australia, are studying the ability of the camel to go for long periods without drinking, in the hope of teaching the trick to cattle and sheep and adapting them to living better in the hot and arid "outback."

One never knows, at the outset, what possible applications may develop from the results of a piece of basic research, and this may very well be a discovery of great consequence. I would suggest that when the secret is learned it be made available for the use of tourists planning to spend the Easter week-end in Scotland. Admittedly, that bonnie land is not so arid on a Sunday as it used to be; the pubs do open, if you can discover the hours, but rather than dash in with a fiery thirst, how much better it would be to enter with the refain, "the Cam(pb)ell's are coming, hurray, hurray!" (Foul pun!)

Indeed, confirmation (of a sort) comes from no less than Lord Kilbrandon, Judge of the Court of Session and recently chairman of the Scottish Tourist Board. In opening an exhibition recently, he chided his countrymen on their notions of hospitality to tourists, saying:

"You cannot expect visitors to put up with being sent to bed by the magistrates at 10PM. We in Scotland have got to begin to take notice of the ordinary requirements of decent holidaymakers or else the stream of even British, let alone foreign, tourists will soon dry up. The teapot is all very well in its place but do not let it exercise a dyspeptic tyranny."

Indeed, we may here be concerned not with the limitation of liquid capacity, but rather with its increase. The camel is said to take in enormous quantities on the rare occasions of imbibition. And the capacity for extra large draughts may be of some importance. As at Cambridge University, for instance.

Membership in the "King Street Run Club," has been a mark of distinction at Cambridge. To qualify for the club tie, an undergraduate must complete the tour of six pubs on the street, drinking eight pints of beer in less than two hours.

The senior proctor, Mr. P. Mathias, a history don at Queens College, says: "The young men who do it now are not the same as the professionals who used to do it and hold their liquor. There have been examples of publicans serving undergraduates who have not been in a condition to take more drink .... The university is not concerned about people who are able to complete the run successfully, but it is concerned about the increasing number of those who cannot. The run has become more popular in recent years, with disastrous results."

So the university has put an end to the "run." Let's hear from those people in Adelaide!
(N.W. Rakestraw)

PHYSICAL SCIENCES

Société Anonyme de Télécommunications

As almost everyone knows, the last thing that a Société Anonyme wants is anonymity. SAT is no exception, and during our recent visit to the Paris office no effort was spared to make known to us the many product lines and the extensive part they have to play, not only in the Common Market, but more generally in the overall world market.

Founded in 1931 as the Société d'Applications Téléphoniques, the company has operated under its present name since 1939. SAT is part of a group which includes two associated companies; Société d'Applications Générales d'Electricité et de Mécanique (SAGEM) and the Compagnie de Signaux et d'Entreprises Electriques (CSEE).

Last year the entire group employed 12,000 people and listed an annual sales figure of $120 million, divided approximately equally among the three companies. While SAT's Head Offices and Laboratories are located in Paris, its production plants are dispersed. Equipment is manufactured in Montluçon, Paris and Dourdan, cables in Riom, and components in Lannion. R and D, including completion of on-the-shelf hardware, is principally devoted to long-distance telecommunication and aerospace electronics. In the former category, approximately one-third of the French long-distance telecommunications system has been produced and installed by SAT, and many French and NATO defense networks have also been brought to fruition under the SAT aegis. In their aerospace work, telemetry, telecommand, and tracking for missiles and satellites, IR detection and guidance, solar cells, and space communications have been principal areas of emphasis.

At SAT some 700 of the staff of 3300 are engaged in R and D for clients which include, in addition to civilian and military government agencies, university laboratories and the National Center for Space Research. International agencies such as NATO, ESRO (European Space Research Organization) and ELDO (European Launcher Development Organization) make extensive use of both its development and manufacturing capabilities.

SAT is particularly proud of its international reputation in cable development and manufacture. J. Turck (ONRL-75-59), a sort of research and development managing director, showed us with obvious enthusiasm some of the company's advanced instrumentation and special cables so designed as to maintain a fixed impedance while displaying a degree of flexibility not found in those of other manufacturers. In the cable area, SAT holds patents of such importance that firms of many countries, including the US and Japan, have exchanged technical licenses with it.

Our business at SAT was prompted partly by a desire to see how increased French nationalism might have affected French-American relationships. The answer to the latter question was immediately obvious. While many reports had already drifted back to us, implying that French pride prohibits the use of English in correspondence and discussion, we were at once made to feel at home and invited to employ our native tongue, in which Turck, at least, is quite proficient. It may well have been merely a natural desire on our hosts' part to avoid our haltingly delivered and murderously pronounced French -- but also, many scientific terms have become universally adopted -- we have not yet seen a French word for "laser," for example. Parenthetically, however, we must note that we had received an invitation to a "Coquetele Laser," and we had thought cocktails also to be one of the few English contributions which had established a permanent identity in all languages.

Only at lunch, when our hosts invited us to begin with "snakes" (their translation of "escargots") did language prove any sort of problem, and French food and drink soon removes whatever barriers may initially exist. (.... and malt does more than Milton can -- to justify God's way to man.")

Taking an overall view of a company which seems to combine some of the aspects of Western Electric and some of the Bell Telephone Laboratories is not a simple task. From a look at their telemetry equipment, all beautifully mounted in stainless steel chassis, one cannot help but be impressed by an emphasis on absolute reliability of each module, even though the initial cost per item must certainly be relatively high. Presumably, this expense is more than offset by a low maintenance cost.

J. Besson told us of his interest in semiconductor materials and described his work with mercury cadmium telluride. At the IVth Quantum Electronics meeting at Phoenix in April he showed his spectrographic data, in which line narrowing can clearly be seen, although lasering has not yet been observed. Cooling is accomplished in his program with a rather neat and compact two-stage Joule-Thomson unit, which enables him to use liquid neon at 27° K. InSb is used as a detector, with a 20-nanosecond response time, and its properties as an emitter are also being further exploited. At the moment they appear to have oscillograph traces showing unexplained sub-nanosecond "spikes" in the InSb output. SAT's best attainable purity is only 1 part in 10^{13} at the present time.

Another area nurtured by Besson and his colleagues is a system for obtaining an inverse Fourier transform from their Gebbie interferometer, without the need for a digital computer. Basically, an analog system is substituted, in which the horizontal scan can be converted by means of an x-y recorder into a polar plot, which is then cut out, paperdoll style, and rotated past a scanning slit. The system uses a fixed tuned audio amplifier, and by controlling motor speed, a quick, albeit low-resolution, spectral analysis can be accomplished.

Other laser work on display is a packaged CW CO_2-N_2 laser, emitting about 40 w, and completely sealed. At the moment SAT is attempting to amplitude modulate the 10-μ beam by using the Faraday effect. The required magnetic field of several hundred gauss seems at present to be a stumbling block. Polyethylene Brewster-angle windows are planned for the CO_2 system, and measurements of refractive index in the 10-μ region are now under way with the Gebbie interferometer.

One of the detectors mentioned during our tour is made of GeHg and is cooled with liquid neon at 27° K. The detector has a directivity of 10^{10} or better within the 8 - 13 μ atmospheric window and a 1 μs response time.

Also described was an InSb photoconductive detector (J. Besson, R. Cano, M. Matteoli, R. Papoular, and B. Philippeau, L'Onde Electrique 45, 107 (1965)) made to operate at wavelengths between 10 mm and 0.1 mm. Photoconductive effects in InSb at millimeter and sub-millimeter wavelengths were first observed by Putley at the Royal Radar Establishment (E.H. Putley, Proc. Phys. Soc. (London) 76, 802 (1960)); as is known by Besson, Putley has also devoted considerable effort toward developing practical detectors since 1960 (Applied Optics 4, 649 (1965)). The SAT detector is cooled with liquid helium and has a response time of 40 nanoseconds as determined by a pulsed 4-mm klystron. Frequency selectivity can be obtained with this type of detector by application of a magnetic field; personnel at SAT have studied reception bandwidths and tunability possible with magnetic fields between 5 and 10 kgauss. The percentage bandwidth obtained by Besson was approximately 15%, and therefore it is not sufficiently narrow to replace a high-resolution spectrometer. However, the resolution should be useful for minimizing higher-order grating harmonics and stray radiation. The InSb detector is fast, is more sensitive than the Golay cell, but is probably less sensitive than the low-temperature germanium bolometer (F.J. Low, J. Opt. Soc. Am. 51, 1300 (1961)) for millimeter and sub-millimeter waves. The InSb detector, in addition to being fast and sensitive, has the advantage of having some selectivity and tunability if a magnetic field is used.

SAT is currently developing a detector-spectrometer unit for measurements to be conducted by a Monsieur Gay of the Astrophysical Section of the Observatory of Paris (located at Meudon, a southwestern suburb). A Gebbie-type interference spectrometer and an InSb detector will be packaged in a cube roughly 4 in on a side and cooled with liquid helium. The system will be operated from a stabilized balloon and is being designed for operation in the 1-mm wavelength region, presumably to study the atmospheric "window" near 1.3-mm.

Generally speaking, one could not help but be impressed with the drive and technical competence of this French company. Whether walking through their dust-free solar cell laboratory, watching their optical grinding and polishing of germanium oxide nose cones for IR seekers, or poking into their large drafting rooms, it is clear that SAT plans to maintain its prominent position in the telecommunications and aerospace world. With regard to their drafting rooms, we were particularly attracted by their draftsmen, pencil in one hand and screwdriver in the other, drawing and modifying diagrams in accord with a quick mock-up chassis and prototype parts immediately at hand. From microwave to optical frequencies, SAT covers the telecommunications business in an effective and productive manner.

Special footnote on status: The higher up you are in an organization the greater your need for an elevator. At SAT only senior members may use the locked elevators and only The Director can open a special override lock which brings the elevator to him no matter which floor he happens to be on. Thus even though some language difficulties may exist, it is easy for a visitor to identify "key" personnel at SAT.
(E.H. Weinberg and M.W. Long)

The Thin Film Group in Great Britain

Great Britain, a nation of rather small geographical area, is the site of extensive scientific effort. This state of affairs is particularly conducive to close internal communication. On the one hand, the volume of activity is large enough to make the total effort self-sustained in many disciplines. On the other hand, most laboratories are within a few hours' train ride or within less than an hour's flying time of each other. Specialists in a given field from all over the country can easily meet at one place and return the same day if necessary. This possibility is particularly attractive in a field such as thin films, which moves fast and has technical implications.

Growing out of what was originally called "The Dielectric Evaporation Group," the Thin Film Group is an entirely informal body of people interested in thin film research. A mailing list of 450 names is the only bond which ties the group together. Forty addressees are residents of the US; approximately the same number are spread all over Europe. The mailing list is open to everyone with a genuine interest in thin films, and additions are welcomed, particularly from the large community in the US. It is the purpose of this note to publicize this group in the US.

Under its present joint secretaries, Messrs. J.R. Balmer and J.H. Bruce (Royal Radar Establishment, Great Malvern, Worcs.),

the group organizes meetings twice a year, usually in the latter part of March and October. The various laboratories involved in thin film research take turns in accommodating these meetings, which last two days. The program is mailed to selected people on the list who are known to be active workers in the field constituting the theme of the meeting, e.g., sputtering, and announces 10-12 papers on recent progress in areas of interest, on new techniques or gadgets, and reports on conferences abroad. On the average approximately 75-100 attend the meeting.

The conferences are held in a refreshingly informal atmosphere. There is plenty of time for discussion, and the climate of a real working session develops which makes topical conferences so valuable. Although the whole field is very close to applications, very little difference can be detected between people from private industry, from universities or from government laboratories. The fear of getting close to matters of proprietary interest, sometimes so well developed in conferences on the continent, does not seem to restrain the discussion in this group.

A large range of subjects is covered in these meetings. For example, the 13th meeting, held at the National Physical Laboratory in Teddington, 19-20 October 1965, presented the following 12 papers: Mechanisms of sputtering - Prof. M. Thompson (Univ. of Sussex) and Dr. R.S. Nelson (A.E.R.E. Harwell); Gaseous Anodization - Mr. N. Jackson (Alan Clark Research Center, Caswell); Low pressure measurement - Dr. Dadson (NPL, Teddington); Scanning electron diffraction - Dr. Grigson (Cambridge Univ.); Surface orientation of thin films - Dr. Wilman (Imperial College); Optical measurements on thin dielectric films - Mr. Clapham (NPL, Teddington); Effects of Irradiation on the growth of tin and SiO films - Dr. Stuart (NPL, Teddington); Photo-conductivity in thin metal films on amorphous substrates - Mr. M.J. Knight (ERA, Leatherhead); Testing of arrays of polymer film capacitors - Mr. West (BSIRA, Chislehurst, Kent); Deposition of lead films - Dr. Curzon (Imperial College); Problems of nucleation theory - Dr. B. Lewis (Alan Clark Research Center, Caswell); Mechanical rate meters - Mr. A. Bennett (Alan Clark Research Center, Caswell).

On the afternoon of the 20th, the facilities connected with thin-film work at NPL were open to the participants.

An additional discussion meeting on electron- and ion-beam processes was held at RRE 7-8 December 1965. The sessions, which were even more informal than usual, came close to "thinking aloud," and the following general applications were considered: cutting and machining (and welding) of films - chiefly metallic, using well-focused electron beams; the programed control of electron beams for such purposes; the deposition of insulating films using electron beams; the deposition of metal films from ion beams; the modification of the electronic properties of a material by ion-implantation, using well-focused beams of very high energy (50 kv and upwards).

The 14th meeting, held in March of this year, emphasized the electron microscopy of thin films, and the Engineering Laboratories of Cambridge University were an appropriate setting. The high-vacuum scanning electron-diffraction camera, a modified electron microscope to allow examination in situ of films deposited under ultra-high vacuum, high-precision electron-beam machining and examination by secondary emission -- all these features made the Engineering Laboratories the ideal host for this meeting. The following papers were presented: Dielectric breakdown of alkali halide films - Dr. McLeod (Univ. of Strathclyde); Effect of residual gases on the properties of evaporated silicon monoxide films - Mr. Siddall (ERA, Leatherhead); Nucleation theory and relevant observations - Dr. Zinsmeister (Balzers); Single crystal sputtering - Mr. Campbell (Plessey, Caswell); Proximity effects in deposited superconducting layers - Dr. Kington (Mond Laboratory, Cambridge); Low angle electron diffraction and the epitaxy of magnetic films - Dr. Ferrier (Cavendish Laboratory, Cambridge); and The aluminum tin cryotron - Mr. D. Griffiths (RRE). During the afternoon of the second day visits were made to relevant sections of the Cavendish Laboratory. Activities of interest at Cavendish include the megavolt electron microscope, studies of deposition and adhesion by various processes (Dept. of Surface Physics), and to work on "cryogenic" thin films in the Mond Laboratory.

One of the most pleasant aspects of these meetings is the informal notes, which are prepared and mailed to everyone within three weeks of the conference. These notes are complete and easy to read, including the general lines of criticism and speculation in the discussions, and therefore present a valuable progress review. I am told that each edition of the notes contains three jokes and one concealed insult. It is up to the reader to discover these. It will be even more fun to read them a few years from now, following the development of new lines, to see how new problems arose and how old ones were solved. Funds provided by the Ministry of Aviation cover the expense of printing and mailing these notes.

I have been told that our British colleagues would appreciate the interest of anyone in the US working in thin film research. If you want your name placed on the mailing list, please write to Mr. Bruce. Since date, place, and main

theme of the next meeting are known six months ahead of time, American physicists passing through England could avail themselves of an excellent opportunity to meet their British counterparts. The location, subject and date of the October meeting will be announced shortly. Progress reports on sputtering work in the US would be particularly welcomed by members of the group.
(B.O. Seraphin)

Oxford Conference on Nuclear Structure and Elementary Particles, 30 March - 1 April 1966

Over three hundred physicists, mostly from the United Kingdom, attended a three-day conference on nuclear physics and elementary particles sponsored by the Institute of Physics and the Physical Society. Except for a joint session on Friday morning, parallel sessions were held on the two subjects. The participants were able to tour either the Nuclear Physics Laboratory at Oxford or the Rutherford High Energy Laboratory about ten miles to the south. Most of the social activities were held at Keble College, named for John Keble, founder of the Oxford Movement, a 19th century revival of High Church Anglicanism. Of the buildings at Keble, Ruskin is reported to have said, "I walk down the street and avert my head."

The British take second place to none in their knowledge of nuclear structure. The mantle, however, has passed from Cambridge's Cavendish Laboratory and now resides in other centers, of which Oxford and the surrounding government establishment take first place. The nuclear part of the Conference was introduced by Prof. J.P. Elliot (Univ. of Sussex), who gave an extremely fine review of the present status of nuclear structure calculations. He started by outlining the various possible assumptions one may make in performing structure calculations; assumptions about nuclear forces, about single-particle wave functions and about the nature of the interactions between particles in the various shells. During the last few years increasingly realistic calculations have been made, whose agreement with the data is therefore all the more impressive. One point of great interest to me is that the substitution of a smooth velocity-dependent potential for the hard-core repulsion has seemed to be a completely satisfactory assumption for the basic two-nucleon interaction, and has the enormous advantage of leading to much more tractable shell-model calculations. To one who has direct experience of the difficulties that the hard-core potential introduces even in the three-body problem, this is pleasant news.

Other invited papers of the nuclear half of the Conference included a good discussion of the intermediate model of nuclear scattering by Dr. J. Young (Los Alamos and Oxford). He discussed the assumptions which lead to the optical model, essentially the averaging of all forces exerted upon an incoming nucleon into an equivalent one-body potential. This leads to agreement with some types of scattering data. However, if one includes certain other interactions, such as the excitation of one particle of the nucleus so that one considers a two-particle one-hole interaction, one gets the intermediate model which predicts resonances of a character somewhere between the broad resonances predicted by the optical model and the rapid fluctuations of the compound-nucleus model. Young then considered a variety of nuclear scattering processes and discussed which of these exhibit the intermediate structure. For example, in the (d,p) reactions, one gets some results which can best be interpreted as a direct one-particle excitation and other results which seem to display the intermediate structure. Young discussed the relationship between these (d,p) data, the proton inelastic-scattering data, and the excitation of isobaric analogue states.

Prof. K. Allen (Oxford) discussed the electromagnetic transitions in N^{14} and F^{18}. The experiments were performed at Chalk River and at Oxford. In order to measure the lifetime of rather short-lived states, one makes use of the Doppler technique. A heavy ion is used as the bombarding particle to insure that the excited isotope will have a large forward momentum. A thick metal strip is positioned behind the target to bring the excited nucleus to rest. Those γ-rays which are emitted before the nucleus comes to rest will display the Doppler shift and those which are emitted after the parent nucleus comes to rest will not. By varying the distance between the target and the backstop one can determine the lifetime of states in the range 10^{-12} sec, a region which has been rather inaccessible by other techniques. Of course, these techniques are, to a large extent, made possible by the extremely fine resolution of the lithium-drifted germanium counters. Allen then discussed the results for the nuclei N^{14} and F^{18}. One is able to estimate spins, mixing ratios and transition strengths with a precision which is impressive. As the germanium counters are increased in size and the tandem accelerators are pushed up in energy, these techniques will be extended to heavier nuclei.

Dr. G. Backenstoss (CERN) reviewed the state of the measurements on muonic X-rays. Although these experiments have been performed for nearly twenty years, two recent developments have increased the accuracy enormously. One is the improvement of counters, particularly solid state detectors. The other is an improved muon beam from the accelerator. Backenstoss compared the information about the nuclear charge density obtained from the muonic

X-ray work with that obtained from the electron scattering work. He discussed the measurement of hyperfine structure in muonic X-rays and how this is used to extract information about nuclear moments.

On Friday morning three invited papers were presented to a joint session of the Conference. Prof. D.H. Wilkinson (Oxford) gave a paper entitled "The symbiosis of nuclear structure and elementary particle physics." He discussed how various parts of pion and muon physics can be used to reveal details about nuclear structure. The muonic atom is, in particular, a fine nuclear probe. The interaction is electromagnetic and the muon penetrates deeply inside the nucleus. At present the X-ray data are precise enough to be used to fit a two-parameter nuclear charge distribution. One could hope to obtain a three-parameter fit if the energies could be measured to a few hundred volts. However, this will be intertwined with a perturbation of the nuclear density by the muon which will be of the same order of magnitude in its effect on energy. The muonic X-ray isotope shift is consistent with that measured from optical spectra and, in fact, may be a more accurate way of obtaining the shift. The hyperfine splitting of the muonic lines can be used to determine the sign and magnitude of the nuclear quadrupole moment in nuclei where it is difficult or impossible to get similar information from optical excitation. In certain cases, one can also use muonic spectroscopy to obtain the nuclear magnetic moment.

The muonic capture process resembles, in first approximation, the electric dipole γ-absorption process, and in fact, it gives information about vibrations other than the usual Goldhaber-Teller vibration of nuclear matter. The pionic atom is, of course, dependent upon the strong interaction, and can be used to obtain information about hard-core correlation of nuclear matter.

Finally, Wilkinson discussed the counterpart of all this, namely, examples of how nuclear-structure data can be used to obtain information about conserved-vector-current hypotheses and vacuum polarization values.

Dr. P.E. Donovan (Bell Telephone Laboratories) discussed the work that he and his collaborators have done on nuclear scattering analysis involving three-body final states. The kinematics of three particles in the final state is vastly more complicated to handle than two-body problems. Donovan and his collaborators use on-line computers to present the results. Instead of trying to unscramble from this data the precise details of the kinematics, they present to the computer alternate theories of the reaction and allow the computer to determine what the result of each such theory would be. By visually comparing the actual experimental plot and the simulated graphs generated by the machine from theoretical assumptions, they can select among various theories. This process is called the "PASER" which denotes "Publication amplification by simulated experimental results."

Prof. George Snow (Univ. of Maryland and the Univ. of Rome) presented a review of the hyperon-nucleon system. After a theoretical discussion of the baryon octet which includes the nucleons and hyperons, Snow discussed how the groups at Maryland, Heidelberg, Weizmann Inst., and elsewhere are analyzing bubble chamber photographs of events which are initiated by incident K-mesons. One can extract information about the Λ-p and the Σ-p scattering. The data is quite difficult to obtain precisely, but at this time one can conclude that for the Λ-p states the singlet interaction is somewhat stronger than the triplet interaction. The results for the Σ-p scattering are quite a bit below the upper bound of geometric cross sections and again point to a weak triplet interaction. The predictions from SU6 are not too useful because the more interesting features of the scattering are probably due to the breakdown of symmetry. This can be deduced from the fact that SU6 predicts that the singlet and triplet nucleon-nucleon scattering lengths should be equal.

Many contributed papers on various aspects of nuclear structure were presented. One is continually impressed by the vigorous state of nuclear physics in spite of frequent predictions of its impending demise. The ingenuity of the physicist and technological advances have confounded the prophets.
(J.G. Brennan)

7th General Assembly of the International Commission for Optics and Congress on Recent Progress in Physical Optics, Paris, 2-7 May 1966

When officially opened in 1958, UNESCO Headquarters was cited as the most international group of buildings in Paris. The Secretariat is housed in the tallest of the three original buildings, which is raised on "pilotis," and completes the semicircle, just behind the Ecole Militaire, designed in the 18th century by Jacques-Ange Gabriel. Another building, with fluted concrete sides and a copper-covered "butterfly" roof, contains the conference hall and committee rooms and is connected to the Secretariat. Much of the concrete is left in the exposed state to contrast with the Roman travertine or the Brittany granite of the walled sides, the Norwegian quartz of the flooring and the copper of the roof. A fourth building, which houses the executive board meeting-room, offices and garage space, is built entirely underground

but is illuminated and ventilated, as though it were above ground, by six sunken patios planted with grass and trees. Paintings, murals, mobiles, ceramics, mosaics, etc., decorate the various building areas and represent the best artistry of the many countries contributing to its design. Picasso's painting on wood dominates the Delegates' Hall, which is just outside the conference room in which our optics meeting was held.

The meeting room, an altogether appropriate place in which to hold the Assembly which attracted some 500 attendees from more than 20 countries, provides the necessary simultaneous translation facilities by means of the customary earphones at each desk. For this particular meeting, only French and English were provided, and even the unique skill of UNESCO's talented translators was occasionally overtaxed by those speakers determined to make the maximum use of their small allotment of eight minutes per paper by reading their offering at top speed. The translators were occasionally dismayed to the point of making some suitable acrimonious remark and sending off a messenger to the podium to try to slow the speaker down. For papers given in French the speaker's speed did pose a serious problem for some of us, since the faster the speech the more desirable it was to have at hand (or ear) the English translation.

Principal topics under discussion at this meeting were propagation of light, coherence, interference, diffraction, polarization, non-linear optics and optical information processing. With well over 100 short communications and a half-dozen invited lectures to report, we are pleased that the July issue of Optica Acta will publish all papers which are not otherwise scheduled for publication elsewhere. Thus we need only describe the general organization of the conference sessions and name the invited speakers.

Session A was simply entitled Coherence. After introductory remarks by A. Kastler (Ecole Normal Superieure, Paris), whose optical pumping research is world renowned, E. Wolf (Univ. of Rochester) gave an invited half-hour paper entitled "Some recent research on coherence and fluctuations of light." In the main, his talk reviewed the fashionable, and often controversial, topic of coherence theory and photon coincidence experiments, and gave particular attention to the Australian stellar interferometer based on the Hanbury Brown-Twiss effect. While, somewhat surprisingly, Twiss is presently working with the NPL English group on an improved Michelson stellar interferometer, Brown is in charge of the Australian one. The latter has been described in Nature (March 1964) and consists of two 22-ft-diameter mirrors mounted on the circumference of a 600-ft-diameter circular track. At the present time, when this instrument is employed with a base line of 390-ft, the smallest measured stellar diameter is 0.0007 sec of arc, which is better by a factor of five than reported in the above article.

Among the contributors to this first session, perhaps Harvard's R.J. Glauber was particularly enlightening as he reviewed the general application of quantum-electrodynamic theory to optical problems. Pointing out that up to about three years ago it was not known how to use this erudite theory in any field other than nuclear physics, Glauber also noted that, unlike the nuclear case, here the value of the theory lies in dealing with very weak fields, since even vacuum fields must be considered as strong by comparison with most optical ones. Due to the absence of one or two scheduled contributors, Glauber was allowed a total of about 25 minutes, thus permitting him sufficient time to present his topic with a degree of comprehensibility which otherwise must certainly have been circumscribed.

Centimeter waves and thin films occupied the afternoon of the first day as Session B. On the following morning, D. Gabor (Imperial College, London), the "father" of holography, opened the third session, entitled Holography, with a paper on "Optical Processing of Information." Presenting his paper entirely in French, Gabor summarized his published work in this field, dating back to his early experiments in 1948. He renewed his interest with the advent of the laser as a plentiful source of coherent light, so necessary for maximal utilization of the principle of wavefront reconstruction which he initially invented for application to electron microscopy. Naturally, in this rapidly moving field, due attention was given to the possibility of combining holography with the Lippman principle of color photography, thus producing 3-D full color reproductions, which require only white light for later viewing. Gabor again emphasized the importance of applying holography to character recognition, particularly for data processing.

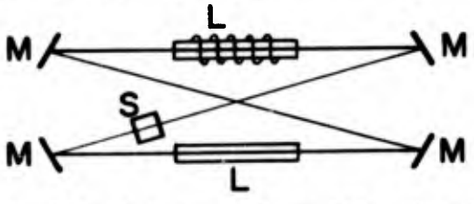
Not unnaturally, among the short contributed papers which followed, G. Stroke, E. Leith (both of Univ. of Michigan) and L. Mandel (Univ. of Rochester) led the list. Further along in that session, R.F. Van Ligten's paper on holographic microscopy pointed toward another important application. Employing a He-Ne laser as the illuminating source, the American Optical group presented striking slides in which whiskers on the head of a mosquito could be seen with a depth of field of perhaps 150-200 μ. With a 50X oil-immersion objective of 0.95 N.A., 1-μ-diameter nerve fibers were shown, and with the same optical arrangement individual neuron cells and the nucleus in brain tissue could be clearly seen.

A neat trick with possibly significant application was reported by B.P. Hildebrand (Univ. of Michigan). By employing either two collimated beams or one beam with two frequencies, it is possible to obtain a holographic image with built-in contour lines. It is not unreasonable to think that at some later time this technique might be employed for three-dimensional terrain mapping for which altitude contour lines are often desired.

During the very brief question period which closed each session, only one or two written questions could be permitted. Stroke was specifically asked about his previous comments to the effect that X-ray holograpy may even now be appearing on the horizon. To this listener, at least, the speaker appeared to express a note of optimism unwarranted by any additional details or practicable suggestions.

Non-linear optics and applications of lasers constituted the subject matter of Session D, which opened with N. Bloombergen speaking on "The properties of reflected second harmonic light." Reviewing his own and his colleagues' initial work carefully but rapidly, he then went on to report several experimental results of the application of generalized Fresnel laws to the non-linear case. Both piezoelectric and non-piezoelectric materials were discussed, and distinction was made between the contribution of the conduction electrons in a metal and the core polarization of atoms of the surface layer in these metals, which interferes with the former contribution.

Among the short papers, one by H. Van de Stadt, et al., from Delft deserves special mention. His laboratory has designed a special type of ring laser capable of measuring extremely small optical rotations. The accompanying sketch shows the design principle.



M represents mirrors with small angles of incidence for the upper and lower gas lasers L. Basically the device constitutes two anti-parallel triangular ring lasers, so that it will be insensitive to effects of a conventional rotation rate. With the sample whose optical rotation is to be measured placed at S, and with a Faraday coil around one laser to produce two opposite circularly polarized eigenstates, a small optical rotation in the sample will produce a difference in frequency between the two circular eigenstates. At the present time a difference frequency of 1 cps has been detected.

Speaking in French, but with slides in English, G. Toraldo di Francia (Univ. of Florence) initiated Session E with a paper on "Optical resonators." This session was devoted to electromagnetic theory, diffraction and optical filtering. Toraldo began with a summary of early attempts to employ a Fabry-Perot to produce lasers. He credited this concept to Schawlow, Townes, Prokhorov and Dicke, with the main work of quantification of these ideas being carried out by Fox and Li, whose computer-obtained numerical approximations provided the real stimulus to further successful effort. Briefly, the lecture continued rapidly with an overall review of Toraldo's and others' analyses of several cavity geometries, including plane parallel, spherical confocal, flat and steep roof. Here again, if one could manage to keep one ear open to the original French and the other to the English translation, he could occasionally be quite amused -- but alas, too often, confused as well. Here, for instance, in discussing the Boyd and Gordon mode-plotting work, the translator described this work as being done with the aid of an "electronic coagulator," and even a week or more later, we still find this phrase insidiously creeping out of the back recesses of our mind to haunt us again and again.

A number of the papers following this invited address were devoted to the mathematical development of diffraction theory. We must confess to letting our attention wander as slides began to appear with ten or more hand-written equations per slide and accompanied by reading the manuscript in such rapid French that the translator felt impelled to comment, as she switched us back to the French original, "I'm sorry, but formulas cannot be translated at that speed." In addition, for us at least, data presented at such a high frequency simply cannot penetrate our mind to any significant skin depth, a phenomenon well known to microwave specialists.

Considerable attention was also given to problems of spatial filtering, as was reported from well-known workers at Imperial College, CGTSF (Compagnie Générale de Telegraphi Sans Fil), Aldermaston and Tokyo. From Aldermaston, C.D. Reid reported further on his fingerprint identification work, as we have previously described (ESN-19-9). W.D. Wright (Imperial College) commented all too realistically that crime detection is becoming a big business in England.

Session F got off to a good start with H.H. Hopkins of Imperial College speaking on "The use of diffraction-based criteria of image quality in automatic optical design." The session was devoted to Fourier analysis and transfer

function theory, and H^3 (as he is familiarly known) emphasized the primitive manner in which lens design continues to be carried out. In particular, Hopkins claims that he is unaware of any published work in which Marechal's quality criterion, in which wave aberration variances, rather than merely mean squares, are minimized. Required corrections based on these two criteria can often be enormously different, Hopkins reported.

By the fourth day of the meeting, we began to note a change for the better in the performance of the slide projectionist. During the first couple of days the words "next slide, please" were followed by inaction -- presumably until the French translation registered in the operator's ears. Many English-speaking participants chose to ask for their slides in French in order to expedite the process. By now, as it turned out, the operator seemed to have become so well adjusted to "next slide, please," that he had become deaf to "la suivante, s'il vous plait," with the end result that French-speaking lecturers would occasionally interrupt their speech long enough to say in careful English "next slide, please" -- much to the amusement of the audience.

The final invited paper, entitled "Interference and coherence," was given by M. Francon (Inst. d'Optique, Paris). The main purport of his talk was to give the only lecture demonstration of the meeting, in which he pointed out an experimental method of determining spatial coherence between two points illuminated from an extended source. Two cases were considered; one in which both points lie along the normal to the source, but at different distances, and the other for two points lying in a plane perpendicular to that normal. The demonstration ended with nice displays of classical interference experiments. Convection currents around a person's hand were readily seen, and for a burning candle these currents were shown in a most striking way. All in all, Francon's was certainly the most colorful lecture of the entire session.

Among the contributed papers, W.L. Hyde (Univ. of Rochester) described a neat technique in which a simple photoelectric photometer can measure a path retardation of 10^{-5} wavelength by employing polarized light in a Jamin interferometer.

The meeting concluded with a number of papers on optical instruments and optics in space. Among these, W.D. Wright's (Imperial College) color slides of beetles and humming birds, as correlated with electron micrographs of those multilayers responsible for such coloration, provided great audience interest. Wright has measured spectral reflectance curves as a function of angle of illumination for many similar fauna. In particular he showed how the overlapping scales from a herring contribute to its silvery color.

During the week, the following new officers of the ICO were elected: President, Toraldo di Francia (succeeding A. Maréchal); four Vice-Presidents, Hopkins, Howlett (Canada), Kubota (Japan) and Skalinsky (Poland); and Secretary-Treasurer, Hyde (succeeding Wright, who has served in that capacity for 13 years).

During two afternoons the delegates were free to visit any of a number of laboratories in the area. Quite a large number chose to visit the Ecole Normale Superieure, where Kastler himself graciously welcomed us and arranged for us to tour his laboratory. Benoit à la Guillaume, who continues Aigrain's original electron pumping semiconductor work under ONR support, made us particularly at home. Other work in this famous laboratory includes optical pumping, nuclear magnetic resonance, magnetometer development using optical pumping of potassium vapor, and studies of various level crossings in excited states of He^4 and He^3. On Saturday morning, a special session was devoted to photon-counting statistics and to a few miscellaneous items for which adequate time had not been allowed in the earlier sessions.

We feel that the meeting was extremely well organized and managed. The papers were kept on schedule and grouped according to the topic. We cannot help but wonder, as we have for many other meetings in the past, whether it would not be better to arrange for such a meeting without having any papers scheduled at all. For the real value of such a gathering, we feel certain, is the opportunity to converse with one's fellow researchers, and this can be done only outside the meeting hall. If only eight minutes can be allowed for each paper and almost no time for discussion, an alternative mechanism would seem desirable. For instance, one might require sufficient advance preparation to distribute in advance copies of one's presentation, so that the available time could be devoted entirely to answering questions. This last system, however, is relatively impracticable, since many speakers will not know until the last moment precisely what their papers will contain. Despite the fact that somewhat more attention was accorded to classical physical optics than was to our liking, we would certainly award at least two, or possibly three, stars, guidebook style, to the entire meeting.
(E.H. Weinberg)

PSYCHOLOGICAL SCIENCES

Teaching Machines and Programed Instruction in Soviet Technical Education

Dr. Harmut Vogt, authority on Eastern education from the Philipps University in

Marburg/Lahn, W. Germany, has recently published a monograph on teaching machines and programed instruction in the Soviet Union. As indicated by its title, Programmierter Unterricht und Lehrmaschinen an Hoch- und Fachschulen der Sowjetunion, the discussion is confined to education at the technical college and vocational school level. This monograph was published last year by Manz Verlag, Munich.

In essence, it is a review of Soviet literature in the area. A 31-item bibliography is appended, but the individual studies are not cited to support the summary conclusions presented. Also appended is a sample list of 42 institutions (ministries, universities, technical and other schools) active and "successful" in research and utilization of teaching machines and programed instruction.

The Soviet Union, like many other countries, has recognized the need for drastic educational reform to cope with modern "galloping technology" and its consequent information explosion. She sees an educational race in progress between East and West, with not only cultural and economic progress as the prize, but military and political domination as well. An educational system of increased efficiency is seen as a powerful weapon of the communist armamentarium in its struggle for world domination. Maximum effort is being devoted to this facet of Soviet enterprise. Development and utilization of educational TV, programed instruction, teaching machines and more general applications of cybernetics or anything that shows promise of increasing teaching and learning efficiency are being pursued with intense energy. These activities are one aspect of an overall movement of educational reform announced by Khrushchev in 1958 and reiterated to some extent in a new program adopted at the 22nd Communist Party Congress in 1961.

Soviet educators see as one of the principal deficiencies of present-day instruction its inability to adapt rapidly to change in the subject matter being taught. Another is its inability to adapt teaching methods to individual differences in aptitude, interest, etc., among students. Teachers are held to be ignorant about the learning process and the means for motivating students. Textbooks are frequently poorly arranged and notoriously difficult to read.

After an initial period of opposition to the application of cybernetic methods to problems of education such as those listed, the pendulum in the Soviet Union has swung to a position of enthusiastic acceptance and accelerated development. Soviet effort in the general area of automated instruction is rated by the author as second only to the US. A considerable part of this effort takes place within the pedagogical high schools, technical colleges and vocational schools. The level of these schools ranges somewhere between the American high school, teacher's training college, and the American university. Whether the graduates are trained as teachers, technicians, or engineers, however, they are all exposed to a curriculum heavily loaded on the technical side. Considerable evening and correspondence study is involved. Hardware and engineering considerations tend as a consequence to overshadow educational considerations, particularly since, in the early days at least, opposition to automated instruction came primarily from the educators. More rapport and communication between these groups is reported to have developed recently.

A twofold program of research and development is underway. One approach critically examines and replicates the work of foreign countries, notably that of the US; the other pursues an independent line of research and development. A set of conclusions or guidelines for present and future research and development has evolved from the program:

1. Programed instruction and teaching machines should and must be developed and used on a broad scale.

2. Programed instruction and teaching machines can be applied during all steps of the educational system, and, with different emphases, can be applied in the teaching of most subjects.

3. Programed instruction and teaching machines should be widely applied in combination with conventional instruction and in combination with other educational aids such as language labs, educational TV, and films.

4. A particularly important application for programed instruction and teaching machines, as well as educational television, is their use in evening and correspondence education, which will become increasingly used in Soviet education.

5. The primary problem of programed instruction and teaching machines is the creation or modelling of teaching algorithms and the development of optimally-constructed teaching programs.

6. Programed instruction and teaching machines are in general in a rather early state of development, even in the US. Many basic questions relating to their use are as yet unresolved and require rigorous research effort. Based on current experience, it appears unnecessary to attach too much emphasis to the development of relatively simple teaching machines, as these instruments have only slight advantages when compared with programed textbooks.

7. It appears that the utilization of electronic cybernetic teaching machines, in particular of electronic systems with appropriate input and output sub-systems (computer-based teaching systems), seem to have the best chance for effective realization of the principles of programed instruction. These computer-based teaching machines incorporate the greatest possible adaptation to the needs of the individual student. Special efforts are to be devoted to their development.

8. The design and installation of so-called "automated classrooms" with cybernetic control and information equipment for independent self-intermediate testing and self-instruction within the educational and vocational school systems is also of particular importance, and is to be pursued with emphasis and priority.

9. The need for effective teaching algorithms and instructional programs based on the principles of programed instruction make necessary the well-coordinated collective efforts or work of scientists of many different disciplines. The assembly and training of such a program-development "collective" is of decisive importance and has to be pursued with care and urgency.

10. The work involved in the development of effective instructional programs has beneficial side effects for conventional instruction, both by lecture and conventional textbook.

The advantages and disadvantages of programed learning gleaned from a search of the Soviet literature do not differ materially from those commonly cited by American investigators in this area. On the positive side there is, however, more emphasis on the use of this approach as a vehicle for testing student achievement, and as will be seen later, some Soviet systems are used almost exclusively as automated testing devices. On the negative side, they deplore the lack of an adequate theoretical foundation underpinning the movement, and feel that this contributes to the dominance of the hardware-oriented technicians in complex machine development. Straight linear programing with small steps and frequent feedback has been rejected in favor of branching programs with provision for both forward and backward branching. What is currently being called the "multi-media" approach in the US, i.e., the combined use of programed techniques, lectures, film, etc., is also favored in the Soviet Union. Constructed responses are held to be superior to multiple-choice when programed instruction is used in a testing mode, and the claim is made that retention is improved when responses are constructed.

Some systems in current use are described briefly. At a technical engineering school in Minsk three versions of a system (ASK 1, ASK 2, ASK 3) have been in use for well over a year. It is a combination testing and teaching machine which can also compile statistical data on student performance for the instructor. The machine presents the student with three questions of different difficulty level on the topic for which the machine is programed. Explicit constructed responses in the form of numbers or coded letters are fed into the machine. The machine grades the student's response on a five-point scale and recommends a remedial "consultation" based on the type of error made. The "consultations" are apparently informational items provided on cards. Time can also be measured, and a limit for student response can be set into the system, after which his responses are no longer accepted.

A Pedagogical Tester, developed at Sverdlovsk, serves essentially the same function, but utilizes multiple-choice responses. Ten questions, each with five alternative answers, are presented to the student, who indicates his response choices via a switch. After answering all the questions, the student then pushes a button marked "Evaluation." A light appears after all questions answered correctly and an overall score is assigned based on the number of correct answers. The time allowed for student response is also controllable on this device. Presumably any feedback is provided by the instructor, who is present during the testing.

Automated lecture halls similar to the "classroom communicators" of the US are in use primarily in conjunction with laboratory work. Their function again seems to be one of testing, and whether or not the student proceeds with his scheduled laboratory work depends on the accuracy of his responses to a brief test presented via the machine at the beginning of the period. The quality of student laboratory performance is said to have improved substantially as a result of the introduction of automated testing, and the development of such equipment is being pursued with great intensity at technical and vocational schools.

It is difficult, of course, to assess the extent to which Vogt's monograph represents an accurate and up-to-date account of Soviet effort in programed learning. If it is truly comprehensive, it presents a somewhat disappointing picture. The reported Soviet all-out acceptance of cybernetic concepts has suggested that much more sophisticated adaptive systems would have been developed. (J.A. Nagay and B. Bartocha)

NEWS AND NOTES

Lecturers Wanted:

The Istituto Italiano di Navigazione is a respected Italian institute and its field of interest goes beyond marine navigation, into aeronautical and space navigation, and indeed into such other

fields as oceanography and ocean transport. The Institute is looking for competent lecturers in any of these fields, to address its monthly meetings in Rome between November,1966 and June, 1967. If there are any eligible American scientists who will be in Europe during this time, and who are able and willing to address the Institute on their subjects of special interest, they are requested to communicate with ONR-London to see if suitable arrangements can be made.

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No Comment

"A Canadian tourist in London filmed a smash-and-grab raid on a New Bond Street jewellers yesterday and gave the film to police. But they cannot get it developed until tomorrow morning. A policeman said: 'It's a Kodak colour film and only Kodak laboratories can process it. They're closed for the weekend.' . . . . Kutchinsky's (the victimized firm) said the raiders took brooches and other jewellery worth more than £10,000." (Sunday Times, London, 15 May 1966.)

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The Central Electricity Generating Board's new biological laboratory at Leatherhead (20 miles SW of London) was recently opened. It has facilities for research on microbiology, fresh water biology and, to a limited extent, marine biology, and an artificial river will allow for the study of fish under controlled conditions.

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Birmingham College of Advanced Technology officially became Aston University on April 25.

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Another CAT to achieve a change of status is Loughborough College of Advanced Technology, now to be known as Loughborough University of Technology.

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Personal News

Dr. B.P. Mullins, Director, Department of Chemistry, Physics and Metallurgy, Royal Aircraft Establishment, Farnborough (Hants.), and a good friend of ONR London, was selected for a course of study at the Imperial Defence College, London. He was granted a one-year leave of absence from RAE commencing January 1966 to complete the course. This particular course normally leads to consideration for promotion to the highest executive levels in the Ministry of Aviation. During Mullins' absence from RAE, Mr. G.A. Earwicker will be Acting Director.

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Dr. D.J. Bradley (Royal Holloway College, Univ. of London) will occupy the Physics Chair at Queen's University, Belfast, effective 1 October 1966, upon the retirement of Prof. K.G. Emeleus.

Mr. L.F. Nicholson, Deputy Director of the Royal Aircraft Establishment, Farnborough, has been appointed Chief Scientist (Royal Air Force).

Dr. S.D. Silvey, Reader in Mathematical Statistics at Manchester Univ., has been appointed to the recently founded Chair of Statistics at Glasgow Univ.

Dr. D.C. Gilles, who has been in charge of the Computing Laboratory at Glasgow Univ., has been appointed to the newly established Chair of Computing Science.

Dr. D.E. Barton, Reader in Statistics at University College, London, has been appointed to the Chair of Statistics at Queen Mary College, in association with the Institute of Computer Science.

Dr. R.H. Tredgold, Reader in Physics in the University College of North Wales, Bangor, has been appointed Professor of Physics and Head of the Dept. of Physics succeeding Prof. F. Llewellyn-Jones, who has been appointed principal of the College.

Lord Snow (better known as C.P. Snow, the novelist) has retired from his post in the British government as Parliamentary Secretary to the Ministry of Technology, and intends to resume his career as a writer.

Prof. George Humphrey, Emeritus Professor of Psychology at Oxford Univ., died in April at the age of 76.

Prof. G.D. Dawson, Professor of Experimental Neurology at the Institute of Psychiatry, London Univ., has been appointed to the Second Chair of Physiology.

Dr. W. Douglas Munn, Senior Lecturer in Mathematics, Glasgow Univ., has been appointed to the Chair of Mathematics at the new Univ. of Stirling.

M.F.A. Harrison of Culham Laboratory, Atomic Energy Authority, has been appointed to the Chair of Physics at the new Univ. of Stirling.

Dr. A. Carrington, Assistant Director of Research in Organic and Inorganic Chemistry at Cambridge Univ., has been appointed to the fourth Chair in the Department of Chemistry, from 1 Oct 1967.

Dr. Max L. Rosenheim was elected last month President of the Royal College of Physicians, in place of Sir Charles Dodds, who has retired.

Prof. R.L. Goodstein, Professor and Head of the Dept. of Mathematics at the Univ. of Leicester, has been appointed Pro-Vice-Chancellor in succesion to Prof. N. Pye, for 1966-69.

Dr. G.S. Nixon, present Senior Lecturer in Periodontology and in Dental Pharmacology and Therapeutics at Glasgow Univ., has been appointed to a newly established Chair of Conservative Dentistry at Manchester Univ. The date of the appointment has not yet been fixed.

Dr. D.H. Murdoch, Reader in Pure Mathematics, has been appointed Erasmus Smith's Professor of Mathematics at the Univ. of Dublin.

Dr. T.D. Spearman, Lecturer in Theoretical Physics at Durham Univ., has been appointed to University Professor of Natural Philosophy at the Univ. of Dublin.

Dr. C.H. Holland, Senior Lecturer in Geology at Bedford College, London, has been appointed Professor of Geology and Mineralogy at the Univ. of Dublin.

Prof. C.C. Butler, FRS, Prof. of Physics at Imperial College, London, has been elected Dean of the Royal College of Science from 1 Oct 1966.

Sir Harry Melville, Chairman of the Science Research Council, is to be Principal of Queen Mary College, London Univ., from 1 October 1967 on the retirement of Sir Thomas Creed.

Dr. D.H. Whiffen has been appointed Superintendent of the Division of Molecular Science at the National Physical Laboratory, Teddington.

TECHNICAL REPORTS OF ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York, New York 09510.

ONRL-14-66 Oceanography in France, Spain and Portugal by N.W. Rakestraw

ONRL-15-66 What the Chemists are Learning about the Ocean (Chemical Oceanography in Europe) by N.W. Rakestraw

ONRL-16-66 Psychology and Biotechnology at the Max-Planck-Institut für Arbeitsphysiologie (Dortmund) by J.A. Nagay

The following conference reports are releasable to European scientists:

ONRL-C-7-66 Conference on Scattering Non-Linear Optics, University of York, 4-7 April 1966 by E.H. Weinberg

ONRL-C-8-66 Eighth Israel Annual Conference on Aviation and Astronautics by I. Estermann

ONRL-C-9-66 March 1966 Meeting of the Physiological Society by C.N. Peiss

Prepared by the Scientific Staff
Submitted by P. King

W.W. SCHAEFER
Captain, U.S. Navy
Commanding Officer

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(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)* Office of Naval Research, Branch Office London, England	2a. REPORT SECURITY CLASSIFICATION 2b GROUP

3. REPORT TITLE

European Scientific Notes

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

N.A.

5. AUTHOR(S) *(Last name, first name, initial)*

Epstein, Bernard and Hewitson, Victoria, ed.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
24 May 1966	20	

8a. CONTRACT OR GRANT NO. N.A. b. PROJECT NO. c. N.A. d.	9a. ORIGINATOR'S REPORT NUMBER(S) ESN-20-5 9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)* N.A.

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510.

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N.A.	N.A.

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This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist

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