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CONTENTS

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Xth GENERAL ASSEMBLY

Publications

U. R. S. I. — Vol. IX — Fascicule 3

ERRATUM

English version

p. 78 :

1st and 2nd lines, read : « Measurements are made after sunrise or before sunset ».

4rd and 5th lines : « If echo height is 100-120 km the... ».

XIth GENERAL ASSEMBLY

Reports and Papers Submitted to the General Assembly

We publish hereunder the text of a note communicated to National Committees.

1. *Reports of National Committees, Commissions and Sub-Commissions* :

1.1. No limits are fixed to the length of such reports.

1.2. The National Committee Reports should be issued in separate chapters corresponding to each Commission of U.R.S.I.

1.3. Every paper submitted to and accepted by National Committees whether or not selected by the Commission Chairman (see 2.4), should be included by title and abstract in the report of the author's National Committee.

1.4. The Secretary General would appreciate to receive, as much as possible, the reports both in English and in French.

1.5. At least two copies of reports should be forwarded to the Secretary General.

2. *Papers submitted to Commissions* (Reports mentioned in 1. excluded) :

2.1. An author who feels that he may have material which would be suitable for, or pertinent to a general discussion topic, should furnish, at least, two summary copies to his National Committee for forwarding to the Secretary General who will send one copy to the Chairman of the appropriate Commission.

2.2. Such papers, written either in English or in French, should be limited to 1500 words and three line drawings.

2.3. Authors who submit papers published or to be published in a scientific journal of wide distribution, are asked to give all useful references concerning such publication.

2.4. The Commission Chairmen should draw up lists of subjects suitable for general discussion, based on the papers submitted to them and mentioned in 2.1. ; only the pertinent documents will be reproduced in extenso by the General Secretariat and distributed for the General Assembly.

3. *General* :

3.1. Only documents sent to the Secretary General by National Committees and by Commission and Sub-Commission Chairmen will be considered.

3.2. All reports from National Committees, Commissions and Sub-Commissions should reach the General Secretariat *before July 1st*, 1954.

3.3. All papers concerned in 2. should reach the General Secretariat *before June 1st*, 1954.

3.4. It is reminded that the official languages of U.R.S.I. are English and French.

Commission Programmes

Commission IV : see p. 23.

Commission VII : see p. 28.

NATIONAL COMMITTEES

Canada

JOINT MEETING OF THE CANADIAN AND U. S. A. NATIONAL COMMITTEES

The Canadian and U. S. A. National Committees together with the Professional Group on Antennas and Propagation of the Institute of Radio Engineers held a meeting in Ottawa, October 5-8, 1953.

The following papers were submitted at the various sessions of the meeting.

Summary of the papers has been distributed to National Committees, some copies are still available at the General Secretariat of U.R.S.I.

Commission I

1. The design and assessment of the paraboloidal optical system for antenna measurements at microwave frequencies, J. H. Crysdale.
2. The use of saturable reactors in two-frequency coil test equipment, P. Gomard.
3. The operation of microwave power meters under pulsed conditions, Max Sucher and Herbert J. Carlin.
4. A general analysis of the diode detector, S. D. Lerner.
5. Application of the IBM calculating punch to antenna design, G. F. Schrader.
6. The attenuation of the surface wave as determined by soil morphology, P. A. Field.
7. A method of measuring flux-current loops of magnetic materials under pulse excitation, O. J. Van Sant and E. D. Burnside.

8. A comparative study of the theoretical errors associated with attenuation measurements, D. L. Fye and B. N. Navid.
9. The impedance of a ground-based vertical radiator of arbitrary length, W. J. Surtees.
10. Radiation from a vertical dipole over a stratified ground, J. R. Wait.

Commission III

12. Hydrogen in aurora, C. W. Gartlein and G. Sprague.
13. Nitrogen oxides in the ionosphere, M. Nicolet.
14. Auroral height determinations in lower latitudes, S. L. Boothroyd and C. W. Gartlein.
15. Day sky-brightness measured by rocketborne photo-electric photometers, H. D. Edwards.
16. Some recent work on the night airglow, Norman J. Oliver.
17. Infrared spectra of the night sky and aurora, A. Vallance Jones and Herbert Gush.
18. Some results of sweep frequency investigation in the low frequency band, J. M. Watts and J. N. Brown.
19. Further studies of ionospheric winds by the radio fading method, T. N. Gautier.
20. On wave propagation in a non-homogeneous medium, J. L. Yen.
21. A long-wave solution near critical coupling, N. Davids.
22. Birefringence in crystals and in the ionosphere, C. H. M. Turner.
23. Radio reflection from aurora, A. G. McNamara.
24. Nocturnal ionosphere disturbance-variations at Saskatoon, J. H. Meek.
25. Magnetic disturbances at Meanook, Baker Lake, and Resolute Bay, G. E. Larocque and W. Petrie.
26. The location of the auroral absorption zone, V. Agy.
27. Some studies of the ionosphere absorption of radio waves, K. Davies.
28. Measurement of effective electron density within the E region through the use of rockets, J. R. Lien, R. J. Marcou, J. C. Ulwick, D. R. McMorrow.

29. An interpretation of radio reflections from the aurora, H. G. Booker, C. W. Gartlein and B. Nicols.
30. The effect of sunrise on the propagation of low frequency waves, S. B. Brown and W. Petrie.
31. Theory of sudden ionospheric disturbances, A. P. Mitra.
32. Whistlers, J. H. Crary and R. A. Helliwell.
33. Some comments on the polarization anomaly presented by recent high frequency measurements, J. Feinstein.
34. Gyro-interaction of radio waves, V. A. Bailey.
35. Systematic upper atmospheric motions during auroral displays, A. B. Meinel.
36. Some auroral research problems, B. W. Currie.
37. The emission spectra of the airglow and aurora, W. Petrie.

Commission IV

38. Lightning stroke counter, A. W. Sullivan, J. D. Wells and H. E. Dinger.
39. A comparison of certain statistical measures of atmospheric and fluctuation noise, A. W. Sullivan and J. M. Barney.
40. An automatic atmospheric analyzer, Perrin F. Smith.
41. Worldwide radio noise levels expected in the frequency band from 10 kc/s to 100 Mc/s, W. Q. Crichlow, D. F. Smith, R. N. Morton and W. R. Corliss.
42. Thunderstorm discharges affecting aircraft radio, M. M. Newman.
43. Lightning discharge penomena-a review and summary, J. Weil.

Commission V

44. Radiation from interstella hydrogen, H. I. Ewan.
45. The height and intensity of meteoric ionization, Peter M. Millman.
46. Some characteristics of solar radio emissive regions at a wavelength of 10.3 cm, A. E. Covington and N. W. Broten.

47. Size and intensity measurements of radio sources at 250 Mc/s, S. MATT.
48. Use of ferrites to isolate microwave radiometers from antenna impedance changes, C. H. MAYER.
49. Microwave receiver output variations with input impedance changes, D. R. J. WHITE.
50. The non-linear theory of space-charge wave in moving, interacting electron beams, with application to solar radio noise, H. K. SEN.
51. Recent work at the Cavendish Laboratory at Cambridge, F. G. SMITH.
52. Forward scattering of radio waves from meteors trails, P. A. FORSYTH and E. L. VOGAN.
53. Meteor echo duration and radio wavelength, D. W. R. MCKINLEY.
54. Microwave observations of solar eclipses, F. T. HADDOCK.

COMMISSIONS

Ordinary Members

(See nº 81, p. 4)

In accordance with article 4 of the Rules for Commissions, were elected as Ordinary Members :

Commission I :

Mrs. DECAUX (France).
FROMY (France).
HERRENG (France).

Commission IV :

Mrs. T. FUJITA (Japan).
M. SHINKAWA (Japan).
Dr. K. HONDA (Japan).
Dr. H. SEKI (Japan).

Commission V :

Mrs. G. ERIKSEN (Norway).
Dr. T. HATANAKA (Japan).

Commission III

REPORT OF THE JAPANESE NATIONAL COMMITTEE TO COMMISSION III

by K. MAEDA, Chairman, Japanese Committee III

1. — GENERALS ON RESEARCH ORGANIZATIONS

1.1. — *Ionosphere Research Committee, Science Council of Japan*

(*Chairman* : Y. HAGIHARA)

See « Proc. Gen. Assembly », Sydney Aug. 11-21, 1952, *Vol. IX, Fasc.* 4, p. 59).

Almost all the individual research members of the institutes of Universities, Governmental and Company Laboratories of Japan, who are interested on ionosphere and ionospheric radio propagation, joint this committee.

Meetings of reporting observed data and results of study, and discussion are held for two days every month.

1.2. — *Society of Terrestrial Magnetism and Electricity of Japan* (*President* : M. HASEGAWA)

(*See* « *U.R.S.I.* » *Vol. IX*, *Fasc.* 4, p. 59).

General meetings are held in Spring and Autumn every year.

1.3. — *Publications*

Publications mainly devoted to ionosphere and radio propagation are as follows.

(1) *Report of Ionosphere Research in Japan* (*R.I.R.J.*), quarterly, English text, *Ionosphere Research Committee.*

(2) *Catalogue of Disturbances*, irregular, English text, *Ionosphere Research Committee.*

(3) *Journal of Geomagnetism and Geoelectricity* (*J. G. G.*), quarterly, English text, *Society of Terrestrial Magnetism and Electricity of Japan.*

(4) Two kinds of reports in Japanese text are published from Radio Wave Laboratories, (R.W.L.), Ministry of Postal Services.

1.4. — *Ionosphere observing stations*

(*See* « *Information Bulletin* », *n*° 77, *p.* 19, 1953).

2. — GENERAL REVIEW OF RESEARCH PROGRESS

2.1. — *Observation technique*

A new method to observe continuously the ionosphere has been developed by Y. Nakata, M. Kan and H. Uyeda (1), which is called the sweep-frequency $h'f$ measurement of the ionosphere. Instead of a fixed frequency used in $h'f$ measurement, the frequency is swept in a certain range and echoes during each sweep are

recorded in a vertical line on the film which moves continuously in the horizontal direction. Then the continuous record of the minimum height of layers in the swept frequency range is obtained in addition to the layer-thickness, the scattered echoes and the absorption state of the ionosphere, removing such an essential defect as in the usual $h't$ measurement in which the real variation of the ionospheric condition cannot be distinguished from the apparent one due to the retardation that the wave of the fixed frequency suffers. The obtained results show a good correspondence of the ionospheric state to rapid geomagnetic changes, which are even in small ranges. Above all, it is noticeable that the ionospheric state on the dark side of the globe shows a response to the solar flare observed on the opposite sunlit side.

2.2. — *Geomagnetic and ionospheric storms*

Geomagnetic storms. — Detailed characteristics of development of magnetic storms, which have an important bearing to the ionospheric storms as well as to the geomagnetism itself, were examined by T. Nagata and N. Fukushima (2, 3, 4, 5) by analyzing the world-wide data of magnetograms. It was concluded by them that the polar magnetic storms are composed of successive occurrences of elementary storms, each of which may be caused by the impinging of a corpuscular beam on the ionosphere over the auroral zone during a rather short period. It was shown that the average of these elementary storms with respect to time forms the Chapman's SD-field, and that the dynamo-theory alone can explain these observed facts. The similar characteristics of geomagnetic bays were also found by N. Fukushima (4, 6).

The distribution of preliminary reverse impulse of sudden commencement (SC*) of magnetic storms was investigated by T. Nagata (7). It was concluded that the reverse impulse takes place only in the afternoon hemisphere and its magnitude is larger at higher latitudes. This results shows that the reverse impulse may be due to some electric current at a height of several hundred kilometers.

Ionospheric storms. — Systematic examinations of disturbances of critical frequency and height of the F2-region associated with magnetic storms have been carried out.

The ionospheric changes after sudden commencements of magnetic storms are considered to be composed of two parts, S_D and D_{st} components, as in the case of geomagnetic variations. K. Sinno (8) analysed statistically the development of ionospheric storms in middle latitudes, and showed seasonal characteristics of the S_D and the D_{st} components separately. The phase of S_D component is almost invariant at every station, and the D_{st} component becomes large about 10 hours after the sudden commencement of magnetic storms. D_{st} (foF2) is revealed generally as the increase and decrease of foF2 values in the local winter and summer respectively. Its systematic seasonal characteristic was demonstrated clearly by N. Fukushima and T. Hayashi (9). The above characteristic of the development of ionospheric storms was confirmed also by analysing the simultaneous world-wide ionospheric data at the time of individual magnetic storms by H. Kamiyama (10), K. Miya and N. Wakai (11). The latter authors suggested the propagation of ionospheric disturbance from high latitudes, where the ionospheric disturbance takes place almost sumultaneously with the sudden commencement of magnetic storms. H. Uyeda and Y. Arima (12) classified F2-layer disturbances into some idealized types according to their dependency on latitude, and found the cyclic appearance of these different types in a year, which is in good accordance with the results mentioned above. H. Kamiyama (13) also analysed the world-wide ionospheric change at the time of geomagnetic bays.

The daily and seasonal characteristics of ionospheric variations under the auroral zone were analysed by T. Nagata and T. Oguti (14). It was shown that the electron density of F2 layer decreases or increases according as the solar ultra-violet radiation beats upon the ionospheric region or not. The ionospheric change there seems to develop nearly at the same time with the beginning of magnetic storms. The observed change was explained by them as an effect of heating of the ionosphere due to the impinging corpuscles.

As for a theoretical interpretation of ionospheric storms in middle latitudes, K. Maeda (15) extended his calculation for the drift of electrons caused by the dynamo action in the ionosphere (for S_D) and by the electromagnetic induction from the D_{st} magne-

tic field (for D_{st}). The theory, which seemed to be in good agreement with the observed fact in the case of undisturbed state, does not yield a quite satisfactory result yet for the disturbed cases in some points.

2.3. — *Stationary characteristics of ionosphere and geomagnetism*

Ionospheric conductivity and geomagnetism. — The electrical conductivity of the ionosphere is theoretically studied by M. Hirono (16) and the abnormally large Sq variation near the magnetic equator was explained by the theory. In his theory a dynamo theory for the E region with anisotropic conductivity, which is linked by highly conductive lines of magnetic force to the F region is examined.

The distribution of geomagnetic lunar tide was examined especially in detail in connexion with the tidal motion of the ionosphere by M. Hirono (17). It was shown that the behaviour of anisotropic conductivity is well responsible for various observed facts of geomagnetic and ionospheric tides.

The dependency of geomagnetic Sq- field upon longitude was examined in detail by H. Maeda (18). The result of his analysis agrees fairly well with the theoretical estimation obtained by Nagata and Sugiura by taking into account the discrepancy between the geomagnetic and the geographic axes of the earth. H. Maeda (19) proposed a new spherical coordinate system, in which the Sq-field can be conserved almost invariant throughout a whole day in Universal Time. The North pole of this coordinate is situated at 82.5° N, 74°0 W.

Continuous observation of pulsatory variations in geomagnetic field by means of an induction magnetograph has been continued by Y. Kato and his collaborators (20, 21, 22).

D-region. — T. Sato (23) examined in detail the results of long wave reflection measurements and estimated the order of magnitude of electron density and collision frequency in the region of the lower E-layer or D-layer.

World-Wide distribution. — World-wide distribution study of f_oF2 has been continued by Y. Aono (24), and in order to obtain the regional anomalies, the monthly median value of noon f_oF2 throughout the world was plotted on the map of the

geomagnetic coordinates. The regional anomalies of the general feature and its seasonal variation of the world-wide distribution can be described simply by dividing the globe longitudinally into four sectors ; i. e. sector 1 including the western region of the Pacific Ocean, sector 2 including the American Continent, sector 3 including the Central Asia and the Far East, and sector 4 including Europe and Africa. The most remarkable anomalies are noticed on the belts of highest *fo*F2 region surrounding the globe in the middle latitude. The belts of the both hemispheres in the sector 1 are widest in summer, expanding until they join closely together on the equator.

K. Maeda (25, 26, 27) treated analytically the problem of world-wide distribution and diurnal variation of F2 layer from the standpoint of dynamo theory. The behaviour of charged particles in ionosphere was studied in connexion to the dynamo action and it was found that the vertical drift gives the most predominant effect to the electron density and height. The geomagnetic latitude distribution of maximum electron density and height and the daytime variation of electron density and height were explained fairly satisfactorily by the theory.

2.4. — *Sporadic E-layer*

Reliablilily of Es Dala. — Relative frequencies of occurrence of *fEs* as a function of observation frequency at several stations were studied by H. Hojo (28) and S. Matsushita (29) and abnormally frequent occurrences at special values of *f*Es (for example 4.7, 8.0, 10.3 Mc/s at Huancayo) were found by them. Then, H. Uyeda, K. Miya and T. Kobayashi (30) confirmed that *f*Es and *f*minF values were influenced by the incoming interference. According to this result we sent a remark to Sir Edward Appleton, recommending that the problem be discussed in Sydney meeting.

Lalilude Dislribulion of Es. — It was reported by H. Hojo (31) that daily variation of Es occurrence percentage has a very dominant feature at the geomagnetic equator and the auroral zone. S. Matsushita (32) studied the latitude distribution and found that Es at the narrow band centred on the magnetic equator is abnormally large in the day time, just corresponding to the

abnormality of *Sq* there, and that *Es* at night is intense at the auroral zone.

Semi-Diurnal Lunar Variations in Es. — The presence of semi-diurnal lunar variation in Es region was detected by S. Matsushita (33, 34, 35). The maximum amplitude of the variation of *f*Es for the period of one year resembles that of the F2, and on the average in local summer it is about 0.2-0.3 Mc/s (about 13 % of mean variation) approximately 7 or 8 hours after the lunar culminations. The magnitude of the height variation in the tide resembles that of the F1 (0.5-0.7 km) and its maximum occurs about 6 hours after the lunar culminations.

Relations between Es *and Geomagnetic Variations.* — A change in geomagnetic declination at Kakioka accompanying intense Es (*f*Es $\geqslant$ 12 Mc/s) at Kokubunji was studied by H. Hojo and T. Yonezawa (36, 37) and it was concluded that the declination shows a small deflection in the direction of amplifying its diurnal variation a few hours after the appearance of an intense Es layer.

S. Matsushita (38) studied statistically Es variations during geomagnetic storms. In June solstice, SD average diurnal variation was detected. The amplitude is about 0.5 Mc/s (about 15 % of the mean variation) and the phase is opposite to the SD variation of *f*oF2. At Huancayo, it seems to occur in any season, and the maximum may occur in earlier time than others. He calculated *Sq* and SD current systems by the dynamo theory under the consideration of anisotropic conductivity, and considered of a mechanism of the formation of Es by drift forces.

2.5. — *Physical processes in the ionosphere*

T. Yonezawa (39) considered the mechanism of electron removal in F2 layer of the ionosphere from a detailed analysis of observational data on the electron density variation in F2 layer during the night and the latitudinal distribution of the diurnal maximum values of the electron density in F2 layer, and derived the following results : (1) The temporal rate of electron removal in F2 layer is of attachment type rather than of recombination one ; (2) the coefficient associated with this rate is about 10^{-4} sec.$^{-1}$ at a height of 300 km ; (3) the scale height associated with the decrease of the coefficient with height is about 100 to 200 km. Then,

some mechanism consistent with these observational facts was sought for, but not successful (40). According to his considerations the process suggested by Bates and Massey which consists in the charge transfer from atomic oxygen ions to some molecules followed by the dissociative recombination of the latters with electrons seems to be inadequate.

Y. Inoue and S. Kato (41, 42) made a detailed study on the radiative, thermal and dissociative equilibrium in the ionosphere and discussed the structure of the ionospheric layers. They assert that the earth's atmosphere is not an absorbing atmosphere as assumed by Chapman, but a scattering one like a stellar atmosphere on account of the abundant existence of atomic oxygen. On some assumptions they made a theoretical calculation of the distributions of temperature and number densities of oxygen molecules and atoms, using Penndorf's values of absorption coefficient of molecular oxygen. The calculated values of temperature and number densities are roughly in accord with the conventional ones.

2.6. — *Ionospheric radio wave propagation*

Propagation mechanism. — Oblique incidence propagation test of impulsive waves at variable frequencies has been carried out by Central Radio Wave Observatory (now Radio Wave Laboratories) since 1948, and it was found (43, 44) that most of the propagation characteristics for distances of about 1,000 km can be well interpreted by Transmission Curve. A trans-Pacific propagation (more than 8000 km) of impulsive waves was observed and K. Miya, S. Ishikawa and T. Kobayashi (45, 46) obtained the relation between the MUF and the broadness of received wave form, and the distance coefficient of attenuation of multiple hopped wave, and clarified the characteristics of angle of incidence. The problem of propagation from antipodal quarters was treated theoretically by H. Furutsu (47) and the rise of field intensity and the variation of coming direction were clarified.

Scattering. — K. Miya, T. Kobayashi and N. Wakai (48) found that the scattering at the ground surface of HF radio waves is important, while the sea surface scatters little the radio waves, and a scattering coefficient was obtained. These results were confirmed by a theoretical study on scattering by H. Furutsu (49).

Es propagation. — Long distance propagation of VHF radio waves through the sporadic E layer has been tested by T. Kono and others (50, 51) since 1950, and it was found that the secant law still holds roughly in this propagation mode, by observing simultaneously the h'-f near the point of apex.

Angle of incidence. — Angle of incidence has been measured by intensity ratio method (46, 52, 53), and a general characteristic of angle of incidence, the relation between angles of incidence and emission as a function of ionosphere distribution, and the characteristics of coming direction were clarified. A new device of continuous measurement of angle of incidence was reported by K. Miya and others (54).

Fading. — F. Minozuma and H. Enomoto (55) made a theoretical and experimental research of HF fading, and connected the phenomena to the turbulence of the ionosphere. M. Nakagami and others (56, 57) continued their statistical research on HF fading and the effect of diversity reception.

2.7. — *Solar phenomena*

Observation. — Continuous observations of solar eruptions with the spectrohelioscope are being carried out during the hours while the sky is clear and other observations of sunspots, flocculi, prominences and dark filaments are being made from time to time at the Tokyo Astronomical Observatory (58, 59). Daily observations of solar corona with the Lyot-type coronagraph are being continued since 1950 at the top of Mt. Norikura (60, 61, 62).

Solar physics. — Z. Suemoto (63) determined the electron temperature of the solar eruptions to be about 13 000° K and estimated the density of the hydrogen atoms at the base of the eruption to be the order of 5×10^{13}. The theory of low temperature of the chromosphere has been confirmed by S. Miyamoto (64) and by I. Kawaguchi (65) again.

Solar and terrestrial relation. — M. Sugiura (66) discussed the velocity spread of the auroral protons observed by Meinel, and pointed out that the maximum of the intensity of protons was located around 1500-2000 km/sec and that the protons with the velocities over 4000 km/sec might still be present.

T. Hatanaka (67) proposed the Lyman-alpha radiation of hydrogen as the most possible mode of acceleration of corpuscular emission by solar eruptions and pointed out the general magnetic field of the sun as an important role to lessen the divergence of the stream. Possible effects of group-types and magnetic characters of sunspots located near the central meridian of the sun have been pointed out by F. Moriyama (68) on geomagnetic storms. M. Notuki (69) discussed the influence of a long-lived active group of sunspots on the daily geomagnetic variations. M. Notuki (70) has pointed out the M region to be at the middle part of two regions of sunspots and long-lived dark filaments.

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CONFERENCE ON THE PHYSICS OF THE IONOSPHERE

The Physical Society informs us that a Conference will be held at the Cavendish Laboratory, Cambridge, from 6th to 9th September 1954, on the subject of the Physics of the Ionosphere.

This Conference has been arranged to follow immediately after the Meeting of the International Scientific Radio Union

in Holland and it is hoped that a number of overseas delegates to that Meeting will wish to be present at the Cambridge Conference.

The Conference will be devoted mainly to a discussion of the following topics :

(*a*) The lowest ionosphere.

(*b*) Irregularities and movements in the ionosphere.

(*c*) The ionospheric F2 layer.

(*d*) The mathematics of wave propagation through the ionosphere.

It is hoped that accommodation may be arranged in one of the Colleges for the men attending the Conference.

Details will be published later in the *Physical Society Bulletin* ; in the meantime Mr. J. A. Ratcliffe, M.A., O.B.E., F.R.S., Cavendish Laboratory, Cambridge, may be consulted for further information.

Commission IV

We are publishing hereunder un excerpt of a letter sent by Mr. Ratcliffe, Chairman of Commission IV, to some members of the Commission.

« I am writing to you in my capacity of Chairman of Commission IV of U.R.S.I. to enlist your help in making our meeting in Holland next year really successful. At the last meeting we listed one topic which was to form the major basis for discussion in Holland : it was « What are the most easily measured characteristics of terrestrial radio noise from which the interference to different types of radio communication systems can be determined ? » We have set up an active Working Party in Great Britain to consider this topic and I hope we shall be able to prepare a paper and circulate it a least to all Committee Chairmen and interested people of the participating countries. I hope it will be possible to circulate this paper in June or July, well before the meeting of U.R.S.I. The paper will also form one of the official documents of U.R.S.I. At the meeting of the Commission itself I hope one of the main topics will be the discussion of this subject, including a discussion of our paper.

It is my hope that other countries will act in a similar way, and it would be particularly beneficial if your country were able to produce a considered document of this kind and have it discussed with ours at the U.R.S.I. meeting. I am strongly of the opinion that we can make these discussions at U.R.S.I. really profitable only if we have papers circulated early so that they can be thought about, and if the papers are of a type in which a problem is reviewed, it should be investigated fully by something like a Working Party.

It is by no means my intention to restrict discussion in Holland to this one topic in Commission IV. I shall be glad if any country will produce a properly considered survey paper on any other problem suitable for discussion at U.R.S.I. It seems to me that appropriate problems might be :

(*a*) Whisling atmospherics.

(*b*) Atmospheric wave forms and their change with distance.

I shall very much look forward to hearing any views which you may have on the procedure for the meeting in Holland next year. »

Commission VI

REPORT TO COMMISSION VI FROM THE JAPANESE NATIONAL COMMITTEE

by K. Morita

I. — Summary of the scientific and administrative activity of the Sub-Committee

(*a*) Twelve meetings were held between Dec. 13, 1951 and July 16, 1953, once in about two months.

(*b*) At the first meeting it was decided that the following four members should be in charge of each of the following four programs in the resolutions made at the U.R.S.I. General Assembly.

1. Information theory : Hidetoshi Takahashi,
2. Non-linear oscillations : Mochinori Goto,
3. Linear theory of circuits : Kenzo Nagai.
4. Antenna theory and wave guides : Hideo Iwakata.

II. — Works carried out in the field of the research programs

(*a*) R. Sato studied the filters for U.H.F. band, and constructed band pass filters by combining a coaxial line and a balanced shielded line. He analyzed the circuit characteristics by the phase sequential method, and gave formulae for the design of m-derived type filters.

(*b*) Y. Moriwaki studied the frequency characteristics of coupled twin parallel wires by taking their line dissipation into account, and developed practical formulae for the case when these circuits are used as band pass filters.

(*c*) Z. Kiyasu and S. Ikeno developed a theory of synthesis of U.H.F. filters in general. They studied filters consisting of many coaxial line elements of various impedances connected in the type of equivalent rudders.

(*d*) F. Miyata developed a new system of 2-terminal synthesis without transformers. This system depends on a special decomposition of a positive real function (abbreviated p. r. f.), that is, any p. r. f. is decomposed into a sum of p. r. f. 's at first by decomposing its real part into a sum of the real parts of any p. r. f. 's. This result gives the number of the resistors necessary to compose the circuits.

(*e*) Y. Nomura studied the multiple diffraction of electromagnetic waves by a series of mountains by assuming the summits of such mountains as consisting of metal wedges. He advanced a step further in Sommerfeld's theory of diffraction of electromagnetic waves. Experiments carried out at Tokyo Institute of Technology proved that the theory is fairly accurate.

(*f*) K. Morita investigated the diffraction of electromagnetic waves by a metallic sphere with its diameter comparable to the wave length. He also studied the condition of energy flow around the sphere.

(*g*) J. Yoshida studied the reflection and transmission coefficients of a metal plate dielectric consisting of thick parallel plates.

(*h*) M. Goto analyzed strictly the problem of a thick cylindrical post in a rectangular wave guide.

(*i*) T. Iijima studied the rigorous solution of the radiation from an opening of semi-infinite circular guide into free space. He has taken account of the current at the edge of the opening and calculated the radiation pattern and the aperture impedance.

(*j*) H. Enomoto made a research on the distortion of F.M. waves by the fading phenomena. According to his result the distortion increases enormously as the fading approaches the Rayleigh distribution but otherwise the distortion is small, especially it is negligible when the reflected waves from the surroundings are weak.

(*k*) K. Udagawa calculated the propagation constants, the phase and the attenuation of electromagnetic waves in a helical circuit surrounded coaxially by a dielectric cylinder. The result may be applied to travelling wave tubes.

(*l*) T. Sakurai studied a new electromagnetic horn of very wide band-width. It has a large opening of flat rectangular shape at one end, and is terminated through an especially designed curved path into a regular wave guide at another end. This curved guide serves as a path length antenna.

III. — On the information theory

The interest in the field of the information theory is gradually spreading wider since a committee for the information theory was organized in the Institute of Electrical Communication Engineers of Japan. Among the most important contributions discussed at this committee is Muroga's paper « On the capacity of discrete channels » which deals with an extensive re-examination of Shannon's theory for the case of noisy channels. Theory of the error-correcting code of Hamming was generalized by Komamiya and Kiyasu so as to enable to make corrections for any number of errors on the basis of the Boolean algebra and the group theory.

IV. — Steps towards the resolutions and recommendations made at the Xth general assembly, U.R.S.I.

The Institute of Electrical Communication in Japan has many professional groups to study specified problems. Among them there are the groups for the information theory, the micro wave

measurement and the electronic computers. We are now keeping in close contact with these groups and are studying in connection with the resolutions made at the Xth General Assembly.

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SYMPOSIUM ON MICROWAVE OPTICS
held at McGill University, Montreal June 22-25, 1953

A highly successful symposium on Microwave Optics was held at the Eaton Electronics Research Laboratory, McGill University, sponsored by the Eaton Laboratory, the Electronics Research Directorate Air Force Cambridge Research Center (U. S. A.), U.R.S.I. Commission VI for Canada, and U.R.S.I. Commission VI

for the U. S. A. The Symposium was well attended, including a number of persons from Europe and Algiers, and it proved to be most stimulating to those in attendance.

The papers which were presented covered a wide range of topics, as can be seen from the title of the sessions : Scattering Theory, Electromagnetic Diffraction, Microwave Optical Systems and Aberrations, Fourier Transforms and Information Theory, Radio Lenses. In general the majority of the papers dealt with various aspects of solving boundary-value problems in which the boundaries involved have dimensions which are not small compared with the wavelength. Although a good deal of progress was reported at the symposium, it became evident that there are still many difficult problems to be solved.

The Symposium clearly demonstrated the need for greater cooperation between investigators in this field, since it was evident there had been insufficient coordination of the efforts of people working on closely related projects. It is to be hoped that further symposia will be held in the not too distant future.

Commission VII

We are publishing hereunder a letter from Dr. G. A. Woonton, Chairman of Commission VII, to the Members of the Commission.

Dear Colonel Herbays,

I have now received about half of the answers to my letter of last July concerning the form that our U.R.S.I. Commission VII meeting might take next August in Holland. In this letter I have attempted to analyse these replies so that all of us night have available the opinion as it exists and so that, that opinion might serve as a basis for further discussion. I hope that you will write to me and give me the benefit of your advice ; perhaps by the new year we may have a solid foundation of agreement on which to plan our program.

In the summary that follows, I have quoted directly from some of your letters in order to give a more personal feeling to what could otherwise be a dry condensation. I trust that there is no objection to this pratice.

I. — A Name for Commission VII

Professor J. Sayers of Birmingham University, England has made the suggestion that the name of the Commission should be changed to « Electron Physics ». This fits so well with the purpose that most of us seem to have in mind for it, that I would very much like to hear your opinion on this suggestion.

II. — Purpose of the Commission

Very definite opinion have been expressed in the United States concerning the purpose of Commission VII. I quote from a letter of Dr. J. R. Whinnery of University of California. « My own view is also that Commission VII should exist primarily for international exchange of information among scientific workers in the field of electron devices and only secondarily as a service group to the Commissions on Propagation. Certainly it is very desirable to have exchange of scientific information among the various fields, but the first purpose to most of us is the exchange of information on tubes and solid state work among the countries having active programs in these fields, such as France, Holland, Great Britain, Sweden and others. If the service aspect is to be primary one, them I feel that the make up of our National Committee must be drastically changed to meet that purpose ».

Although most of the replies gave some support to my suggestion that the Commission could serve in co-operation with other Commissions, I believe that I sensed that the opinion was only lukewarm. I believe that we should reconsider our position before deciding finally that co-operation is our major function.

III. — The Nature of Our Meeting at the General Assembly

On this subject there is unanimous agreement ; the meeting should be given over to the discussion of topics of interest to those present. Even on the subject of the admission of formal papers at the meeting, there was little disagreement ; recommendations vary from « no papers » to « a bare minimum ».

Dr. Masao Kotani, of the University of Tokyo, Japan, has made the following special recommendation concerning Japan : « One point, in which Japan is to be regarded as rather different

from most adhering countries, is that since Japan is geographically very distant from western countries she cannot send enough number of delegates. Although we hope to limit the papers to be submitted to those worthy of presentation from the viewpoint described in your letter, most of the authors are not expected to be able to participate in the actual meeting. One method of solving the difficulty might be to ask the introduction of each paper whose author will be absent to some participants whose field of interest coincides with that of the author. For this purpose it would be convenient to circularize the list of expected participants in advance. »

I have introduced this suggestion here since international co-operation will be necessary in order to help our Japanese members in this matter.

IV. — Name of Delegates to the General Assembly

I judge that it is impratical to request detailed information of this kind until late next spring. The consensus seems to be that it is more logical to choose topics of interest now and let our choise of topics serve as a guide to the National Commissions in choosing individuals.

V. — Topics

(*a*) *The Characteristics of Weather Radars.* — Dr. Gérard Lehmann of France wrote to me as follows : « The last suggestion in your letter is the determination of meteorological Radar. As this point your letter draws attention to the two different significations of the word « Electronics ». Up to now the word « Electronic » as in Commission VII title has been somewhat restricted to its ancient signification : study of electronic property of matter and vacuum.

If we go to the study of Radar circuitry, it means that the word « Electronic » will be accepted with its more modern and general signification which, in fact, is everything in electricity but 60 cycle power distribution.

It is my personal opinion, naturally open to discussion, that if Commission VII moves to discuss complete systems such as Radar, it will again be submerged by dozens of communications

being out of the fields of the six other commissions, and being not very much of international nature. This is a danger to be watched. »

Dr. Sayers of Great Britain makes the following comment on this same point : « I am not altogether happy about a session on the characteristics of Radar for meteorological measurements. This might reduce to a discussion on instrumentation in connection with experiments which lie in the field of the other commissions ».

I had reconsidered this suggestion independently and come to approximately the same conclusions as those set out above. If agreeable to all I suggest to deleate from our agenda all topics such as this that lead to instrumentation.

(*b*) *Solid State Electronics.* — Opinion seems unanimous that Solid State Electronics should be discussed at the General Assembly. Although I would like to have your suggestions concerning specific interesting topics in this field, I realize that such a request may be impratical. If it is possible, later, when topics and individuals have been chosen by the National Commissions, it might be of advantage to compile the topics for general information and circulation.

Comment is requested on the following suggestion due to Dr. Lehmann of France. « Semi conductors and solid state theory study : here also your own letter specifies the importance of this field with the addition of the more modern fields of magnetic materials as ferrites and ferro-electric materials. No doubt that at each assembly it might be a very useful work for Commission VII to publish a short report stating what is the up-to-date situation of this fast moving new field ».

(*c*) *Gas Discharges.* — Opinion is general but not unanimous that at least one session of the meeting be given over to the study of discharges in gases. Professor Sayers of Great Britain makes the following comment « It might be appropriate to have two sessions devoted to gas discharges ; one to deal with the radio frequency properties of ionized gases and a second dealing with collisions processes such as, for example, recombination and electron attachment. The first finds its application in ionospheric propagation and radio-astronomy while the second concerns the detailed mechanism of layer formation ».

In view of the general agreement, I recommend that we count on one session on gas discharges and extend it to a second session if it is warranted by the number of interested contributors.

VI. — Other Topics Suggested

(*a*) *Microwave Spectroscopy.* — Dr. Bricout of Canada has made the following suggestion « A symposium on spectroscopy. An inventory of publications and papers dealing with wavelengths and absorption measurements or a compilation analogue to Kaiser's Handbuch des Spektroskopie for Optics would be in my opinion very useful ».

I would very appreciate your comments.

(*b*) *High Frequency Tubes.* — Dr. Bricout's letter contains the following suggestion : « Lectures and discussion on frequency limitation in UHF tubes. The leader of the session should be possibly world-known specialists as Varain and Pierce from the States, Warnecke from France and so on ».

Dr. Lehmann of France makes the following comment : « High frequency vacuum tubes : Although new vacuum tubes are the basis of new researches, for example in propagation, it is my feeling that difficulties will be experienced by Commission VII in the field of vacuum tubes. This might be because most of vacuum tube development is of industrial nature, or even of military nature. It so happens that U.R.S.I. work on vacuum tubes is very thin considering what vacuum tubes do ».

To these comment I would like to add some of my own. In reading Dr. Whinnery's letter (U. S. A.) I am led to feel that the interchange of information on microwave valve is one of the positive assets that our American colleagues hope to find in Commission VII. I am personnally interested in all varities of microwave valves and would derive considerable profit from at least one session on travelling wave amplifier, magnetron amplifier, two stream amplifiers, velocity jump tubes and the likes. There is currently so much information in the litterature on these tubes that I am led to believe that many sessions, in fact, could be held without encountering difficulties with either defence or industrial restrictions. For these reasons, I request your opinions of the possibilities of a session on microwave amplification with particular reference to millimetre wavelengths.

VII. — Summary of This Letter

(*a*) *Agreement has been reached on the following points* :

1. The meeting are to take the form of a series of discussions on topics of general interest to those present. Distinguished authorities may be invited to lead the discussion and summarize results.
2. It is our function to choose topics now ; the choice of delegates should be made by National Commissions, where possible, in relation to our choice of topics.
3. We have agreed to hold at least one session on solid state electronics.
4. We have agreed to hold at least one session on gas discharges.

(*b*) *Comments are specially invited on the following points* :

Paragraph I : The name of the Commission.

Paragraph II : The purpose of the Commission.

Paragraph III : The Japanese proposal.

Paragraph V : (*a*) Weather radar to be dropped as a topic.

Paragraph VI : (*a*) Microwave spectroscopy.
(*b*) Would a session on centimetre and millimetre tubes be (i) desirable (ii) possible ?

Sincerely yours,

Sgd G. A. Woonton,
Chairman, Commission VII.

URSIGRAMS

Schedule of Japanese Ursigrams

The schedule of the Ursigram Broadcast in Japan is as follows, and the codes are transmitted daily, except Saturdays, Sundays and National Holidays.

I. — Broadcast Station

Radio Research Laboratories, Ministry of Postal Services, Kokubunji, Koganeishinden, Koganeimachi, Kitatama-gun, Tokyo (35°42′ N, 139°29′ E).

II. — Call Sign, Frequency and Time

Call Sign	Time (U.T.)	Frequency (kc/s)	Type of Emission
JJD	12.00	8000	A1
JJD	15.00	8000	A1
JJD	17.00	8000	A1
JJD	19.00	8000	A1
JJD	23.30	9175	A1

III. — Ursigram Codes [1]

1. SPIDE (Radio Wave Disturbance).
2. IONOS (Ionospheric Condition)
3. CHROM (Solar Activity).
4. COSOL (Corona).
5. SOLER (Solar Radio Emission).
6. MAGNE (Geomagnetism).
7. CORAY (Cosmic Ray).

IV. — Form of Message

Prefix « U.R.S.I. » shall be indicated at the top of Ursigram. Following this prefix, the above seven items shall be arranged, each of which carries the abbreviation in 5 letters expressing the code to be applied.

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[1] See *Inf. Bul.*, n° 74, p. 42.

STATIONS PERFORMING RADIO-SOLAR OBSERVATIONS

Erratum

Bullelin nº 80, p. 16, last column read « Ir. A. H. de Voogt » instead of « Ir. B. V. Dijl ».