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International Scientific Radio Union

U. R. S. I.

CONTENTS

IN MEMORIAM

Prof. Matz Jenssen

It is our sad duty to inform our readers of the death of Professor Matz Jenssen, Member of the Norwegian National Committee and Official Member of U.R.S.I. Commission VI.

U. R. S. I. NEWS

It is with a great pleasure that we have been informed that Dr. I. Koga, Vice-President of U.R.S.I. and President of the Japanese National Committee, has been appointed as Dean of the Faculty of Engineering, University of Tokyo. We want him to accept our warmest congratulations.

INFORMATIVE PAPER

International Radio Consultative Committee (C. C. I. R.)

Prior to the First World War the frequency spectrum then usable for radiocommunications was relatively unoccupied, so that international agreement was only required for the use of specific frequencies, mainly connected with safety of maritime navigation, although a time signal and standard frequency service was operating in a number of countries.

However, it may be said that the problem of finding suitable undisturbed frequencies for general communication problems was not yet acute. But the growth of radiocommunications which took place due to military requirements during the First World War caused a different situation to prevail after that conflict.

In fact, in the early 1920s, it had become evident that the frequencies considered usable by radiocommunications at that time would have to be more carefully allocated if utter confusion, caused by overcrowding of the spectrum, were not to occur. In consequence, it became necessary to study on an international basis, the allocation of frequency bands to the various services and hence, in turn, the study of the physical properties of radio equipment, as well as of propagation media, also became urgently required internationally, in order that experience and research in the various countries could be put to the most efficient use.

As a consequence of this necessity, several international conferences to consider the technical aspects of radio were held, with a limited participation. It soon became clear that, in order to achieve the most satisfactory collaboration between countries, it would be necessary for these studies to be pursued by one body on a universal basis. It was thus that, amongst the proposals presented to the Radio Conference held in Washington in 1927, there was one suggesting the organisation of an International

Committee for the study of technical radio problems, this in analogy with similar committees which were founded shortly before for telegraphy and telephony.

The substance of this proposal was adopted by the governments meeting in Washington, representing practically all governments which had, or were likely to have, radio services. Hence, when the Washington Convention came into force on 1st January 1928, the *C.C.I.R.* was constituted as essentially a *governmental body*, although, because radiocommunications were in some countries in the hands of private companies, such companies were also authorized to participate in its work.

From 1928, up to the beginning of the Second World War, the C.C.I.R. operated through the services of the various Member Governments. Thus, whilst it held plenary assemblies which were organized by the old « Bureau International Télégraphique » in Berne, between plenary assemblies the replies to the questions on its programme were collected by the governments which had agreed to act as centralizing agencies for these questions.

This arrangement proved satisfactory up to and including the Fourth Plenary Assembly held in Bucharest in 1937. However, at the Atlantic City Plenipotentiary and Radio Conferences held in 1947, the structure of the International Telecommunication Union and, in particular, of the International Radio Consultative Committee, as one of the permanent organs of this Union, underwent considerable modification, in view of the further great extension of telecommunication services in general, and radio services in particular, during the Second World War.

For instance, at Atlantic City the International Frequency Registration Board (I.F.R.B.) was created, which concerns itself with the allocation of frequencies with a view to avoiding interference between services operating in different countries.

The C.C.I.R., too, was made into a more permanent body and a Specialized Secretariat, headed by a Director, and a Vice Director specialized in broadcasting, was established, which Secretariat took over the tasks previously assigned to the centralizing governments.

This Secretariat, with Headquarters at Geneva, is now entrusted with the centralization and distribution of documentation on the work of the C.C.I.R., and also with the organisation and coordination of the work connected with its meetings.

In addition, the participation in the work of the C.C.I.R. was somewhat extended by the admission of manufacturers of radiocommunication equipment to participate in the work of the C.C.I.R. Study Groups, while, recognizing the ever-increasing importance of international collaboration in other fields which are also interested in radiocommunications, international organisations — and particularly the United Nations and its specialized agencies — were also admitted to participate in the work of the C.C.I.R. in the quality of observers.

The subjects for study, decided upon by the Plenary Assembly, were no longer the responsibility of certain governments, but were assigned to one of the — originally 13, now 14 — Study Groups, set up under international Chairmen and Vice-Chairmen to consider specific aspects of radiocommunication problems. The findings of the Study Groups are then communicated to the Plenary Assembly, which is empowered to make recommendations and issue reports on these matters for the information of all concerned with radiocommunications. Moreover, the findings of the Plenary Assembly are also to a great extent responsible for the technical bases on which the Radio Regulations are founded. (In the Radio Regulations the rules are laid down for international radio communications in its different forms).

From the above it will be seen that the C.C.I.R. is essentially a governmental body, although, under certain conditions, other interested bodies are admitted to participate in its work, while, of course, numerous representatives of scientific, technical and industrial interests are included in the delegations of the various governments at C.C.I.R. meetings.

It will also be clear that the C.C.I.R. occupies an intermediate position between the abstract scientific studies, such as those pursued by the U.R.S.I., and the practical application of radio in its widest sense, which may be considered to be the primary occupation of radiocommunication agencies and manufacturers.

The C.C.I.R. is, by the nature of its work, highly interested in U.R.S.I. activities and existing relations between the two organisations, through official and personal channels, are therefore most useful to the C.C.I.R.

In fact, it may be said that the C.C.I.R. is a forum where international theoretical and practical interests meet, its basic purpose being to develop radiocommunications throughout the world, including outer space.

XIIth GENERAL ASSEMBLY

In « *L'Onde Electrique* » (July 1958, n° 376) an important series of articles from French Delegates to the XIIth General Assembly of U.R.S.I. have been published.

The XIIth General Assembly : B. DECAUX.

Radio Measurements and Standards : P. ABADIE.

Tropospheric Radio-Propagation : F. DU CASTEL, P. MISME, J. VOGE.

Ionosphere : D. LÉPÉCHINSKY.

Radio Noise of Terrestrial Origin : R. RIVAULT.

Atmospheric Radio-Noise : G. FOLDÈS.

Radio-Astronomy : M. LAFFINEUR.

Radio Waves and Circuits : J. LOCHARD.

Radio Electronics : A. BLANC-LAPIERRE.

DISTRIBUTION OF PUBLICATION AND NEW SCALE OF SUBSCRIPTION

The following letter has been sent to all National Committees :

January, 5th 1959.

Dear Mr. Chairman,

I want to recall that consequently to the decision of the Board of Officers of U.R.S.I. (see *Information Bulletin*, n° 111 and my letter n° 992 of July 31st, 1958) the free distribution of the *Information Bulletin* and of U.R.S.I. administrative publications will be made from January 1st, 1959, onward according to the following scale :

Category	Number of free copies
1	1
2	10
3	20
4	40
5	80
6	160

I want to inform you that several National Committees have given their formal agreement on the category in which they decided to adhere to U.R.S.I. They are as follows :

Country	Category	Country	Category
Australia	3	Morocco	1
Austria	2	Netherlands	3
Canada	4	Norway	1
Czechoslovakia	2	Poland	3
Denmark	1	Spain	2
Finland	1	Sweden	2
Germany	5	Union of South Africa	2
Greece	2	U.S.S.R.	6
India	2	United Kingdom	6
Italy	4	United States of America	6
Japan	5	Yugoslavia	3

I would be most thankful to those National Committees who have not yet informed me of the category to which they have decided to adhere, to send me such information as soon as possible.

On the other hand, some Committees receive more copies of the *Information Bulletin* that those to which they are entitled according to the new rules (Australia, Austria, Finland, Italy, Morocco, Norway, Poland, Sweden). I beg these Committees to let me know whether they wish to receive the same number of copies as before and in this case whether they agree to subscribe at the price fixed for National Committees, i.e. B. F. 187,50 or $ 3.75.

Committees for which the Bulletin is sent directly by my office are kindly requested to inform me of the modifications they wish to bring to the lists previously used (Austria, Belgium, Denmark, Finland, Germany, Greece, Morocco, Norway, New Zealand, Spain).

It is obvious that National Committees receiving a number of free copies not reaching the number they are entitled to, may if they wish increase the number of copies (Canada, Japan, Spain, United Kingdom, U. S. A., U. S. S. R.).

In thanking you for the consideration you will give to this letter,

I remain,
Sincerely yours,
HERBAYS,
Secretary General.

Switzerland

The Swiss National Committee has informed the U.R.S.I. General Secretariat of its decision to adhere to category 2.

NATIONAL COMMITEES

Czechoslovakia

SYMPOSIUM ON THE PROPAGATION OF ULTRA-SHORT WAVES

The Czechoslovak National Committee of U.R.S.I., in conjunction with the Institute of Radio Engineering and Electronics of the Czechoslovak Academy of Sciences, organized a symposium on the Propagation of Ultra-short Waves, which was held in Liblice Castle near Melnik during November 10th-12th, 1958. The items treated were :

1. Beyond the horizon tropospheric propagation,
2. Propagation in radar and direction finding,
3. Ionospheric propagation of ultra-short waves,
4. Apparatus used in propagation research.

The symposium was attended by about 80 Czechoslovak scientists ; 13 guests from 5 other countries were also present. The following papers were given and discussed at the symposium (Czechoslovak speakers, unless otherwise indicated) :

Dr. U. Kühn (G.D.R.) : Propagation in the 1200 Mc band.

Dr. R. Schünemann (G.D.R.) : Signal-amplitude and fading distribution at 10 cm wavelength as a function of antenna-pattern azimuth.

A. I. Kalinin (U. S. S. R.) : A theory of coherent scattering in the troposphere.

I. A. Gusyatinsky (U. S. S. R.) : Signal distortion in tropospheric propagation beyond the horizon.

Ing. P. Beckmann : Propagation beyond the horizon by reflection from rough layers.

Prof. G. A. Zeytlenok (speaker), Prof. M. P. Dolukhanov, Dr. K. C. Muravyev, Dr. V. V. Plashkov, Dr. I. N. Fomichev, Dr. A. Z. Fradin (U. S. S. R.) : Research work of the Leningrad Electrical Communications Institute in tropospheric propagation beyond the horizon on the experimental path Leningrad-Petrozavodsk.

Ing. A. Weber : Some problems of centimetre-wave propagation met in radar engineering.

Prof. Ing. Dr. B. Kvasil : On the possibility of detecting radioactive aerosols by radar.

Ing. P. Beckmann : The height-error in radar measurements due to propagation.

B. Chytil : On the depolarisation of back-scattered electromagnetic waves.

Ing. J. Pokorny : A graphical method for computing Fresnel coefficients.

Prof. Ing. Dr. G. Megla (G.D.R.) : On the applicability of passive direction-changing mirrors in radio engineering.

Ing. V. Blaha : The polarisation of VHF direction finders and errors caused by their environment.

Dr. E. Chvojkova : Propagation of signals from artificial earth-satellites from the antipodes.

Ing. L. Triskova : Reflection of frequencies exceeding the MUF from the space ionised by artificial earth-satellites.

Ing. M. Skop : Propagation via the *Es* layer in television band I.

J. Hajkova, J. Mrazek : On the correlation between the nocturnal *Es* layer and geomagnetic activity.

Ing. Dr. J. Grosskopf (G.F.R.) : Equipment for the evaluation of statistical processes in the propagation of electromagnetic waves.

Ing. J. Hrycey : An instrument for the evaluation of the signal amplitude distribution.

Ing. J. Karpinsky : Equipment for continuous recording of VHF field strength.

The symposium proved very successful. Representatives of three Eastern and three Western countries participated in both

the professional and social programmes of the symposium, which thus also helped to promote friendship among the scientists of different countries.

France

MEMBERSHIP OF THE BOARD

The French National Committee on Scientific Radio, at its General Assembly, elected the following personalities to the Board which will hold office until December 1961 :

President : General A. ANGOT.

Vice-Presidents : Mrs. P. BESSON,
R. RIVAULT,
E. VASSY.

Secretary General : Mr. J. VOGE.

Treasurer : Mr. P. ABADIE.

Mr. DECAUX, Past President, was elected as Honorary President of the Committee.

India

REPORT OF THE NATIONAL COMMITTEE

PREFACE

This is the official report of the Indian National Committee of the U.R.S.I. on work done in India during 1955-57 in the various Commissions of the U.R.S.I. The reports have been prepared by the following scientists :

Commission I : Mr. C. S. RANGAN, National Physical Laboratory, of India, New Delhi 12.

Commission III : Professor S. K. MITRA (Official member for Commission III) University of Calcutta, Calcutta.

Commission IV : Professor S. V. Chandrasekhar Aiya (Official member for Commission IV), Principal, L. C. College, Ahmedabad 9.

Commission V : Dr. A. P. Mitra (Official member for Commission V), National Physical Laboratory of India, New Delhi 12.

Commission VI : Mr. B. V. Baliga (Official member for Commission VI), Broadcasting House, All India Radio, New Delhi.

Commission VII : Dr. K. S. Krishnan (Official member for Commission VII) Director, National Physical Laboratory of India, New Delhi, 12, and Dr. Amarjit Singh, National Physical Laboratory of India, New Delhi 12.

No report is given on Commission II since, for this field, no new results have been achieved. However, there have been some analysis on the cases of anomalous propagation of microwaves observed during the Second World War, and more recently line-of-sight propagation experiments are being carried out by the National Physical Laboratory at 2000 Mc/s from Mussorie to Roorkee (a distance of about 80 km).

A. P. Mitra,

Secretary, Indian National Committee for the U.R.S.I.

Commission I. — Radio measurements and standards

Prepared by Mr. C. S. Rangan

1. — Time and Frequency Standards

The establishment of a Standard Frequency and Time Transmission Centre at New Delhi was taken up by the National Physical Laboratory of India early in 1956. A primary standard quartz crystal clock was put into operation in June 1956. The associated equipments such as frequency dividers, frequency multipliers, seconds pulse generator, comparators, etc. were constructed. The regular check up of the accuracy of the present standard is being carried out with the signals received from other standard frequency transmission centres. The receptions of J.J.Y. at 15 Mc/s and W.W.V.H. at 10 Mc/s are good, particularly towards

the evening. W.W.V. is rather weak for taking any precise measurements. An electronic counter chronograph and a chronoscope having a resolution of 1/10 millisecond, are being used for the time comparison. The complete set up for the establishment of a standard frequency transmission centre is being completed presently. It is presumed that the experimental transmission would begin early next year.

The equipments for the calibration of radio frequency signals from 0 to 500 Mc/s have been constructed and put into operation in the above section. The construction of a calibration system up to 40 000 Mc/s using marker pips, will be completed shortly.

2. — The Measurements of the Properties of Matter in the Microwave Region

The measurement of the electrical properties of indigenous materials like steatite, wax, shellac, ivory, etc. at 3 cm have been carried out in the National Physical Laboratory of India. The standing wave technique (1) has been utilised for the measurement of K and tan δ of solid samples, because of their medium and high-loss range. For some of the low-loss materials, the cavity technique was adopted using a E_{01} cylindrical cavity at 10 cm (2) and a H_{01} cylindrical cavity at 3 cm (3). Some of the white and green marble found in the Rajasthan show low attenuation and their use as supports in co-axial lines and microwave strips are suggested. The effect of temperature on the dielectric loss of different grades of shellac of high purity was also investigated (4).

A free space method (5) to measure the absorption coefficient of polar liquids such as water, ethyl alcohol etc. was conducted in the 1 cm region. The measurement of K and tan δ of some solid materials in the 8 mm region are also being studied.

The absorption coefficients of several gases such as NH_3, C_2H_5Cl, CH_3Cl, $C_2H_5NH_2$, etc. at different temperatures in the 3 cm region were measured by Mr. Krishnaji and his associates at the University of Allahabad (6, 7). The temperature and pressure variation of the electric susceptibility was also measured for the CH_3 group liquids (8).

The dielectric properties of thermoplastic resins of indigenous origin was investigated by Dr. P. N. Sharma and his associates at Lucknow University. The dipole moment and relaxation time

of liquids such as phenol, chlorophenol, dinitrofluorobenzene, etc. in the 3 cm region using the wave guide as well as the cavity resonator techniques has been determined by Professor Rangadhama Rao (9, 10, 11).

The pulse characteristics of a large number of low power vacuum tubes was investigated (12) by Nath and Banerjee at the Institute of Nuclear Physics, Calcutta. An extensive study on the tolerance limits of resistors in binary scaling units was made by Chowdhury and Banerjee (13).

Investigations on the design and development of electronic wattmeters, suitable for low and high frequency power measurements, were carried out (14, 15) by S. S. Banerjee at the Banaras Hindu University. A sensitive microammeter connected between the plates of two triodes operating in pushpull over the square law region of their characteristics, has been used as the indicator of power consumed, in the load circuit. The instrument was calibrated with a standard electrodynamometer type of watt meter at power frequencies.

3. — Miscellaneous

The following two equipments have been designed and constructed at the Institute of Radiophysics and Electronics, Calcutta.

a) A new type of capacitance meter wherein the capacitances and power factors of small condensers can be measured directly on two calibrated meters (12).

b) A wide band oscillator wherein the signal frequency can be varied from 10 to 450 Mc/s by the turning of a single control, the tuning element being a conical helixtype inductance (13).

REFERENCES

1. Puri, D. D. *et al.* — Microwave Dielectric Measurements Part III. *J. Sci. Industr. Res.*, 1956, **15** B, nº 4, 161.
2. Srivastava, S. S., Rangan, C. S. — Microwave Dielectric Measurements 2700 to 3300 Mc/s, 1954. *J. Sci. Industr. Res.*, **13** B, 225.
3. Rangan, C. S. *et al.* — Microwave Dielectric Measurements, Part II, 8700-9700 Mc/s. *J. Sci. Industr. Res.*, 1955, **14** B, 315.
4. Puri, D. D. — Temperature dependence of Dielectric Loss of Shellac in Microwave Region. *J. N. I. S.*, Jan. 1957.

5. Puri, D. D. — Absorption coefficient of liquids in the 1 cm region. *J. Sci. Industr. Res.*, 1955, **14** B, 413.

6. Note on Microwave Spectrum of Methyl Bromide, Prem Swarup. *Zeit für Physik*, 1956, 154.

7. Srivastava, G. P. — Dielectric behaviour of mixture of polar gases at microwave frequencies. *Current Science*, 1956, **25**, 111.

8. Srivastava, G. P., Varshini, Y. P. — Variation of Dielectric Constant with Temperature. *Physica*, 1956, **22**, 584.

9. On the determination of the dipole moment and relaxation time at 3 cm. *Current Science*, 1956, **25**, 49.

10. Dielectric Properties of 2, 4, Dinitrofluorobenzene. *Indian Journal of Physics*, 1956, **30**, 91.

11. Dielectric Behaviour of Ethyl Acetate at U.H.F. *Current Science*, 1956, **25**, 49.

12. Nath, S. C., Banerjee B. M. — A Search for a Pulser of High Output requiring Small Grid Drive. *J. Sci. Industr. Res.*, 1955, **15** A, 444.

13. Tolerance Limits of Resistors in Higinbotham Type Binary Scaling Units. *Technical Report nº* 4, *Inst. of Nuclear Physics*, Calcutta, Oct. 1955.

14. Banerjee, S. S., Ravindranath, B. — Use of Balancing Resistances and Cathode Voltages in the Design of Electronic Wattmeters. *J. Sci. Industr. Res.*, 1955, **14** B, 355.

15. Sarkar, H. — Variation of range and Sensitivity of Electronic Wattmeter. Communicated for publication to *J. Sci. Industr. Res.*

16. Bhattacharya, J. C. — An Instrument for Direct Measurements of Capacitance and Power Factor. *Ind. J. Physics*, 1954, **28**, 75.

17. Chatterjee, J. S. — A wide band Oscillator using a Conical Helix Tuning Indicator. *Proc. I.E.E.*, 1954, **101**, Pt. III, 165.

Commission III. — Ionospheric radio

Prepared by Professor S. K. Mitra

The report summarises Indian work carried out during 1954-56. The main topics of research in the field of Ionospheric Radio are listed below. This is followed by a brief outline of research under each of these headings.

Much of the research is concentrated at the University of Calcutta, at the Radio Propagation Unit of the C.S.I.R., New Delhi, at the Research Department, All India Radio, New Delhi and at the Physical Research Laboratory, Ahmedabad.

Subjects of Research :

1. Ionospheric Sounding and Data Coordination Work.
2. Ionospheric Predictions.
3. Ionospheric Absorption Measurements.
4. Physics of the Ionosphere.
5. The Ionosphere in Relation to Geophysical Phenomena.
6. Winds and Tides in the Ionosphere.
7. Other Works : e. g. Scatter Observations, Self-Gyro-interaction, Triple-splitting, Polarisation.

1. — Ionospheric Sounding and Data Coordination Work

Regular ionospheric observations are, at present, being made in India at seven stations (1). These are : Delhi, Bombay, Madras, Tiruchirapalli (All India Radio), Haringhata (Calcutta, Institute of Radiophysics and Electronics, University of Calcutta), Ahmedabad (Physical Research Laboratory) and Kodaikanal (India Meteorological Department). At Haringhata, Ahmedabad and Kodaikanal automatic sweep frequency recorders are in operation. The rest employ manual recorders. Data coordination work is done at the Radio Propagation Unit, New Delhi, and detailed data are published in the form of monthly bulletins (RRC-A Series).

2. — Ionospheric Prediction

Ionospheric predictions for the East Zone, prepared six months in advance, are issued every month (RRC-B Series) by the Radio Propagation Unit at Delhi. The prediction procedure used is in some respects similar to that used in the C.R.P.L., U. S. A. For the prediction of sunspot numbers the procedure adopted, is, however, different from the current procedures elsewhere. This procedure is empirical in nature and is based on the behaviour of the past 18 solar cycles.

At Calcutta the methods of prediction of ionospheric characteristics and the probable sources of error have been critically

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(1) The eighth station at Trivandrum (magnetic dip = 0°) has recently been initiated.

examined (Baral, 1956). The systematic errors that are found to occur in the predicted values of *fo* and M for the various ionospheric layers are found to be due to (i) error in forecasting the sunspot numbers, (ii) error in the assumed laws of diurnal, seasonal and solar cycle variations of the characteristics and (iii) errors due to the imperfect knowledge of the geographical variations of the characteristics. As determination of exact laws of variation, taking all the factors into account has not yet been possible, it is concluded that the method of extrapolation of the trends is preferable to that of computation with the approximate laws. The law of geomagnetic control on which the F2 layer predictions are based is found to be different for different hours of the day. Hence it is suggested that predictions should be made in G. M. T. rather than LMT.

3. — Ionospheric Absorption Measurements

(*a*) *Pulse method.* — Four stations will be in operation during the Geophysical Year. Work has already been started at Delhi (All India Radio) where mid-day absorption at 5 Mc/s is recorded daily. The other stations will be Haringhata (Calcutta), Waltair (Andhra University) and Ahmedabad.

(*b*) *Oblique incidence method.* — Field strength measurements over a complete solar cycle have been made at Delhi of transmissions from Madras, Bombay and Calcutta Short wave transmitters of All India Radio (S. N. Mitra and Srivastava, 1955, *a*, *b*). The measure values of sky wave field intensities do not agree with those calculated by C.R.P.L. and the S.P.I.M. methods.

(*c*) *Cosmic noise method.* — Three stations will be in operation during the I.G.Y. namely : Delhi (Radio Propagation Unit, Ahmedabad and Madras (Madras Institute of Technology).

4. — Physics of the Ionosphere

(*a*) *Methods of determination of height distribution of ionization from P'-f records.* — The various methods, that have been developed in recent years for the determination of true height distribution of ionization from P'-*f* records have been examined and applied to P'-*f* records obtained at Haringhata (A. K. Saha, 1956).

It is concluded that for routine work Ratcliffe's method is quickest, though, under some restricted conditions, Kelso's method gives more accurate results. Methods taking into account earth's magnetic field lead to corrections which are of the same order as the limits of observational error. The complications involved in such computations for magnetic latitude of Calcutta are therefore not warranted.

(*b*) *Rate of electron production* (q) *and recombination coefficient* (α). — The anomalous negative and zero values of q and α that are sometimes obtained when they are computed from the diurnal variation of maximum electron density (Nm) are found to disappear when computed from the diurnal variation of total electron content (n) below the level of maximum ionization (Datta, 1957). The values of n have been obtained for a number of quiet days from P′-f records obtained at Haringhata (Calcutta) by the method of Ratcliffe.

It is observed that the anomaly of the midday dips in the diurnal variations of q and α persists even with the above computations, though less markedly. This may be ascribed either to vertical ion drifts (Skinner and Wright) or to the diurnal temperature variations (Lepechinsky).

Assuming that the recombination coefficient falls off at an exponential rate, a method has been suggested for determining the value of α at the maximum ionisation density height from the recombination rate in the unit column below the maximum ionization.

(*c*) *Intermediate layers between E and F*1 *layers.* — At Haringhata (Calcutta) E2 layer reflections are regularly observed in the afternoon records. The E2 layer trace first appears as a « ridge » in the F1 layer trace and then moves downwards to the normal E layer height, ultimately forming sporadic ionization at this height (Saha and Roy, 1955, *a*, *b*). Similar phenomena are also observed at Ahmedabad (Rastogi, 1954, 1956). E2 layer is also regularly observed at Ahmedabad during the early morning hours. At Calcutta, however, early morning records show E2 layer trace only during the equinox months. At Ahmedabad another layer (distinct from the E2 layer) at about 125 km is also sometimes observed.

(*d*) *Abnormal night time records.* — Abnormal night time records include spread F echoes and parallel F layer traces (distinct from multiple echoes). Strong correlation of the spread F echoes with magnetic activity has been observed at Haringhata and at Kodaikanal. No such correlation could be found in the case of F layer double traces at Calcutta.

(*e*) *Sunrise effect.* — At Calcutta, attempt has been made to explain the sunrise effect delay from the observation of the time of « sunrise effect » (increase in ionization following sunrise) (Baral, 1955). It has been found that the tilt of ionospheric region on the two sides of the « sunrise line » determines the amount of the delay.

(*f*) *D and E layer models.* — Work on this topic has been carried out at Delhi (R. P. U.) (A. P. Mitra, 1955). A new method has been developed by which the relative amounts of D and E region absorption in any medium and short wave observation may be determined purely on physical basis. The method utilises the concept of relaxation time in ionospheric levels and rests on the fact that the relaxation time at the D-region levels is appreciably different from that at the E-region level.

The D-layer model by A. P. Mitra and the E-layer model by R. E. Jones have been revised on the basis of current experimental data at low, medium and high frequencies. For the D-region the maximum electron density for overhead sun for medium latitudes appears to be around $2 \times 10^3/cm^3$.

(*g*) *Oxygen Dissociation.* — A new method has been developed at Delhi (R. P. U.) for the study of oxygen dissociation from experimental determinations of the effective-recombination coefficients at night *as a function of height* (A. P. Mitra, 1956). From the latter, values of λ, negative ion to electron ratio is derived. The magnitude of λ at any height will be controlled by the rate coefficient of these various reactions but will also depend on the concentrations of O and O_2 at these heights. Values of x, the fraction of the dissociation, from 80 to 110 km have been deduced in this way.

(*h*) *Collisional frequency measurements.* — The effective collisional frequency in the F region over Calcutta has been computed from measurements of reflection coefficient of the region and has been

found to be of the order of 4×10^3 per sec per electron (Datta, 1955). An attempt has been made to find out how the collisional frequency varies with height.

5. — The Ionosphere in relation to other Geophysical Phenomena

(*a*) *Solar ionospheric relationships.* — The variations of the E and F1 layers in different seasons and phases of the sunspot cycle were studied at Ahmedabad. The F1 layer at low latitudes seems to share the abnormal behaviour of the F2 layer.

An experimentally linear relationship between the sunspot number and *fo*F2 has been suggested for the ionospheric stations run by the All India Radio (Roy, 1956).

At Delhi (R. P. U.) efforts have been made to study the noon bite-out at equatorial latitudes and on the determination of S_D and D_{sl} variations for stations in India (Sharma and A. P. Mitra, 1956). Pronounced asymmetry in the bite-out has been observed and certain relationships have been established between the magnitude of asymmetry and the sunspot number and geomagnetic coordinates of the station concerned.

(*b*) *Eclipse observations.* — Observations during the solar eclipses of 30th June 1954, 20th June 1955 and 14th December 1955 have been taken at several stations in India (Saha et al, 1955 ; Rastogi and Sheriff, 1955 ; Rastogi, Sheriff and Nanda, 1956 ; Bhargava, 1955 ; Banerjee, Surange and Sharma, 1955). Observations include vertical incidence sounding, field strength measurements of broadcast transmissions and absorption measurements. Pronounced optical effects have been reported from most places while some claim to have established the presence of corpuscular effect on the F2 region.

(*c*) *Thunderstorms and sporadic E.* — Following the report by S. K. Mitra, at the 1954 meeting of the Mixed Commission on the Ionosphere, on the increase of E_s ionisation during the onset of nor'westers, observations at Calcutta have been continued. Similar effects have been reported also from Ahmedabad (Rastogi, 1957).

6. — Winds and Tides in the Ionosphere

Ionospheric drift measurements are being made at Ahmedabad and Waltair (Andhra University). Two more stations are planned

for the I.G.Y., namely Haringhata (Calcutta) and Delhi (A.I.R.). Spaced aerial technique will be used in all the stations.

A four spaced-receiver method of measuring movements in the ionosphere is being developed at Waltair (Rao, 1957). This technique is superior in some respects to the usual three spaced-receiver method.

Attempts have also been made at Banaras (Hindu University) (Subhadramma, 1955-56), at Delhi (A.I.R.) and at Waltair to measure the velocity of ion clouds from observations on random fading of oblique incidence continuous wave radio signals.

Studies have been made at Ahmedabad of the lunar tide in the F2 layer critical frequencies and heights (Katodia and Ramanathan, 1956). A reversal in the phase of the lunar tide variations is observed between the latitudes of Bombay and Madras.

Some studies on the solar tides have also been carried out at Delhi (A.I.R.) and at Kodaikanal (Thiruvengadathan, 1956).

The « 150 km echoes » observed at Pennsylvania at 150 kc/s had been attributed to effects of vertical drifts (Peiffer and Mitra). This work has been extended by N. M. Rao and A. P. Mitra at Delhi (R. P. U.), by including nocturnal ionization values which had been neglected in the earlier work.

7. — Other Works

(*a*) *Scatter Observations.* — Scatter observations are made at Banaras on the following lines :

(i) Diurnal and seasonal variations of the intensity of back-scattered signals.

(ii) Angle of arrival of the downcoming scattered signals.

(iii) Frequency limit of the scattered signals in the presence of sporadic E.

(*b*) *Self-gyrointeraction.* — An experimental study has been carried out on selfgyrodemodulation (Mitra, S. N., 1955) in the ionosphere utilising the net-work of medium wave transmitters of All India Radio. The gyrofrequency has been determined from the maximum demodulation that occurred in propagation through the ionosphere. This works out to be 1.02 Mc/s. It has also enabled the evaluation of earth's magnetic field at ionospheric heights which comes out to be 0.36 oersted at E layer.

Further experimental work was conducted on the variation of self-gyrodemodulation with different depths of impressed modulation and with different modulating frequencies.

(*c*) *Triple-splitting.* — Some records of magneto-ionic triple splitting obtained at Delhi (A.I.R.) have been analysed (Mitra, S. N. 1955). It has been suggested that the occurrence of triple splitting at low geomagnetic latitude may be due to the longitudinal propagation of the ordinary ray.

(*d*) *Polarisation.* — Some experimental studies on the polarization characteristics of the echoes from the ionospheric layers have been made at Calcutta using an improved type of radio polarimeter worked in conjunction with a high resolution radiosonde (Verma and Roy, 1956). The high resolving limit of the equipment has made it possible to record the true polarization patters of the echoes due to normal reflection and those due to irregularities in the ionized regions. A method had been indicated for the identification of the thin layer type of E*s* echoes from other types on the basis of their polarization characteristics.

Some work has also been done at Banaras on the polarization of downcoming waves from some medium and short wave broadcast stations.

REFERENCES

1. Banerjee, D. K., Surange, P. G., Sharma, S. K. — Ionospheric observations at Banaras during the total solar eclipse on June 20, 1955. *J. Sci. Industr. Res.*, **14** A.
2. Banerjee, S. S., Surange, P. G. — *Science and Culture*, 21, 750 (1956).
3. Baral, S. S. — Studies on the « Sunrise Effect » in regions E and F of the Ionosphere. *J. Atmos. Terr. Phys.*, **6**, 160 (1955).
4. Baral, S. S. — Studies on Ionospheric Predictions. *Ind. Jour. Phys.*, **30**, 189 (1956).
5. Bhargava, B. N. — Ionospheric F2-layer behaviour during the total solar eclipse of June 20, 1955. *Kodaikanal Observatory Bulletin*, n° 144.
6. Bhargava, B. N. — Effect of Solar Eclipse of June 20, 1955 on the lower ionospheric layers. *Kodaikanal Observatory Bulletin*, n° 144.
7. Thiruvengadathan, A. — Solar tides in the F2 region over Kodaikanal. *Ind. Jour. Meteor. Geophys.*, Vol. 7, 205 (1956).
8. Datta, S. — Electronic collisional frequency in the F region over Calcutta. *Ind. Jour. Phys.*, **29**, 279 (1955).

9. DATTA, S. — Recombination coefficient and electron production rate from total electron content in unit column below the level of maximum ionization. *Ind. Jour. Phys.*, **31**, 43 (1957).

10. KATODIA, K. M. — Sporadic echoes from the E region over Ahmedabad, *Jour. Atmos. Terr. Phys.*, **8**, 331 (1956).

11. KATODIA, K. M., RAMANATHAN, K. R. — Variation with lunar phase of midday critical frequencies and heights of the F2 layer over Ahmedabad and other low latitude stations. *Proc. Ind. Acad. Sci.*, **43**, 394 (1956).

12. MITRA, A. P. — A method of determining the relative amounts of D and E region absorptions of medium and short radio waves. *Ind. J. Physics*, **30**, 518 (1955).

13. MITRA, A. P. — Progress Report of the Radio Research Committee of India, March-Aug. 1955, 89-92.

14. MITRA, A. P. — *Ibid.*, Sept. 1955-Feb. 1956, 64-75.

15. MITRA, S. N., SRIVASTAVA, R. B. L. — Analysis of Skywave field intensity, Part I. *Ind. J. Phys.*, **29**, 167 (1955).

16. MITRA, S. N., SRIVASTAVA, R. B. L. — Analysis of Skywave field intensity, Part II. *Ind. J. Phys.*, **29**, 227 (1955).

17. MITRA, S. N. — Magneto-ionic triple splitting over Delhi. *Jour. Inst. Telecom. Eng.*, **1**, 124 (1955).

18. MITRA, S. N. — Self-Gyrodemodulation, The Physical Society Symposium on the Ionosphere, 1955, 71-73.

19. MURTY, T. V. S. — Design and development of a simple ionospheric equipment. *Jour. Sci. Industr. Res.*, **15** A, 70 (1956).

20. RAMANATHAN, K. R., KATODIA, K. M. — The ionospheric F2 layer over India in Minimum Sunspot Year 1953. *Ind. Jour. Meteor. Geophys.*, **5**, 117 (1954).

21. RAMANATHAN, K. R., BHOUSLE, R. V., KATODIA, K. M., RASTOGI, R. G. — The great solar flare of February 23, 1956 and associated ionospheric effects at Ahmedabad. *Proc. Ind. Acad. Sci.*, 43, 306 (1956).

22. RAO, N. M., MITRA, A. P. — Progress Report of the Radio Research Committee of India, Sept. 1955-Feb. 1956, 92-96.

23. RASTOGI, R. G. — Intermediate layers of ionization between the E and F1 layers of the ionosphere over Ahmedabad. *Proc. Ind. Acad. Sci.*, **40**, 158 (1954).

24. RASTOGI, R. G. — The occurrence of high multiple reflections from the F2 region of the ionosphere based on a study of the Ahmedabad records. *Proc. Ind. Acad. Sci.*, **41**, 253 (1955).

25. RASTOGI, R. G., SHERIFF, R. M. — A note on radio field strength observations made at Ahmedabad during the total solar eclipse on 30th June 1954. *Jour. Sci. Ind. Res.*, **14** A, 159 (1955).

26. Rastogi, R. G., Sheriff, R. M., Nanda, N. G. — Some measurements of the signal strength of radio waves reflected from the ionosphere during the solar eclipse of June 30, 1954 and June 20, 1955, Solar eclipses and the Ionosphere (London) (1956), pp. 137 (1956).

27. Rastogi, R. G., Sethuraman, R. — Field strength measurements of radio wave during the partial solar eclipse of 14th December 1955 at Ahmedabad. *Jour. Sci. Ind. Res.*, **15** A, 303 (1956).

28. Rastogi, R. G. — Two types of the development of the E2 layer at Ahmedabad. *J. Atmos. Terr. Phys.*, **9**, 71 (1956).

29. Rastogi, R. G. — Thunderstorms and sporadic E layer ionisation. *Ind. J. Meteor. and Geophysics*, **80**, nº 1, (1957).

30. Roy, J. M. — Correlation between noon *fo*F2 and sunspot numbers. *Jour. Inst. Telecom. Eng.*, **2** (1956).

31. Saha, A. K., Ray, S. — Some features of the E2 layer observed at the Ionosphere Field Station Haringhata, Calcutta. *J. Atmos. Terr. Phys.*, **7**, 107 (1955).

32. Saha, A. K., Ray, S. — Some features of the P′-*f* records obtained at Haringhata. *Science et Culture* (Calcutta), **21**, 111 (1955).

33. Saha, A. K. — On the determination of electron density distribution in the ionospheric regions from *h′-f* records. *Ind. Jour. Phys.*, **30**, 464 (1956).

34. Saha, A. K., Ray, S., Datta, S., Mitra, R. K. — Ionospheric observations during the solar eclipse of June 20, 1955. *Science and Culture* (Calcutta), **21**, 475 (1956).

35. Sarkar, H. — A linear time base circuit for ionospheric investigations *J. Sci. Industr. Res.*, **15** B, 217 (1956).

36. Sarma, N. V. G., Mitra, A. P. — *J. Sci. Industr. Res.*, **15** B, 320 (1956).

37. Satyanarayana, R., Bakhru, K., Khastgir, S. R. — Colloquium on Radio Wave Propagation, Comité National Français de Radio électricité Scientifique (U.R.S.I.) et Société des Radio-électriciens, Sept. 1956.

38. Satyanarayana, R., Bakhru, K., Khastgir, S. R. — *J. Sci. Industr. Res.*, **15** B, 331 (1956).

39. Sheriff, R. M. — A study of the total electron content of the F region of the ionosphere over Ahmedabad, India. *J. Atmos. Terr. Phys.*, **8**, 91 (1955).

40. Subhadramma, G. V. — *J. Sci. Res.*, Banaras Hindu University, Vol. VI (1), 1955-56.

41. Venkasubramaniam, P. K., Rao, B. V. T. — A modulation indicator for fading signals. *Jour. Inst. Telecom. Eng.*, **2**, 104 (1956).

(*To be continued*)

Poland

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Switzerland

ANNUAL MEETING

The Swiss National Committee held its annual meeting on November 7th, 1958, at Neuchâtel. The scientific programme was devoted to the *determination of time and frequency*. The following papers were submitted and discussed in presence of representatives of science and technics :

1. Problèmes généraux de la détermination de la fréquence et de l'heure. J. ROSSEL, Université, Neuchâtel.
2. Die Atomuhren und ihre Arbeitsweise (Beschreibung der verschiedenen, in Neuenburg und anderswo vorhandenen Arten). J. Bonanomi, Laboratoire Suisse de recherches horlogères, Neuchâtel.

3. Technik der atomaren Frequenz- und Zeitbestimmung. P. KARTASCHOFF und J. DE PRINS, Laboratoire suisse de recherches horlogères, Neuchâtel.
4. Problèmes de l'heure astronomique. W. SCHULER, Observatoire, Neuchâtel.
5. Signaux horaires et fréquences étalons. CH. WYSER, Observatoire, Neuchâtel.
6. Der Zeitdienst der schweizerischen Post-, Telegraphen-, und Telephonverwaltung. K. BOHREN, Generaldirektion, P.T.T., Bern.

After the meeting, the participants visited the Laboratoire suisse de recherches horlogères and the Astronomical Observatory of Neuchâtel.

The papers presented will appear in extenso in the *Bulletin Technique P.T.T.* of January 1959.

United States of America

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The following corrigenda and addenda are to be brought to the list published in *Information Bulletin*, nº 109, page 9.

To be added :

Mrs Helen E. HART, Administrative Secretary.

Maj. Gen. Harold W. GRANT, Directorate of Communications-Electronics, U. S. Air Force, Room 5B479, The Pentagon, Washington 25, D. C.

Mr. Allen H. SCHOOLEY, Code 5000, Naval Research Laboratory, Washington 25, D. C.

To be deleted :

Rear. Adm. H. C. BRUTON,

Maj. Gen. Alvin L. PACHINSKY,

Dr. R. M. PAGE.

JOINT MEETING
OF THE U.R.S.I. NATIONAL COMMITTEE
AND THE INSTITUTE OF RADIO ENGINEERS

Pennsylvania State University, October 20, 21, 22, 1958

Papers submitted to the Meeting

Commission II

1. Propagation characteristics of 2.15 mm radio waves — C. W. Tolbert, C. O. Britt, A. W. Straiton, *Electrical Engineering Research Laboratory, The University of Texas, Austin, Texas.*
2. Mean-squared-error of a band-limited long line-of-sight radio link affected by atmospheric turbulence — Dimitri S. Bugnolo, *Dept. of Electrical Engineering, Columbia University, New York.*
3. The phase instability in a microwave ground link — Rabindra N. Ghose, *The Ramo-Wooldridge Corp., Los Angeles* 45, *California.*
4. Tropospheric motions observed in rapid beam-swinging experiments — A. T. Waterman, Jr., *Stanford Electronics Laboratories, Stanford University, Stanford, California.*
5. Power spectra of temperature, humidity and refractive index from tethered balloon measurements — E. E. Gossard, *U. S. Navy Electronics Laboratory, San Diego, California.*
6. Trans-horizon UHF radio field characteristics as a function of the meteorological scale of influence — W. F. Moler, *U. S. Navy Electronics Laboratory, San Diego, California.*
7. Radar terrain cross-section at microwave frequencies — D. R. Bianco, C. S. Morris, *The Johns Hopkins University, Applied Physics Laboratory, Silver Spring, Maryland.*
8. Effect of antenna beamwidth and upper-air wind velocity on fading of 4 kmc waves propagated beyond the horizon — D. C. Hogg, L. R. Lowry, *Bell Telephone Laboratories, Holmdel Radio Laboratory, Holmdel, New Jersey.*
9. Comparison of short-term fading at 41 10 and 460 Mc/s in propagation beyond the horizon — D. C. Hogg, L. R. Lowry, *Bell Telephone Laboratories, Holmdel Radio Laboratory, Holmdel, New Jersey.*
10. Propagation into the twilight region by guided modes contained in the normal air by partial reflections — Thomas J. Carroll, Rose M. Ring, *Air Force Cambridge Research Center, Bedford, Massachusetts.*
11. Spectral analysis of dual frequency multirange beyond-the-horizon microwave scattered fields — N. R. Ortwein, *U. S. Navy Electronics Laboratory, San Diego, California.*

12. Dual-frequency multi-range overwater measurements of beyond-the-horizon microwave scattered field strength — R. U. F. HOPKINS, *U. S. Navy Electronics Laboratory, San Diego, California.*
13. Sweep-frequency studies in beyond-the-horizon propagation — W. H. KUMMER, *Bell Telephone Laboratories, Holmdel, New Jersey.*
14. Reciprocity and scattering by rough surfaces — W. S. AMENT, *Naval Research Laboratory, Washington D. C.*

COMMISSION III

1. Statistical methods in radio wave propagation — W. C. HOFFMAN, *the Rand Corp., Santa Monica, California.*
2. On scattering of waves by random distributions of tenuous objects — V. TWERSKY, *Sylvania Electronic Defence Laboratory, Mountain View, California.*
3. Aeronomic conditions in the thermosphere — Marcel NICOLET, *Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.*
4. Early results from the equatorial close-spaced chain of vertical sounding stations — R. W. KNECHT, D. W. SCHLITT, *National Bureau of Standards, Boulder, Colorado.*
5. Study of vertical drift in the F region from true height profiles — S. CHANDRA, J. J. GIBBONS, E. R. SCHMERLING, *Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.*
6. Some effects of strong blast waves upon the ionosphere — Fred B. DANIELS, Arthur K. HARRIS, *U. S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey.*
7. Rocket studies of arctic ionosphere — J. C. SEDDON, J. E. JACKSON, *U. S. Naval Research Laboratory, Washington D. C.*
8. A versatile computer program for obtaining refractive indices and polarizations from the Appleton-Hartree equations — E. A. MECHTLY, L. M. MEIXSELL, J. J. GIBBONS, *Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.*
9. Coefficients for the rapid reduction of h'-f records to N-h profiles without computing aids — C. A. VENTRICE, E. R. SCHMERLING, *Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.*
10. Prediction of lower frequency limits for F-layer oblique transmissions by direct ray and by Pedersen ray — B. FULTON, O. SANDOZ, E. WARREN, *Defence Research Telecommunications Establishment, Defence Research Board, Ottawa, Canada.*
11. The oblique propagation of long and very long waves, Abnormal phenomena associated with great geomagnetic storms — J. S. BELROSE, *Defence Research Telecommunications Establishment, Defence Research Board, Ottawa, Canada.*

12. Angular scintillations of Cassiopeia — B. NICHOLS, J. L. ROSSON, *Cornell University, Ithaca, New York.*
13. Observations of the zenith angle dependence of radio star scintillations at Manchester, England and College, Alaska — C. GORDON LITTLE, *Geophysical Institute, University of Alaska, College, Alaska.*
14. Comparison of phase and amplitude radio-star scintillations with other ionospheric phenomena — Robert S. LAWRENCE, *National Bureau of Standards, Boulder, Colorado.*
15. Incoherent scattering of radio waves by free electrons with applications to space exploration by radar — W. E. GORDON, *Cornell University, Ithaca, New York.*
16. A theory of electrostatic fields in a non-homogeneous, non-isotropic conducting medium, with application to the ionosphere — Donald FARLEY, Jr., *Cornell University, Ithaca, New York.*
17. Evidence for a 200 Mc ionospheric forward scatter mode associated with the earth's magnetic field — J. L. HERITAGE, S. WEISBROD, W. J. FAY, *Smyth Research Associates, San Diego, California.*
18. The simultaneous observation of meteor echoes over a 1250 km path at two VHF frequencies — M. L. MEEKS, Jesse C. JAMES, J. B. BERRY, *Georgia Institute of Technology, Atlanta, Georgia.*
19. Wave propagation through ionized gases — F. J. TISCHER, *The Ohio State University Columbus, Ohio.*

COMMISSION IV

1. Precipitation static on modern aircraft — Philip W. COUCH, *Communication and Navigation Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.*
2. On the electrostatic theory of lightning discharges — Heinz W. KASEMIR, *U. S. Army Signal Engineering Laboratories, Fort Monmouth, New Jersey.*
3. Amplitude probability distribution measurements of atmospheric radio noise from 13 kc to 20 Mc — W. Q. CRICHLOW, C. J. ROUBIQUE, W. M. BEERY, *National Bureau of Standards, Boulder, Colorado.*
4. A graphical method of obtaining amplitude-probability distributions from statistical moments of atmospheric radio noise — W. Q. CRICHLOW, A. D. SPAULDING, *National Bureau of Standards, Boulder, Colorado.*
5. Some unusual features of the tornado oscillator that accompanied the Blackwell tornado — Herbert L. JONES, *Oklahoma State University, Stillwater, Oklahoma.*
6. Recent results from the whistler-west I.G.Y. program — R. A. HELLIWELL, J. H. CRARY, R. L. SMITH, W. T. KREISS, *Radio propagation Laboratory, Stanford University, Stanford, California.*

7. Propagation of electromagnetic waves along a columnar ionic irregularity — F. H. NORTHOVER, *Carleton University, Ottawa, Canada.*

COMMISSION V

1. Developments in radio astronomy as shown by the Paris-Moscow meetings — Prof. K. M. SIEGEL, *Dept. of Electrical Engineering, University of Michigan, Ann Arbor, Michigan,* Prof. F. T. HADDOCK, *The Observatory, University of Michigan, Ann Arbor, Michigan.*

COMMISSION VI

1. Geomagnetic-analytic theory of transition in electrical engineering — E. FOLKE BOLINDER, *Electromagnetic Radiation Laboratory, Air Force Cambridge Research Center, Bedford, Massachusetts.*
2. Inductive probability in radar and communications — Leonard S. SCHWARTZ, *College of Engineering, New York University, New York, N. Y.*
3. Capacity of channels with memory — George H. MYERS, *Bell Telephone Laboratories, Whippany, New Jersey.*
4. On the identity of absolute capacity and ergodic capacity of a discrete stationary channel with finite memory — S. S. L. CHANG, *College of Engineering, New York University, New York, N. Y.*
5. Some practical aspects of signal-compression coding — Arthur E. LAEMMEL, *Microwave Research Institute, Polytechnic Institute of Brooklyn, Brooklyn, New York.*
6. On synthesis of information networks — Robert ASH, *Dept. of Electrical Engineering, Columbia University.*
7. Proofs of some network theorems by topological formulas — S. L. HAKIMI, W. MAYEDA, *University of Illinois, Urbana, Illinois.*
8. A surface wave antenna paradox — F. J. ZUCKER, *Air Force Cambridge Research Center, Bedford, Massachusetts,* A. F. KAY, *Technical Research Group, Inc., New York, New York and Somerville, Massachusetts.*
9. Four-dimensional antenna systems — H. E. SHANKS, R. W. BICKMORE, *Hughes Aircraft Company, Culver City, California.*
10. A reciprocity relation for non-periodic fields — G. GOUBAU, *Signal Engineering Laboratories, Fort Monmouth, New Jersey.*
11. The far fields excited by a point source in a dissipationless passive anisotropic uniform wave guide — A. D. BRESLER, *Microwave Research Institute, Polytechnic Institute of Brooklyn, Brooklyn, New York.*
12. The calculation of reflector antenna polarized radiation — Louis E. RABURN, *General Electric Company, Philadelphia, Pennsylvania.*
13. High-frequency diffraction of electromagnetic waves by a circular, aperture in an infinite plane conducting screen — S. R. SESHADRI, TAI TSUN WU, Gordon MCKAY, *Laboratory of Applied Science, Harvard University, Cambridge, Massachusetts.*

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Commission 3. — Ionospheric Radio Propagation

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Commission 4. — Terrestrial Radio Noise

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Commission 6. — Radio Waves and Circuits

Chairman : Dr. John I. BOHNERT

Subcommission 6.1. — *Information Theory*

Chairman : Prof. L. A. ZADEH

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Subcommission 6.2. — *Circuit Theory*

Chairman : Prof .L. A. ZADEH

Membership same as Subcommission 6.1 above.

Subcommission 6.3. — *Antennas and Waveguides*

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Commission I

INDIA

See the Report of the National Committee on page 5.

Commission III

INDIA

See the Report of the National Committee on page 18.

THIRD REPORT ON REGULAR VHF IONOSPHERIC PROPAGATION OBSERVABLE OVER LONG DISTANCE

National Bureau of Standards, N.B.S. Rept. 6014, september 26, 1958

Edited by R. C. Kirby and R. M. Davis, Jr.

This is the third and final of a series of Reports in which the results of studies of regular VHF ionospheric propagation (scattering), obtained from the routine recording program of NBS from Sept. 1952 to Dec. 1955, are presented.

A summary of most of the important results of this program was published as a technical paper in the October 1955 issue on « Scatter Propagation » of the Proc. I.R.E. ; the scope of the present report is largely to supplement that summary paper with detailed technical data, as well as to report on the results obtained in limited experimental work subsequently.

It is believed that this data presented in this and the preceding reports are sufficient to provide a basis for system engineering in temperate and high latitudes.

The program included : variation with season, geographical position and solar activity, frequency dependence, scattering heights dependence of transmission loss on path geometry, sporadic E observation, development of low-power narrow band recording equipment.

Commission IV

ATMOSPHERIC NOISE MEASUREMENTS AT COOK, Sthou AUSTRALIA

The Research Laboratories of the Australian Post Offices are co-operating in the National Bureau of Standards international programme of atmospheric noise measurement and location as covered by U.R.S.I. Commission IV. For this purpose a recording station has been established at Cook about 500 miles west of Adelaide, South Australia.

Regular measurements — some hourly, others daily — commenced at Cook in August 1958 and this data is subject to statistical analysis at the Laboratories in Melbourne after which it is forwarded monthly to the N.B.S. for collation with comparable data from stations similarly engaged throughout the world.

The power, voltage and the logarithm of the voltage of the incident noise, averaged over fifteen minutes is recorded once per hour at each of eight frequencies in the range 13 kc/s to 20 Mc/s. Once per day the distribution of noise intensity with azimuthal angle is measured to aid in location of major noise centres.

It is intended to continue these measurements beyond the period of the I.G.Y. to furnish data over a full eleven year cycle of sunspot activity.

Commission V

RADIO ASTRONOMY STATIONS IN POLAND

The Secretary of U.R.S.I. National Committe in Poland, Dr. K. Bochenek, gave the following information on radio astronomy stations « Skala » (Astronomical Institute of Cracow, Prof. Koziel) and « Piwnica » (Observatory of Torun, Prof. Iwanowska).

Station « Skala » (Cracow, Prof. Koziel).

$f = 810$ Mc/s ; B = 1,5 Mc/s ; direct superheterodyne ;

Parabolic reflector of 5 m aperture ; gain 920.

Continuous recording of solar radiation in equatorial polarization between 09 h 00 and 12 h 00 U.T.

Observers : MM. O. Czyzewski and J. Maslowski.

Station « Piwnica » (Torun, Prof. Iwanowska).

$f = 128$ Mc/s ; B = 1 Mc/s ; system Rule-Vonberg ;

16 dipole-array with cylindroparabolic reflector 26 × 12 m ; gain 400.

Recording of solar radiation at meridian transit.

Observer : M. S. Gorgolewski.

U. R. S. I. - A. G. I. COMMITTEE

World Wide Sounding Committee

Interim Recommendation for Ionospheric Vertical Soundings Programme in 1959

1. As many stations as possible should continue operation, reduction and circulation of data at least on the level considered normal before the I.G.Y. This minimum recommendation should apply to the great majority of stations which are to operate at all.

2. As many stations as have the necessary resources should in addition operate, reduce and circulate data partly or wholly on the increased scale recommended for the I.G.Y. The possible additions include :

(*a*) quarter-hourly schedule of operation at least on World Days,
(*b*) *f*-plots at least on World days,
(*c*) *h*-plots on World days,
(*d*) quarter-hourly operation and *f*-plots on all days,
(*e*) N-*h* profiles,
(*f*) any other special studies.

All stations with long series of data or special importance for regional and zonal studies should be encouraged to adopt as large a supplementary programme as their resources will permit or as their special importance warrants.

3. Where the minimum recommendations of (1) are impracticable, it may still be useful for certain subsidiary stations of a network to operate on a « patrol » basis, i. e. producing records on a normal operating schedule but reducing only sufficiently to ensure good quality of the records. It is pointed out however that if *some* daily reduction is being done, relatively little extra effort is required to fulfill the normal programme and this should be attempted wherever possible.

4. In certain cases stations may have a reduced operating schedule designed for some special investigation or for the support of some other project (satellite, drifts, etc.). Some stations attached to universities may be in this position.

December 22, 1958.

Any comments on this interim recommendation will be welcomed by the Secretary General of U.R.S.I. who will forward them to the interested Committee.

URSIGRAMS

European Regional Committee on Ursigrams

Membership of the Committee on January 1st, 1959

Provisional Chairman : Col. E. HERBAYS.

Secretary : Dr. R. COUTREZ.

Members : Austria : Prof. Dr. O. BURKARD,
Belgium : Dr. R. COUTREZ,
Czechoslovakia : Dr. J. MRAZEK,
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Germany : Dr. B. BECKMANN,
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Norway : Dr. L. HARANG,
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Sweden : Ing. S. GEJER,
United Kingdom : Dr. R. L. SMITH-ROSE.

IONOSPHERIC STATIONS

New Publication

Observations Ionosphériques — Station de Dourbes — Edited by the Institut Royal Météorologique de Belgique, 3 avenue Circulaire, Uccle, Bruxelles 18, Belgique, first issue, July 1957.

CALENDAR OF OUTSTANDING GEOMAGNETIC OCCURRENCES AND CHROMOSPHERIC SOLAR FLARES

At the request of some of our readers, we are publishing tables of chromospheric solar flares and associated outstanding geomagnetic occurrences.

These tables contain for each day of the month, from January 1st, 1958, onwards :

1. *Chromospheric Solar Flares* of importance 2, 2+, 3 and 3+, with the U. T. hour of the start and of the end of the phenomenon.

Column « start » gives the hour of the beginning of the flare or of the first observation of the phenomenon.

Column « end » gives the hour of the end of the last observation or of the end of the phenomenon.

2. *Outstanding Geomagnetic Occurrences* :

(*a*) bays,

(*b*) storms,

(*c*) giant pulsations, sudden impulses, crochets, confirmed or not confirmed.

3. *Indicator of the Observing Station.*

4. If the outstanding occurrence has been observed at several stations, the indicator is replaced by *the number of stations which have observed the phenomenon.*

Data used to draft the tables have been collected by the « Service de Radio Astronomie et de Physique Solaire » of the Royal Observatory of Belgium and have been drawn from the following sources :

(*a*) *Solar-Geophysical Data*, C.R.P.L.-F-Reports, Part B, National Bureau of Standards, Boulder, Colorado, U. S. A.

These reports contain data on chromospheric flares observed during a world wide survey.

(*b*) *Observations and Optical Phenomena* given monthly by the station of Ondrejov (General list of daily Solar Maps and *Observations carried out in U. S. S. R.*).

(*c*) Data reported by the stations participating to the *Central Service of Ursigrams.*

Description of symbols

Solar flares

Importance		Code digit
2	=	2
3	=	3
2+	=	8
3+	=	9

Outstanding Geomagnetic occurrences

R1 = bay with gradual beginning (P.S.C.).
R2 = bay with oscillating or sudden beginning.
R3 = giant pulsation.
R4 = typical crochet confirmed by associated solar or ionospheric phenomena.
R5 = crochet, not confirmed.
R6 = gradual storm beginning.
R7 = storm sudden commencement (SC).
R8 = very marked storm sudden commencement (SC).
R9 = sudden impulse.
R0 = micropulsation.

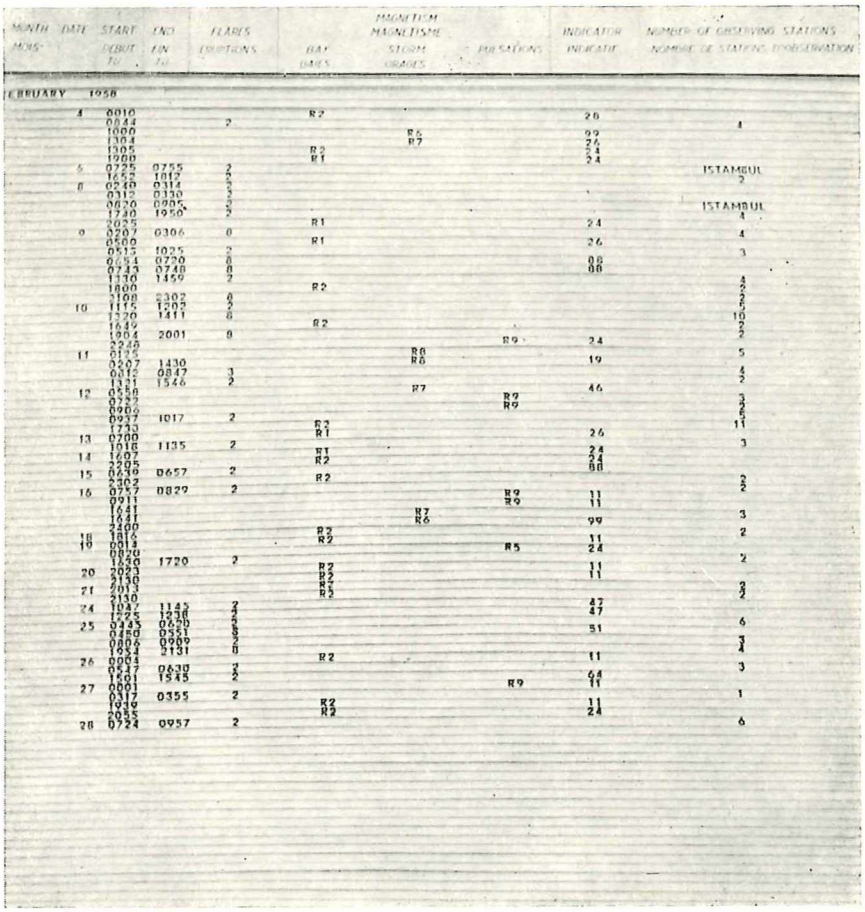
Indicator of the observing station

This indicator is normally used in the transmission of data by Ursigrams or Interchange Codes. Cf. *Manual of Ursigram Codes*, published by U.R.S.I. General Secretary, and Second Supplement to the *Draft Manual for World Days and Communications*, by A. H. Shapley, C.S.A.G.I. Reporter for W.D.C. (December, 1957).

JANUARY 1958

MONTH / MOIS	DATE	START / DEBUT TU	END / FIN TU	FLARES / ERUPTIONS	MAGNETISM / MAGNETISME BAY / BAIES	STORM / ORAGES	PULSATIONS	INDICATOR / INDICATIF	NUMBER OF OBSERVING STATIONS / NOMBRE DE STATIONS D'OBSERVATION
JANUARY 1958	1	1729	1911	2					2
	3	1505	1610	2					2
	4	2029	2253	2					2
	5	0026			R2			23	
		0526			R2			23	
		1010	1035	2				16	
		1915	1919	2					2
		1847			R2			28	
	7	0952	1002	2				11	
		1520	1925	2					2
	9	1852			R1			24	
		1836			R2			11	
	10	0843	0943	2					2
		0947	1010	2				64	
		1033	1102	2				64	
	13	0218		2				07	
		1558	1420	3					4
		2008			R2			11	
		2010			R1			34	
	14	2031			R2			11	
		2055			R1			24	
	15	1640	1722	1					6
	16	1415	1427	2				62	
		1806		2				33	
		2305	2347	2					2
	17	0057			R2			28	
		0140			R2			28	
		1247			R2			28	
		1352			R2			28	
		2015			R2			28	
		2330			R2			28	
	18	0700				R6		99	
		1211			R2			11	
	20	0035	0245	2					1
		1435	1601	8					6
		2100				R6		45	
		2143				R7		26	
	21	0248	1635	2				41	
		0259					R9	24	
		1000			R1			45	
		0100			R1			26	
	22	0805	0840	2					2
		1104					R5	24	
		1802	1937	2					2
	23	0904	1053	3					6
	24	0200				R6		99	
		1210	1420	2					4
	25	0040	0105	8					4
		0225	1100	3					16
		0958	1619	2					4
		1050					R9	24	
		1052				R7		26	
		1306	1333	3					3
		1500			R1			24	
		2300			R2			11	
	26	0952			R1			24	
	27	2150						11	
							R9	11	
	28	1107							3
	30	1750	2015	6				28	
	31	0007			R2				7
		1130	1452	3					3
		2320			R2				

February 1958



MONTH MOIS	DATE	START DEBUT TU	END FIN TU	FLARES ERUPTIONS	MAGNETISM MAGNETISME BAY BAIES	MAGNETISM MAGNETISME STORM GRADES	MAGNETISM MAGNETISME PULSATIONS	INDICATOR INDICATIF	NUMBER OF OBSERVING STATIONS NOMBRE DE STATIONS D'OBSERVATION
FEBRUARY	1958								
	4	0810			R2			26	
		0844		2					4
		1000				R5		99	
		1304				R7		24	
		1305			R3			24	
		1900			R1			24	
	5	0725	0755	2					ISTAMBUL
		1652	1812	5					2
	8	0240	0314	5					
		0312	0330	5					
		0620	0805	5					ISTAMBUL
		1720	1950	2					4
		2025			R1			24	
	9	0207	0306	8					4
		0600			R1			26	
		0515	1025	2					3
		0654	0730	8				08	
		0745	0748	8				08	
		1330	1459	2					4
		1800			R2				2
		2100	2302	8					2
	10	1115	1202	2					2
		1320	1411	8					10
		1649			R2				2
		1904	2001	8					2
		2248					R9	24	
	11	0112				R6			5
		0207	1430			R6		19	
		0812	0847	1					4
		1131	1546	2					2
	12	0558				R7		46	
		0722					R9		3
		0900					R9		2
		0927	1017	2					6
		1733			R3				11
		0700			R1			26	
	13	1016	1135	2					3
		1607			R1			24	
	14	2205			R2			24	
		0630	0657	2				88	
	15	2302			R2				2
		0757	0829	2					2
	16	0911					R9	11	
		1641					R9	11	
		2400				R7			3
		1814			R3	R6		99	
	18	0015			R2			11	2
	19	0820					R5	24	
		1830	1720	2					2
		2023			R2			11	
	20	2130			R2			11	
		2013			R5				2
	21	2130			R5				2
		1042	1145	2				47	
	24	1225	1238	4				47	
		0445	0620	5					6
	25	0542	0551	8				51	
		0802	0909	2					3
		1652	2131	8					4
		0004			R2			11	
	26	0617	0630	2					3
		1501	1545	2				64	
		0001					R9	11	
		0317	0355	2					1
	27	1919			R2			11	
		2055			R2			24	
	28	0724	0957	2					6

March 1958

MONTH / MOIS	DATE	START / DEBUT TU	END / FIN TU	FLARES / ERUPTIONS	MAGNETISM / MAGNETISME BAY / BAIES	MAGNETISM / MAGNETISME STORM / ORAGES	PULSATIONS	INDICATOR / INDICATIF	NUMBER OF OBSERVING STATIONS / NOMBRE DE STATIONS D'OBSERVATION
MARCH	1958								
	1	0905	1007	9					6
		0912					R5	11	
		2251			R1			11	
	3	0929				R7			8
		1005	1250	9					9
		2031			R2			24	
	5	0100			R1			26	
		0538	1000			R7		26	
		1637	1720	2					7
	6	0715	0735	2					ISTAMBUL
	7	1020	1212	3					9
		1910			R1			26	
	8	0851	0858	2					2
		1750	1755	2					2
		2336	2358	2					2
	9	0116			R2				2
		0946	1032	2				64	
		1540	1740	2					3
			2100			R6		59	
	10	1335	1345	2				46	
		2022	2128						4
	11		0837	2				64	
		1600					R5	99	
	12	0024	0233	6				51	
		0700				R7		19	
		0943	0959	2				64	
		1128	1200	2				64	
		1139	1157	2				64	
		1432	1531	9					2
		2200				R6		25	
		2210				R7		90	
	13	1218					R9		2
		1830						15	
	14	0028	1100	2		R7			4
		1215						15	
		1301	1325	2					2
		1518	1541	3		R7			2
	15	1000					R9	24	
		2000			R1			20	
	16	0039	0850	2				64	
			1600			R6		99	
		2119			R2			24	
	17	0743				R6		26	
		0858	0909	2					4
		1000	1144	2					4
		1700				R6		99	
		1927			R2			24	
	18	0804	1125	2			R9		2
		1548						24	
		1839			R2			23	
	19	1114	1140	2					2
		1938			R2			11	
		2315			R5				2
		2340			R2				2
	20	0733	0802	7				64	
		0828	0900	2				64	
		1250	1355	2					3
		1445	1552	2					5
		1718					R9	24	
		2025	2130	2				32	
		2330			R2			24	
	21	0819					R7	11	
		1019	1050	2					5
		1850	1925	2					3
	23	0950	1420	9					14
							R4		3
		1056	1329	8					2
		1928	1215	2				46	
		1952			R2			24	
			2200			R6		99	
	24	0749	0827	2					3
		1045	1056	2					2
		2002			R2				2
	25	0559	0737	2					6
		0857	0902	2					3
		1449	1605	2					7
		1530				R7			5
		1955					R9	11	
	26	0527	0020	2					2
	27	0042	1116	8					4
		1514	1710	9					3
		2133			R2				2
		2134							2
		2147	2217	8					2
	28	0809	0813	2					2
		0916	0940	5					2
		1019	1114	6					7
		1151	1237	2					3
		1547	1622	2					3
		1707	1904	8					3
		1725		3				08	
		2042	2131	2					3

March-April 1958

MONTH / MOIS	DATE	START / DEBUT TU	END / FIN TU	FLARES / ERUPTIONS	MAGNETISM / MAGNETISME: BAY / BAIES	MAGNETISM / MAGNETISME: STORM / ORAGES	PULSATIONS	INDICATOR / INDICATIF	NUMBER OF OBSERVING STATIONS / NOMBRE DE STATIONS D'OBSERVATION
MARCH 1958									
	29	0853	0909	2				15	
		0912	1023	2					
		0921							3
		1335	1410	8			R3	21	
		1340					R4		1
		1342					R3	21	2
		1820	1910	2					
	30	0102	0109	2				51	2
		0700				R5			
		0817	0846	8				79	3
		0842	0853	2					
		0850	1000	2				64	3
		0915	1421	0					
		1533	1526	2					7
		2007	2117	2					2
		2114	0129	2					2
	31	0005	0106	8				17	
		0420				R7		03	4
		0605	0708	2				58	
		0622	0656	2				20	
APRIL 1959									
	1	1351	1230	8					9
	2	0019					R5	29	
		0221			R2			28	
		0500					R4	03	
		0502	0515	2					2
		0733				R7		29	
		1042	1115	2					3
		1230					R9		3
		1326					R9		3
		1605	1622	2					3
		1641	1738	2					3
		1951	2201	2					1
		2023			R2			28	
		2153	0033	2					1
	3	0156			R2			20	
		0817	0915	2					2
			0930			R6		07	
		1407			R2			28	
		1435	1526	2					3
		1826	2012	3					5
		2035			R2			26	
	5	0732	0847	6					6
		1340	1420	2				16	
		1825	1950	2					2
	6	0727	0800	2				85	
	7	1036	1100	3					3
	8	2035			R2			23	
	9	0332			R2			28	
		1435	1500	2					3
		1635			R2			29	
	10	1010	1150	2					3
		1530	1652	2					3
	14	2040	2255	2					3
	15	1968			R2			24	
	16	1016	1030	2					2
		1500				R6		99	
		1535	1900	2				03	
		1900			R2			24	
	17	1615	1646	2					3
		1635					R9		3
		1850			R1				3
	18	1753			R2				2
	19	1716	1745	2				08	
		2153			R2			34	
	20	2120			R2			36	
			2300			R6		99	
	22	0827	0905	2					2
	23	1955			R2			23	
		1505					R5	11	
	26	1047	1116	2					5
		1242				R7			3
	27	0745	0825	2					2
		2203			R2			28	
	28	2137			R2				
		2317	0150	2					7
	29	0900	1002	2					2
		1128	1230	2					3
		1855	2013	2					2
		2126	2133	2				08	2
	30	0935	1001	2					2
		0937	1004	2					2
		1932	2015	2					3

May 1958

MONTH. MOIS	DATE	START DEBUT TU	END FIN TU	FLARES ERUPTIONS	MAGNETISM MAGNETISME BAY BAIES	MAGNETISM MAGNETISME STORM ORAGES	MAGNETISM MAGNETISME PULSATIONS	INDICATOR INDICATIF	NUMBER OF OBSERVING STATIONS NOMBRE DE STATIONS D'OBSERVATION
MAI	1958								
	1	1041					R2	23	
		1703	1734	2				16	
		1804	1905	2					3
		2046	2130	0					3
		2116	2241	1					4
		2210			R2				2
	2	0754	0914	2					0
		0800	0821	2					2
		0937	1102	0					0
		1305	1325	2				15	
	3	0745	0847	2					7
		0858	0944	2					4
		1300	1436	0					0
	4	0710	0730	2					2
	5	0356	0457	0			R4	01	2
		0513							0
		0859	1021	1					5
		0925	1038	2					10
		1305	1407	2					2
		1915	2020	0					2
		2032	2115	2					2
		2126			R2			24	
	6	0310	0329	2					2
		0525	0601	2					4
		1425	1200	2					1
									3
	7	1454	1707	2					
		2116			R2			24	
	8	2127			R2			24	
							R9	24	
	9	0739						15	
	11	1000	1027	2					
	12	2007			R2				2
		2228			R2				2
		2548	0005	8				31	
	13	0805				R6		45	
		1407			R2			28	
		2234			R2			28	
						R6		99	
	18		1700						
	19	0125	0505	2					4
		1052	1153	2					4
	21	0433	0443	2				88	
		0612	0652	2				88	
	22	0210	0758	2				88	
	25	1500				R6		24	
	26	1739	1803	2					4
		2000				R6		25	
	28	0040			R2			28	
	29	0030				R6		26	
		0345	0550	2					2
	31	0557	0611	2				51	
		1139	1150	2					2
		1638				R8			0

BIBLIOGRAPHY

of scientific reports and papers published in Proceedings of the General Assemblies

(See *Information Bulletin*, nº 112, p. 23)

(R) after the title of a paper indicates that only a summary has been published ;

(Re) that a summary in English language follows the text ;

(Rf) that a summary in French language follows.

Ionospheric Radio

1922-1948. — Commission II on Radio Wave Propagation.

1948-1954. — Commission III on Ionospheric and Wave Propagation.

1954. — Commission III on Ionospheric Radio.

Commission, Sub-Commission and Working Group Reports

1927. — Report of Commission II, L. W. Austin, I, fasc. 2, 25.

1928. — Report of the Chairman of the Commission on Radio Wave Propagation, L. W. Austin, II, fasc. 3, 38.

1934. — Report of the Sub-Committee on Interaction of modulated radio waves in the Ionosphere, IV, 53.

1938. — Report of Commission II, Radio Wave Propagation, J. H. Dellinger, Chairman, V, fasc. 1, 289.

1938. — Report of Ionospheric Sub-Commission of Commission II, E. V. Appleton (Chairman), R. Naismith (Secretary), V, fasc. 1, 313.

1946. — Report of ionospheric measurement during a solar eclipse, VI,125.

1948. — Rapport du Groupe de Travail sur l'emplacement des stations ionosphériques, VII, 186.

1950. — Report of Working Party on Non-Linear effects in the ionosphere, VIII, P. I, 337.

1950. — Report of Working Party on Production and Reduction of Ionospheric Information, VIII, P. I, 343.

1950. — Report of Sub-Committee appointed to consider C.C.I.R. memorandum on long-distance propagation of waves 30-300 Mc/s by means of regions E and F of the ionosphere, VIII, P. I, 338.

— Report of Working Party concerning Report of C.C.I.R., Study Group 6, Question 5 : Problems of medium and long wave propagation, VIII, 341.

— Report of Working Party on Ursigrams, VIII, P. I, 354.

1950. — Report of the Working Party of Commission III on the Ionospheric Absorption of Radio Waves, VIII, P. I, 355.

— Report of Committee on Reduction of Ionospheric Data for Geophysical Purposes, VIII, P. I, 359.

1952. — Report from the Chairman of Sub-Commission III*b* on Wave Interaction, E. PICAULT, IX, fasc. 4, 15.

— Report of Working Party on Wave Interaction in the Ionosphere, IX, fasc. 4, 125.

— Report of Working Party on Propagation of frequencies below 1500 kc/s, IX, fasc. 4, 125.

— Report of Working Party on Ionospheric Absorption, IX, fasc. 4, 125.

— Report of Working Party on the Selection and Prediction of Solar Activity Indices, IX, fasc. 4, 126.

— Report of Working Party on the Reduction of Ionospheric Data, IX, fasc. 4, 127.

1954. — Speech by the President of Commission III at the Administrative Opening Session, X, P. 3, 168.

— Report of Work of Commission III, X, P. 3, 187.

— Report of Sub-Commission III*a* on Ionospheric Observations and Reduction of Data, X, P. 3, 176.

— Report from Sub-Commission III*b* on Radio Wave Interaction, E. PICAULT, X, P. 3, 26.

— Report of Sub-Commission III*b*, X, P. 3, 177.

— Report of Sub-Commission III*c*, On Propagation Velocity of Time Signals, M. BOELLA, X, P. 3, 32.

— Sub-Commission III*c* : Informations from A.G.I. National Committee Reports to be presented to the Rome meeting of C.S.A.G.I., concerning the activity of Sub-Commission III*c*, X, P. 3, 34.

— Report of Sub-Commission III*c*, X, P. 3, 179.

— Reports of Working Parties on C.C.I.R. topics, X, P. 3, 181.

NATIONAL COMMITTEE REPORTS

Australia, 1948. — Report of the Australian National Committee, Commission II, Propagation, VII, 48.

Australia, 1950. — Report of the Australian National Committee : Commission III, VIII, P. I, 93.

Australia, 1952. — Report of the National Committee to Commission III, IX, fasc. 4, 18.

Australia, 1954. — Report of the National Committee to Commission III, X, P. 3, 36.

Belgium, 1952. — Notes on activities in Belgium and in Belgian Congo in the field of Commission III, IX, fasc. 4, 22.

Canada, 1952. — Report of the National Committee, J. C. W. Scott, X, fasc. 4, 23.

Canada, 1954. — Report of the Canadian National Commission III, X, P. 3, 43.

France, 1928. — Propositions du Comité Français de Radiotélégraphie scientifique pour l'organisation d'une étude d'ensemble sur les phénomènes de propagation des ondes, II, fasc. 2, 25.

France, 1931. — Etude de la propagation, III, 38.

France, 1934. — Rapport établi par le Comité National Français sur les renseignements que peuvent fournir les résultats du trafic sur les phénomènes de propagation.

France, 1948. — Rapport du Comité National Français, Ionosphère, VII, 36.

France, 1950. — General Report of the French National Committee, Commission III, VIII, P. I, 93.

France, 1952. — General Report of the National Committee to Commission III, IX, fasc. 4, 29.

France, 1954. — General Report of the National Committee, Commission III, X, P. 3, 43.

Germany, 1954. — Report of the National Committee to Commission III, W. Dieminger, X, P. 3, 73.

Germany, 1954. — Report of the National Committee to Commission III, Solar and Terrestrial Relationships, K. O. Kiepenheuer, X, P. 3, 79.

Germany, 1954. — Report of the German National Committee to Commission III, Research activities of the Wendelstein Observatory, R. Muller, X, P. 3, 84.

India, 1952. — Report of the National Committee to Commission III, IX, fasc. 4, 50.

Italy, 1952. — Report of the National Committee to Commission III, IX, fasc. 4, 58.

Italy, 1954. — Report of Commission III of the National Committee, X, P. 3, 95.

Japan, 1934. — Publications on radio wave propagation in « The report of radio research in Japan », IV, 132.

Japan, 1950. — Results of scientific activity of the Japanese Ionosphere Research Committee, Y. Hagihara, T. Nagata, VIII, P. I, 172.

Japan, 1952. — Report from the National Committee, K. MAEDA, IX, fasc. 4, 59.

Japan, 1954. — Report of Commission III of the National Committee, X, P. 3, 95.

Morocco, 1954. — Report of the National Committee to Commission III, X, P. 3, 105.

Netherlands, 1934. — Rapport pour la Commission de Propagation des Ondes, J. G. ELIAS, IV, 121.

Netherlands, 1948. — Radio-amateur cooperation.

Netherlands, 1950. — Report from Commission III of the Netherlands National Committee on ionospheric work in the Netherlands during 1948-1950, H. J. GROENEWALD, VIII, P. I, 191.

Netherlands, 1950. — Dutch Progress Report of Sub-Commission on Amateur cooperation (Commission III), 1948-1950, VAN DYL, VIII, P. I, 193.

Netherlands, 1952. — Report from Commission III of the National Committee on Ionospheric Work in the Netherlands during 1950-1951, J. VELDKAMP, IX, fasc. 4, 71.

Netherlands, 1954. — Report of the National Committee to Commission III, P. 3, 127.

New Zealand, 1948. — Ionosphere work in New Zealand, VII, 280.

New Zealand, 1952. — Report of the National Committee, IX, fasc. 4, 72.

New Zealand, 1954. — Report of the National Committee III, J. BURTT, X, P. 3, 128.

Sweden, 1948. — Report of Commission II of the Swedish National Committee, O. E. H. RYDBECK, VII, 221.

Sweden, 1950. — Report of the Swedish National Committee, Commission III, O. E. H. RYDBECK, VIII, P. I, 210.

Sweden, 1952. — Report of the National Committee, S. GEJER, IX, fasc. 4, 76.

Sweden, 1954. — Report of the National Committee to Commission III, S. GEJER, X, P. 3, 132.

Switzerland, 1934. — Publications relatives aux recherches radioélectriques, IV, 133.

Switzerland, 1948. — Rapport du Comité National Suisse, Commission II, VII, 45.

Switzerland, 1950. — Report of the Swiss National Committee for the period 1948-1950, MERCIER, VIII, P. I, 220.

Switzerland, 1952. — Report of the National Committee, MERCIER, IX, fasc. 4, 76.

Switzerland, 1954. — Report of the National Committee to Commission III, MERCIER, X, P. 3, 133.

Union of South Africa, 1952. — Report of the National Committee, IX, fasc. 4, 80.

United Kingdom, 1934. — Report to Commission II on Investigations of the Propagation of Waves carried out in Great Britain from July 1934 to June 1938 (Rf), R. L. Smith-Rose, V, fasc. 1, 41.

United Kingdom, 1946. — British researches on the physics of the ionosphere published since 1938, VI, 109.

United Kingdom, 1946. — Report on British Ionospheric Work 1938-1946, VI, 117.

United Kingdom, 1948. — Report on location of ionospheric recording stations, VII, 295.

United Kingdom, 1948. — Report of the British National Committee, Propagation, VII, 54.

United Kingdom, 1948. — A summary of experimental and theoretical works relating to wave interaction, VII, 198.

United Kingdom, 1948. — Report on Amateur Co-operation, VII, 217.

United Kingdom, 1950. — Report on British Work on the Ionosphere and Propagation, W. J. G. Beynon, VIII, P. I, 132.

United Kingdom, 1952. — Report of the British National Committee to Commission III, J. A. Ratcliffe, IX, fasc. 4, 41.

United Kingdom, 1954. — Report of the National Committee to Commission III, W. J. G. Beynon, X, P. 3, 85.

U. S. A., 1950. — Report of the U. S. A. National Committee, Commission III, VIII, P. I, 257.

U. S. A., 1952. — Report of the U. S. A. Commission III, IX, fasc. 4, 81.

U. S. A., 1952. — Special Report of the U. S. A. National Committee on Establishment of Ionospheric Stations in South-America, IX, fasc. 4, 103.

U. S. A., 1952. — Special Report on VHF Ionospheric Propagation, IX, fasc. 4, 104.

U. S. A., 1954. — Report of the U. S. A. Commission III on progress in ionospheric research in the United States between X and XIth General Assemblies, M. G. Morgan, X, P. 3, 134.

Papers

Ionosphere Morphology

Appleton, E. V. — The existence of more than one ionized layer in the upper atmosphere, I, fasc. 1, 2, 1927.

Appleton, E. V. — Some notes on wireless methods of investigating the electrical structure of the upper atmosphere, II, fasc. 1, 149, 1928.

Appleton, E. V., Sayers, J. — Recombinaison dans l'ionosphère, V, fasc. 1, 274, 1938.

BATES, D. R., MASSEY, H. S. W. — The atomic processes effective in the ionosphere, VII, 299, 148.

BUDDEN, K. G., RATCLIFFE, J. A., WILKES, M. V. — Ondes très longues et les parties inférieures de l'ionosphère (R), V, fasc. 1, 100, 1938.

COTTE, M. — Sur la courbure des rayons hertziens dans un sondage vertical et la détermination de la hauteur vraie de l'ionosphère (R), VII, 210, 1948.

DURAND, J., LEJAY, P. — Notes sur les variations dans l'espace et dans le temps de la couche E sporadique (R), VIII, Part II, 256, 1950.

ESTRABAUD, S. — Sur la réfraction ionosphérique (R), VII, 252, 1948.

FAGEN, W. F., KESSLER, W. J., ZETRAUER, W. F., SILLER, H. K. — Investigation of the vertical ionosphere height for the 18 kc/s frequency region (R), VII, 228, 1948.

GAUTIER, T. N. — Spatial and time variations in F2 critical frequencies (R), VII, 226, 1948.

GAUZIT, J. — A propos de la physique de l'ionosphère, VI, 97, 1946.

GAUZIT, J. — A propos de l'origine de la couche E, VII, 252, 1948.

HAUBERT, A. RIVAULT, R. — Sur la présence de nuages à forte concentration électronique à l'intérieur de la couche F2 normale (R), VIII, P. II, 265, 1950.

ITO, Y., SINKAWA, H., TANI, K. — Variations à longues périodes dans la région F2 de l'ionosphère, V, fasc. 11, 22, 1938.

JOUAUST, R. — Les phénomènes de réflexion métallique dans la région D, VI, 153, 1946.

KESSLER, W. J., ZETRAUER, W. F., SILLER, H. K., FAGEN, W. F. — Investigation of the vertical ionosphere height for the 18 kc/s frequency region (R), VII, 228, 1948.

KESSLER, W. J. — Determination of source distance and the vertical ionosphere height through the graphical analyses of Loran pulse wave shapes (R), VII, 229, 1948.

KRUSE, F. W., Jr., HELLIWELL, R. A., MALLINCKRODT, A. J. — On the nature of the ionosphere (Re), VIII, P. II, 193, 1950.

KRUSE, F. W., Jr., WAMBGASS, B. A., HELLIWELL, R. A., MALLINCKRODT, A. J. — Pulse studies of the ionosphere at low frequencies (R, Rf), VIII, P. II, 212, 1950.

LEJAY, P. — Note sur l'aide que peuvent apporter les amateurs dans l'étude de la couche E sporadique, VII, 325, 1948.

LEJAY, O., LÉPÉCHINSKY, D. — Etude de la répartition théorique du champ réfléchi par l'ionosphère, VII, 329, 1948.

LEJAY, P., DURAND, J. — Note sur les variations dans l'espace et dans le temps de la couche E sporadique (R), VIII, P. II, 256, 1950.

LÉPÉCHINSKY, D., LEJAY, P. — Etude de la répartition théorique du champ réfléchi par l'ionosphère, VII, 329, 1948.

Lindeman Phillips, M. — Harmonic analysis of F2 layer (R), VII, 228, 1948.

Loeb, J. — Théorie synthétique du pouvoir inducteur spécifique et de la conductibilité de l'ionosphère (R), VI, 151, 1946.

Lung, H. L. — The existence of E2-layer in the ionosphere near sunrise (R), VII, 250, 1948.

Mallinckrodt, A. J., Kruse, F. W., Jr., Helliwell, R. A. — On the nature of the ionosphere (Re), VIII, P. II, 193, 1950.

Mallinckrodt, A. J., Kruse, F. W., Jr., Wambgass, B. A., Helliwell, R. A. — Pulse studies of the ionosphere at low frequencies (R, Rf), VIII, P. II, 212, 1950.

Massey, H. S. W., Bates, D. R. — The atomic processes effective in the ionosphere, VII, 299, 1948.

Menzel, D. H. — Theory of ionospheric stratification, VI, 132, 1946.

Ratcliffe, J. A. — Le facteur de Lorentz dans la théorie de l'ionosphère (S), V, fasc. 1, 99, 1938.

Ratcliffe, J. A., Wilkes, M. V., Budden, K. G. — Ondes très longues et les parties inférieures de l'ionosphère (R), V, fasc. 1, 100, 1938.

Rivault, R., Haubert, A. — Sur la présence de nuages à forte concentration électronique à l'intérieur de la couche F2 normale (R), VIII, P. II, 265, 1950.

Sayers, J., Appleton, E. V. — Recombinaison dans l'ionosphère, V, fasc. 1, 274, 1938.

Siller, H. K., Fagen, W. F., Kessler, W. J., Zetrauer, W. F. — Investigation of the vertical ionosphere height for the 18 kc/s frequency region (R), VII, 228, 1948.

Sinkawa, H., Tani, K., Ito, Y. — Variations à longues périodes dans la région F2 de l'ionosphère, V, fasc. 1, 22, 1938.

Tani, K., Ito, Y., Sinkawa, H. — *Idem.*

Tukada, T. — Une nouvelle théorie de l'ionosphère (R), V, fasc. 1, 23, 1938.

Vassy, A. et E. — Relations entre la région D de l'ionosphère et la radiation 5893 A du sodium atmosphérique, VII, 256, 1948.

Wachtel, I. S., White, G. R. — Virtual heights of the F2 layer (R), VII, 228, 1948.

Wambgass, B. A., Helliwell, R. A., Malinckrodt, A. J., Kruse, F. W. — Pulse studies of the ionosphere at low frequencies (R, Rf), VIII, P. II, 212, 1950.

White, G. R., Wachtel, I. S. — Virtual heights of the F2 layer (R), VII, 228, 1948.

Wilkes, M. V., Budden, K. G., Ratcliffe, J. A. — Ondes très longues et les parties inférieures de l'ionosphère (R), V, fasc. 1, 100, 1938.

WOLBACH, J. G., MENZEL, D. H. — Behavior of the F and F2 layers (R, Rf), VIII, P. II, 201, 1950.

YONEZAWA, T. — On the electron-ion recombination coefficient in the F2 region of the ionosphere (R), VIII, P. II, 199, 1950.

ZETRAUER, W. F., SILLER, H. K., FAGEN, W. F., KESSLER, W. J. — Investigation of the vertical ionosphere height for the 18 kc/s frequency region (R), VII, 228, 1948.

HELLIWELL, R. A., MALLINCKRODT, A. J., KRUSE, F. W., Jr. — On the nature of the ionosphere (Re), VIII, P. II, 193, 1950.

HELLIWELL, R. A., MALLINCKRODT, A. J., KRUSE, F. W. Jr., WAMBGASS, B. A. — Pulse studies of the ionosphere at low frequencies (R, Rf), VIII, P. II, 212, 1950.

Propagation Phenomena

ALLCOCK, G. MCK. — Short path radio propagation, VII, 291, 1948.

BARFIELD, B. H., ROSS, W. — La mesure de la déviation latérale des ondes à l'aide d'un radio-goniomètre à cadres espacés (R), V, fasc. 1, 96, 1938.

BORNETTI, S. — Considerazione sulla propagazione delle onde sincronizzate e sulla ricezione delle stazioni isoonda (Rf), V, fasc. 1, 236, 1938.

BREMMER, H. — Theoretical considerations on wave propagation in an inhomogeneous atmosphere, VI, 159, 1946.

DE VOOGT, A. H. — Les échos radioélectriques autour de la terre (R), VIII, P. II, 278, 1950.

ECKERSLEY, T. L. — Report on long distance broadcasting transmission (600-1500 kc/s), Polarisation of broadcast waves — charts for short wave transmission. Ultra-short wave transmission (R), IV, 135, 1934.

FEINSTEIN, J. — Ionospheric wave propagation at low frequencies (R, Rf), III, P. II, 211, 1950.

FORSGREEN, S. — Horizontal deviation of radio waves in the ionosphere (R), VIII, P. II, 555, 1950.

GATES, H. P. — Observations of long-distance pulse propagation (R, Rf), VIII, P. II, 208, 1950.

GREGORY, J. B. — Reflections from D-region of the ionosphere, VII, 288, 1948.

HAUBERT, A. — Propagation sans absorption d'une onde plane, de grande longueur, entre le sol et l'ionosphère, considérés comme des conducteurs parfaits. Amplitude relatives des échos multiples du signal direct (R), VI, 149, 1946.

HOUTSMULLER, J. — Survey of the propagation properties of medium waves during the period when the day changes into night, VIII, P. II, 276, 1950.

JOUAUST, R. — Les phénomènes de propagation des ondes radiotélégraphiques, II, fasc. 1, 149, 1928.

KERR, F. J. — Survey of superrefraction in the costal region of Australia (R), VII, 246, 1948.

ROSS, W., BARFIELD, B. H. — La mesure de la déviation latérale des ondes à l'aide d'un radio-goniomètre à cadres espacés (R), V, fasc. 1, 96, 1938.

NAKAI, T. — On directional observation of long-distance short-wave stations and the relation between directional deviation and scattering in the ionosphere, IV, 146, 1934.

NIESSEN, K. F., VAN DER POL, B. — Summary of some theoretical contributions of the problem of propagation of radio-waves over the Earth, IV, 148, 1934 (R).

VAN DER POL, B., NIESSEN, K. F. — *Idem.*

WAYNICK, A. H. — Ionospheric propagation at 150 kc/s, VIII, P. II, 207, 1950.

Solar and ionospheric relationships

ABETTI, G. — L'attivita solare e la sua influenza sulla terra (Rf, Re), V, fasc. 1, 68, 1938.

APPLETON, E. V., NAISMITH, R. — Variations du rayonnement solaire pendant un cycle de taches solaires, V, fasc. 1, 150, 1938.

AUSTIN, L. W. — Solar and radio relationships, III, 52, 1931.

AUSTIN, L. W., WAYMORE, I. J. — On the influence of solar activity on radio transmission, I, fasc. 1, 3, 1927.

AUSTIN, L. W. — Suggestions for the international study of the correlation between radio transmission phenomena and solar activity, I, fasc. 4, 14, 1927.

BUREAU, R. — Eruptions chromosphériques et ionosphère, VI, 153, 1946.

BUREAU, R., DAUVILLIER, A. — L'éruption chromosphérique du 19 novembre 1949 et ses conséquences géophysiques (R), VIII, P. II, 322, 1950.

BUREAU, R. — L'effet sur l'ionosphère du rayonnement électromagnétique solaire, VIII, P. II, 322, 1950.

COBLENTZ, W. W., STAIR, R. — Photoelectric measurements of ultra violet solar activities in the stratosphere transmitted from unmanned balloons (Rf), V, fasc. 1, 187, 1938.

DAUVILLIER, A., BUREAU, R. — L'éruption chromosphérique du 19 novembre 1949 et ses conséquences géophysiques (R), VIII, P. II, 322, 1950.

DELLINGER, J. H., KIRBY, S. S., GILLILAND, T. R., SMITH, N. — Ionosphere disturbances associated with solar activity (Rf), V, fasc. 1, 251, 1938.

GAUZIT, J. — Sur la formation d'une ride de la couche E au lever et au coucher du Soleil et son rôle dans la propagation des atmosphériques, VII, 356, 1948.

GILLILAND, T. R., KIRBY, S. S., SMITH, N. — Regular characteristics of the ionosphere throughout half a sunspot cycle (Rf), V, fasc. 1, 152, 1938.

GILLILAND, T. R., SMITH, N., DELLINGER, J. H., KIRBY, S. S. — Ionosphere disturbances associated with solar activity (Rf), V, fasc. 1, 251, 1938.

JOUAUST, R. — Remarques au sujet des relations entre les phénomènes solaires et la propagation des ondes, V, fasc. 1, 371, 1938.

KIRBY, S. S., SMITH, N., GILLILAND, T. R. — Regular characteristics of the ionosphere throughout half a sunspot cycle (Rf), V, fasc. 1, 152, 1938.

MARTYN, D. F. — Some consequences of solar tides in the F2 region of the ionosphere (R), VII, 244, 1948.

MENZEL, D. H. — The Sun and the Ionosphere, VI, 134, 1946.

MENZEL, D. H. — A new theory of solar activity and solar terrestrial relationships (R, Rf), VIII, P. II, 205, 1950.

NAISMITH, R., APPLETON, E. V. — Variations du rayonnement solaire pendant un cycle de taches solaires, V, fasc. 1, 150, 1938.

OHMAN, Y. — On the solar work of the Stockholm Observatory (R, Rf), VIII, P. II, 228, 1950.

PEAVEY, R. C., WHITE, G. R. — Changes of maximum usable frequency with sunspot number (R), VII, 226, 1948.

PICKARD, G. W. — The relation between radio reception, sunspot position and area, I, fasc. 1, 51, 1927.

SCHELLING, J. C. — Memorandum on sunspots, IV, 143, 1934.

SMITH, N., GILLILAND, T. R., KIRBY, S. S. — Regular characteristics of the ionosphere throughout half a sunspot cycle (Rf), V, fasc. 1, 152, 1938.

SMITH, N., DELLINGER, J. H., KIRBY, S. S., GILLILAND, T. R. — Ionosphere disturbances associated with solar activity (Rf), V, fasc. 1, 251, 1938.

STAIR, R., COBLENTZ, W. W. — Photoelectric measurements of ultra violet solar activities in the stratosphere transmitted from unmanned balloons (Rf), V, fasc. 1, 187, 1938.

STELSON, H. T. — Solar effects on radio reception at broadcast frequencies, V, fasc. 1, 381, 1938.

STELSON, H. T. — Changes in the diurnal field intensity patterns of WWV with the recent rise in the sunspot cycle as received at Needham, Massachusetts (R), VII, 223, 1948.

TAYLOR, E. W. — Absorption of radio waves reflected at vertical incidence as a function of the sun's zenith angle (R), VII, 227, 1948.

WAYMORE, I. J., AUSTIN, L. W. — On the influence of solar activity on radio transmission, I, fasc. 1, 3, 1927.

WHITE, G. R., PEAVEY, R. C. — Changes of maximum usable frequency with sunspot number (R), VII, 226, 1948.

Eclipses

APPLETON, E. V., CHAPMAN, S. — Ionization changes during a solar eclipse (R), IV, 189, 1934.

CHAPMAN, S., APPLETON, E. V. — *Idem.*

H. M. NAUTICAL ALMANAC OFFICE. — The ionospheric eclipse of 1940, Oct. 1 (R), V, fasc. 1, 324, 1938.

IRO, Y., MINOHARA, T. — Ionosphere heights measured in the South Sea Island and radio observations made during the solar eclipse of Feb. 14, 1934, IV, 147, 1934.

ITO, Y., MINOHARA, T. — Etudes de l'ionosphère pendant l'éclipse totale du Soleil du 19 juin 1936 (R), V, fasc. 1, 31, 1938.

LIANG, P. H. and colleagues. — Effect on F2 ionization of the partial eclipse of May 9, 1948, as observed at Wu-Chang (R), VII, 247, 1948.

MAEDA, K. — Ionospheric measurements at Losap Island during the solar eclipse of February 14, 1934, IV, 147, 1934 (R).

MAEDA, K., YSAGAWA, K. — Mesures ionosphériques pendant l'éclipse totale du 19 juin 1936 (R), V, fasc. 1, 18, 1938.

MINOHARA, T., IRO, Y. — Ionosphere heights measured in the South Sea Island and radio observations made during the solar eclipse of February 14, 1934, IV, 147, 1934.

MINOHARA, T., ITO, Y. — Etudes de l'ionosphère pendant l'éclipse totale du Soleil du 19 juin 1936 (R), V, fasc. 1, 31, 1938.

NAKAMURA, T. — Mesure de la hauteur de l'ionosphère à Heiho, Mandchourie, pendant l'éclipse solaire totale du 19 juin 1936 (R), V, fasc. 1, 32, 1938.

WATTS, J. M. — Motion picture of the ionosphere during a total solar eclipse (R), VII, 224, 1948.

YSAGAWA, K., MAEDA, K. — Mesures ionosphériques pendant l'éclipse totale du 19 juin 1936 (R), V, fasc. 1, 18, 1938.

Relations with geophysical phenomena

ALLEN, E., Jr. — Reflections of very high frequency radio waves from meteoric ionization (R), VII, 223, 1948.

APPLETON, E. V. — The influence of the earth's magnetic field on wireless transmission (R), I, fasc. 1, 2, 1927.

APPLETON, E. V. — Measurement of ionospheric layer heights and correlation with other geophysical and cosmic data, IV, 152, 1934.

APPLETON, E. V., INGRAM, L. C. — Magnetic storms and upper atmospheric ionization, V, fasc. 1, 311, 1938.

APPLETON, E. V., NAISMITH, R. — The radio detection of meteor trails and allied phenomena (R), VII, 386, 1948.

ARDILLON, J., LEJAY, P. — Summary on the changes in the characteristics of the F1 layer at noon according to the latitude of the stations, VIII, P. II, 259, 1950.

DAHL, O., GEBHARD, L. A. — Measurements of the effective heights of the conducting layer and the disturbances of August 19, 1927, I, fasc. 1, 16, 1927.

DIEMINGER, W., PLENDS, H. — Phénomènes anormaux dans l'ionosphère à l'apparition de l'aurore boréale (R), V, fasc. 1, 100, 1938.

EYGRIG, R., GOUBEAU, G., NETZLER, Th., ZENNECK, J. — L'état de l'ionosphère pendant l'aurore boréale du 25 au 26 janvier 1938 d'après les observations de la station du Horzagstand (R), fasc. 1, 101, 1938.

FRANZ, K., WAGNER, K. W. — Relations entre les phénomènes de propagation et les échos, et les phénomènes de la géophysique, IV, 194, 1934.

FUKUSHIMA, N., NAGATA, T. — Electrical state of ionosphere viewed from geomagnetic variations (R), VIII, P. II, 200, 1950.

GAUTIER, N. T., MCNISH, A. G. — Lunar effects on F2 layer ionization (R), VII, 225, 1948.

GAUTIER, N. T., KNECHT, R. W., MCNISH, A. G. — Lunar stratification of the F2 layer at Huancayo (Rf), VIII, P. II, 216, 1950.

GEBHARD, L. A., DAHL, O. — Measurements of the effective heights of the conducting layer and the disturbances of August 19, 1927, I, fasc. 1, 16, 1927.

GOUBEAU, G., NETZLER, Th., ZENNECK, J., EYGRIG, R. — L'état de l'ionosphère pendant l'aurore boréale du 25 au 26 janvier 1938 d'après les observations de la station de Horzagstand (R), V, fasc. 1, 101, 1938.

HULBURT, E. O. — Eclat du ciel crépusculaire et température de l'atmosphère à environ 60 km d'altitude (R), V, fasc. 1, 88, 1938.

HULBURT, E. O. — Ionosphere during morning twilight (R), V, fasc. 1, 384, 1938.

INGRAM, L. G., APPLETON, E. V. — Magnetic storms and upper atmospheric ionization, V, fasc. 1, 311, 1938.

JOHNSTON, H. F., MCNISH, A. G. — The American magnetic character-figure C_A in relation to communication problems (Rf), V, fasc. 1, 157, 1938.

KERR, F. J., SHAIN, C. A. — Moon echoes and transmission through the ionosphere (Rf), VIII, P. II, 186, 1950.

KNECHT, R. W., MCNISH, A. G., GAUTIER, T. N. — Lunar stratification of the F2 layer at Huancayo (Rf), VIII, P. II, 216, 1950.

LEJAY, P., ARDILLON, J. — Summary on the changes in the characteristics of the F1 layer at noon according to the latitude of the stations, VIII, P. II, 259, 1950.

LÉPÉCHINSKY, P., PILLET, G. — Contribution to the study on the influence of the terrestrial magnetism on the ionization of the F2 layer (R), VIII, P. II, 260, 1950.

LIANG, P. H. — F2 ionization and geomagnetic latitudes (R), VII, 250, 1948.

LUGEON, J. — Les perturbations radiophoniques pendant l'aurore polaire du 25 janvier 1938 en Suisse, V, fasc. 1, 326, 1938.

MARIS, H. B. — A theory of the upper atmosphere and meteors, I, fasc. 1, 41, 1927 (R).

MAURAIN, M. C. — Note sur la recherche des relations entre la propagation des ondes électromagnétiques et d'autres phénomènes terrestres ou solaires, II, fasc. 2, 21, 1928.

MCNISH, A. G., JOHNSTON, H. F. — The American magnetic character-figure C_A in relation to communication problems (Rf), V, fasc. 1, 157, 1938.

MCNISH, A. G., GAUTIER, T. N. — Lunar effects on F2-layer ionization (R), VII, 225, 1948.

MCNISH, A. G., GAUTIER, T. N., KNECHT, R. W. — Lunar stratification of the F2-layer at Huancayo (Rf), VIII, P. II, 216, 1950.

MINOHARA, T., INOUYE, T. — Correlation of long wave day time radio transmission with magnetic disturbances, II, fasc. 1, 146, 1928.

NAGATA, T., FUKUSHIMA, N. — Electrical state of ionosphere viewed from geomagnetic variations (R), VIII, P. II, 200, 1950.

NAISMITH, R., APPLETON, E. V. — The radio detection of meteor trails and allied phenomena (R), VII, 386, 1948.

NETZLER, Th., ZENNECK, J., EYFRIG, R., GOUBEAU, G. — L'état de l'ionosphère pendant l'aurore boréale du 25 au 26 janvier 1938 d'après les observations de la station du Horzagstand (R), V, fasc. 1, 101, 1938.

PILLET, G., LÉPÉCHINSKY, D. — Contribution to the study on the influence of terrestrial magnetism on the ionization of the F2 layer (R), VIII, VIII, P. II, 260, 1950.

PLENDS, H., DIEMINGER, W. — Phénomènes anormaux dans l'ionosphère à l'apparition de l'aurore boréale (R), V, fasc. 1, 100, 1938.

SHAIN, C. A., KERR, F. J. — Moon echoes and transmission through the ionosphere (Rf), VIII, P. II, 186, 1950.

VAN DER WYCK, C. Th., F. — Influence of a magnetic field on the propagation of electromagnetic waves (R), VI, 147, 1946.

VASSY, A. et E. — Sur quelques relations entre la lumière du ciel nocturne et les régions ionisées de l'atmosphère (R), VI, 91, 1946.

WAGNER, K. W., FRANZ, K. — Relations entre les phénomènes de propagation et les échos, et les phénomènes de la géophysique, IV, 194, 1934.

WANG, S. — Sporadic E-ionization, auroral displays and geomagnetic latitudes (R), VII, 249, 1948.

WAYMORE, I. J. — Further study of the relation of radio wave propagation to disturbances in terrestrial magnetism, II, fasc. 1, 98, 1928.

INOUYE, T., MINOHARA, T. — Correlation of long wave day time radio transmission with magnetic disturbances, II, fasc. 1, 146, 1928.

ZENNECK, J., EYFRIG, R., GOUBEAU, G., NETZLER, Th. — L'état de l'ionosphère pendant l'aurore boréale du 25 au 26 janvier 1938 d'après les observations de la station du Horzagstand (R), V, fasc. 1, 101, 1938.

Ionisation

APPLETON, E. V. — Laboratory investigation of dielectric constant of ionised air, IV, 148, 1934 (R).

APPLETON, E. V., NAISMITH, R., INGRAM, L. J. — La méthode de la fréquence arctique pour la mesure de l'ionisation de la haute ionosphère (R), V, fasc. 1, 310, 1938.

BANWELL, C. J., WHITE, F. W. G. — Preliminary measurements of F2 region ionization (Rf), V, fasc. 1, 75, 1938.

COHEN, N., GOLDSTEIN, L. — Conductivity of ionized gases in the microwave region (R), VII, 223, 1948.

GOLDSTEIN, L., COHEN, N. — *Idem.*

HULBURT, E. O. — Ionization in the upper atmosphere, I, fasc. 1, 37, 1927 (R).

INGRAM, L. J., APPLETON, E. V., NAISMITH, R. — La méthode de la fréquence arctique pour la mesure de l'ionisation de la haute ionosphère (R), V, fasc. 1, 310, 1938.

KAMOSHITA, T., MAEDA, K., TUKADA, T. — Variations annuelles dans l'ionisation de la haute atmosphère (R), V, fasc. 1, 23, 1938.

MAEDA, K., TUKADA, T., KAMOSHITA, T. — *Idem.*

NAISMITH, R., INGRAM, L. J., APPLETON, E. V. — La méthode de la fréquence arctique pour la mesure de l'ionisation dans la haute ionosphère (R), V, fasc. 1, 310, 1938.

TUKADA, T., KAMOSHITA, T., MAEDA, K. — Variations annuelles dans l'ionisation de la haute atmosphère (R), V, fasc. 1, 23, 1938.

WHITE, F. W. G., BANWELL, C. J. — Preliminary measurements of F2 region ionization (Rf), V, fasc. 1, 75, 1938.

Ionospheric disturbances

BUREAU, R. — Le spectre radioélectrique des perturbations ionosphériques, VI, 94, 1946.

BUREAU, R. — Les perturbations ionosphériques à début brusque (P.I.D.B.) de février 1945 (R), VI, 156, 1946.

BUREAU, R. — Nouvelles recherches sur le spectre des perturbations ionosphériques à début brusque, VI, 158, 1946.

BUREAU, R. — Liste des perturbations ionosphériques à début brusque (R), VI, 159, 1946.

DEMING, L. S., WULF, O. R. — On the production of the ionospheric regions E and F and the lower altitude ionization causing radio fadeouts (R), V, fasc. 1, 380, 1938.

GILLILAND, T. R., KIRBY, S. S., SMITH, N. — The effects of ionosphere storms on radio transmission (Rf), V, fasc. 1, 286, 1938.

JOUAUST, R. — Rapport sur les perturbations ionosphériques, VI, 94, 1946.

KIRBY, S. S., SMITH, N., GILLILAND, T. R. — The effects of ionosphere storms on radio transmission (Rf), V, fasc. 1, 286, 1938.

MUNRO, G. H. — Travelling disturbances in the ionosphere (Rf), VIII, P. II, 188, 1950.

SMITH, N., GILLILAND, T. R., KIRBY, S. S. — The effects of ionosphere storms on radio transmission (Rf), V, fasc. 1, 286, 1938.

WULF, O. R., DEMING, L. S. — On the production of the ionospheric regions E and F and the lower altitude ionization causing radio fadeouts (R), V, fasc. 1, 380, 1938.

Motions in the ionosphere

APPLETON, E. V., WEEKES, K. — Les marées dans la haute atmosphère, V, fasc. 1, 25, 1938.

MANNING, L. A., VILLARD, O. G., PETERSON, A. M., Jr. — Meteoric echo study of ionospheric winds (R, Rf), VIII, P. II, 191, 1950.

MARTYN, D. F. — Some consequences of horizontal tidal air movements in the ionosphere (R), VII, 243, 1948.

MARTYN, D. F. — Some consequences in the ionosphere of height gradient in tidal air motions (R), VII, 244, 1948.

PETERSON, A. M. Jr., MANNING, L. A., VILLARD, O. G. — Meteoric echo study of ionospheric winds (R, Rf), VIII, P. II, 191, 1950.

VILLARD, O. G., PETERSON, A. M., Jr., MANNING, L. A. — *Idem.*

WEEKES, K., APPLETON, E. V. — Les marées dans la haute atmosphère, V, fasc. 1, 25, 1938.

Interaction

APPLETON, E. V. — Note sur une méthode pour étudier l'interaction des ondes électromagnétiques, V, fasc. 1, 94, 1938.

CUTOLO, M. — Résonance dans le phénomène d'intermodulation ionosphérique et mesures des degrés de modulation parasitaire, VII, 322, 1948.

GROSSKOPF, J. — L'interférence de modulation mutuelle dans l'ionosphère (R), V, fasc. 1, 3, 1938.

RATCLIFFE, J. A. — The interaction of radio waves, VII, 196, 1948.

VAN DER MARCK, J., VAN DER POL, B. — Interaction of radio waves (R), IV, 192, 1934.

VAN DER POL, B., VAN DER MARCK, J. — *Idem.*

VAN DER POL, B. — The effect of the retroaction on the received signal strength, I, fasc. 1, 57, 1927.

VAN DER POL, B. — Interaction of radio waves II (R), V, fasc. 1, 311, 1938.

VAN DER POL, B. — Report on interaction of radio waves, VII, 193, 1948.

Forecast

BERKNER, L. V., WELLS, H. W. — Investigations of fadeouts at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington (Rf), V, fasc. 1, 168, 1938.

GARDNER, A. L., GREEN, G. M. — An ionospheric index (R), VII, 294, 1948.

GAUTIER, T. N. — Comparison of predictions of maximum usable frequency and lowest useful high frequency with actual frequency usage on radio communication circuits in 1944 (R), VI, 150, 1946.

GILLILAND, T. R., SMITH, N., KIRBY, S. S. — The application of graphs of maximum usable frequency to communication problems (Rf), V, fasc. 1,

GREEN, G. M. — Short term forecasts of radio conditions. Progress report of correlation work (R), VII, 287, 1948.

GREEN, G. M. — Radio forecasts : Notes on lack of agreement (R), VII, 287, 1948.

GREEN, G. M., GARDNER, A. L. — An ionospheric index (R), VII, 294, 1948.

GERBER, W., WERTHMÜLLER, A. — Variations de l'intensité des évanouissements à courte distance des émetteurs de radiodiffusion au cours d'une période d'activité solaire (R), VI, 146, 1946.

KIRBY, S. S., GILLILAND, T. R., SMITH, N. — The application of graphs of maximum usable frequency to communication problems (Rf), V, fasc. 1, 127, 1938.

PARKINSON, T. — Some observations of short-period radio fading, II, fasc. 1, 105, 1928.

SMITH, N., KIRBY, S. S., GILLILAND, T. R. — The application of graphs of maximum usable frequency to communication problems (Rf), V, fasc. 1, 127, 1938.

THOMSON, I. L. — Short-term forecasts of radio propagation conditions (R), VII, 288, 1948.

WELLS, H. W., BERKNER, L. V. — Investigations of fadeouts at the Department of Terrestrial Magnetism of the Carnegie Institution of Washington (Rf), V, fasc. 1, 168, 1938.

WERTHMÜLLER, A., GERBER, W. — Variations de l'intensité des évanouissements à courte distance des émetteurs de radiodiffusion au cours d'une période d'activité solaire (R), VI, 146, 1946.

Observations and Measurements

APPLETON, E. V. — Ionospheric station at Slough, England, VII, 214, 1948.

ARGENCE, E., BARRÉ, M., RAWER, K. — Ionospheric observations taken on board « Commandant Charcot » in Adelie Land (R), VIII, P. II, 270, 1950.

BARRÉ, M., RAWER, K., ARGENCE, E. — *Idem.*

BOREL, G. — Note sur le dispositif consistant à additionner les puissances recueillies sur deux antennes perpendiculaires lors de sondages verticaux (Re), VIII, P. II, 247, 1950.

BOTTINI, A. — Le esplorazioni della ionosfera nel centro radio sperimentale G. Marconi di Torrechiaruccia (R), V, fasc. 1, 328, 1938.

CARBENAY, F. — Sur la mesure de l'inclinaison d'une onde électromagnétique (R, Re), VIII, P. II, 557, 1950.

DAUVILLIER, M. A. — Note sur l'intérêt de sondages continus de l'ionosphère par la méthode des radio-échos, IV, 120, 1934.

DECAUX, B., GALLE, J. B. — Observations effectuées le 14 mars 1934 de 01.45 à 03.40 (TMG), IV, 166, 1934.

ESTRABAUD, S. — Récepteur pour l'étude de la polarisation des échos ionosphériques (R), VIII, P. II, 242, 1950.

FEINSTEIN, J. — Higher order approximations in ionospheric wave frequencies (R, Rf), VIII, p. II, 210, 1950.

FERRIÉ, G. — Note au sujet de certains dispositifs utilisés pour l'étude de la propagation des ondes radioélectriques, II, fasc. 1, 89, 1928.

GALLE, J. B., DECAUX, B. — Observations effectuées le 14 mars 1934 de 01.45 à 03.40 (TMG), IV, 166, 1934.

GALLET, R. — Propositions of a revision of the ionospheric terminology and the conventions of calculating medians (R), VIII, P. II, 253, 1950.

GALLET, R. — On the use of punch-cards for publication of ionospheric measurements and direct exchange of cards for statistical work (R), VIII, P. II, 255, 1950.

GEORGE, D. E., WATTS, J. M. — Detection of rapidly moving clouds (R), VI, 145, 1946.

GLINZ, C. — Station d'essais pour sondages ionosphériques à ondes longues (Re), VIII, P. II, 272, 1950.

GOLDMAN, S., HALLBORG, H. E. — Radiation angle variations from ionosphere measurements (R), VII, 213, 1948.

GORDON, W. E., LAGRANE, A. H., STRAITON, A. W. — A method of measuring angle of arrival (R), VII, 231, 1948.

HALLBORG, H. E., GOLDMAN, S. — Radiation angle variations from ionosphere measurements (R), VII, 213, 1948.

HELLIWELL, R. A. — Vertical incidence ionosphere measurements at 100 kc/s (R), VII, 230, 1948.

KENRICK, G. W. — Radio observations in Puerto Rico (Rf), V, fasc. 1, 205, 1938.

KIRBY, S. S., NORTON, K. A., LEBSTER, G. H. — An analysis of continuous records of field intensity at broadcast frequencies, IV, 183, 1934.

LAGRANE, A. H., STRAITON, A. W., GORDON, W. E. — A method of measuring angle of arrival (R), VII, 231, 1948.

LEBSTER, G. H., KIRBY, S. S., NORTON, K. A. — An analysis of continuous records of field intensity at broadcast frequencies, IV, 183, 1934.

LEHMANN, G. — Les méthodes d'investigation expérimentales de la couche D de l'ionosphère (Re), VIII, P. II. 235, 1950.

LEJAY, P. — Station ionosphérique française, VII, 234, 1948.

LÉPÉCHINSKY, D. — Note résumée sur la formation des couches ionisées. Méthode graphique d'analyse des résultats expérimentaux. Applications à la couche F2 (Re), VIII, P. II, 250, 1950.

LINCOLN, J. V., SMITH, N. — Method for developing radio propagation quality figures for analysis of actual radio propagation conditions (R), VI, 152, 1946.

LIANG, P. H., LUNG, H. L., WANG, S. — A study of ionospheric data obtained at Wu-chang from September 1946 to December 1947 (R), VII, 248, 1948.

LUNG, H. L., WANG, S., LIANG, P. H. — *Idem.*

MIMNO, H. R., WANG, P. H. — Auxiliary apparatus for operating Kennelly-Heaviside layer height recorders, IV, 138, 1934.

MIMNO, H. R., WANG, P. H. — Analysis of a 6000 hour record of Kennelly-Heaviside layer heights, IV, 139, 1934.

NAISMITH, R. — The presentation of ionospheric data (world values of F2 (R), VI, 121, 1946.

NAISMITH, R. — Sources of errors in ionospheric measurements, VII, 251, 1948.

NATIONAL BUREAU OF STANDARDS. — Program of ionosphere measurements and form for analyzing data, IV, 134, 1934.

NORTON, K. A., LEBSTER, G. H., KIRBY, S. S. — An analysis of continuous records of field intensity at broadcast frequencies, IV, 183, 1934.

PODHARSKY, I. — Etude de la couche D par la méthode de Merrick et Hentschel (Re), VIII, P. II, 247, 1950.

RAWER, K., ARGENCE, E., BARRÉ, M. — Ionospheric observations taken on board « Commandant Charcot » in Adelie Land (R), VIII, P. II, 270, 1950.

ROCARD, Y. — Note sur la station ionosphérique de Fribourg-en-Brisgau, VI, 122, 1946.

SAVELLI, V. — Appareil pour la mesure de la hauteur des régions ionisées de la haute atmosphère (R), V, fasc. 1, 375, 1938.

SMITH, R. A. — Measurement of the velocity of propagation of radio waves in the atmosphere using pulse technique, VI, 161, 1946.

SMITH, N., LINCOLN, J. V. — Method for developing radio propagation quality figures for analysis of actual radio propagation conditions (R), VI, 152, 1946.

STRAITON, A. W., GORDON, W. E., LAGRANE, A. H. — A method of measuring angle of arrival (R), VII, 231, 1948.

WANG, P. H., MIMNO, H. R. — Auxiliary apparatus for operating Kennelly-Heaviside layer height recorders, IV, 138, 1934.

WANG, P. H., MIMNO, H. R. — Analysis of a 6000 hour record of Kennelly-Heaviside layer heights, IV, 139, 1934.

WANG, S., LIANG, P. H., LUNG, H. L. — A study of ionospheric data obtained at Wuchang from September 1946 to December 1947 (R), VII, 248, 1948.

WATTS, J. M., GEORGE, D. E. — Detection of rapidly moving clouds (R), VI, 145, 1946.

Miscellaneous

ANAZAWA, C., NAKAGAMI, T. — Readability of long distance radio communications, II, fasc. 1, 101, 1928.

ARGENCE, E., MAYOT, M., RAWER, K. — Etude du décrément d'absorption $\delta 2$ et détermination du nombre de chocs (R, Re), VIII, P. II, 267, 1950.

ASTRÖM, E. — Magneto-hydrodynamic waves in a plasma (Rf), VIII, P. II, 229, 1950.

BREMMER, H. — The geometry and the field of waves coming from outside the earth (R), VII, 213, 1948.

CONES, H. N. — Interim report on experimental braodband antennas for vertical-incidence ionosphere sounding (R), VII, 232, 1948.

GERBER, W., WERTHMÜLLER, A. — Fluctuation du champ des émetteurs de radiodiffusion au-delà du rayon d'audition agréable (R), VII, 218, 1948.

HARRINGTON, M. B., SMITH, N. — The variability of sky-wave field intensities at median and high frequencies (R), VI, 152, 1946.

HERLOFSON, N. — Magneto-hydrodynamic waves in a compressible fluid conductor (Rf), VIII, P. II, 232, 1950.

KOURGANOFF, V., LAFFINEUR, M. — Sur une méthode de mesure de l'absorption de la couche D utilisant la Voie Lactée comme source de rayonnement sur ondes métriques (Re), P. II, 261, 1950.

LAFFINEUR, M., KOURGANOFF, V. — *Idem.*

MAYOT, M. RAWER, K., ARGENCE, E. — Etude du décrement d'absorption δ 2 et détermination du nombre de chocs (R, Re), VIII, P. II, 267, 1950.

NAKAGAMI, T., ANAZAWA, C. — Readability of long distance radio communications, II, fasc. 1, 101, 1928.

PETERSON, A. M. — Backscatter studies (R), VIII, P. II, 214, 1950.

PRICE, W. L. — Radio shadow effects produced in the atmosphere by inversions (R), VII, 245, 1948.

RAWER, K., ARGENCE, E., MAYOT, M. — Etude du décrément d'absorption δ 2 et détermination du nombre de chocs (R, Re), VIII, P. II, 267, 1950.

SMITH, N., HARRINGTON, M. B. — The variability of sky-wave field intensities at median and high frequencies (R), VI, 152, 1946.

SMITH-ROSE, R. L. — Radio direction finding by transmission and reception, II, fasc. 1, 54, 1928.

SMITH-ROSE, R. L. — Report on meeting of C.C.I.R. Study Group n° VI in Stockholm, May 1952, IX, fasc. 4, 15, 1952.

WERTHMÜLLER, A., GERBER, W. — Fluctuation du champ des émetteurs de radiodiffusion au-delà du rayon d'audition agréable (R), VII, 218, 1948.

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INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

Report of the 10th Meeting of the Executive Board of the I.C.S.U.

The 10th meeting of the Executive Board of the I.C.S.U. (International of Scientific Unions) took place in the building of the National Academy of Sciences, 1201 Constitution Avenue, N. W., Washington, D. C., U. S. A., September 29th, October 1st, 1958. Following this meeting, the VIIIth General Assembly of the I.C.S.U. was held in the same premises, October 2nd-October 6th, 1958.

Mr. E. Herbays, who is at the same time Secretary General of U.R.S.I. (Union Radio Scientifique Internationale) and Treasurer of I.C.S.U., also attended both meetings, and a report from his hand of the General Assembly was published in *Information Bulletin*, nº 112, page 31. We therefore limit ourselves here to a summary report of the meeting of the Executive Board, in which report we stress those items, which seem of special interest to U.R.S.I. A more extensive report, prepared by the I.C.S.U. itself, may be obtained from the U.R.S.I. Secretariat, 7, place Danco, Brussels 18, Belgium, which report was used in preparing these notes.

The meeting was presided over by Dr. L. V. Berkner, President. Present were 8 members of the Bureau, 19 representatives of the « General and Special Unions », 8 observers and alternates, and 8 persons, invited to discuss specific subjects. It is not usual to invite to the Executive Board delegates from the National Academies, however, they were present at the meeting of the General Assembly.

Proposed Levy on Special Committees, Permanent Services, and all other Dependent Organisms of I.C.S.U., for services rendered by the Secretariat

The Bureau recommends the adoption of a 3 ½ percent levy on all funds received on behalf of the Special Committees and similar organisms of I.C.S.U., which was accepted.

I.C.S.U. Publication Office

The Executive Board gives approval to the establishment of an I.C.S.U. Publications Office, under the direction of Sir Harold Spencer Jones.

The objective of this office, situated at the Royal Institution, Albemarle Street, London W. 1, will be :

(*a*) To encourage publication of needed scientific material arising from the activities of I.C.S.U. and its dependent organisms ;

(*b*) To produce self consistent series of volumes of a high standard in the fields of activity of I.C.S.U. and its dependent organisms ;

(*c*) To ensure effective and satisfactory financing of I.C.S.U. publications ;

(*d*) To provide assistance to scientific groups associated with I.C.S.U. in prompt production of suitable publications ;

(*e*) To effectuate arrangements to provide for suitable promotion and distribution of I.C.S.U. publications ;

(*f*) To minimize costs of publication, to expedite publication arrangements and to relieve the dependent organisms of I.C.S.U. of the burden of the functions to be carried by the Publications Office.

These objectives will be realized within the framework of the following regulations :

(*a*) In establishment of the Publications Office, the I.C.S.U. recognizes the editorial rights and responsibilities of each organism responsible for the discharge of an I.C.S.U. function. Under the rules established for each I.C.S.U. activity, it is the responsibility of each Special Committee, Joint Commission or other organism to organize and edit its own publications. However, all such publications should be processed for publication through the

I.C.S.U. Publications Office. The I.C.S.U. Publications Office should be notified of each publication in its transmittal to the publisher and its distribution. The I.C.S.U. Publications Office will endeavor to provide whatever services are within its capacity, to assist the completing and expediting of the publication, and, when necessary, in finding and contracting with a suitable publisher. It will maintain close contact with publishers suitable for rapid publications and promotion of its publications.

(*b*) The I.C.S.U. Publications Office will review each publication with respect to its general quality and format and will aid by offering suggestions for improvement where these seem appropriate. When requested, additional services will be provided within the capacity of the office to meet those needs. It will also review the financial arrangements for each publication, to protect I.C.S.U.'s financial interests, and will aid in finding such further financial resources as may be needed to make possible necessary publication. The I.C.S.U. will not establish nor change publication arrangements without full consultation with the I.C.S.U. organism concerned.

(*c*) The I.C.S.U. Publications Office will endeavor to use commercial contracts for publication and promotion wherever possible, which may be either self-liquidating or return a portion of the profits to I.C.S.U. Such contracts are subject to approval by the President and Treasurer of I.C.S.U. before effectuating and must specifically avoid exploitation of I.C.S.U.'s good name for unconnected promotion or advertising. Publication or financing in other forms are subject to the approval of the I.C.S.U. Bureau.

In case of a difference of opinion between the I.C.S.U. Publications Office and any dependent organism of I.C.S.U., on such questions as publisher, format, distribution, etc , the matter will be referred by the President of I.C.S.U. to arbitration by a three-men committee of trusted advisers, appointed by him.

The services of the I.C.S.U. Publications Office will be available upon request to any Union adhering to the I.C.S.U. for assistance by that Union. The Publications Office, in consultation with the Treasurer, may make acceptable arrangements with the Union concerned, for a suitable division of any profits.

The I.C.S.U. Publications Office will report to the I.C.S.U. Bureau annually on publications issued, in work, and anticipated.

It will further report promptly on financial assistance needed to maintain desirable and necessary publications, and possible arrangements to meet these needs. It will also keep I.C.S.U. agencies advised regularly of states of publications in process.

It was decided that in future a new quarterly journal, the I.C.S.U. Review, will be published with Sir Harold Spencer Jones as Editor. The first number will appear in January 1959. The I.C.S.U. Publications Office will edit the I.C.S.U. Review with the expediting assistance of the Administrative Secretary of I.C.S.U.

Rules for Special Committees

See *Bulletin*, nº 112, page 46.

International Astronautical Federation

The possible affiliation of the International Astronautical Federation (I.A.F.), (President Mr. Haley), to I.C.S.U. was discussed. This matter of recognition was referred to the General Assembly, which adopted the following resolution :

« The General Assembly,

Aware of the useful activities of the International Astronautical Federation in furthering the science and technology of astronautics,

Welcomes the interest shown by the International Astronautical Federation in cooperating with the International Council of Scientific Unions and looks forward to the possibility of arranging in the future a more formal affiliation in matters of common concern ».

Representation of the Unions on the Executive Board

The Executive Board accepted the proposal of the Bureau, whereby in future each Union will nominate a specific delegate or delegates, with alternates, to serve the Executive Board for the period between successive General Assemblies of the Unions ; it being noted that the Statutes of both U.R.S.I. and I.U.G.G. (International Union of Geodesy and Geophysics) already covered this item.

Application for National Membership from Argentina and Bulgaria

Both applications were transmitted to the General Assembly with the unanimous approval of the Board, and were subsequently ratified by that body.

International Geophysical Year (I.G.Y.)

The next point on the agenda was the International Geophysical Year (C.S.A.G.I.). Professor Chapman (President) and Professor Nicolet (Secretary) elaborated and spoke in defence of a report submitting further activities of the C.S.A.G.I. This item appeared somewhat controversial, as the I.C.S.U. Board also submitted somewhat different views on the same subject and no decision could be obtained in the Executive Board, reason why the item was again brought up in the General Assembly. The General Assembly originally was also unable to accept either of these texts and therefore an ad hoc Committee was appointed consisting of van der Pol (Chairman), Herlofson, Laclavère, Kaplan and Ogorodnikov, to reconcile the two documents.

This Committee came back with a unanimous recommendation, which thereupon was accepted unanimously by the General Assembly and which ran as follows :

« 1. The General Assembly resolves to establish a Special Committee for Inter-Union Cooperation in Geophysics, henceforward called the SCG, to consist of the members of the Bureau of the C.S.A.G.I. and of its present reporters on the various I.G.Y. disciplines.

The SCG will be organized and managed in accordance with the I.C.S.U. Rules for Special Committees.

The S.C.G. will enter into function on the date when the C.S.A.G.I. terminates its work, i. e., on July 1, 1959.

2. The General Assembly accepts the recommendation of the C.S.A.G.I. in respect of the International Geophysical Cooperation 1959 that the observational and data collecting activities in the geophysical and related sciences be conducted during 1959 on the same general plan as in 1957-1958, under the direction of the C.S.A.G.I., respectively the S.C.G., as far as practicable and at

such a level and in such fields as may be determined by each participating National Committee.

3. The primary task of the S.C.G. will be to deal with all aspects of the closing stage of the I.G.Y. enterprise, including the International Geophysical Cooperation 1959. Its activities will include publication, finance, and organization of international cooperation in the use and analysis of I.G.Y. data by World Data Centres, the International Unions, the World Meteorological Organization and otherwise.

In the accomplishment of this task, a close cooperation between the S.C.G. on one hand, and the Unions and other organizations concerned on the other hand, shall be maintained. »

The Board clarified the understanding that those programmes which have been entrusted to other Special Committees or Services of I.C.S.U. shall be transferred by the C.S.A.G.I. to those Committees or Services on or before December 31st, 1958. Accordingly it was understood that the C.S.A.G.I. calendar is as follows :

Termination date of the International Geophysical Year, December 31st, 1958.

Termination date of C.S.A.G.I., June 30th, 1959.

Termination date of C.S.A.G.I. Secretariat, October 31st, 1959.

Proposed Special Committee on Space Research (COSPAR)

The President urged that the Executive Board accept the recommendation of the Bureau for the immediate formation of a Special Committee on Space Research, in view of the enormous scientific potential of this activity. In particular, he stressed the need for I.C.S.U. to take the scientific initiative, whereby the United Nations would fulfil its proper role in governing the international regulation which was clearly necessary in the new field of Space Research.

Opinion amongst the members of the Board was sharply divided on this question. After hearing Professor Massey speak, on the President's invitation, of the need for a Special Committee : Oort, Wilson, Brode, Lindblad and van der Pol spoke in favour of its formation ; on the other hand, Engelhardt, Fleury, Laclavère and Morf warned against too hasty a decision.

On the suggestion of Boesch, it was finally agreed to propose a

Committee to function for one year only, by which time it might be more clearly seen what the next step ought to be.

Note : The proposal of the Board was accepted by the Assembly in the following terms :

The General Assembly :

Recognising the need of an International Committee on Space Research and

Considering that I.C.S.U. should continue its work of coordination in this field ;

Establishes an I.C.S.U. Committee on Space Research (COSPAR) to function until the end of the year 1959 as follows :

(*a*) a representative from each of the countries which are actually launching earth satellites, as also of those having major programmes in rocketry ;

(*b*) three representatives, designated on an agreed system of rotation, from among countries actively participating in tracking and other aspects of space research ;

(*c*) one representative each from the following Unions : Astronomy, (I.A.U.), Geodesy and Geophysics (I.U.G.G.), Pure and Applied Chemistry (I.U.P.A.C.), Radio Science (U.R.S.I.), Pure and Applied Physics (I.U.P.A.P.), Biological Sciences (I.U.B.S.), Theoretical and Applied Mechanics (I.U.T.A.M.), Physiological Science (I.U.P.S.) and Biochemistry (I.U.B.).

Proposed Special Committee on World Days (I.W.D.S.)

The Bureau of I.C.S.U., having considered the proposal of the C.S.A.G.I. Reporter for the formation of a Joint Commission on World Days, proposed to the Board instead an International World Days Service (I.W.D.S.) to function under U.R.S.I. The Board unanimously accepted this proposal, which was transmitted to the General Assembly, which adopted it in the following terms :

The General Assembly

ratifies the action of the Executive Board in establishing the following organism : International Service for World Days (I.W.D.S.), to function under U.R.S.I.

Special Committee on Contamination by Extra-Terrestrial Exploration (C.E.T.E.X.)

On the invitation of the President, Mr. Peter Alexander spoke to his report on the first meeting of C.E.T.E.X., and asked for the support of the Board for a second meeting, which, with the advice of experts in the field of satellites and space probes, should draw up a Code of Conduct for Space Research.

The Board voted unanimously for a second meeting of C.E.T.E.X.

Federation of Astronomical and Geophysical Services (F.A.G.S.)

The Secretary General of F.A.G.S., in presenting his report, noted the following points :

(1) The Service on Ultra-violet Radiation has been dropped from the Federation ;

(2) The work of the International Bureau of Atmospheric Ozone would soon pass to the World Meteorological Organization (WMO).

Joint Commissions

The Board reviewed the work of the existing Joint Commissions against the historical background and arrived at the following decisions :

(*a*) That the Joint Commission for the Ionosphere be abolished, to become an inter-union Commission under U.R.S.I.

(*b*) That the Joint Commission for Radio-Meteorology be abolished, to become an inter-union Commission under either U.R.S.I. or I.U.G.G. (International Union of Geodesy and Geophysics).

(*c*) That the Joint Commission on Solar and Terrestrial Relationships be abolished and that a Committee consisting of Professor Allen, Père Lejay (now deceased) and Professor J. T. Wilson consider the need or otherwise of a new Joint Commission, charged with a specific task in this field.

(*d*) That the continuance of the Joint Commission on Spectroscopy be referred to a Committee of I.U.P.A.P. (International Union of Pure and Applied Physics), I.U.P.A.C. (International Union of Pure and Applied Chemistry) and I.A.U. (International Union of Astronomy).

(*e*) That the Joint Commission on Applied Radioactivity be extended for three years under the new Rules, so that it may make specific recommendations to I.C.S.U. in regard to future needs of investigation in this field.

New Rules for Joint Commissions

See *Information Bulletin*, nº 112, page 42.

Budget of the Natural Sciences Department of Unesco

The Resolution adopted at the Ninth Meeting of the Executive Board, urging that the percentage of the total Unesco budget for 1959-60 to be allocated to the Natural Sciences Department be substantially increased, not having been reflected in the Draft Appropriation to be laid before the Tenth General Conference of Unesco, the Board decided unanimously to reaffirm its former resolution and to transmit it to the General Assembly for action.

Note : The General Assembly subsequently adopted the following resolution :

The General Assembly

endorses the recommendation of the Unesco Advisory Committee on Research in the Natural Sciences Programme of Unesco and also the recommendation of the Executive Board of I.C.S.U.

decides to transmit once again to all National Members of I.C.S.U. its urgent plea, that they make immediate contact with the Unesco National Commission in their respective countries, urging the Commissions to recommend to their Governments to include a scientific member in their respective National Delegations to the Tenth General Conference of Unesco to ensure that such Delegations bring pressure to bear on the General Conference, so that the percentage of the total budget for 1959-60 to be allocated to the Natural Sciences Department be substantially increased ; and so that the Department of Education and Mass Communication be instructed to devote more effort to science education and the dissemination of scientific knowledge.

Unesco Conference on Information Processing

The Administrative Secretary reported that this conference would be held in Paris in the summer of 1959, and that I.C.S.U.

and the interested Unions would be invited to be represented thereat.

Use of the Unions' Proper Funds

This item was introduced on the Agenda at the request of the Bureau, which made the following three recommendations :

A. that in future the total allocation to a Union from the Unesco subvention should not exceed its own proper revenue ;

B. that no further allocations should be made towards the cost of administrative meetings of the Unions ;

C. that the Unions should defray the cost of the attendance of their representatives at meetings of the Executive Board.

There was a lively comment on these proposals. Eventually, B was accepted in principle. Under C, Laclavère proposed that a fixed sum of $ 10 000 per annum should be earmarked from I.C.S.U.'s proper funds for meetings of the Board, any amount above this sum over each three year period to be billed to the Unions, and this suggestion was incorporated in the Report of the Finance Committee to the General Assembly. As to A, it was agreed that for the next three year period the Bureau should take account of the proper revenues of the Unions in recommending allocations from the Unesco subvention.

Date and Place of next meeting

It was unanimously agreed to accept most warmly the invitation of the Royal Netherlands Academy to hold the 1959 meeting of the Executive Board in the Hague. The date of the meeting would be decided after consultation between the Secretariat and all interested parties.

Any other business

1) I.U.P.A.C. introduced an item on the 180 recommendations for the M.K.S. system. This was referred to the incoming Bureau for study.

2) I.U.P.A.P. tabled the following resolution, which was duly adopted :

Resolved that all important questions to be submitted to a vote of the Executive Board should, whenever possible, be sent with supporting arguments to members of the Board at least one month in advance of the meeting.

In terminating this report, we would like to stress the very efficient and always clear way in which the meetings were conducted by the retiring President, Dr. L. V. Berkner and the excellent international cooperation of all those present. Also we wish to mention the very hospitable way in which we were all received by the U. S. A. National Academy of Sciences. The perfect organization materially helped the progress and the atmosphere of the meetings.

Wassenaar, Netherlands, December 1958.

Balth. VAN DER POL,
U.R.S.I. Delagate to I.C.S.U.

Committee on Space Research

Draft Report on first meeting, London, November 14-15, 1958

This report will be considered as the final report of this meeting if no objections will have been received from the members before January 5, 1959.

INTRODUCTION

The Committee on Space Research (C.O.S.P.A.R.) set up by the I.C.S.U. at its General Assembly 2-6 October 1958, held its first meeting in London on 14-15 November 1958 as guests of the Royal Society. Those in attendance were :

Convenor : Dr. Homer E. NEWELL, Jr.

Australia : Mr. E. J. DRAKE and Mr. R. C. RICHARDSON, who attended as observers. The delegate is Dr. D. F. MARTYN, Chief Scientist, Upper Atmosphere Section, C.S.I.R.O., Camden, New South Wales, Australia.

Canada : Dr. D. C. ROSE, National Research Council, Ottawa, Canada. Advisor will be Dr. J. N. CHAPMAN.

France : Dr. Paul MULLER, Observatoire de Meudon, Meudon, Seine-et-Oise, France.

Japan : Professor Hideo ITOKAWA, Institute of Industrial Science, University of Tokyo, Japan.

United Kingdom : Professor H. S. W. Massey, University College, Gower Street, London W. C. 1.

U. S. A. : Professor W. Albert Noyes, Jr., Department of Chemistry, University of Rochester, Rochester 20, New York, U. S. A. and Alternate Dr. R. W. Porter.

U. S. S. R. : Academician A. A. Blagonravov and alternate Academician L. I. Sedov, Academy of Sciences of the U. S. S. R., Moskow, U. S. S. R. It is understood that the permanent delegate will be Professor E. K. Fedorov.

I.A.U. : Professor H. C. van de Hulst, Sterrewacht te Leiden, Leiden, Netherlands.

I.U.G.G. : Professor Joseph Kaplan, Department of Physics, University of California, Los Angeles 24, California, U. S. A.

I.U.P.A.C. : Professor Klaus Clusius, University of Zurich, Rämistrasse 76, Zürich, Switzerland.

U.R.S.I. : Dr. J. G. Davies, Jodrell Bank Experimental Station, Cheshire, who attended in place of Professor A. C. B. Lovell, who was not able to attend.

I.U.B.S. : Dr. Peter Alexander, Chester Beatty Research Institute, Royal Cancer Hospital, Fulham Road, London S. W. 3.

I.U.T.A.M. : Professor Maurice Roy, 29, avenue de la Division Leclerc, Châtillon-sous-Bagneux (Seine) France.

I.U.P.S. : Professor W. O. Fenn, School of Medicine, University of Rochester, Rochester 20, New York, U. S. A.

I.U.B. : Dr. Peter Alexander for Professor M. Florkin, Laboratoires de Biochimie de l'Université de Liège, 17, place Delcour, Liège, Belgium, who was unable to attend.

I.U.P.A.P. : Professor H. S. W. Massey, University College, London.

The Committee convened on 14 November 09.00 to 12.30 and 16.30 to 18.00 and on 15 November 09.30 to 10.00, 11.30 to 13.00 and 14.00 to 16.00. Most of the intervening time was taken by meetings of four ad hoc working groups :

(i) Procedures, rules and organization (chairman Prof. Roy).

(ii) Charter, draft of final report (chairman Prof. MASSEY).

(iii) Rotating membership (chairman Prof. KAPLAN).

(iv) Permanent working groups (chairman Dr. PORTER).

The resolutions of these working groups, as amended in the subsequent sessions of the full committee, have been incorporated in the following pages.

The C.O.S.P.A.R., in pursuance of the General Assembly's resolution establishing the Committee on Space Research, has agreed on its charter, responsibilities and a detailed organization for the conduct of its affairs, and begs to submit these as set forth below to the Bureau of I.C.S.U. for approval.

CHARTER

The purpose of C.O.S.P.A.R. is to further on an international scale the progress of all kinds of scientific investigation which are carried out with the use of rockets or rocket-propelled vehicles. C.O.S.P.A.R. shall be concerned with fundamental research. It will not normally concern itself with such technological problems as propulsion, construction of rockets, guidance and control.

These objectives shall be achieved through the maximum development of space research programs by the international community of scientists working through the I.C.S.U. and its adhering national academies and unions. Recognizing the need for international regulation and discussion of certain aspects of satellite and space probe programs, the Committee shall keep itself fully informed on United Nations or other international activities in this field, in order to assure that maximum advantage is accorded international space science research through such regulations, and to make recommendations relative to matters of planning and regulation that may effect the optimum program of scientific research.

C.O.S.P.A.R. shall report to I.C.S.U. those measures needed in the future to achieve the participation in international programs of space research of all countries of the world with those which are already actively engaged in research programs within the domain of C.O.S.P.A.R.

The composition of the Committee is as follows :

(*a*) A representative from each of the countries which are actually launching earth satellites, and also from those conducting fundamental researches using rockets.

(*b*) Three representatives, designated on an agreed system of rotation, from among countries actively participating in tracking and other aspects of space research.

(*c*) One representative each from the following Unions : I.A.U., I.U.G.G., I.U.P.A.C., U.R.S.I., I.U.P.A.P., I.U.B.S., I.U.T.A.M., I.U.P.S. and I.U.B.

Procedures, rules and organization and rotating Memberships

1. — *Operating Rules and Procedures*

In consideration of the expressions of the members of the Committee on Space Research that C.O.S.P.A.R. should be converted to a Special Committee of the I.C.S.U., the I.C.S.U. Rules for Special Committees are adopted for the conduct of C.O.S.P.A.R. business. The following special rules have also been adopted by the C.O.S.P.A.R. :

(*a*) *Quorum.* — A quorum of the C.O.S.P.A.R. shall consist of 50 % or more of named delegates to C.O.S.P.A.R. in attendance at any designated meeting. Union or national members of C.O.S.P.A.R. may name alternate delegates who, in the absence of the principal delegates, shall have voting authority at C.O.S.P.A.R. meetings and shall be counted in determining a quorum.

(*b*) *Majority Vote.* — Official actions by C.O.S.P.A.R., except as provided in (*c*), may be taken by a majority of those present and voting for or against each action. Abstentions from the voting will not be considered in determining the majority action but may be entered in the record if so desired by the abstaining delegates.

(*c*) *Changes in Operating Rules and Financial Assessments.* — C.O.S.P.A.R. actions which require a change in the rules or which may involve financial assessments on the principal unions and

national members constituting C.O.S.P.A.R. shall require a two-thirds majority vote of the full C.O.S.P.A.R. to achieve favourable action.

(*d*) *Additions to Established Agenda.* — Established agenda for designated meetings of C.O.S.P.A.R. may be amended upon the request of five members.

(*e*) *Minutes of Meetings.* — The preliminary drafts of the minutes of all meetings of C.O.S.P.A.R., all meetings of the Executive Committee, and all meetings of working groups shall be circulated promptly to all members of the respective groups for approval ; such minutes shall be considered approved if objections to these drafts as written are not received within one month of date of transmittal. Minutes of meetings of the C.O.S.P.A.R. Executive Committee and of C.O.S.P.A.R. working groups shall be distributed to all members of C.O.S.P.A.R. following approval.

(*f*) *Succession of C.O.S.P.A.R. Officers.* — The duly elected President of C.O.S.P.A.R. shall preside at all C.O.S.P.A.R. meetings and shall conduct the affairs of C.O.S.P.A.R. between designated C.O.S.P.A.R. meetings. In the absence or inability of the President to discharge his responsibilities the two Vice Presidents shall alternately as principal Vice President assume the responsibilities of the office of President : alternation of the office of principal Vice President shall take place each three months. It shall be the prime responsibility to the principal Vice President upon assuming the Presidential responsibility to convene C.O.S.P.A.R. at the first opportunity for the purpose of electing a new President. In the absence or inability of the President and Vice Presidents to discharge these responsibilities, the other members of the Executive Committee may take such steps as may be necessary to ensure the continued activity of C.O.S.P.A.R.

2. — *Responsibilities of the Executive Committee*

The Executive Committee will administer the affairs of C.O.S.P.A.R. in accordance with the policy decisions and directives of C.O.S.P.A.R.

3. — *Finance Committee*

In accordance with rule 15 (*a*) (i) of I.C.S.U. Rules for Special Committees, C.O.S.P.A.R. will have a Finance Committee of two members.

4. — *Rotating Membership*

Rotating membership of C.O.S.P.A.R. shall be selected from among countries actively participating in tracking and other aspects of space research, in the following manner :

(*a*) Initial selection will be based upon staggered terms for each of three nations on three-, two- and one- year memberships.

(*b*) Subsequent appointment of rotating members will be made for a period of three years each with due regard to geographical considerations.

5. — *Adhering bodies*

The Committee on Space Research hopes that many nations will become adherents through properly qualified scientific bodies such as Academies, Research Councils or learned Societies. Should no such scientific body exist in a given country the government itself may adhere. The only qualification shall be a valid scientific interest.

The rights and duties are as follows :

1. To become one of the rotating members.
2. To establish scientific channels for obtaining data and carrying out space experiments.
3. To participate in obtaining data and evaluating the information as far as feasible.
4. To be informed concerning conferences, congresses and colloquia organized by C.O.S.P.A.R. or the unions regarding space research.
5. To attend occasional conferences of C.O.S.P.A.R. and its adhering bodies.
6. To provide freely to C.O.S.P.A.R., its adhering bodies and the community of international scientists any significant results of space research experiments or data analysis which may be conducted.

7. To contribute to financial support of the activities of C.O.S.P.A.R.

6. — *Liaison with United Nations*

The Executive Committee of C.O.S.P.A.R. shall perform the task set forth in the Charter, of maintaining liaison with the United Nations Organization on the subject or regulations affecting space research. It shall make use in an unofficial manner of the advice of C.O.S.P.A.R. members who may have special knowledge of or connexions with the United Nations Organization.

Working groups

1. — *Working Group Constitution*

The C.O.S.P.A.R. resolves that it shall have Working Groups. Each Working Group shall consist of a Chairman, who will call meetings and preside over them, and several other members. Each Working Group will adopt such working rules and procedures as may seem appropriate for achieving the objectives set by C.O.S.P.A.R. or its Executive Committee. The rules and procedures referred to in the previous sentence include such matters as quorum, method of voting, as by mail, telephone or cable, and rules of order.

The C.O.S.P.A.R. resolves that all action communications to individuals or groups outside C.O.S.P.A.R. initiated by the Working Groups, shall be subject to approval in advance, either specifically or in principle, by the C.O.S·P.A.R. Executive Committee.

2. — *Establishment and membership of Working Groups*

In order to constitute the Working Groups, the C.O.S.P.A.R. resolves that the Executive Committee shall carry out the following steps :

(*a*) Appoint the Chairmen and recommend to each a list of proposed members ;

(*b*) Solicit the Chairmen's opinion as to desired additions or changes ;

(*c*) Accept or reject their recommendations as may seem appropriate ; and

(*d*) Make firm appointments. In the process of making their recommendations the Chairmen will ascertain that members proposed by them are willing to serve.

The C.O.S.P.A.R. resolved that each Working Group shall have a life of one year, and be reconstituted at the end of each working year by action of the Executive Committee. It is further resolved that the Chairmen shall not serve more than three successive terms, and that at least twentyfive percent of the membership shall be changed each year. These new members shall be appointed by the Executive Committee on the recommendation of the Chairmen-elect.

The members of the Executive Committee may act as *ex officio* members of any of the Working Groups at any time they desire.

3. — *Working Group Budgets*

The C.O.S.P.A.R. will arrange to provide funds for reasonable secretarial expenses for the Working Groups and for travel expenses, in accordance with I.C.S.U. regulations, of Chairmen, members, and invited consultants. Each Working Group shall prepare, on request, a budget of such expenses, which will be subject to approval and audit as directed by the Executive Committee after consideration by the Finance Committee. Expenditures of this nature within the budget shall be approved by the Working Group Chairmen.

4. — *Number of Working Groups*

The C.O.S.P.A.R. resolves to establish three working groups as noted below in points 5-7. The C.O.S.P.A.R. further considers that the availability of rocket and launching sites open to international visitors would be desirable but believes this is not a suitable activity for assignment to a working group at this time.

5. — *Working Group on Tracking and Transmission of Scientific Information*

The C.O.S.P.A.R. resolves to establish a Working Group on Tracking and Transmission of Scientific Information. This group shall concern itself with :

(i) delineating problems that may exist in this area ;

(ii) proposing and facilitating specific working arrangements for and among operating networks ;

(iii) studying the compatibility of frequencies, equipement and problems of radio interference.

In connection with the last point, the Working Group shall not take into its own hands the responsibility for requesting frequency allocations, but it will work to ensure adequate and timely actions through existing organizations responsible for such activity.

6. — *Working Group on Scientific Experiments*

The C.O.S.P.A.R. resolves to establish a Working Group on Scientific Experiments such working group to :

(i) evaluate scientific experiments submitted by countries which do not have facilities for launching space vehicles in order to determine the scientific desirability and feasibility of incorporating them in some form of space vehicle. In this connexion it is resolved that :

(*a*) any proposal from a country which has established an active national space science committee should normally be presented first to that committee,

(*b*) evaluation services of C.O.S.P.A.R. should be available also to launching countries at their request,

(*c*) in reaching its decisions, the Working Group shall have power, and will normally be expected, to obtain assistance from experts at its own discretion.

(ii) draw attention to fields or research not receiving sufficient emphasis, which fields might profitably be investigated through the use of space vehicles ;

(iii) arrange for co-ordinated activities similar to that represented by the I.G.Y. World Rocket Week.

The scope of this Working Group shall include all fields of science but not fields of technology such as communications, combustion, heat transfer, etc. Ionospheric experiments shall be included in the scope of this Working Group rather than in that of the Working Group on Tracking and Transmission of Scientific Information, although close contact between the two groups is important. In

addition to giving consideration to equipment that must be carried in vehicles for such experiments, the groups shall also facilitate arrangements for appropriate ground stations for ionospheric research.

7. — *Working Group on Data and Publications*

The C.O.S.P.A.R. resolves to establish a Working Group on Data and Publications, such group to :

(i) study the need for various forms of data exchange and for the publication of results, continuing in this connexion the use of existing World Data Centres and arranging for the continued operation of any recommended means for such publication and exchange,

(ii) recommend to C.O.S.P.A.R. the selection of an editor of publications who shall then become an *ex officio* member of this Group.

The C.O.S.P.A.R. further resolves to encourage the use of existing journals rather than initiate new forms of publication.

RESOLUTIONS CONCERNING IMMEDIATE ACTION

1. — *Officers*

The C.O.S.P.A.R. proposed, elected and installed the following officers :

President : Professor H. C. VAN DE HULST (I.A.U.).

Vice Presidents : Professor E. K. FEDOROV (U. S. S. R.),
Professor W. Albert NOYES, Jr. (U. S. A.).

Members : Professor Maurice ROY (I.U.T.A.M.),
Professor H. S. W. MASSEY (I.U.P.A.P.).

It was resolved that the Vice-President from the U. S. S. R. will assume the office of principal Vice-President for the initial term of three months, beginning on 15 November 1958.

It was resolved that the list of officers be subject to review when and if C.O.S.P.A.R. becomes a Special Committee of I.C.S.U.

2. — *Secretariat*

It was resolved :

(*a*) that the possibility be investigated to place the secretariat at The Hague, with the secretariat of I.C.S.U. ;

(*b*) that in the event of the I.C.S.U. secretariat being unable to provide the C.O.S.P.A.R. secretariat, the Royal Society be requested to furnish the place for the secretariat, the Administrative Secretary to be paid by funds made available by C.O.S.P.A.R.

3. — *Finance Committee*

Professor Klaus Clusius and Dr. Peter Alexander were appointed to the membership of the Finance Committee.

Noting that it is not possible at this time to prepare a provisional budget of expenditures for C.O.S.P.A.R., the Executive Committee is instructed to consult with the I.C.S.U. to provide the funds required to cover the cost of C.O.S.P.A.R. activities and working groups through the second meeting of C.O.S.P.A.R. Further the Executive Committee is directed to submit a provisional budget to cover the cost of C.O.S.P.A.R. activities for consideration at the second C.O.S.P.A.R. meeting.

4. — *Membership*

The seven countries represented at this first meeting are considered to have permanent membership under category (*a*) of the Charter.

Immediate rotating membership was accorded to the following nations for the following terms :

Union of South Africa : 3 years.
India : 2 years.
Peru : 1 year.

5. — *Adhering Bodies*

The C.O.S.P.A.R. respectfully requests the Bureau of I.C.S.U. to consult C.S.A.G.I. to obtain a preliminary list of possibly interested adherents.

The C.O.S.P.A.R. respectfully requests the Bureau of I.C.S.U. promptly to obtain many adhering nations and believes the Bureau should adjudicate the scientific qualifications.

6. — *C.E.T.E.X.*

The C.O.S.P.A.R. resolves that no Working Group need be established at this time within the area now under consideration

by C.E.T.E.X. It is resolved that C.E.T.E.X. be asked at its next meeting to consider and recommend what if any continuing activity and continuing organization may be appropriate.

7. — *Working Groups*

The C.O.S.P.A.R. directs the Working Groups to proceed with their work as soon as they are constituted and financed and directs them to report at the next meeting of C.O.S.P.A.R. on their progress and their plans for action.

The following persons are suggested for the Chairmanship of the Working Groups which have been recommended for establishment and alternative persons are also suggested in case the first designated person cannot serve.

I. *Working Group on Tracking and Transmission of Scientific Information* :

		Chairman
Lovell	U. K.	Alternate choice
Ambartsumian	U. S. S. R.	for Chairman

II. *Working Group on Scientific Experiments* :

		Chairman
Lindblad	Sweden	Alternate choice
Bartels	Germany	for Chairman
Rose	Canada	

III. *Working Group on Data and Publication* :

		Chairman
Day	U. K.	Alternate choice
Odishaw	U. S. A.	for Chairman

An additional list of suggested members for these Working Groups has been prepared for presentation to the Executive Committee and to the Chairmen when appointed.

8. — *United Nations*

In view of the fact that problems relating to space research may come up for discussion in the United Nations in the very

near future, C.O.S.P.A.R. directs its president to send at once a copy of the adopted Charter to the General Secretary of I.C.S.U. with the respectful request to forward it to Unesco and the United Nations Organization.

Special Committee on Antarctic Research
S. C. A. R.

The first number of the *S.C.A.R. Bulletin* (January 1959) has been issued. It contains the following items :

— Aims and establishment of S.C.A.R.
— First meeting of S.C.A.R. (The Hague, 3-5 February, 1958),
— Second meeting of S.C.A.R. (Moscow, 4-11 August, 1958),
— Constitution of S.C.A.R.
— Scientific investigations recommended by S.C.A.R.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

General Meeting

The dates of 1st to 16th November have been fixed for the General Meeting of the I.E.C. which will be held in New Delhi in 1960.

CALENDAR OF INTERNATIONAL SCIENTIFIC MEETINGS

Date	Place	Meeting	Organiser
1959			
March 23-26	New-York	Radio Engineers Show.	Institute of Radio Engineers, William C. Copp Associates, 75 West 45th Street, New-York 22, U. S. A.
March 31-April 2	New-York	International Symposium on Millimetre Waves.	Professor H. J. Carlin, Microwave Research Institute, 55, Johnson Street, Brooklyn, 1, New-York, U. S. A.
April 1-3	Cambridge, U. K.	I.C.S.U. Bureau.	I.C.S.U. Administrative Secretariat, Paleis Noordeinde, The Hague, Netherlands.
April 1	Los Angeles, California	International Radio Consultative Committee, 9th Plenary Assembly.	International Telecommunications Unions, Palais Wilson, Geneva, Switzerland.
April 6-9	London	Radio and Electronic Computer. Show.	Radio and Electronic Component Manufacturers' Federation, 21. Thothill Street, London, S. W. 1, U. K.

Date	Place	Meeting	Organiser
April 1-May 2	Geneva	World Meteorological Organization (W.M.O.), 3rd Session of Congress.	W.M.O. Campagne Rigot, 1, Avenue de la Paix, Geneva, Switzerland.
May 25-29	London	International Convention on Transistors and Associated Semiconductor Devices.	Institution of Electrical Engineers, Savoy Place, London, W. C., 2, U. K.
June 5-20	Toronto	Symposium on Electromagnetic Theory (Sponsored by U.R.S.I. Commission VI).	Professor G. Sinclair, Chairman U.R.S.I. Sub-Commission VI-3 University of Toronto, Ontario, Canada.
June 16-18	Los Angeles, California	Institute of Radio Engineers, Internal Symposium on Circuit and Information Theory.	Mr. G. L. Turin, Hughes Research Laboratories, Culver City, California, U. S. A.
June 29-July 3	Cambridge U. K.	Colloquium on Supraconductivity (I.U.P.A.P.).	Dr. Schoenberg, Esq., Mond Laboratory, Cambridge, U. K.
June 30-July 10	Madrid, Spain	International Electrotechnical Commission, General Meeting.	I.E.C., 1-3, rue de Varembé, Geneva, Switzerland.
July 1-5	Cambridge, U. K.	International Radio and Electronics Convention.	British Institution of Radio Engineers, 9, Bedford Square, London, W. C. 1, U. K.

Date	Place	Meeting	Organiser
July 13-17	Geneva	International Organization for Standardization (I.S.O.) Council Meeting.	I.S.O., 1-3, rue de Varembé, Geneva, Switzerland.
August 24-28	Perth, Australia	Australian and New Zealand Association for the Advancement of Science (Congress).	Professor J. R. A. McMillan, Honorary General Secretary, Science House, 137, Gloucester Street, Sidney, Australia.
August 26-29	Munich	I.U.P.A.C., 20th General Conference.	Dr. R. Morf, Secretary General I.U.P.A.C., c/o Sandoz S. A., Basle, Switzerland.
September 26	The Hague, Netherlands	I.C.S.U., Bureau and Executive Board.	I.C.S.U. Administrative Secretariat, Paleis Noordeinde, The Hague, Netherlands.
October 2-9	York, U. K.	British Association for the Advancement of Science, Annual Meeting.	The Secretary B.A.A.S., 18, Adam Street, Adelphi, London W. C. 2, U. K.
October 14 (2 months)	Geneva, Switzerland	International Telecommunications Union, Plenipotentiary Conference.	I.T.U., Palais Wilson, Geneva, Switzerland.

Date	Place	Meeting	Organiser
October 26-28	Baltimore Md.	Institute of Radio Engineers, Electronic Devices Meeting.	Institute of Radio Engineers, 1, East 79th Street, New-York 21, U. S. A.
December 26-31	Denver, Colorado or Cleveland, Ohio	American Association for the Advancement of Science, Annual Meeting.	Dr. R. L. Taylor, American Association for the Advancement of Science, 1515, Massachusetts Avenue, N. W. Washington 5, D. C., U. S. A.
1960			
July 25-August 8	Helsinki, Finland	12th General Assembly of I.G.G.U.	Secretariat of I.G.G.U., 30, Avenue Rapp, Paris 7e.
August 31-Sept. 7	Stresa, Italy	10th International Congress, I.U.T.A.M.	Prof. Maurice Roy, Secretary General of I.U.T.A.M., 29, Avenue Division Leclerc, Châtillon-sous-Bagneux, France.
September 5-15	London, U. K.	U.R.S.I., 13th General Assembly.	E. Herbays, Secretary General 7, Place Emile Danco, Brussels 18, Belgium.
October 11-19	Paris	11th Conference on Weights and Measurements.	Secrétariat, Bureau International des Poids et Mesures, Pavillon de Breteuil, Sèvres, Seine-et-Oise, France.

BIBLIOGRAPHY

International Electrotechnical Commission

Publication 50 (45). — Second edition, International Electrotechnical Vocabulary, Group 45 : Lighting.

Publication 91. — First edition, Recommended methods of measurement on receivers for frequency — modulation broadcast transmissions.

These publications are on sale at the Central Office of the I.E.C. at the price of Sw. Fr. 10, per copy, plus postage, for Publication 50 (45), and of Sw. Fr. 15, per copy, plus postage, for Publication 91.

International Telecommunication Union

We have been informed of the publication by the I.T.U. of the *31st edition of the List of Coast and Ship Stations*, which has just been issued.

According to the Radio Regulations annexed to the International Telecommunication Convention, this List must be in the possession of stations on board ships compulsorily equipped with a radiotelegraph station, but it can also be of great use to other ship stations, as well as to shipowners, life-saving organizations, transport companies, etc.

It is divided into two main parts which contain :

1. The particulars of coast stations throughout the world, arranged in the alphabetical order of countries. The indications include the name of the station, the call sign, the frequencies used, the power and class of emission, the nature of the service, the working schedules, charges, the geographical position, the operating concern and any other details of use in operation.

2. The particulars of ship stations, grouped in the alphabetical order of stations, regardless of nationality. The indications include the name of the ship, the call sign, the country to which the station belongs, the frequencies used, the power and class of emission, the nature of the service, the working schedules, charges collected for exchange of correspondence, the authorities settling the accounts and, where relevant, the owner of the ship, the number of lifeboats equipped with radio apparatus, etc.

An annex at the end of the List gives information on inland and limitrophic telegraph rates for the routing of correspondence to the country of the coast station or to adjacent countries.

Titles and explanatory texts are in French, English and Spanish.

The price of this publication of 2044 pages has been fixed at 17.25 *Swiss francs* per copy, postage by ordinary mail and packing paid.

Those interested in this publication, may apply to the General Secretariat of the I.T.U., Palais Wilson, Geneva, Switzerland.

The *International Telecommunication Union* has informed us of the following publications :

1° the *List of Fixed Stations* sixteenth edition.

This comprises particulars of fixed stations throughout the world. It is divided into two Volumes, the first of which gives stations using frequencies between 10 kc/s and 27,500 kc/s, while the second shows stations using frequencies above 27,500 kc/s.

In each volume, there are two sub-divisions :

Part A : an alphabetical list of stations classified by stations. Details are given in the following order : country abbreviation, name of the station, frequency, call sign (1) ;

Part B : an alphabetical list of stations classified by countries. Details are given in the following order : name of the station, frequency, call sign, observations (1).

A preface common to both volumes, in English, Spanish and French, appears at the beginning of Volume I.

The sales price per copy will be :

Volume I (1028 pages) : 85 Swiss francs.

Volume II (268 pages) : 30 Swiss francs.

These figures include the cost by ordinary mail, carriage, and such supplements as may appear, at quarterly intervals, between now and the next edition.

2° *List of Special Service Stations* (16th edition).

This List is a service document of the International Telecommunication Union, published in accordance with the provisions of the Radio Regulations attached to the International Telecommunications Convention.

It comprises the following 7 sections, in which the stations are classified by country :

1. Stations transmitting time signals.
2. Stations transmitting regular meteorological bulletins.
3. Stations transmitting notices to navigators.
4. Stations transmitting medical advice.
5. Stations transmitting standard frequencies.
6. Stations transmitting epidemiological bulletins.
7. Stations transmitting Ursigrams.

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(1) The Radio Frequency Record, whence this information is taken, gives fuller data about stations. It is published by the I.T.U. too.

The 16th edition of the List of Special Service Stations is published in separate English and French editions.

The price per copy of this 380 pages publication, in English or French, is 9 *Swiss francs*; this price includes postage by ordinary mail, packing, and the subscription to the quarterly supplements which appear pending publication of the next edition.

Orders should be sent to the General Secretariat of the I.T.U., Palais Wilson, Geneva, Switzerland.