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# U. R. S. I.

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## GENERAL GUSTAVE FERRIÉ 1868-1932

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Reprint from *Telecommunication Pioneers*

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General Gustave Ferrié, the originator and first president of the International Union of Scientific Radiotelegraphy, was born at St. Michel-de-Maurienne, France in 1868.

His interest in science and fascination for discovery became apparent early in life, and later, when he was 21, he enrolled at the Ecole Polytechnique as a student engineer.

Upon completion of his studies, Ferrié joined the French Army as an engineering officer and remained devoted to the military throughout his life. His career with the Army brought him many distinctions, and as a culminating honor he was retained for service by a special law which set aside the fixed age of retirement.

As the head of the entire military communications system, Ferrié cultivated his subject with unflagging enthusiasm. A characteristic feature of his scientific viewpoint was his great sense of international organization. When the French Government summoned him to take part in the International Conference on Time in 1913, Ferrié enthusiastically participated as an organizer and secretary.

Always cognizant of the unique opportunities which long-distance wireless transmission and reception offered to the world of communications, Ferrié spared no effort in facilitating its growth and experimentation. It was under his direction that the famous Eiffel Tower was equipped as a wireless station, and it was through his intercession that the Tower was made available to Major Edwin H. Armstrong for extended experimentation on his superheterodyne.

Among the General's various inventions outside the « wireless » field was included a clock which operated on a photo-electric cell, serving to keep the pendulum in oscillation without the aid of any mechanical contact.

General Ferrié had an avid interest in astronomy and was an active member in the Royal Astronomical Society to which he was elected an Associate in 1928. He was also first president of the Commission on «Longitude by Wireless Time-Signals», and vice-president of the special Commission on «Time».

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## XV<sup>th</sup> GENERAL ASSEMBLY

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### Letter from the Chairman to the Official Delegates of Commission VI

Dear Sirs,

In my letter of July 12, 1965, I have given you the detailed scientific programme of our meetings during the Plenary Assembly in Munich. This letter will give the names of the authors of invited papers and the provisional agenda of the first business meeting.

September 6 a.m., 1966.

*Diffraction and scattering in non-ionized media.*

*Chairman* : Professor H. M. BARLOW, London.

*Invited speakers* : Professor H. MEINKE, Munich;  
Professor J. B. KELLER, New York.

September 6 p. m., 1966.

*Coding, modulation and signal processing.*

*Invited speakers*: Professor A. V. BALAKRISHNAN, Los Angeles;  
Professor V. I. SIFOROV, Moscow.

September 7, 1966, a.m. (jointly with V).

*Antennas (including information theory aspects).*

*Invited speakers* : Dr. R. C. Hansen, Los Angeles.  
Dr. V. G. Welsby, Birmingham.

September 8, 1966, a.m.

*Nonlinear circuits.*

*Invited speakers* : Professor A. BLAQUIÈRE, Paris;  
Dr. I. W. SANDBERG, Murray Hill.

September 9, 1966, a.m.

*Space Communications.*

The National Committees of U. S. A. and U. S. S. R. have agreed to design one invited speaker each, but we have not yet received the nominations.

September 12, 1966, a.m. (jointly with VII).

*Microminiaturization.*

*Chairman* : M. J. BERTRAIS, Paris.

*Invited speakers* : Dr. W. G. DUMMER.

Professor J. G. LINVILL, Stanford.

(probably two other speakers to be designed by Commission VII).

September 12, 1966, p.m.

*Linear Circuits.*

*Chairman* : Professor V. I. BELEVITCH.

*Invited speakers* : Dr. S. DARLINGTON, Murray Hill.

Dr. J. O. SCANLAN, Leeds.

September 13, 1966, p.m.

*Electromagnetic properties of ionized media I : Source-free solutions in ionized regions.*

*Invited speakers* : Professor K. BOCHENEK, Warsaw;

Professor N. MARCUVITZ, Brooklyn.

September 14, 1966, a.m.

*Electromagnetic properties of ionized media II : Radiation and scattering in Ionized Regions.*

*Chairman* : Professor E. W. GORDON, Ithaca.

*Invited speakers* : Mr. P. BACHYNSKI, Montreal;

Professor L. FELSEN, Brooklyn.

If the general arrangements allow this, I propose to schedule the morning sessions from 9 to 12.30 and the afternoon sessions from 14.30 to 18.00, so that we have ample time for discussion, even allowing for a coffee- or teabreak.

#### INDIVIDUAL PAPERS.

Contributions to the topics mentioned on the list approved by the Coordinating Committee (my circular letter of July 12) can be sent in. We need three 500-word abstracts before May 15, 1966. Individual papers will only be discussed if their author is present. If distribution of the full paper is desired the author should have a sufficient number reproduced and sent to Munich well before the meeting. Participation in the Assembly is restricted to Delegates nominated by National Committees and to Observers invited by the President of U.R.S.I. or the German National Committee.

In order to have more time for an open discussion, individual papers will in general not be read by their authors but they will be reviewed by the invited speakers. The authors can elucidate their views in the discussion, but will not have time to read a long paper or to present a long series of slides.

This is the first time we try this arrangement, that was accepted by the Coordinating Committee at the proposal of Mr. Ratcliffe. A possible disadvantage is that the arrangement may be less attractive to individual authors. We hope that Official Members who know of good work on one of our topics in their country, will stimulate the sending of such contributions and the participation in the discussion.

*Provisional Agenda of the Organizing Meeting of Commission VI*  
on September 5, 1966 at 14 h 30.

1) *Chairman's Report on the period 1963-1966.*

The chairman's report will be based on the Progress Reports of National Committees. Official Members are reminded of the fact that these Reports have to reach the Secretary General by May 31, 1966.

2) *Report on the Commission VI Symposium on Theory of Electromagnetic Waves, Delft 1965.*

3) *Nomination of reporters for the scientific sessions.*

(Usually the French Committee nominates reporters for the French language, and the U. K. and U. S. Committees for the English language).

4) *Consideration of terms of reference.*

The Official Members have seen the proposals of the Loeb-Silver-Shepherd-Marcuvitz Committee and the proposals of the French Committee. As I announced in my letter of July

12, 1965 the Coordinating Committee is willing not to have a very sharp dividing line between the programmes of Commissions VI and VII but to let the Chairmen decide on the subjects to be covered in their respective sessions and in joint sessions. The same arrangement is valid between Commissions III and IV. The chairman and the vice-chairmen feel that under these circumstances it is not necessary to fix terms of reference.

5) *Consideration of Recommendations concerning future work or action.*

Official Members are invited to make proposals. In my opinion one of our open tasks is to provide a link between the information theory approach and the electromagnetic wave theory approach to fading channels. Another subject is the organisation of a symposium on electromagnetic wave theory in 1968 (Invitation?).

6) *Answers to C.C.I.R. questions.*

As the C.C.I.R. has its Plenary Assembly in Oslo, June-July 1966, the formal questions are not yet available. Moreover the answers are needed only before the Interim Study Group meetings in 1968. The promises to help answer these questions by correspondence only worked well with the U.S. Committee. Perhaps it is better to appoint individual scientists to a small committee, not necessarily only working during the Plenary Assembly.

7) *Elections of Commission Officers.*

The Official Members can make nominations for chairman, but the Executive Committee appoints the chairman. The chairman is reeligible for one further term. The vice-chairmen are appointed by the Commission. They are also reeligible.

8) *Any other business.*

Official Members wishing to add items to the provisional agenda should communicate them to me well before the meeting.

14.1.1966

Sincerely yours,

Dr. F. L. STUMPERS,  
Philips Research Laboratories  
Eindhoven, the Netherlands  
Chairman of Commission VI U.R.S.I.



## XIV<sup>th</sup> GENERAL ASSEMBLY

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### Progress in Radio Science 1960-1963

#### VOLUME V. — RADIO ASTRONOMY

Report of Commission V on Radio Astronomy during the XIVth General Assembly of U.R.S.I., Tokyo, September, 1963. Edited by E. HERBAYS, Secretary General of U.R.S.I., in collaboration with J. W. WARWICK, R. COUTREZ and R. GONZE. 6 × 9", vii + 140 pages, 4 tables, 13 illus. Price : fl. 35.00 or 70s.

The meetings of the U.R.S.I. General Assembly every three years serve as the authoritative review of radio science over the intervening period. Each volume contains the record of one of the various U.R.S.I. commissions, while, taken as a whole, the systematic recording of the entire proceedings provides a comprehensive study in depth of all aspects of radio science including the most recent developments.

The proceedings of Commission V on Radio Astronomy were divided into seven sessions. I. Radio Astronomy of the Galaxy; II. Radio Sources; III. Radio Astronomy of the Quiet Sun; IV. Radio Astronomy of the Active Sun; V. Radio Astronomy of the Solar System; VI. Observational Techniques and Measurements in Radio Astronomy; VII. Miscellaneous Subjects in Radio Astronomy dealing more particularly with Instrumentation. In each area a speaker presented a comprehensive account of the previous three years. These accounts are given here in full and are followed by résumés of the shorter papers subsequently contributed. In this way a complete picture of the period was built up.

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## NATIONAL COMMITTEES

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### Argentina

#### BOLETIN DEL COMITE RADIO CIENTIFICO ARGENTINO

CONTENTS OF Nº 2, NOVEMBER 1965

- Obituary notices of Sir Edward V. Appleton and Prof. R. BUREAU.
- Summary of information contained in *U.R.S.I. Information Bulletin*, nº 149 and 150.
- List of topics selected for the forthcoming General Assembly.
- Minutes of the Meeting of I.U.C.A.F., January 1965.
- Announcement of the Inter-Union Symposium on Solar-Terrestrial Physics.
- Information concerning U.R.S.I. National Committees.
- Bibliography.

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### U. S. A.

#### CENTRAL RADIO PROPAGATION LABORATORY BECOMES THE INSTITUTE FOR TELECOMMUNICATION SCIENCES AND AERONOMY

by A. H. SHAPLEY

The international U.R.S.I. family will be interested to know something of the recent change in name and affiliation of the Central Radio Propagation Laboratory in the U. S. A. As of October 11, 1965, the C.R.P.L. became a part of a new agency, the Environmental Science Services Administration and its name has been changed to Institute for Telecommunication Sciences and Aeronomy.

The Environmental Science Services Administration is a newly formed arm of the U. S. Department of Commerce, the same Department which contains the National Bureau of Standards of which C.R.P.L. was formerly a part. E.S.S.A. is a merger of the activities of the Department of Commerce concerned with the science and services relating to man's physical environment — the U. S. Weather Bureau, the U. S. Coast and Geodetic Survey and C.R.P.L. Among the aims of the reorganization is the pooling of resources, facilities and talents available in the Department for these related activities.

The main research component of E.S.S.A. is the Institutes for Environmental Research (I.E.R.), comprising the following individual institutes : Telecommunication Sciences and Aeronomy (formerly C.R.P.L.), Atmospheric Sciences (formerly the research arm of the Weather Bureau), Oceanography, and Earth Sciences (these last two drawn from research activities of the Coast and Geodetic Survey). Other components of E.S.S.A. are the Environmental Data Services and the Environmental Satellite Center. The Weather Bureau and the Coast and Geodetic Survey continue their names within E.S.S.A. with major responsibilities for services in the areas of meteorology, hydrology, geomagnetism, geodesy, seismology, hydrography and oceanography.

The C.R.P.L., essentially intact, becomes one of the research institutes of I.E.R. Under its new name, Institute for Telecommunication Sciences and Aeronomy, it remains in the same laboratory building at Boulder under the continued direction of Dr. C. Gordon Little. It is planned that the I.E.R. itself will have headquarters at Boulder and in time the headquarters or major components of the other research institutes will be located in Boulder.

The I.T.S.A. has the identical mission of the old C.R.P.L. the same leadership and essentially the same structure. The work is organized into four laboratories (formerly called divisions), namely the Ionospheric Telecommunications Laboratory, headed by R. C. Kirby; the Tropospheric Telecommunications Laboratory, under R. S. Kirby; the Space Disturbances Laboratory, with R. W. Knecht as Director, and the Aeronomy Laboratory under Dr. E. K. Smith.

The disappearance of C.R.P.L. as a name comes after nineteen years of active participation in almost all aspects of radio science

and solar-terrestrial and more recently space science. Formed in 1946 under the late Honorary President of U.R.S.I., Dr. J. Howard Dellinger, it was the U. S. focus for international cooperation through U.R.S.I. in the post-war years. In its lifetime C.R.P.L. grew from a group of about 200 to some 500 plus the 300 people in the N.B.S. Radio Standards Laboratory which split off from C.R.P.L. in 1954. The activities engaged in by C.R.P.L. steadily broadened as modern science and technology developed, and the new name, Telecommunications Sciences and Aeronomy, is more fitting to the present work.

The enhanced role of C.R.P.L. also made it appropriate for it to be one of the three organizations forming the new E.S.S.A. Modern techniques in meteorology and geodesy, for instance, make much use of radio, and tropospheric propagation is intimately tied up with meteorology. The height ranges of the atmosphere of concern to meteorology and aeronomy have long since overlapped, and the inter-relationships of geomagnetism and ionospheric and magnetospheric physics are well known. Many techniques of forecasting are common to weather, radio propagation, ionosphere and the space environment. Much should be gained, scientifically and economically, by locating together observing sites for many of these scientific disciplines. Bringing together of research scientists in these related sciences should stimulate progress in each.

Dr. Robert M. White, the Administrator of E.S.S.A. was formerly Chief, U. S. Weather Bureau, and his Deputy, Vice Admiral H. Arnold Karo was Director of the U. S. Coast and Geodetic Survey. Their headquarters are at the Washington Science Center, Rockville, Maryland, a suburb of Washington, D. C. One of the major staff offices, the Office of Sciences and Engineering, is headed by Dr. John S. Rinehart, who in addition to the usual staff functions, will act for the Administrator in the coordination of the four research institutes pending the appointment of a Director for the Institutes for Environmental Research.

Thus, the new I.T.S.A. is the C.R.P.L. in everything but name, and in time, we may even get used to the new name. The obvious value of the E.S.S.A. concept of bringing together related sciences and services having to do with man's environment should provide a bright future for the modern objectives of the C.R.P.L.-I.T.S.A. and its staff.

December 3, 1965.

## COMMISSIONS AND COMMITTEES

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### Commission III on the Ionosphere

#### WAVE PROPAGATION

(From «This is the E.B.U. »)

It is most important for broadcasting organisations to know how the waves that carry their programmes are propagated. In effect, propagation, apart from its useful effects, may prove to be harmful to the extent that the waves cannot be strictly contained within the desired service area of the transmitters, and consequently they cause disturbances, either by interfering with the signals of other transmitters, or by causing degradation of the wanted signal through the behaviour of the propagation.

This is particularly true for *long and medium waves*, the «classical» broadcasting wavebands, those by means of which it took its first steps and which even today reach the largest number of listeners. *Working Party B* (Ionospheric propagation on kilometric, hectometric and metric waves) has been studying this question since 1951. It has organised, with the aid of twenty-three receiving stations in fifteen European countries, systematic measuring campaigns, which made it possible to undertake numerous scientific studies, and finally to analyse the results of more than 45 000 hours of field-strength recordings. These results have been condensed into a series of formulae and curves which make it possible to predict the value of the field strength under the most diverse conditions (E.B.U. Monograph Tech. 3081 «Ionospheric propagation on long and mediumwaves »).

In order to be of active assistance in establishing a frequency-assignment plan for the African continent, this same Working

Party also organised in 1963 and 1964, in collaboration with the Union of African National Broadcasting Services (U.R.T.N.A.) and the International Radio and Television Organisation (O.I.R.T.), regular recordings of the field-strength of African broadcasting transmitters at some ten measuring stations throughout the African continent.

The conclusions of these studies will constitute the basic essential data for future frequency-assignment conferences. These conferences must, nevertheless, also have available precise data on the *technical quality* of indirect-wave reception — that which is effected by reflection in the ionosphere, which permits reception at distances from the transmitters that may amount to thousands of kilometres. It is evident that a frequency-assignment plan that will take into account this signal as a wanted signal will be fundamentally different from a plan which provides only for a service by the direct wave, whose average range is only about 100 km. This question is one of the subjects for study by *Working Party A* (Sound broadcasting on long and medium waves).

The *metric* (VHF) and *decimetric* (UHF) waves are utilised for television and for frequency-modulated sound broadcasting. These waves are propagated in a manner very different from long, medium and short waves, but the prediction of their field-strength is also important to the broadcasting organisations and to frequency-assignment conferences.

*Working Party K* (Television and sound broadcasting on VHF and UHF) has undertaken the coordination of work carried out in this field in several European countries. The propagation curves at present in use are to a large extent the outcome of this coordination. This Working Party also deals with matters of *propagation within the service area* of transmitters. The study of the behaviour of UHF waves in large towns is in fact necessary to determine the optimum power of transmitters, the situation and height of aerials and the like.

Furthermore, Working Party B has organised a measuring campaign to study one particular problem: that of the *propagation of metric waves over very long distances*; in effect, during period of abnormal propagation, there are sometimes seen on West-European television screens pictures originated from transmitters situated in Siberia or in South Africa.

## INDICES D'ACTIVITE SOLAIRE POUR LA PROPAGATION IONOSPHERIQUE

(Extrait du *Journal des Télécommunications*,  
Vol. 32, n° 12, décembre 1965)

Les tableaux ci-après, contenant les valeurs des indices fondamentaux de la propagation ionosphérique, ont été établis par le Secrétariat Spécialisé du Comité consultatif international des radiocommunications (C.C.I.R.), conformément à la Résolution 4, l'Avis 371 et le Rapport 246 du C.C.I.R.

*Remarques* : De nombreux détails sur les indices ionosphériques sont contenus dans une publication récente : *Advances in radio research*, volume 2, éditée par J. A. Saxton (Academic Press, Londres et New York, 1964). Il s'agit de la contribution de C. M. Minnis, intitulée *Ionospheric indices*, pages 1-36, de l'ouvrage en question.

### VALEURS OBSERVÉES :

●  $R_{12}$  (moyenne glissante sur douze mois du nombre de taches solaires) :

Mois	1	2	3	4	5	6	7	8	9	10	11	12
Année												
1964	19	18	15	13	11	10	10	10	10	10	10	11
1965	12	12	12	13								

●  $I_{F_2}$  (indice ionosphérique) :

Mois (année 1964).

1	2	3	4	5	6	7	8	9	10	11	12
0(2)*	6(2)*	20(2)*	14(2)*	1(2)*	—3(1)*	1(1)*	—3(1)*	4(1)*	3(1)*	—3(1)*	—4(1)*

Mois (année 1965).

1	2	3	4	5	6	7	8	9	10	11
7(1)*	5(1)*	20(1)*	18(1)*	10(1)*	15(1)*	17(1)*	12(1)*	9(1)*	6(1)*	6(1)*

(\*) Les chiffres entre parenthèses indiquent le nombre de valeurs de  $f_oF_2$  qui ne sont pas encore parvenues au Secrétariat du C.C.I.R. et dont on n'a donc pas tenu compte dans le calcul de l'indice  $I_{F_2}$ . Pour plus de détails, voir *Journal des Télécommunications* (avril 1964, page 119).

Par rapport aux données contenues dans le Rapport 246 du C.C.I.R., une station de sondages ionosphériques a cessé de fonctionner — celle de Porto Rico (en juin 1963). Les valeurs de  $I_{F_2}$  contenant entre parenthèses le chiffre (1) sont donc depuis le mois de juin 1963 les valeurs définitives de l'indice  $I_{F_2}$ . En outre, la station de Fairbanks (College) n'a pas fonctionné pendant la période août-octobre 1963. Pour cette période les valeurs définitives de l'indice  $I_{F_2}$  sont celles contenant le chiffre (2) entre parenthèses.

●  $\emptyset$  (flux du bruit solaire moyen mensuel) \*\* :

Mois	1	2	3	4	5	6	7	8	9	10	11	12
Année												
1964	74	76	75	73	69	69	67	69	70	73	73	78
1965	78	75	74	72	78	77	74	75	76	80	76	

(\*\*) Renseignements obligeamment fournis par le « National Research Council », Ottawa.

PREVISIONS POUR LES MOIS A VENIR (1<sup>er</sup> DÉCEMBRE 1965) \*\*\* :

●  $R_{12}$

Année \ Mois	Mois				
	1	2	3	4	5
1965					
1966	23	25	27	28	30

(\*\*\*) Renseignements obligeamment fournis par le professeur Waldmeier, Observatoire fédéral de Zurich.

●  $I_{F_2}$  \*\*\*\*

Année \ Mois	Mois					11	12
	1	2	3	4	5		
1965						14	16
1966	29	33	36	40	(44)		

(\*\*\*\*) Renseignements obligeamment fournis par le Department of Scientific and Industrial Research, Radio and Space Research Station, Slough.

La valeur prévue six mois à l'avance est donnée entre parenthèses.





●  $I_{F_2}$  (ionospheric index) :

Month (year 1964).

1	2	3	4	5	6	7	8	9	10	11	12
0(2)*	6(2)*	20(2)*	14(2)*	1(2)*	—3(1)*	1(1)*	—3(1)*	4(1)*	3(1)*	—3(1)*	—4(1)*

Month (year 1965).

1	2	3	4	5	6	7	8	9	10	11
7(1)*	5(1)*	20(1)*	18(1)*	10(1)*	15(1)*	17(1)*	12(1)*	9(1)*	6(1)*	6(1)*

(\*) The figures in brackets represent the number of values of  $foF_2$  which have not yet reached the C.C.I.R. Secretariat, and which have not therefore been taken into account in the calculation of  $I_{F_2}$ . For further details, see the *Telecommunication Journal*, April 1964, page 119.

With regard to the data contained in C.C.I.R. Report 246, one ionospheric sounding station has ceased to operate — Puerto Rico (in June 1963). The values of  $I_{F_2}$ , that include the figure (1) in brackets are therefore, as from the month of June 1963, definitive values for  $I_{F_2}$ . Furthermore the sounding station Fairbanks (College) did not operate during the period August-October 1963. For this period the definitive values of  $I_{F_2}$  are those including the figure (2) in brackets.

●  $\varnothing$  (monthly mean value of solar noise flux) \*\* :

Month	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1964	74	76	75	73	69	69	67	69	70	73	73	78
1965	78	75	74	72	78	77	74	75	76	80	76	

(\*\*) Data kindly supplied by the National Research Council, Ottawa.

FORECASTS FOR THE NEXT FEW MONTHS (1 DECEMBER 1965) \*\*\* :

●  $R_{12}$

	Month											
Year												12
1965												22
	1	2	3	4	5							
1966	23	25	27	28	30							

(\*\*\*) Data kindly supplied by Prof. Waldmeier, Federal Observatory, Zurich.

Estimated error in forecasts of  $R_{12}$  :  $\pm 10$

●  $I_{F_2}$  \*\*\*\*

Month		11	12
Year			
1965		14	16
	1 2 3 4 6		
1966	29 33 36 40 (44)		

(\*\*\*\*) Data kindly supplied by the Department of Scientific and Industrial Research, Radio and Space Research Station, Slough.

The figure in brackets is the value forecast six months in advance.

Estimate of the error in  $I_{F_2}$  predictions :

Month		11	12	
1965				
Maximum		+ 7.5	+ 11.5	
Minimum		— 7	— 11	
Month		3	4	5
1966	1 2			
Maximum	+ 13 +12.5	+ 11.5	+ 10.5	+ 9
Minimum	— 13.5 — 15	— 17	— 18	— 19

## I.Q.S.Y. PROGRAMMES OF PARTICIPATING COMMITTEES

From I.Q.S.Y. Notes n° 15, Dec. 1965

### Argentine

1. — *Vertical Incidence.*

Station soundings are proceeding as planned.

3. — *Soundings by means of Rockets.*

Launching from Chamental took place in December instead of October 1964. Simultaneously, ionospheric vertical soundings were obtained with TRIO type sounder (L.I.A.R.A.).

4. — *Reception of Beacon Satellite Signals.*

Observations were made from Ushuaia and Tucuman.

5. — *Measurements of Absorption.*

Measurements of absorption were made as planned from General Belgrano Base, since May 1964.

6. — *Measurements of Drift.*

Measurements of drift have not yet started.

By the end of 1964, launchings from Chamaical took place, to measure density and temperature of electrons. The information obtained is being processed.

## Japan

1. — *Vertical Incidence.*

Soundings will be made at quarter-hour intervals daily and at five-minute intervals on World Days. N(h) profiles are calculated for selected days at Kokubunji.

*Stations* : Wakkanai, Akita, Kokubunji and Yamagawa.

2. — *Absorption Measurements.*

2.1. — *Method A1 (pulse reflections).*

Measurements are made daily at noon on 2.0 and 2.4 Mc/s. On Regular World Days, the continuous measurement from one hour before sunrise to one hour after sunset is made on the same frequencies. *Station* : Kokubunji.

2.2. — *Method A2 (riometer).*

Continuous measurements are made at Uji on 30 and 50 Mc/s. Hiraiso will start observations in April 1965 on 4, 6, 8, 10, 12, 15 and 30 Mc/s. *Stations* : Hiraiso and Uji.

2.3. — *Method A3 (field strength).*

At Akita, the field strength of the sky-wave signal of the station JJY (distance 450 km) on 2.5 Mc/s is measured. At Hiraiso, pulses from the LORAN station at Okamazaki (distance 361 km) on 1.85 Mc/s are measured from March 1964. *Stations* : Akita and Hiraiso.

3. — *Method D1 (Drift measurements).*

Measurements are made during 20-minute intervals in each hour on 2.2 and 4.5 Mc/s on Wednesday and Thursday every week and on RWDs and during WGI. *Station* : Yamagawa.

6. — *Special Propagation Experiment.*

In order to investigate trans-equatorial radio propagation, continuous recordings are made at Yamagawa of transmissions from Darwin (North Australia) on 32.85, 49.00 and 72.71 Mc/s. These stations have approximately conjugate magnetic coordinates. The experiment began in August 1964. *Station* : Yamagawa.

7. — *Back-scatter Observations.*

In order to study ionospheric propagation, especially across the equator, back-scatter reflections will be recorded once an hour during World Days on 27 Mc/s using a rotating aerial. *Station* : Hiraiso.

8. — *Radio Observation of Satellites.*

The Doppler frequency shift and the Faraday rotations are observed at the stations. Observations began at Uji in September 1964.

*Stations* : Kokubunji and Uji.

## **Pakistan**

### **IONOSPHERE.**

Ionograms of vertical incidence soundings at hourly intervals were obtained at Quetta during the period January to December 1964.

The ionospheric data from January to June 1964 are now ready for despatch to the World Data Centres.

## **Poland**

### **IONOSPHERE.**

1. Vertical incidence sounding. Routine sweep-frequency records have been maintained at Miedzeszyn. Data in the form

of « Ionospheric Data for Miedzeszyn » have been sent to the WDCs.

2. Absorption measurements at the station Piwnice-Torun are in preparation.

#### EXOSPHERE.

Experimental sounding of the exosphere has been carried out. This work includes :

- (a) radioecho observations and their theoretical interpretation;
- (b) correlation of exospheric echoes with cosmic events.

The final report will be presented in 1965.

### South Africa

#### 1. — *Vertical Incidence Soundings.*

Bulletin prepared for January 1964 for Cape Town and Johannesburg stations. February bulletin being typed. Complete scaling of March film in progress. Bulletins prepared for SANAE station up to the end of July 1964. Ionosonde put into operation in Grahamstown in November 1964. Bulletin to be prepared for December.

#### 2. — *Ionospheric Absorption.*

A1, A3 station in operation in Johannesburg as stated. Results are being analysed.

#### 3. — *Riometer.*

Riometers operating at 30 Mc/s in operation at Hermanus and SANAE.

#### 6. — *Special Experiments.*

6.1. — Special vertical incidence work in operation since January 1964.

6.2. — Instrument troubles in oblique incidence programme at Grahamstown. Work on interpretation of results temporarily discontinued owing to lack of manpower.

6.4. — Conjugate point, whistler and micropulsation experiments, between Grahamstown and Prof. Delloue of the Univer-

sity of Paris and Prof. du Castel of the Centre National d'Etudes Télécommunications in Seine, were commenced in July and October 1964 respectively and will be continued for approximately a year.

### **Spain**

#### *Vertical Incidence Soundings.*

Vertical incidence soundings have been made at Tortosa. Monthly tables of hourly values and medians of the following parameters are collected and published :

$f_oF2$ ,  $f_oF1$ ,  $f_oE$ ,  $f_oEs$ ,  $f_bES$ ,  $f_{min}$ ,  
 $n'F$ ,  $h'E$ ,  $h'Es$ ,  
MUF (3000) F2  
Es types.

### **Sudan**

Faraday rotation measurements are being successfully made at Khartoum on transmissions from the S-66 satellite.

### **United Kingdom**

#### *Vertical Incidence Soundings.*

The stations at Slough, Stanley and Singapore have maintained routine recordings of ionograms at hourly intervals on ordinary days and at quarter-hourly intervals on Regular World Days and during special events. The station at Akrotiri (Cyprus) has carried out a full vertical incidence soundings programme since 1 April 1964.

Ionograms and tabulated data are being sent from these stations to the World Data Centre (C1) at Slough and from there distributed to the other WDCs. Publication by the Radio and Space Research Station of bulletins of hourly data has continued normally.

## 2. — *Absorption Measurements.*

Measurements by the A1 method are being made at Singapore (i) at noon and (ii) when  $\cos \alpha = 0.6$ . The data obtained have undergone preliminary analysis at Slough. The A1 method is also being used at Aberystwyth on frequencies of 1.9 and 3.5 Mc/s; observations are made daily at noon and at hourly intervals on Regular World Days.

Absorption measurements by the A2 method on a frequency of 30 Mc/s have been carried out at Edinburgh since mid-August 1964 throughout each 24-hour period; the data are automatically printed on tape for computer processing. A two-frequency (10 and 20 Mc/s) riometer system is expected to be in operation from February 1965 at Sheffield.

The A3 technique is being employed at Leicester using signals on 2.61 Mc/s from Nordleich, W. Germany. Daily measurements at five-minute intervals over the noon period commenced on 1 April 1964 and useful records are available for 15 to 20 days per month. Records are also being taken at night between about 2200 and 0400 GMT.

## 3. — *Drift Measurements.*

Measurements by the D1 method are in progress at Aberystwyth and at Singapore. Recording of the fading of the echoes is made simultaneously on a 3-pen recorder and on magnetic tape during five-minute periods every hour on Wednesdays, Thursdays, RWDs and WGIs. Processing of the magnetic tapes and correlation analysis of the digitized recordings from Singapore is being carried out at the Radio and Space Research Station.

At Sheffield, ionospheric drifts have been measured over 24-hour periods during RWDs by the meteor trail method (D2) since July 1964. Results are presented in the form of N-S and E-W components of the mean wind at meteor heights.

An exploratory analysis of fading meteor echoes is being made to see whether useful data on wind structure can be obtained.

## 4. — *Top-Side Sounding of the Ionosphere.*

Ionograms have been received throughout 1964 from the US-Canadian satellite ALOUETTE and, since its launch in August



1964, from the US satellite EXPLORER 20. The data from these satellites are analysed at the Radio and Space Research Station. Attention has been devoted, in particular, to the study of the composition of the F region, to the equatorial anomaly and to field-aligned phenomena in the top-side ionosphere. The signals emitted by EXPLORER 20 have been used in investigations of trans-ionospheric propagation between satellite and ground. ALOUETTE AND EXPLORER 20 data are supplied regularly to WDC A at Boulder.

##### 5. — *Electron Density Profiles and Total Electron Content.*

At the Royal Radar Establishment, Malvern, the incoherent backscatter radar technique is being used to measure electron density-height profiles in the ionosphere. Mean profiles up to a height of about 500 km for each successive two-hourly period of the day have been obtained for two World Geophysical Intervals in 1964 (April and October).

At the Nuffield Radio Astronomy Laboratories, Jodrell Bank, the total electron content of the ionosphere has been measured daily during the WGIs of April and October 1964 by a lunar-radar technique.

Concurrently with the lunar-radar observations, recordings are being made at Jodrell Bank of the 40 and 41 Mc/s beacon signals of the satellite S-66A. It is hoped that these will enable the difference between electron content up to the satellite height and the total electron content to be determined.

Recordings of the 20, 40 and 41 Mc/s signals from satellite S-66A are also being made at Aberystwyth. At the Norman Lockyer Observatory, Sidmouth, measurements of the Doppler shift of transmissions from S-66A are being attempted in order to investigate the integrated electron density of the ionosphere.

At the Argentine Islands station, whistlers of natural origin are monitored with a high speed recorder as part of a world-wide synoptic study; the equipment records for two minutes in each hour concurrently recording WWV transmissions for the time scale. The magnetic tape records are despatched to Dartmouth College, New Hampshire, U. S. A. for reduction and analysis of the data.

6. — *Ionospheric Studies on Low and Very Low Frequencies.*

At Slough, measurements of waves reflected from the ionosphere at low and very low frequencies are being continued during the I.Q.S.Y. The amplitude and phase of the sky-wave received on 16 Mc/s and the amplitudes of the total wave received from the broadcasting stations at Berlin, Prague and Motala are recorded. At Lerwick, the amplitudes of the waves received from Berlin and Motala are also recorded.

Lists of the Sudden Phase Anomalies recorded at Slough on 16 Mc/s are prepared and are deposited in the WDC.

At King's College, London, and at an associated station in Jersey studies are being made of radio noise, atmospheric wave-forms, energy spectrum, and of vlf and elf propagation. During 1964, simultaneous observations on atmospheric wave-form were made under both day and night propagation conditions at the two stations. The stations have been in operation on RWDs, Regular Geophysical Days and on days of unusual meteor shower activity. Results obtained from an analysis of about one thousand atmospherics recorded in 1963-64 are being published. A statistical study is being made of the amplitude-frequency spectrum of atmospherics in the frequency range 100 c/s to 30 kc/s. A systematic study is also being made of elf noise phenomena in the frequency range 1 to 100 c/s including recordings of the diurnal variation of noise in this band.

7. — *Backscatter Measurements.*

At Sheffield, regular data have been obtained on backscatter from ionospheric irregularities with the 17 Mc/s radar used for the meteor patrol. During 1964, additional equipment with greater overall sensitivity has been brought into commission with which radio echoes from meteors and various types of ionospheric irregularity are being studied.

Coordinated observations on radio reflexions from the aurora on frequencies in the 28.0 to 29.7 and 144 to 146 Mc/s bands are being made by a group of amateur radio workers in the United Kingdom. In addition, the same network of observers are studying sporadic E propagation in the former band, and tropospheric propagation in the latter band. Close collaboration is being maintained with amateur radio observers, who are conduc-

ting a similar programme in Germany, and the data from these investigations are regularly exchanged.

8. — *Forward Scatter Measurements.*

The forward scatter link between II Qortin (Gozo) and ST. Lawrence (Isle of Wight), established in the spring of 1964, has been operated almost continuously into 1965; the temporal fluctuations of signal level have been studied and data are available from the Signals Research and Development Establishment, Christchurch, Hampshire.

9. — *Ionospheric Disturbances and Solar Flares.*

At Leicester, standard frequency transmissions at oblique and vertical incidence are being recorded to study the effect of solar flares and travelling disturbances on the ionosphere. Signals on 5 Mc/s from Rugby and Geneva have been monitored continuously during the day-time since 1 January 1964. Since September 1964, recordings have also been made on 2.5 Mc/s from Rugby. During 1964, the only solar flares reported were of importance class 1 or 1- and about 20 % of these produced sudden frequency disturbances. Variations of the phase path, under varying ionospheric conditions, of the 2.5 Mc/s MSF transmission from the Rugby transmitter have been studied at Sidmouth.

10. — *Meteor Patrol.*

At Sheffield, a medium power 17 Mc/s radar has been in continuous operation since September 1963. The major showers are all clearly evident in the records which reveal considerable structure in the sporadic background. Additional equipment is to be used to record automatically the integrated meteor echo durations above different levels of sensitivity.

11. — *Ionospheric Studies in Antarctica.*

A full programme of vertical soundings is being carried out at Halley Bay, and a more limited programme of soundings is being made at Argentine Islands. Hourly absorption measurements on two frequencies using the A1 method were started at Halley Bay on 1 April 1964. Drift measurements on three frequencies by the D1 method were also started in April. All these observations have been continuously maintained though, in the June mid-winter period, the absorption and drift measurements were

limited to one frequency since  $f_oF_2$  rarely rose above about 1.5 Mc/s. The seasonal variation in ionospheric absorption appears to follow that observed during the IGY with maxima at the equinoxes. It is hoped to start riometer and forward scatter observations in 1965. Radar auroral observations on 72 Mc/s will be carried out during 1965.

A temporary summer base was established some 270 km south of Halley Bay at 77°57'S, 24°48'W, where vertical soundings are being made with a portable ionosonde. It is hoped to use these data together with those for the main base in a study of travelling disturbances in the ionosphere.

## 12. — *Rocket-Borne Experiments.*

The concentrations and temperature of positively and negatively charged particles in the ionosphere are to be investigated by several SKYLARK and BLACK KNIGHT rounds to be flown from Woomera and from the ESRO range in Sardinia. Two CENTAURE rounds which carried electron temperature and sporadic-E probes were launched in May 1964 and the results are being assessed as are those from SKYLARK rounds carrying sporadic-E probes launched from Woomera in 1964.

A NIKE-APACHE round which carried a University of Birmingham 39 Mc/s electron density probe was flown from Wallop Island on 15 July 1964. This equipment recorded a strong sporadic-E layer at the usual altitude near 100 km and, in addition, demonstrated the presence of a narrow layer of ionization at about 120 km. A further similarly instrumented NIKE-APACHE round is to be launched in 1965 as part of the collaborative programme between the University of Illinois and the University of Birmingham.

Four SKYLARK rounds are to be launched from Woomera during one night, each round carrying the new version of the rf plasma probe, to measure the electron density and temperature, and similar equipment may be flown during 1965 in French CENTAURE and VERONIQUE vehicles.

Two SKYLARK rounds carrying both the cw and pulse propagation experiments were launched in the late summer of 1964 and it is hoped to fly similar equipment in two further SKYLARK rounds before the end of the I.Q.S.Y.

SKYLARK rounds are also being prepared to determine electron density by low frequency propagation and by measuring the aerial impedance of a short electric dipole.

13. — *Satellite-Borne Experiments.*

The payload of the US satellite EXPLORER 20 (formerly designated S-48), launched on 25th August 1964, includes an ion energy spectrometer, similar to that flown in ARIEL 1, to give direct measurements of ion mass spectrum and temperature that will be complementary to the topside soundings from the satellite.

A similar spectrometer is being provided for the US satellite Direct Measurement Explorer — A (S-30A), to be launched in 1965, which is also to include an electron temperature (and density) probe in the payload.

An electron density experiment, with the new 39 Mc/s plasma frequency probe, is being contributed to the payload of the first French satellite scheduled to be launched by NASA in 1965.

**U.S.S.R.**

1. — *Vertical Incidence Soundings.*

Vertical soundings of the ionosphere are carried out at 21 stations, including one in Antarctica and one on the ice-floe in the Arctic. Stations at high latitudes conduct soundings every 15 minutes.

2. — *Absorption Measurements.*

Absorption measurements were carried out at 7 stations by the pulse method.

3. — *Drift.*

Observations of ionospheric drifts were carried out at 7 stations. Photographic and visual observations of meteor trails were carried out at 4 stations; these data were used for the determination of air currents in the meteor zone of the atmosphere at an altitude of 60-120 km.

**Democratic Republic of Vietnam**

The ionosphere programme has been cancelled.

**Sub-Commission IVa  
on Radio Noise of Terrestrial Origin**

**I.Q.S.Y. PROGRAMMES OF PARTICIPATING  
COMMITTEES**

(from I.Q.S.Y. Notes, n° 15, Dec. 1965)

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**Argentina**

2. — *Whistlers and VLF Emissions.*

Records were obtained, as planned, at Tucuman.

7. — *Measurement of atmospheric Noise.*

Measurements of atmospheric noise will be started during 1965.

**Japan**

4. — *Whistlers.*

Simultaneous observations of whistlers will be made at four stations from 20-22 and from 50-52 minutes after each hour. At Kakioka, the frequency range is 425 c/s to 9.6 kc/s, and at Uji the range is 1kc/s to 20kc/s. At Moshiri and Toyokawa the range is 400 c/s to 10kc/s. The «nose effect» will be observed up to 100kc/s. *Stations* : Moshiri, Kakioka, Uji and Toyokawa.

5. — *Noise (Terrestrial and Extra-Terrestrial).*

The propagation of atmospheric radio noise depends on the frequency and the conditions in the magnetosphere or the ionosphere. Observations of noise at various frequencies are made to study these conditions and also to investigate the generation of ELF and VLF noise by the mutual action between charged particles and the magnetic field in the magnetosphere.

**Spain**

2. — *Atmospheric Radio Noise.*

Atmospheric radio noise is observed at Tortosa.

3. — *Spherics* are observed at Coruna and Madrid.

## Commission V on Radio Astronomy

### I.Q.S.Y. PROGRAMMES OF PARTICIPATING COMMITTEES

(from I.Q.S.Y. Notes, n° 15, Dec. 1965)

#### Japan

##### *Radio Observations.*

The continuous observations of intensity and polarization at Mitaka will be made at 227.5, 408, 612 and 17 000 Mc/s from 0000 to 0700 UT.

#### Poland

##### *Radio-Observations of the Sun (N. Copernicus University, Torun).*

###### 2.1. — *Monitoring of the Solar Flux at 127 MHz.*

Daily mean values of the solar flux and of the unusual phenomena at frequency 127 MHz in the form of monthly tabulations are delivered to :

- a) I.Q.S.Y. WDC C (Sydney) :
- (b) I.Q.S.Y. Analytical Center C1 (Zurich) (the data are published in the «Quarterly Bulletin of Solar Activity») :
- (c) WDC C (NERA);
- (d) Publikationen des Astrophysikalischen Observatoriums zu Potsdam, (Berlin, German Dem. Rep.).

###### 2.2 — *Interferometric Observations of the Sun's Active Regions at 127 MHz.*

Observations were systematically made from 16 May to 19 September 1964 by means of a 127 MHz interferometer with base 100 wavelengths. This method of observation makes possible the determination of position in E/W direction, of drift velocity and the sun's radiation from enhanced regions of small angular dimensions, as well as the flux larger than one tenth of the quiet sun flux.

The detailed results will be published in 1965.

2.3. — *Studies of the Outer Solar Corona During the Occultations of the Radio Sources.*

The occultation of the radio source Taurus A by the solar corona was observed in June 1964 by means of the interferometer with base 150 wavelengths at 32.6 Mc/s. The results are now being analysed and will be published in 1965.

3. — *Radio Observations of the Solar Radiation at 810 MHz.*

Measurements have been made at the Astronomical Observatory of Cracow University.

### South Africa

3. — *Whistlers and VLF Emissions.*

Whistler recording has been carried out at Durban since the beginning of the I.Q.S.Y. programme, using the same apparatus and schedule that was used during the I.G.Y. Nine months of records have been analysed and sent to the World Data Centre. Significant differences between present whistler reception and that observed during the I.G.Y. have been revealed.

Results from equipment sent to the Antarctic have been extremely disappointing. It is hoped that worthwhile results will be obtained with new equipment despatched to SANAE at the beginning of 1965.

Pulsed 18kc/s signals were transmitted by a group of French scientists from Paris and received by members of the same team stationed at Grahamstown. Both direct transmission and whistler-mode echoes were successfully detected. During the course of these experiments a suitable receiver was used in the laboratories at Durban. Whilst the direct transmission of signals was strongly received, protracted analysis of many records indicate that whistler-mode echoes, at best, were only very weakly received. It is hoped that useful information concerning the extent of a «geomagnetic conjugate point», as used in this context, may come out of this work.

7. Since the earlier South African programme was prepared, the following programme has been initiated by the University of Natal, Durban :

«By means of a 27kc/s receiver coupled to a long-period integrating circuit, the level of integrated atmospherics on this fre-



quency is being recorded continuously in order to detect SEAs. It is proposed to construct additional integrating recorders for observing the levels of atmospherics on frequencies above and below the 20-40kc/s band. At the same time a theoretical study, based on the magneto-ionic theory, is being undertaken which will be applied to the observed results. It is hoped that from this study a quantitative model of the lower ionosphere during disturbed conditions will be produced.

«Continuous recordings on 27kc/s have now been taken since November 1964, but so far only one possible SEA has been recorded. Information is being exchanged with the American Association of Variable Star observers (Solar Division) which is using SEAs to detect solar flares. This body reports that it has observed no SEAs and ascribes this to the relatively quiet solar conditions. Regular fluctuations (period about 15 minutes) in the 27kc/s integrated atmospherics level have been observed between 0500 and 1200 UT on certain days. So far no satisfactory explanation of this phenomenon has been possible.

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**Commission VI on Radio Waves and Circuits**  
**COLLOQUIUM ON MICROWAVE**  
**COMMUNICATION**

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The third colloquium on microwave communication will be held in Budapest, 19-22 April 1966.

The colloquium is sponsored by the Hungarian Academy of Sciences and the Scientific Society of Telecommunication. The Organizing Committee is under the chairmanship of G. Bognar, member of the Hungarian Academy of Sciences and President of the Hungarian National Committee for U.R.S.I.

The specialized subjects dealt with during the colloquium are : communication systems theory, network theory, electro magnetic theory, microwave theory and techniques, microwave electronics, systems and microwave measurements.

Further information available by Mrs A. Valko, Administrative Secretary, Third Colloquium on Microwave Communication, Technika Háza, Budapest, V., Szabadság tér 17 Hungary.

## U.R.S.I.-C.I.G. Committee

### TOTAL SOLAR ECLIPSE OF NOVEMBER 12, 1966

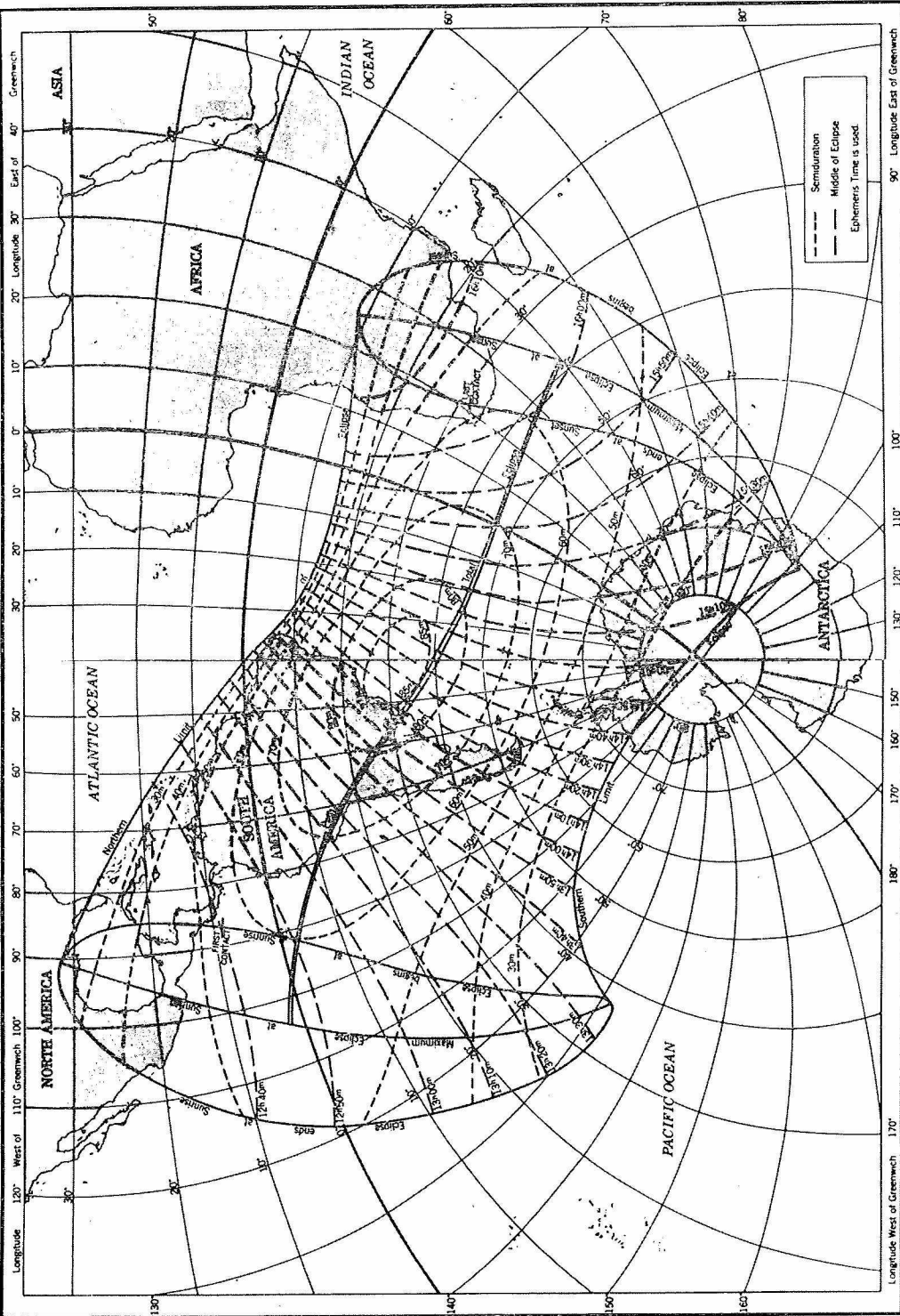
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The total eclipse of the sun on November 12, 1966, is of particular interest in that it is the last this century which will affect the countries of South America and the region of the equatorial electrojet over this continent.

Details of the path of this eclipse are given in Fig. 1, which is reproduced from the «Astronomical Ephemeris 1966» by kind permission of the U.K. Nautical Almanac Office, Royal Greenwich Observatory. Very detailed information on the circumstances of the eclipse have been published by the United States Naval Observatory in Circular No. 110 by Juliana S. Duncombe, dated 27 August 1965, and any interested are strongly advised to obtain a copy of this document from U. S. Naval Observatory, Washington, D. C. 20390. The information given includes the following: general map of the path of the eclipse, together with detailed maps of portions of the path across South America; table of times and positions of the path of total phase; tables of times and positions of the central line of total eclipse and of the duration of total phase and width of path on the central line at 10 000, 20 000, 30 000 and 40 000 feet, and at 100, 200 and 300 km; tables of local circumstances for points on the central line, and for particular geographic locations in both total and partial phase regions.

A communication received from Dr. Sandro M. Radicella, Universidad Nacional de Tucuman, Estacion Ionosferica, Argentine, draws attention to the fact that during the Second International Symposium on Equatorial Aeronomy held in Brazil in September 1965 a group of scientists from Latin America considered the possibility of coordinating efforts for observations during this eclipse, and formulated the Recommendation given below. Dr. Radicella was appointed provisional coordinator of an ad-hoc Working Group for the eclipse established within the Consejo Latino Americano de Fisica del Espacio (CLAFE), the initial objectives of which are

- 1) To maintain contacts and exchange information between scientists planning observations during the eclipse.



- 2) To establish contacts with similar working groups in other countries.

Dr. Radicella will be pleased to receive information regarding programmes for the eclipse from any country outside South America planning observations.

In this context it is relevant also to note that the Chairman of U.R.S.I. Commission III, Mr. J. A. Ratcliffe, has received the following communication from Ing. Victor H. Padula-Pintos, Chairman of the Argentine National Committee for U.R.S.I. Commission III :

« We are planning to make some special observations from some site in the continent and also from a ship at sea, in November 1966, during the total Solar Eclipse observable from the Northern part of Argentina.

As scientists from other parts of the world might also be interested in making measurements, I believe that the Argentine National Committee for U.R.S.I. (C.O.R.C.A.) might help them to solve problems regarding the temporary import of instruments and equipment, etc. Therefore, I beg you to inform those interested of our will to cooperate with them as much as we can ».

Interested scientists are invited to communicate directly with Ing. Padula-Pintos, Chairman Commission III (Ionosphere), Comite Radio Cientifico Argentino, Vicente Lopez, Argentine.

GEOFFREY M. BROWN  
*Secretary, URSI-CIG Committee.*

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## **Second International Symposium on Equatorial Aeronomy**

Sao Jose dos Campos (Brazil) September 1965

### **RECOMMENDATION NO. 40**

The total solar eclipse of November 12, 1966 is of extraordinary scientific importance as it is the last in this century which will affect the countries of South America and the electrojet region and the peculiar characteristics of the atmosphere above the continent. Starting in the Pacific Ocean off the coast of Ecuador the path of totality crosses Perù, Chile, Bolivia, Argentina, Paraguay, Uruguay and Brazil.

Accordingly, the II I.S.E.A. recommends to the International Scientific Unions and to the Governments of South America that they give their valuable cooperation to the world scientific community interested in making detailed observations of this rare phenomenon. The governments can assist materially by facilitating the anticipated mobilization of international scientists and their equipments within their respective territories and airspace and by providing support to scientist and scientific institutions of their own countries.

The Symposium also notes with pleasure the formation of a Working Group of the C.L.A.F.E. (Consejo Latino Americano de Fisica Espacial) to maximize the effectiveness of observations by scientists of Latin America.

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## INTER-UNION COMMISSIONS

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### Inter-Union Commission on Radio Meteorology

#### International Colloquium on the Fine-Scale Structure of the Atmosphere and its Relation to Radio Wave Propagation

##### Summary REPORT

This Colloquium was held from June 15 to 22, 1965 at the Academy of Science of U. S. S. R. Moscow, and was attended by 64 scientists from 12 countries.

This Colloquium was organized in order to mount a unified attack on problems pertaining to the fine-scale structure of the atmosphere, and its relation to radio propagation phenomena, by pooling the knowledge and resources of specialists in the fields of fluid mechanics, meteorology and radiophysics. As planned, several days were spent in the exchange of background material among the various disciplines, in the reporting of pertinent recent results, and in the delineation of principal problem areas. During the remaining time small working parties studied specific questions in an attempt to resolve apparent discrepancies between theory and experiment and to determine most profitable directions for future investigations.

The major conclusions reached, over and above the enthusiastic agreement as to the effectiveness of the informal, small-group format employed, were :

- (1) relative to clear-air turbulence and fine-scale motions in the free atmosphere, that there remains a high degree of uncertainty as to the causal mechanisms and as to whether this is truly turbulence in the « energy transfer », « diffusive mixing » sense, or if it is simply a mixture of random, linear waves :
- (2) relative to the fine-scale structure of refractive index, that finer and sharper deviations of  $n$  have been observed than were previously thought possible in the atmosphere, but

that the fluid dynamical processes responsible for such structure are still unclear and that the theoretical analysis of «reflections» from this type of structure has yet to be put in a satisfactory state.

Numerous recommendations were made, among the principal of which were :

- (i) pertaining to radio and radar, that simultaneous observations be made of radar angles, at several wavelengths, both with tracking and PPI-RHI instruments, and that simultaneous forward scatter and refractometer measurements be conducted;
- (ii) pertaining to meteorology, that the prediction of the occurrence of a buoyancy subrange at the base of an elevated inversion be tested on a meteorological tower;
- (iii) pertaining to fluid mechanics, that an all-out effort be made to clarify the interactions between wave modes and small-scale turbulence;
- (iv) pertaining to future meetings, that another similar «working» colloquium devoted to these problems be organized within the next three years and that reconvened sessions of the study groups be held annually, if possible.

R. BOLGIANO, Jr.

Chairman, Organizing Committee.

Information concerning the publication of the full report will be given in the forthcoming issue of the *Information Bulletin*.

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## SYMPOSIA

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### **Second International Symposium on Equatorial Aeronomy**

#### **PUBLICATIONS**

The Second International Symposium on Equatorial Aeronomy took place at the Space Physics Laboratory of the Comissão Nacional de Atividades Espaciais in São José dos Campos, São Paulo, Brazil in the period 6-17 September 1965.

The sessions were devoted to eleven topics namely :

- I. The D — Region and Lower Atmosphere.
- II. Absorption in the Equatorial Ionosphere.
- III. The regular E Region and Equatorial Es.
- IV. The Regular Low Latitude F — Region : Bottom and topside studies.
- V. F — Region disturbances and irregularities.
- VI. Ionospheric drifts.
- VII. Exosphere.
- VIII. Airglow.
- IX. Low latitude current system including electrojet and magnetic variations.
- X. Magnetic and ionosphere storms.
- XI. Low latitude magnetic pulsations.

The sessions were started with 25 minutes reviews, followed by 10 minute papers interspersed with comments. At the final session a résumé of each topic discussed in the symposium was presented.

It has been decided to present the results of the meetings in two types of publications. First a « Report on Equatorial Aeronomy » containing THE REVIEWS (about 1500 words), ILLUSTRATED ABSTRACTS including introduction and conclusions (average of 4 figures and 500 words each one) and the SUMMA-



RIES of the sessions. Second, the full papers will be submitted for publication in the Annales de Géophysique (March and June 1966 issues).

The Report on Equatorial Aeronomy will be published with the format of this circular and it is estimated that it will have about 600 pages with 400 figures.

The price per copy is US \$3.00 for personal use and US \$6.00 for libraries, institutes, etc. Airmailing will be less than US \$2.00 additional, to any where in the world. A limited number of bound copies will be available at extra cost.

Please enter orders to : S.I.S.E.A. Report, C.N.A.E., São José dos Campos, São Paulo, Brasil.

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## INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

### Election of new Officers

As result of the elections at the 11th General Assembly of I.C.S.U., the composition of the Executive Committee is as follows :

Dr. J. M. HARRISON (*President*), Dept. of Mines and Technical Surveys, 588 Booth Street, Ottawa 4, Ontario, Canada.

Prof. H. W. THOMPSON (*Past-President*), St. John's College, Oxford, U. K.

Prof. K. CHANDRASEKHARAN (*Secretary-General*), Eidg. Technische Hochschule, 8006 Zurich, Leonhardstrasse 33, Switzerland.

Ing. Gén. G. R. LACLAVÈRE (*Treasurer*), 136 bis rue de Grenelle, Paris 7, France.

Prof. H. BOESCH (*Vice-President*).

Prof. H. BROWN (*Vice-President*).

Prof. R. V. GARCIA (*Vice-President*).

Prof. W. KLEMM (*Vice-President*).

### UNION REPRESENTATIVES

I.A.U. Prof. J.-C. PECKER (France).

I.U.G.G. Prof. J. KAPLAN (U. S. A.).

U.R.S.I. Dr. R. L. SMITH-ROSE (U. K.).

I.U.P.A.C. Prof. W. KLEMM (Fed. Rep. of Germany).

I.U.P.A.P. Sir Gordon SUTHERLAND (U. K.).

I.G.U. Prof. H. BOESCH (Switzerland).

I.U.B.S. Prof. C. H. WADDINGTON (U. K.).

I.U.H.P.S. Prof. R. TATON (France).

I.U.C.r Prof. J. D. BERNAL (U. K.).

I.U.T.A.M.	Prof. M. ROY (France).
I.M.U.	Prof. G. de RHAM (Switzerland).
I.U.B.	Prof. M. FLORKIN (Belgium).
I.U.P.S.	Prof. J. W. DUYFF (Netherlands).
I.U.G.S.	Prof. W. P. van Leckwijck (Belgium).
I.O.P.A.B.	Prof. A. K. SOLOMON (U. S. A.).

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Prof. I. MALECKI	Poland
Dr. D. F. MARTYN	Australia
Dr. S. PRAWIROHARDJO	Indonesia

*Note* : The Chief Officers have recommended that the vacancy caused by the resignation of Prof. G. Polvani be filled by Prof. A. Marussi (Italy).

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## **I.U.G.G.**

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### **XIVth General Assembly**

The International Union of Geodesy and Geophysics has decided to hold its XIV General Assembly in Switzerland during the period 25 September — 7 October 1967.

Due to the large size of the I.U.G.G. General Assemblies, the meetings will be held simultaneously in four cities. The distance between any pair of these cities is such that not more than 90 minutes are required for travelling between them by train. Meetings of the I.U.G.G. Council and the Plenary Sessions will be held in Zurich, while Association programmes will be distributed as follows :

International Association of Geodesy (I.A.G.), International Association of Seismology and Physics of the Earth's Interior (I.A.S.P.E.I.), International Association of Volcanology (I.A.V.) in Zurich;

International Association of Scientific Hydrology (I.A.S.H.), International Association of Physical Oceanography (I.A.P.O.) in Berne;

International Association of Geomagnetism and Aeronomy (I.A.G.A.) in Basel;

International Association of Meteorology and Atmospheric Physics (I.A.M.A.P.) in Lucerne.

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## **I.A.G.A.**

### **HONORS**

Reprint from *I.A.G.A. News*, n° 4, Nov. 1965

Three internationally known I.A.G.A. scientists received the U. S. Smithsonian Institution's Hodgkins prize during the I.A.G.A. symposium on « Density and Composition of the Upper Atmos-

phere », held at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, during 16-20 August 1965.

The awards were presented to Dr. Sydney Chapman of the Geophysical Institute, University of Alaska; Dr. Joseph Kaplan of the Department of Physics, University of California at Los Angeles; and Professor Marcel Nicolet of the National Center for Space Research, Brussels, Belgium. Nicolet's presentation was made in absentia, with his associate, Gaston Kockarts making the formal acceptance.

The awards were presented by Secretary S. Dillon Ripley, Chief Executive of the Smithsonian Institution, Washington, D. C. with the following citations :

MARCEL NICOLET

- for major contributions to our understanding of chemical, radiative and diffusion phenomena in the high atmosphere.
- for devoted service to the International Geophysical Year as former Secretary General of the Special Committee for the International Geophysical Year (I.G.Y.) and
- for establishing from early satellite data the fundamentals of the structure of the very high atmosphere.

SYDNEY CHAPMAN

- for joining theoretically the sun's atmosphere to the earth's atmosphere.
- for discovering relationships between the earth's magnetic field and the high atmosphere and
- for being a tower of strength in the International Geophysical Year, whereby his theories were remarkably verified and extended. Dr. Chapman was former president of the I.G.Y's central organizing committee.

JOSEPH KAPLAN

- for his long continuing effort in making and inspiring laboratory experiments that have enable us to understand the observed radiations from the upper atmosphere.
- for his foresight in anticipating the significance of space research and

— for his major contribution to the International Geophysical Year and his enthusiastic impetus to international atmospheric and geophysical research.

The presentations were the first in 39 years, having been given only twice before in history — once in 1899 to James Dewar for his contributions to atmospheric research, and once in 1902 to J. J. Thomson for his investigations of the conductivity of atmospheric gases.

*U.R.S.I. is pleased to present its warmest congratulations to those three scientists who are closely connected with the activities of our Union.*

### **Publications**

The Proceedings of the Symposium on Density and Composition of the Upper Atmosphere is now being prepared as « I.A.G.A. Symposium No. 4 ». This symposium was held at Cambridge, Massachusetts, August 16-20, 1965, with the Smithsonian Astrophysical Observatory acting as the host. Abstracts of most of the papers are contained in this I.A.G.A. News under Reports of Recent Meetings.

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**C.O.S.P.A.R.**

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**Reports of National Institutions on Space Research  
Activities**

**(from Argentina to United Kingdom)**

Those reports which were presented at the Eighth Plenary Meeting of C.O.S.P.A.R., Mar del Plata, Argentina, May 1965 have been published in *C.O.S.P.A.R. Information Bulletin*, n° 27, December 1965.

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## U.N.E.S.C.O.

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### **L'Enseignement de la Physique dans les Universités**

#### **(L'enseignement des sciences fondamentales)**

Parmi les activités poursuivies dans le cadre du programme de l'Unesco en matière de sciences exactes et naturelles figurent des études comparatives, et, plus précisément, des enquêtes sur l'enseignement des sciences fondamentales (physique, chimie, biologie, mathématiques, etc.) au niveau universitaire.

Les recommandations de la Conférence Internationale sur l'Enseignement de la Physique, Paris, 1960, qui soulignaient la nécessité de procéder à des échanges internationaux d'informations sur l'enseignement de la physique, ont encouragé l'Unesco à entreprendre l'enquête dont le présent rapport est le résultat. Ce rapport a été rédigé en étroite coopération avec la Commission internationale de l'enseignement de la physique de l'Union internationale de physique pure et appliquée.

La Commission de l'enseignement de la physique de l'U.I.P.P.A. a été invitée à proposer un plan d'action et à indiquer les noms de physiciens qui pourraient procéder à des enquêtes et rédiger des rapports sur l'enseignement universitaire de la physique dans les pays suivants : République fédérale d'Allemagne, Etats-Unis d'Amérique, France, Royaume-Uni, Tchécoslovaquie et U.R.S.S.

Toutes les nations s'intéressent aujourd'hui à l'enseignement de la physique. Conscients de l'apport capital de la physique au progrès des connaissances scientifiques et à la préparation du développement technique, les pays scientifiquement avancés comme ceux dont le développement est de date récente, s'efforcent de faciliter à leurs ressortissants l'étude de la physique, et d'améliorer l'enseignement de cette discipline à tous les niveaux.

Le présent rapport contient des résultats d'une enquête internationale sur l'enseignement de la physique dans les universités.



Il a deux buts principaux : 1) aider les pays en voie de développement à mettre sur pied des programmes d'enseignement universitaire de la physique, et 2) permettre aux pays qui ont une solide tradition scientifique de savoir ce qui se fait dans d'autres pays et de comparer les méthodes appliquées à l'enseignement de la physique. Tout en espérant servir à la fois ces deux fins, nous accorderons une plus grande attention à la première. Le présent rapport traitera de l'enseignement de la physique à chacun des niveaux où l'on étudie cette science, mais il y sera surtout question de l'enseignement de la physique dans les universités et autres établissements d'enseignement supérieur.

Chacun des chapitres qui suivent est consacré à un aspect particulier de l'enseignement de la physique. Chacun commence par une introduction ayant pour objet de définir les problèmes à examiner et de préparer le lecteur à ce qui va suivre. Le corps du chapitre traite des différentes conceptions de l'enseignement de la physique dans les pays qui ont participé à l'enquête et consiste, le plus souvent, en extraits pertinents des rapports nationaux. Chaque chapitre se termine par une récapitulation, indiquant dans quelle mesure les usages et méthodes détaillés — programmes, listes d'expériences, listes d'ouvrages, etc. — figure dans les annexes.

#### TABLE DES MATIÈRES.

La préparation aux études universitaires de physique et les conditions d'admission dans les universités — Le rôle de la physique dans la formation des enseignants, des ingénieurs et d'autres spécialistes — La formation des physiciens professionnels dans les universités jusqu'au premier grade universitaire — Les hautes études de physique pour l'obtention de grades universitaires supérieurs — La recherche universitaire dans le domaine de la physique — Programmes spéciaux de physique : éducation permanente, cours du soir et enseignement péri-universitaire — Les professeurs de physique des universités — Le matériel — L'amélioration de l'enseignement de la physique.

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## **Study Abroad**

### **International guide : Fellowships, scholarships, educational exchange**

XVI, 1966-1968.

The sixteenth edition of STUDY ABROAD contains information on over 170 000 individual opportunities for subsidized study and educational travel abroad. Awards are offered by 77 international organizations and by 1,685 donors in 120 States (or non-self-governing territories dependent on them) which are members of the United Nations or other organizations of the United Nations system.

The present possibilities of travel to virtually every country of the world, and for study of almost every academic subject during the years 1966, 1967 and 1968.

Following the practice of earlier editions, there is a chapter accompanied by charts and tables, which presents statistical information on foreign student enrolments and offers of fellowships for study abroad.

Several important changes have been made in the presentation of this edition. STUDY ABROAD now conforms closely to its companion volume UNESCO HANDBOOK OF INTERNATIONAL EXCHANGES, the second edition of which will appear in 1966.

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### *Commission III.*

- Daily response of the ionospheric F-region to changes in thermospheric temperature, by S. CHANDRA and S. RANGASWAMY — Radio Propagation Unit, Scientific Report n° 24, National Physical Laboratory, Delhi, October 30, 1965.
- Electron distribution in the ionosphere over Delhi, by K. K. MAHAJAN — Radio Propagation Unit, Scientific Report n° 23, National Physical Laboratory, Delhi, September 15, 1965.
- Ionospheric observations during the I.G.Y. 1957-58 and the International Geophysical Cooperation, issued by the Research Department, All India Radio, November, Delhi, Vol. 2, n° 7 : « Ionospheric characteristics over Tiruchirapalli, January to March 1959 ».

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### *Commission IV.*

- The daily variation produced by a model magnetosphere, by H. R. RADOSKIN — *Bulletin de Géophysique*, Collège Jean-de-Brébeuf, Montréal, n° 18, November 1965.

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### *Sub-Commission IVa.*

- Observations of whistlers and VLF emissions at Godhavn and Narsarsuaq, Greenland, and at Tromso, Norway, in 1963 — Technical final report issued by the Ionosphere Laboratory, the Technical University of Denmark, Lingby.

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*Radio Science* — Vol. 69D, n° 11, November 1963, has been issued. It contains the following papers :

- Propagation of pulses in dispersive media, James R. WART.
- An anisotropic electron velocity distribution for the cyclotron absorption of whistlers and VLF emissions, H. GUTHART.
- Nose whistler dispersion as a measure of magnetosphere electron temperature, H. GUTHART.
- Interference rejection capability of a switched radiometer, Roger E. CLAPP.

- Atmospheric breakdown limitations to optical maser propagation, Richard G. TOMLINSON.
- Phase steps and amplitude fading of VLF signals at dawn and dusk, D. WALKER.
- Propagation in a model terrestrial waveguide of nonuniform height : theory and experiment, E. BAHAR and James R. WAIT.
- Comments on H. Volland's « Remarks on Austin's Formula », James R. WAIT.
- The path integrals of LF/VLF wave hop theory, Leslie A. BERRY and Mary E. CHRISMAN.
- Reactive loading of arbitrarily illuminated cylinders to minimize microwave backscatter, Kun-Mu Chen.
- On the statistical theory of electromagnetic waves in a fluctuating medium (II). Mathematical basis of the analogies to quantum field theory (a digest), K. FURUTSU.

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*Telecommunication Pioneers* — Radio Engineering Laboratories, Inc., Long Island City 1, New York.

The I.U.T. began in 1935 to publish a series of etchings of a group of distinguished men who became outstanding in the field of electronics and electrical communications over a period of two centuries. This series inspired the Radio Engineering Laboratories, on their fortieth anniversary, to print in 1962 *The REL Communicator*, a historical feature series based on the ITU portraits. In 1963 this series was collected and published in book under the title of « *Telecommunication Pioneers* ».

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The European Broadcasting Union (E.B.U.) has issued a book « *There is the E.B.U.* » which gives the aims and organization, the activities and some information on the publications of the E.B.U. (See abstracts p. 13).

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*Union Internationale des Télécommunications.*

Nomenclature des stations fixes qui assurent des liaisons internationales, 3<sup>e</sup> édition, 1965, trilingue : français, anglais, espagnol. Prix : Fr s. : 25.

*International Telecommunication Union.*

List of fixed stations operating international circuits, 3rd edition 1965, three-language edition : French, English and Spanish. Price : Swiss Frs : 25.

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