

# U. R. S. I.

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## MÉDAILLE D'OR BALTH. VAN DER POL

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Nous avons le plaisir d'annoncer à nos lecteurs que, grâce à la générosité de Madame van der Pol, l'U.R.S.I. a institué un prix triennal dénommé la « Médaille d'Or Balth. van der Pol ».

Les règles pour l'attribution de ce prix sont données ci-dessous :

### Médaille d'Or Professeur Balth. van der Pol

1. Pour honorer la mémoire du Professeur Balth van der Pol et pour rappeler son long attachement et son dévouement fécond à la cause de l'U.R.S.I., il est fondé un prix triennal consistant en l'attribution d'une Médaille d'Or qui sera appelée « Médaille d'Or Balth. van der Pol ».
2. Cette médaille sera décernée lors de chaque Assemblée Générale de l'U.R.S.I. à un radiophysicien éminent qui, au cours de la période de trois ans se terminant un an avant l'Assemblée Générale, aura apporté une contribution de valeur dans un des domaines d'activité de l'Union, soit par ses écrits, travaux, découvertes, réalisations, ou par toute autre activité.
3. Pour le 15 juillet au plus tard, de chaque année précédant celle où sera décernée la médaille, les Comités Nationaux de l'U.R.S.I. désirant présenter un candidat, feront parvenir au Secrétaire Général de l'Union le nom d'un seul candidat. Cette proposition sera accompagnée :
  - (i) d'une note biographique mentionnant, entre autres, les travaux réalisés par le candidat et les écrits publiés,
  - (ii) d'une note justificative donnant les raisons pour lesquelles le candidat est présenté.
4. Les membres du Bureau et les Présidents des Commissions procéderont de la même façon pour un candidat que chacun d'eux désirerait présenter.

5. Les documents cités aux art. 3 et 4 ci-dessus seront envoyés par le Secrétaire Général, pour avis et commentaires, aux Présidents des Commissions.
6. Les avis et commentaires ainsi recueillis, accompagnés des documents mentionnés aux art. 3 et 4 seront communiqués aux membres du Bureau de l'U.R.S.I. par le Secrétaire Général. Après avoir pris connaissance de ces documents, les membres du Bureau décideront du nom du lauréat. Celui-ci devra recueillir au minimum  $\frac{3}{4}$  des voix (chaque membre disposant d'une voix). Dans le cas où aucun candidat ne recueillerait ce quorum, il pourrait être fait appel à l'arbitrage des Présidents d'Honneur.
7. Dans le cas où le Bureau de l'U.R.S.I. estimerait qu'aucun candidat n'est suffisamment qualifié, il pourrait décider de ne pas décerner la Médaille.

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## BALTH. VAN DER POL GOLD MEDAL

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We have the pleasure to inform our readers that due to the generosity of Mrs van der Pol, U.R.S.I. has founded a triennial award, the « van der Pol Gold Medal ».

The rules governing the award are as follows :

### **Balth. van der Pol Gold Medal**

*(Translation)*

1. In order to commemorate Professor Balth. van der Pol's long attachment and fruitful devotion to U.R.S.I.'s activities, a triennial award is established consisting of a Gold Medal which shall be named « Balth. van der Pol Gold Medal ».
2. This Medal shall be awarded at each General Assembly of U.R.S.I. to an outstanding radio scientist who, during the three year period preceding the year of the General Assembly, will have made a valuable contribution in one of the fields of activity of the Union, either by his research work, discoveries, achievements, or by any other activity.

3. At the latest by July 15th of the year preceding the one during which the Medal will be awarded, U.R.S.I. National Committees wishing to present a candidate will forward to the Secretary General of the Union the name of a single candidate together with :
    - (i) a biographical notice mentioning, inter alia, the works and the writings of the candidate,
    - (ii) an explanatory note to justify the proposal.
  4. The Officers of U.R.S.I. (Members of the Board and Commission Chairmen) will proceed in the same way for one candidate each they would wish to propose.
  5. Documents in art. 3 and 4 shall be forwarded for suggestions and comments to the Commission Chairmen by the Secretary General.
  6. Such suggestions and comments, together with the documents mentioned in art. 3 and 4 shall be communicated to the Board of Officers of U.R.S.I. by the Secretary General. After consideration of these documents, the Officers will designate the name of the laureate. He would have to obtain  $\frac{3}{4}$  of the votes (each Officer having one vote). In case no candidate obtains this quorum of votes, the Honorary Presidents shall be called upon to decide by arbitration.
  7. In case the Board of Officers should judge that there is no sufficiently qualified candidate, it may decide not to award the Medal.
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## ARTICLE D'INFORMATION

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### **A propos de l'histoire de l'U.R.S.I.**

D'aucuns peuvent considérer que parcourir les archives est une perte de temps. Ce n'est pas l'avis du Secrétaire Général. Il a constaté, en feuilletant de vieux documents, que les dons suivants avaient été faits à l'U.R.S.I. il y a quelques années :

En 1928, le Prof. Balth. van der Pol et le Prof. B. van der Berg ont fait don chacun de la somme de 50 florins.

En 1929, le Comité National des U. S. A. fit deux dons se montant à 107.813 francs belges, le Comité National Français un don de 8400 francs belges et le Comité National des Pays-Bas un don de 14.395 francs belges (1000 florins). Le total de ces sommes s'élevait à 130.608 francs belges, alors que les cotisations payées durant cette même année se chiffraient à 49.540 francs belges.

Il convient également de mentionner qu'au cours de cette même année 1929, les dépenses de l'U.R.S.I. se sont élevées à 103.277 francs belges dont 52.000 furent consacrés au fonctionnement du Secrétariat Général, 43.860 pour les publications et 7365 pour l'Assemblée Générale de 1928.

Les commentaires ne sont pas nécessaires ici !

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## INFORMATIVE PAPER

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### **Around U.R.S.I. History**

Some may think that looking through old archives is a waste of time, the Secretary General has another opinion. Going through old papers, he found that some years ago the following grants were made to U.R.S.I.

In 1928, 50 Dutch Guildens from Prof. Balth. van der Pol and the same amount from Prof. B. van den Berg.

In 1929, the U. S. A. National Committee made two grants amounting to B. F. 107,813, the French National Committee one of B. F. 8400 and the Netherlands National Committee one of B. F. 14.395 (1000 Guildens), or a total amount of B. F. 130.608, while the subscriptions paid during 1929 amounted to B. F. 49.540.

It should also be mentioned that during that year the total expenses of U.R.S.I. amounted to B. F. 103.277 of which B. F. 52.000 were spent for functioning of the General Secretariat, B. F. 43.860 for publication and B. F. 7365 for the 1928 General Assembly.

This does not need any comments !

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## XIV<sup>e</sup> ASSEMBLÉE GÉNÉRALE

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### Calendrier

- 1962-15 juillet. — Les propositions pour l'attribution de la Médaille d'Or Balth. van der Pol doivent parvenir au Secrétaire Général.
- 1962-16 septembre. — Les Présidents des Commissions doivent envoyer au Secrétaire Général la liste des orateurs qui présenteront les communications introductives aux discussions (un par sujet et par séance scientifique).
- 1963-1<sup>er</sup> mai. — Date limite de la réception des rapports des Comités Nationaux (en trois exemplaires).
- 1963-1<sup>er</sup> juillet. — Date limite de la réception des rapports des Présidents de Commission (2 exemplaires).
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## XIV<sup>th</sup> GENERAL ASSEMBLY

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### Calendar

- 1962-July 15. — Nominations for the Balth. van der Pol Medal should reach the Secretary General.
- 1962-September 16. — Commission Chairmen should inform the Secretary General of the names of the speakers invited to present review papers (one per topic and per scientific session).
- 1963-May 1st. — For this date the National Committee Reports should reach the Secretary General (three copies).
- 1963-July 1st. — For this date the Secretary General should receive the Reports of the Commission Chairmen (two copies).

**Commission I**  
**Etalons et mesures radioélectriques**

**PROGRAMME PROVISOIRE**  
**POUR LA XIV<sup>e</sup> ASSEMBLÉE GÉNÉRALE**

Les modifications ci-après ont été apportées au programme provisoire de la Commission I pour la XIV<sup>e</sup> Assemblée Générale, publié au Supplément au *Bulletin d'Information* n° 131, p. 4.

Séance 1 : Etalons atomiques et moléculaires de fréquence et de temps.

Séance 2 : Emissions de fréquence et de signaux horaires, Mesures de fréquence, horloge à quartz.

Séance 3 : Mesures et étalons radioélectriques jusqu'à environ 1 Gc/s.

Séance 4 : Mesures et étalons radioélectriques, hyperfréquences.

Séance 5 : Mesures de précision des constantes physiques au moyen de techniques radioélectriques.

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**Commission I**  
**On Radio Measurements and Standards**

**PROVISIONAL PROGRAMME**  
**FOR THE XIV<sup>th</sup> GENERAL ASSEMBLY**

The following modifications have been made to the provisional programme of Commission I for the XIV<sup>th</sup> General Assembly, which has been published in Supplement to *Information Bulletin* n° 131, p. 14.

Session 1 : Atomic and Molecular Standards of Frequency and Time.

Session 2 : Frequency and Time Broadcasts, Frequency Measurements, Quartz clocks.

Session 3 : Radio Measurements and Standards to about 1 Gc/s.

Session 4 : Radio Measurements and Standards, Microwaves.

Session 5 : Precision Measurements of Physical Constants using Radio Techniques.

## XIII<sup>e</sup> ASSEMBLÉE GÉNÉRALE

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### **Conférence à la Mémoire de R. Goldschmidt**

Une brochure intitulée « Conférence à la Mémoire de R. Goldschmidt » vient de sortir de presse. Cette brochure qui a été distribuée aux officiels de l'U.R.S.I. et des Comités Nationaux, contient :

- une Introduction,
- un article : Qu'est-ce que l'U.R.S.I. ?
- une bibliographie de R. GOLDSCHMIDT,
- le discours d'ouverture de Sir Edward V. APPLETON,
- la conférence « La Science dans l'Espace » par le D<sup>r</sup> L. V. BERKNER.

Les lecteurs désirant obtenir un exemplaire de cette brochure peuvent s'adresser au Secrétariat Général de l'U.R.S.I.

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## XIIIth GENERAL ASSEMBLY

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### **Goldschmidt Memorial Lecture**

A booklet entitled « Goldschmidt Memorial Lecture » has been issued and distributed to U.R.S.I. and National Committee Officers. This booklet contains :

- an Introduction,
- a paper : What is U.R.S.I. ?
- a bibliographical notice on R. GOLDSCHMIDT,
- the opening address by Sir Edward V. APPLETON,
- the Lecture on Science in Space by Dr. L. V. BERKNER.

Copies of the booklet are available to readers on request to the General Secretariat of U.R.S.I.

## COMITÉS NATIONAUX

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### Belgique

#### COMPOSITION DU BUREAU

*Président* : J. MARIQUE.

*Vice-Président* : M. NICOLET.

*Secrétaire* : J. CHARLES.

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### Japan

#### MEMBERSHIP

*Chairman* : I. KOGA.

*Secretary (Executive)* : Prof. S. OKAMURA.

#### COMMISSION I

Dr. S. AMARI, Consultant, Kokusai Denshin Denwa Company  
(Japan's Overseas Radio and Cable System).

Dr. I. KOGA, Prof. EMERITUS, University of Tokyo (*Commission  
Chairman*).

Prof. M. NAITO, Department of Electrical Engineering, Tokyo  
Institute of Technology.

Mr. F. MIKUMA, Director, Engineering Department, Japan Broad-  
casting Corporation.

#### COMMISSION II

Dr. H. HATAKEYAMA, Director, Tokyo District Meteorological  
Observatory (*Commission Chairman*).

Dr. T. KOONO, Vice-Director, Radio Research Laboratories,  
Ministry of Posts and Telecommunications.

Dr. I. MURAKAMI, Vice-Chief, Radio Research Division, Technical Research Laboratories, Japan Broadcasting Corporation.

Dr. I. SOMEYA, Associate Director, Electrical Communication Laboratory, Nippon Telegraph and Telephone Public Corporation.

COMMISSION III

Mr. Y. AONO, Vice-Director, Radio Research Laboratories, Ministry of Posts and Telecommunications.

Prof. K. MAEDA, Department of Electronics, Faculty of Engineering, Kyoto University.

Prof. T. NAGATA, Department of Geophysics, Faculty of Science, University of Tokyo.

Dr. S. NAMBA, Director, Kokusai Denshin Denwa Company (Japan's Overseas Radio and Cable System) (*Commission Chairman*).

Dr. H. UYEDA, Director, Radio Research Laboratories, Ministry of Posts and Telecommunications.

COMMISSION IV

Mr. T. FUJITA, Vice-Director, Technical Research Laboratories, Japan Broadcasting Corporation.

Prof. A. KIMPARA, Director, Research Institute of Atmospherics, Nagoya University (*Commission Chairman*).

Dr. F. MINOZUMA, Director, Domestic and International Service Administration Section, Radio Regulatory Bureau, Ministry of Posts and Telecommunications.

Dr. H. SHINKAWA, Deputy Director, Research Laboratory, Kokusai Denshin Denwa Company (Japan's Overseas Radio and Cable System).

COMMISSION V

Prof. T. HATANAKA, Department of Astronomy, Faculty of Science, University of Tokyo.

Prof. M. MIYADI, Director, Tokyo Astronomical Observatory (*Commission Chairman*).

Prof. S. OKAMURA, Department of Electronic Engineering, Faculty of Engineering, University of Tokyo.

Prof. H. TANAKA, Research Institute of Atmospherics, Nagoya University.

COMMISSION VI

Prof. M. GOTO, Department of Electrical Engineering, Tokyo Institute of Technology.

Prof. Z. KIYASU, Department of Electronic Engineering, Faculty of Engineering, Tohoku University.

Prof. K. MORITA, Director, Oki Electric Industry Company  
(*Commission Chairman*).

Prof. H. TAKAHASHI, Department of Physics, Faculty of Science, University of Tokyo.

COMMISSION VII

Prof. Y. ASAMI, Department of Electrical Engineering, College of Engineering, Seikei University.

Dr. G. M. HATAYAMA, Director, Research Laboratory, Sony Corporation Research Laboratory.

Prof. Y. KOIKE, Director, Tokyo Electronics Research Laboratories, Matsushita Electric Company.

Prof. M. KOTANI, Department of Physics, Faculty of Science, University of Tokyo (*Commission Chairman*).

Prof. E. SUGATA, Department of Electronic Engineering, Faculty of Engineering, Osaka University.

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**U. S. A.**

**1962 SPRING MEETING**

This meeting was held at Georgetown University, Washington, D. C., April 30-May 3, 1962, with the joint sponsorship of the following Professional Groups of the Institute of Radio Engineers: Antennas and Propagation, Circuit Theory, Information Theory, Instrumentation, and Microwave Theory and Technique.

The following papers were submitted to the meeting.

COMMISSION I. — ON RADIO STANDARDS AND MEASUREMENTS

*Electromagnetic Measurement Methods.*

1. A New Technique for Measuring the Electromagnetic Field by Means of a Coil Spring — Keigo IZUKA, Gordon McKay Laboratory, Harvard University, Cambridge, Mass.
2. The Receiving Loop as a Probe in the Electromagnetic Field — Haven Whiteside, Gordon McKay Laboratory, Harvard University, Cambridge, Mass.
3. Measurement of Short-Term VLF Phase Perturbations — C. F. SECHRIST, Jr., HRB-Singer, Inc., State College, Pa.
4. Insertion Loss Concepts — R. W. BEATTY, National Bureau of Standards, Boulder, Colorado.
5. Recent Work on the Application of Hall Effect Devices to the Measurement of Microwave Power Density — R. A. LEAVENWORTH, Jurij MACZUK, R. F. SCHWARTZ, The Moore School of Electrical Engineering, University of Pennsylvania.
6. Microwave Power Density Measurement Utilizing the D. C. Glow Discharge in Neon — N. FARHAT, The Moore School of Electrical Engineering, University of Pennsylvania.

COMMISSION II. — ON RADIO AND TROPOSPHERE

*Lunar and Planetary Echoes.*

1. Venusian and Lunar Radar Depolarization Experiments — G. S. LEVY, D. SCHUSTER, Jet Propulsion Laboratory, California Institute of Technology.
2. Coefficient of Reflectivity of Lunar Surface at X-Band Frequencies — W. E. MORROW, Jr., D. KARP, B. NICHOLS, R. V. LOCKE, Jr., Lincoln Laboratory, Massachusetts Institute of Technology.
3. Bandwidth of Lunar Reflections — Roy E. ANDERSON, B. H. CLAXTON.
4. Radar Reflections from the Moon at 425 Mc/s — George H. MILLMAN and Fred L. ROSE, General Electric Company, Syracuse, New York.
5. Information on the Surface, Atmosphere, and Rotation Rate of Venus from Radar Observations — Duane O. MUHLEMAN, Harvard College Observatory, Cambridge 38, Massachusetts.
6. Radar Determination of the RMS Slope of the Lunar Surface — Fred B. DANIELS, U. S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey.
7. Statistical Radar Estimate of the Lunar Surface Roughness — H. S. HAYRE, Department of Electrical Engineering, Kansas State University.

*Atmospheric Structure.*

1. Spectra of Refractive Index Fluctuations — A. W. STRAITON, A. P. DEAM and G. B. WALKER, Electrical Engineering Research Laboratory, University of Texas, Austin, Texas.

2. Study of the Eddy Transfer of Water Vapour above an Outdoor Surface — D. R. HAY and E. V. PEMBERTON, Department of Physics, University of Western Ontario, London, Canada.
3. The Correlation of Measured Total Atmospheric Refraction with Surface Refractivity — J. M. HOLT and W. R. LIFF, Collins Radio Company, Cedar Rapids, Iowa.  
The Prediction of Total Atmospheric Refraction at Low Elevation Angles — Walter R. LIFF and John M. HOLT, Collins Radio Company, Cedar Rapids, Iowa.
4. A Radar Refraction Correction for Symmetric and Nonsymmetric Tropospheric Index Distributions — Ralph J. RAINEY and Donald C. THORN, Engineering Experiment Station, University of New Mexico. An Approach to Azimuth Angle Refraction Corrections — Wallis R. CRAMOND and Donald C. THORN, Engineering Experiment Station, University of New Mexico.
5. Antenna Temperature Gradients of Atmospheric Oxygen Emission at Wavelengths near 6 mm — Alan C. ANWAY, Collins Radio Company, Cedar Rapids, Iowa.
6. The Effective Earth Radius Obtained Through Conformal Mapping — Kurt TOMAN, Ionospheric Physics Laboratory, Air Force Cambridge Research Laboratories, Bedford, Massachusetts.

*Surface and Subsurface Propagation.*

1. Ground Wave Propagation — J. R. WAIT, National Bureau of Standards, Boulder, Colorado.
2. On the Computation of Ground Wave Propagation over Mixed Paths on a Spherical Earth — L. C. WALTERS, National Bureau of Standards, Boulder, Colorado.
3. Radio Wave Propagation over Inhomogeneous Spherical Earth — K. FURUTSU, National Bureau of Standards, Boulder, Colorado, and Radio Research Laboratories, Japan.
4. The Electrical Conductivity Structure of the Earth's Crust and Subsurface Electromagnetic Wave Propagation — T. CANTWELL and T. R. MADDEN, Geophysics Laboratory, Massachusetts Institute of Technology.
5. Point-to-Point Communication on the Moon Using the Ground Wave — L. E. VOGLER, National Bureau of Standards, Boulder, Colorado.

*Surface Propagation and Subsurface Antennas.*

1. Transient Response in a Lossy Dielectric — Charles R. BURROWS, 4634, 38th St., North Arlington, Virginia.
2. Impedance Properties of Long Subsurface Antennas — A. W. GUY and G. HASSERJIAN, Physics Technology Department, Aero-Space Division, The Boeing Company, P. O. Box 3707, Seattle 24, Washington.

3. Low Frequency, Subsurface Radiating Structures — G. HASSERJIAN and A. W. GUY, Physics Technology Department, Aero-Space Division, The Boeing Company, Seattle 24, Washington.
4. Insulated and Bare Linear Antennas for Deep Strata Propagation — J. T. de BETTENCOURT, 18, Sterling Street, West Newton, Mass.
5. Electrical Characteristics of Granitic Media for Deep Strata Propagation — G. J. HARMON, Raytheon Company, CADPO., Norwood, Mass.
6. A Method of Investigating Air-to-Subsurface VLF Propagation — S. KOWNACKI, Lockheed Missiles and Space Co., Sunnyvale, California.

*Transhorizon Propagation.*

1. The Existence during Daytime Summer Conditions of a Unique Periodic Structure of the Mean Refractive Index and its Effect on Tropospheric Scatter Propagation — David Parker WHITE, School of Electrical Engineering, Cornell University.
2. An Investigation of Anomalous Transhorizon Radiowave Propagation over Irregular Terrain — R. P. CASSAM, Griffiss Air Force Base, Rome, N. Y.
3. On the Determination of Permittivity Variations in the Troposphere by Electromagnetic Measurements. Scatter-propagation Measurements on 6000 Mc/s over 340 and 170 km Paths — Dag T. GJESSING, Forsvarets Forskningsinstitut, Norwegian Defence Research Establishment, Lillestrom, Norway.
4. A Critique on Scatter Theories Applied to Radio Wave Propagation — Lee A. MORGAN and John B. SMYTH, Smyth Research Laboratories, San Diego, Calif.
5. Minimizing Antenna Gain Loss in Twilight Propagation — Thomas J. CARROLL and J. L. LEVATICH, Bendix Radio Division, Towson, Md.
6. Monopulse Measurements of Amplitude and Angle-of-Arrival Scintillations — E. B. TEMPLE, Lincoln Lab., Mass. Inst. of Technology, Lexington, Mass.

*Scattering from Surfaces.*

1. Radar Sounding of the Troposphere — J. A. SAXTON, Radio Research Station, D.S.I.R., Slough, Bucks, U. K. (visiting at Electrical Engineering Research Laboratory, University of Texas).
2. A Preliminary Study of Radar Angels at Wallops Island, Virginia — T. H. ROELOFS and R. BOLGIANO, Jr., School of Electrical Engineering, Cornell University.
3. On the Scattering of Electromagnetic Waves by a Moving Tropospheric Layer Having Sinusoidal Boundaries — D. T. GJESSING and F. IRGENS, Defense Research Establishment, Nygardsgt. 124, Bergen, Norway.
4. A Sample of Propagation by Reflection — P. J. HARNEY, USAF, Cambridge Research Laboratories, Bedford, Mass.

5. The Reflection of Radio Waves from an Undulating Tropospheric Layer — A. T. WATERMAN, Jr. and J. W. STROHBEHN, Stanford Electronics Laboratories, Stanford University.
6. Radar Reflectivity of the Ocean for Circular Polarization — I. KATZ, Applied Physics Laboratory, Johns Hopkins University.
7. Geometrical Considerations in the Measuring of Bistatic Radar Reflectivity of the Ocean Surface — H. McLAUGHLIN, Applied Physics Laboratory, Johns Hopkins University.

COMMISSION III. — ON IONOSPHERIC RADIO

*Disturbance Phenomena.*

1. 1961 November 10 PCA Effects Observed at 16 kc/s at College, Alaska — H. F. BATES, Geophysical Institute, University of Alaska.
2. Effects of Geomagnetic Storm Activity on 300 kc/s H'F Recording — J. J. GIBBONS and E. A. WILHELM, Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.
3. HF Communication during Ionospheric Storms — G. E. HILL, Geophysics Section, AVCO, Wilmington, Massachusetts.
4. Ionospheric Disturbances Associated with Solar Flare of 1961 September 28 — D. P. KANELAKOS and O. G. VILLARD, Jr., Radioscience Laboratory, Stanford University, Stanford, California.
5. The Mean Spatial Distribution of Auroral Zone Blackout during the I.G.Y. — V. AGY, National Bureau of Standards, Boulder, Colorado.
6. Polar Cap and Auroral Zone Absorption Effects on 2.5 and 5.0 Mc/s Atmospheric Radio Noise — J. R. HERMAN, Geophysics Section, AVCO, Wilmington, Massachusetts.

*Satellite and Radio Star Scintillation.*

1. Irregularities in the Ionosphere and the Diffraction of Satellite Radiations — J. P. DEBARBER, Ionosphere Research Laboratory, Pennsylvania State University, University Park, Pennsylvania.
2. Multiple Scattering of Radio Star and Satellite Signals in the Auroral Ionosphere — L. OWREN, Geophysical Institute, University of Alaska, College, Alaska.
3. A Study of Radio Star Fadeouts — W. A. FLOOD, Cornell Aeronautical Laboratory, Box 235, Buffalo 21, New York.
4. Spaced Station, Two-Frequency Satellite Scintillation Observations at Boulder, Colorado — J. L. JESPERSEN and G. KAMAS, National Bureau of Standards, Boulder, Colorado.
5. Satellite Scintillation and the Nora-Alice Project — G. W. SWENSON, Jr., and K. C. YEH, Department of Electrical Engineering, University of Illinois.

6. Scintillation of Radio Stars and Satellites during Intense Magnetic Disturbances — W. C. KIDD, H. SILVERMAN, H. WHITNEY, J. AARONS, USAF Cambridge Research Laboratories, Bedford, Massachusetts.
7. Large Scale Ionospheric Irregularities Deduced from Satellite Observations — G. E. CHISHOLM, II, Ionospheric Research Laboratory, Pennsylvania State University, University Park, Pennsylvania.

*Meteor Echoes ; Ionospheric Structure.*

1. Duration of Short Wave Specular Echo from Low Density Meteor Trails — Thaddeus KALISZEWSKI, Sylvania Electronic Systems, Applied Research Laboratory, 40 Sylvan Road, Waltham 54, Massachusetts.
2. Radio Echoes from the Ionized Trails Generated by a Manned Satellite during Re-Entry — S. C. LIN, W. P. GOLDBERG and R. B. JANNEY, Avco-Everett Research Laboratory, Everett, Mass.
3. Investigation of the Ionospheric D-Region — J. S. BELROSE, Defense Research Telecommunications Establishment, Defense Research Board, Ottawa, Canada.
4. Solar X-Ray and Lyman- $\alpha$  Radiation Measured by the NRL SR-I Satellite Experiment — R. W. KREPLIN, U. S. Naval Research Laboratory, Washington 25, D. C.
5. The Structure of the Nighttime E-Region — L. G. Smith, Geophysics Corporation of America, Bedford, Massachusetts.
6. The Formation of the Daytime Peak of the Ionospheric F<sub>2</sub> Layer — S. A. BOWHILL, Ionosphere Research Laboratory, the Pennsylvania State University, University Park, Pennsylvania.
7. Universal Time Control of the Arctic and Antarctic F-Region — R. A. DUNCAN, Natl. Bureau of Standards and High Altitude Observatory, Boulder, Colo., on leave from C.S.I.R.O., Australia.

*ELF and VLF Studies.*

1. Excitation of Modes at VLF in the Earth-Ionosphere Waveguide — James R. WAIT, Central Radio Propagation Laboratory, National Bureau of Standards, Boulder, Colo.
2. Theoretical Investigation of Interference Fringes Observed on Swept-Frequency Polarization Records — A. J. FERRARO and C. P. TOW, Ionosphere Research Laboratory, the Pennsylvania State University, University Park, Pennsylvania.
3. An Experimental Investigation of EM Wave Propagation at 400 Cps — Mr. G. DUNN, Command and Control Lab., Space-General Corporation, Glendale 1, California.
4. The Polarity of Sferics Ground Pulses and the Nature of their Origin in Lightning Discharges — H. ISHIKAWA, Research Institute of Atmospherics, Nagoya Univ., Consultant National Bureau of Standards, Boulder, Laboratories.

5. Daytime Whistler-Mode Attenuation through the Lower Ionosphere at 15.5 kc as Measured on Explorer VI During Launch Trajectory — R. F. MLODNOSKY, R. A. HELLIVELL, Radioscience Laboratory, Stanford University, California and L. H. RORDEN, Stanford Research Institute, Menlo Park, California.

*Miscellaneous Ionospheric Radio Topics.*

1. Ionospheric Forward Scatter as a Mechanism for Communication with Earth Satellites — D. R. MACKEN, R. D. WATSON.
2. Ray Theory in the Ionosphere — Kurt TOMAN, Ionospheric Physics Lab., Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Bedford, Mass.
3. D-Region Studies Using Phase-Stable VLF Transmissions from a Horizontal Dipole Antenna over Short Paths — Merle R. PAULSON and John F. THEISEN, U. S. Navy Electronics Lab., San Diego 52, California.
4. The Time Variation of the Optimum Azimuth for High Frequency Around - the - World Propagation — R. B. FENWICK and O. G. VILLARD, Jr.
5. Cosmic Noise Measurements at 5 Mc/s — Jules AARONS, Herbert WHITNEY and Donald KNIGHT.
6. Natural Tolerance Limits of Doppler Measurements of Outer-Space Radio Signals — P. R. ARENDT, Inst. for Exploratory Research, U. S. Army Signal Research and Development Lab., Fort Monmouth, N. J.

*Ionospheric Electron Content and Gradients.*

1. Total Electron Content of the Ionosphere at the Magnetic Equator — L. J. BLUMLE, Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.
2. Diffusion of Electrons Near the Magnetic Equator — R. A. GOLDBERG and E. R. SCHMERLING, Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.
3. The Quiet Ionosphere — J. Carl SEDDON.
4. Horizontal Gradients in the Ionosphere — H. W. BUTLER, Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania.
5. Ionospheric Parameters from Electron Density Height Profiles — T. D. SCOTT.

COMMISSION IV. — ON RADIO NOISE OF TERRESTRIAL ORIGIN

*Physics of the Magnetosphere.*

1. The Precipitation of Energetic Electrons from the Geomagnetic Field — J. R. WINCKLER and P. D. BHAVSAR, School of Physics, Univ. of Minnesota, Minneapolis, Minn.; and K. A. ANDERSON, Physics Department, Univ. of California, Berkeley, Calif.

2. Flow of Solar Plasma Around the Earth — Paul J. KELLOGG, School of Physics, University of Minnesota.
3. The Seasonal Variations of High-Latitude Storm Phenomena — C. O. HINES, Defence Research Board, Ottawa, Canada.
4. Equatorial Electron Density Profiles to 5,000 km, Using the Incoherent Scatter Technique — K. L. BOWLES, National Bureau of Standards, Boulder, Colorado.
5. Electron Density Variations in the Magnetosphere Deduced from Whistler Data — D. L. CARPENTER.

*Structure of the Magnetosphere.*

1. The Interaction between the Solar Wind and the Earth's Magnetosphere — W. I. AXFORD, Defence Research Board, Ottawa.
2. Application of Relaxation Technique to the Calculation of the Boundary Between the Geomagnetic Field and the Solar Wind — Ronald BLUM, Physics Dept., Stanford University.
3. On the Shape of the Magnetosphere — S. MATSUSHITA, High Altitude Observatory, Boulder, Colo.
4. Solar Wind Distortion of the Geomagnetic Field Boundary — Ralph J. SLUTZ, Natl. Bureau of Standards, Boulder, Colo.
5. Distribution of Electron Velocities in the Magnetosphere — S. F. SINGER, Jet Propulsion Lab., CIT, and Univ. of Maryland.
1. A Theoretical Study of the Distortion of the Earth's Magnetic Field by the Ring Current — S. I. AKASOFU, J. C. CAIN and S. CHAPMAN, National Bureau of Standards, Boulder, Colorado.
2. On Magnetospheric Interchange Instability — M. J. LAIRD and B. SONNERUP, Center for Radiophysics and Space Research, Cornell University.
3. Some Results of the NBS Conjugate Point Program at Eights, Antarctica and Quebec, Canada — E. R. SCHIFFMACHER and C. G. LITTLE, National Bureau of Standards, Boulder, Colorado.
4. Measurements of Positive Ions and Electrons between 150 and 1800 km — R. SAGALYN, M. SMIDDY, U. S. A. F. Cambridge Research Laboratories, Bedford, Mass., and J. WISNIA, Comstock and Wescott, Cambridge, Mass.
5. Helium in the Magnetosphere — M. P. NAKADA, National Aeronautics and Space Administration, Washington, D. C., and S. F. SINGER, Jet Propulsion Laboratory, California Institute of Technology, and Dept. of Physics, University of Maryland.
6. Radar-Doppler Measurements of Changes in the Integrated Cislunar Electron Density — V. R. ESHLEMAN, H. T. HOWARD and P. YOH, Radioscience Laboratory, Stanford University.

*Satellite and Radio Star Scintillation.*

See Commission III.

*Scattering Phenomena.*

- diurnal Variation of the Spectral Width and Shape and Other Characteristics of Incoherent Ionospheric Backscatter Observed at 440 Mc/s during a 24 - Hour Period in May, 1961 — V. C. PINEO, D. P. HYMEK, Lincoln Laboratory, Massachusetts Institute of Technology.
- Plasma Scattering Theory — M. H. COHEN, Cornell University, Ithaca, New York.
- Scattering of Radiation by the Fluctuations in a Non - Equilibrium Plasma — O. BUNEMAN.
- A Limit on the Average Non-Thermodynamic Fluctuations in the Ionosphere — F. W. PERKINS, Jr., Center for Radiophysics and Space Research, Cornell University (Introduced by E. E. Salpeter).

*Wave Propagation and the Earth's Magnetic Field.*

1. Periodic Noise Associated with Whistler Echo Trains Observed at Spaced Stations in Opposite Hemispheres — R. A. HELLIWELL, J. KATSUFRAKIS, M. TRIMPI and N. DUNCKEL, Radioscience Laboratory, Stanford University.
2. Some Puzzling Observations in Whistler Propagation — T. LAASPERE, M. G. MORGAN and W. C. JOHNSON, Thayer School of Engineering, Dartmouth College.
3. Geometrical Hydromagnetics — J. BAZER and J. HURLEY, Div. of Electromagnetic Research, Courant Institute of Mathematical Sciences, New York University.
4. Guiding of Electromagnetic Waves along a Magnetic Field in a Plasma — M. S. V. Gopal RAO and H. G. BOOKER, Center for Radiophysics and Space Research, Cornell University.
5. Extremely Low Frequency Waves in an Inhomogeneous Hydromagnetic Medium and Geomagnetic Pulsations — W. C. HOFFMAN, Boeing Scientific Research Laboratories, Seattle, Wash.
6. Measurements of the Geomagnetic Field Dip Angle above the Earth's Surface — L. J. BLUMLE, Ionosphere Research Laboratory, Pennsylvania State University.
7. The Latitude Dependence of the Occurrence of « Dawn Chorus » — W. E. THOMPSON and R. BARRINGTON, Defence Research Board, Shirley Bay, Ottawa, Ont., Canada, and M. G. MORGAN, Thayer School of Engineering, Dartmouth College.

COMMISSION V. — ON RADIO ASTRONOMY

*Satellite and Radio Star Scintillation.*

See Commission III.

*Lunar and Planetary Echoes.*

See Commission II.

*Radio Astronomy.*

- The Relation of Solar Activity to Jupiter Decimeter Radiation — M. S. ROBERTS, Harvard College Observatory, Cambridge, Massachusetts.
- Some Proposed Measurements of Atmospheric Radiation at Millimeter Wavelengths — A. E. LILLEY, Harvard College Observatory, Cambridge, Mass., and M. L. MEEKS, Lincoln Laboratory, Mass. Institute of Technology, Lexington, Mass.  
Interpretation of type II and III Bursts — M. H. COHEN, Cornell University.
- The Exciters of Fast-Drift Solar Radio Bursts — M. P. HUGHES and R. L. HARKNESS, Radio Astronomy Station of Harvard College Observatory, Fort Davis, Texas.
- Solar Coronal Occultation of Jupiter's Decametric Emission in 1962 — James W. WARWICK, High Altitude Observatory, Boulder, Colorado.
- Radar Studies of the Sun at 38 Mc/s — W. G. ABEL, J. H. CHISHOLM, J. C. JAMES, Lincoln Laboratory, Mass. Institute of Technology.
- Some Theoretical Results on the Sensitivity of Phase Radiometers — James W. MCGINN, Lincoln Laboratory, Mass. Institute of Technology, Lexington, Mass.
- Measuring Brightness Temperature and State of Polarization with a Large Array — R. T. ADAMS, P. E. AHRENS and J. GRANLUND.
- 3000-Foot Radio Telescope — A. T. BROWN, D. J. LEVINE, M. A. PERRY, W. M. SPANOS.
- Characteristics of Faint Radio Meteors — Richard B. SOUTHWORTH, Smithsonian Astrophysical Observatory and Harvard College Observatory.

COMMISSION VI. — ON RADIO WAVES AND CIRCUITS

*Passive Reflectors.*

- Optimum Spherically Symmetric Corner Reflectors — R. GRAHAM, K. M. SIEGEL, A. WREN, Conductron Corporation, R. GOODRICH and B. HARRISON, Univ. of Michigan, R. DRESSLER and P. RAIBOURN, Autometric Corporation.
- Passive Reflector Concepts for Communication Satellites — Joseph R. BURKE.

- Analysis and Evaluation of Passive Communication Satellite Systems — Joachim KAISER, Institute for Defense Analysis; Gordon RAISBECK, Arthur D. LITTLE, Inc.
- Orbiting Passive Electromagnetic Reflectors Constructed of Fine Metallic Wire Mesh — W. E. BRADLEY, Institute for Defense Analyses.
- Coherent and Incoherent Scattering by Orbital Distributions of Scatterers V. TWERSKY, Electronic Defense Laboratories.
- High Frequency Scattering by Finite Cones and by Ellipsoids — J. E. BURKE, L. MOWER and V. TWERSKY, Sylvania Electronic Defense Laboratories, Mountain View, Calif.

*Transmission of Information and Space Communication.*

- Sub-Optimum Space Communications — P. F. CHRISTOPHER, USN Engineering Experiment Station, Annapolis, Maryland.
- Analysis of Binary Error Statistics Obtained on VHF Scatter Communications Systems — E. W. BROWN, Jr., A. W. HATCH and P. A. PORTMAN, Page Communications Engineers, Inc., Washington, D. C.
- Optimum Integration Time for the Incoherent Detection of Noise-Like Communication Signals — I. JACOBS, Bell Telephone Laboratories, Inc., Whippany, New Jersey.
- Some Results on the Factorization Problem — D. R. ANDERSON, Jet Propulsion Laboratory, California Institute of Technology.
- Self-Synchronizing Codes for the Continuous Channel — J. J. STIFFLER, Jet Propulsion Laboratory, California Institute of Technology.

*Pseudo-Random Sequences in Modern Communications Systems.*

- The Nature and Uses of Pseudo-Random Sequences — Solomon W. GOLOMB, Jet Propulsion Laboratory, Pasadena, California.
- The Theory of Pseudo-Random Sequence Generation — L. R. WELCH, Institute for Defense Analysis, Princeton University.
- A Pseudo-Random Technique for Communication through Multipath — Robert Price, Lincoln Laboratory, Massachusetts Institute of Technology.
- A Pseudo-Random Acquirable Ranging System — Mahlon EASTERLING, Jet Propulsion Laboratory, California Institute of Technology.
- Hadamard Matrices in Communication Systems — Richard TURYN, Sylvania Applied Research Laboratory, Waltham, Massachusetts.

*Antennas.*

- Linear Arrays with Elements of Unequal Length — Sheldon S. SANDLER and Ronald W. P. KING, Cruft Laboratory, Harvard University.
- An Experimental Simultaneously Scanned Antenna System — A. T. VILLENEUVE, F. G. TERRIO and W. H. KUMMER, Antenna Department, Hughes Aircraft Company, Culver City, California.

- Noise Computations in Array Antenna Receiving Systems — H. H. GRIMM and D. H. KUHN, Electronics Laboratory, General Electric Company, Syracuse, New-York.
- Theory of Unequally Space Arrays — Akira ISHIMARU, Department of Electrical Engineering, University of Washington, Seattle, Washington.
- Circularly Symmetrical Antenna Arrays — C. O. STEARNS and A. C. STEWART, National Bureau of Standards, Boulder, Colorado.
- Wave Propagation in Helices — R. MITTRA, Dept. of Electrical Engineering, University of Illinois.
- Asymptotic Behavior of the Current in an Infinite Cylindrical Antenna — K. S. KUNZ, Research Center, New Mexico State University.
- A Near-Field Cassegrainian Antenna — D. C. HOGG and R. A. SEMPLAK, Bell Telephone Laboratories, Inc., Holmdem, New Jersey.
- The Transient Response of Antennas — R. W. P. KING and H. J. SCHMITT, Gordon McKay Laboratory, Harvard University.
- Analysis of the Infinite Monopole Antenna — R. H. DUNCAN, Research Center, New Mexico State University.
- A Flush-Mounted Endfire Frequency Independent Antenna — Gary D. BERNARD and Akira ISHIMARU, Department of Electrical Engineering, University of Washington, Seattle 5, Washington.
- Pattern Measurements of an Experimental Compound Interferometer Antenna — W. F. GABRIEL, Aero Geo Astro Corporation, P. O. 1082, Alexandria, Virginia.
- Reflector Surface Errors of Parabolic Antennas — L. J. Anderson, Cornell Aeronautical Laboratory, Inc., Buffalo, New York.
- A Cassegrainian-Type Low-Noise Antenna Feed for Radio and Radar Astronomy — P. D. POTTER and W. V. T. RUSCH, Jet Propulsion Laboratory, California Institute of Technology.
- The Input Impedance of a Thin Biconical Antenna Immersed in a Dissipative Medium — Sinclair N. C. CHEN and Chen To TAI, Antenna Laboratory Department of Electrical Engineering, Ohio State University, Columbus, Ohio.
- Performance Characteristics of a Conical Horn-Reflector Antenna — Tingye LI and R. H. TURRIN, Bell Telephone Laboratories, Inc., Holmdel, New Jersey.
- Coupled-Wave Analysis of the Stop-Band Characteristics of Modulated Reactance Surfaces — Paul E. MAYES, University of Illinois, Urbana, Illinois.
- Excitation of the Sommerfeld Wave on a Finite Conductivity Rod by a Uniform Magnetic Ring Source — Marvin COHN and Marcia J. KING, Electronic Communications, Inc., Research Division, Timonium, Maryland.

- Excitation of the Dipole Mode on a Dielectric Rod by a Non-Uniform Magnetic Ring — Marvin COHN and Marcia J. KING, Electronic Communications, Inc., Research Division, Timonium, Maryland.

*Electromagnetic Theory.*

- Use of Dirac's Bra and Ket Notation in Classical Electromagnetic Wave Theory — E. Folke BOLINDER, USAF Cambridge Laboratories, Office of Aerospace Research, L. G. Hanscom FIELD, Bedford, Mass.
- Power Relationship Associated with the TE Modes in an Electronic or a Gyrotropic Rectangular Waveguide — Chen PANG WU, Antenna Laboratory, Dept. of Electrical Engineering, Ohio State University, Columbus 10, Ohio.
- Periodic Structures as Transmission Lines — J. SHEFER, Div. of Engineering and Applied Physics, Harvard University.
- What Does the Theory of Partially Coherent Electromagnetic Fields Contribute to the Radio Art? — Francis J. ZUCKER, U. S. A. F. Cambridge Research Laboratories, Bedford Mass, and G. B. PARRENT, JR., Technical Operations, Inc., Burlington, Mass.
- On the Reception of Quasi-Monochromatic, Partially Polarized Radio Waves — H. C. KO, Dept. of Electrical Engineering, Ohio State University, Columbus 10, Ohio.
- Experimental Methods of Predicting Transmission Path Changes — James H. Van HORN, Adler Electronics, Inc., New Rochelle, N. Y.
- Lateral Waves on an Uniaxially Anisotropic Interface — L. B. FELSEN, Dept. of Electrophysics, Polytechnic Institute of Brooklyn.
- Two-Dimensional Radiation and Diffraction Problems in Uniaxially Anisotropic Media — L. B. FELSEN, Dept. of Electrophysics, Polytechnic Inst. of Brooklyn.
- Scalar Scattering by a Semi-Infinite Cone : Time Dependent Solution — F. B. SLEATOR, The University of Michigan, Radiation Laboratory Ann Arbor, Michigan.
- Electromagnetic Wave Scattering by Metallic Cylinders and Spheres in Dissipative Media — L. M. VALLESE, ITT Federal Laboratories, Nutley 10, N. J.
- Approximate Boundary Conditions for a Good Conductor — Yoshio HAYASHI, Mathematics Research Center, The United States Army, The University of Wisconsin, and Nihon University, Tokyo, Japan.
- Singular Integrals of Plane Waves and their Use in Diffraction and Refraction Problems — Michael PAPADAPoulos, of the Mathematics Research Center, U. S. Army, Univ. of Wisconsin, and Melbourne Univ.
- Excitation of Surface Waves on a Unidirectionally Conducting Screen — S. R. SESHADRI, Gordon MCKAY Laboratory, Harvard University.

- The Field of a Dipole above an Infinite Corrugated Plane — T. S. CHU and S. N. KARP, Courant Institute of Mathematical Sciences, New York University.
- An Approximate Approach to the Scattering of Electromagnetic Waves by Discontinuities of Surface Wave Structures — W. R. JONES, Hughes Aircraft Company.
- Electromagnetic Signal from Nuclear Explosions — B. A. LIPPMAN, Lawrence Radiation Laboratory, University of California, Livermore, Calif.
- The Frequency of a Moving Oscillator at a Stationary Observer — K. TOMAN, USAF Cambridge Research Laboratories, Bedford, Mass.
- The Generation of Electromagnetic Waves by an Arbitrary Current Distribution in a Conducting Half-Space — A. P. STOGRYN and R. N. GHOSE, Space General Corporation, Glendale, California.

*Surface Propagation and Subsurface Antennas.*

See Commission II.

*Summaries of the above papers are available by the Administrative Secretary of the U. S. A. National Committee, Mrs. H. Hart, National Research Council, 2101 Constitution Avenue, Washington 25, D. C.*

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## **U. S. A.**

### **1962 FALL MEETING**

The next meeting of the U. S. A. National Committee, jointly with the Canadian National Committee, will be held at Ottawa (Canada), October 15-17, 1962.

For further information apply to the Administrative Secretary of the U. S. A. National Committee : Mrs H. E. Hart, National Research Council, 2101, Constitution Avenue, Washington 25, D. C., U. S. A.

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## COMMISSIONS AND COMMITTEES

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### Commission I

#### On Radio Measurements and Standards.

##### INTERNATIONAL COMPARISON OF MEASUREMENT ACCURACIES OF RADIOELECTRIC QUANTITIES

Resolution IV adopted by the XIIIth General Assembly in London <sup>(1)</sup> calls for co-operation in an international comparison of measurement accuracies of radio quantities.

At the time being the following countries seem to have some interest in such comparison : France, Germany, Italy, Japan, Sweden, United Kingdom and U. S. A. Co-operation from other countries is expected.

In order to initiate a world wide comparison, the following letter was sent to some laboratories and to the Official Members of Commission I by M. C. Selby, Chief 92.10, H-F Electrical Standards Section, Radio Standards Laboratory, National Bureau of Standards, Boulder Laboratories, Boulder, Colorado, U. S. A.

« Dear Sir,

In the interest of the U.R.S.I. resolution referred to above we would like to make necessary arrangements for the intercomparison of measurements with your laboratories of the quantities tabulated in the reference cited <sup>(1)</sup>. Please let us know if you are interested in any of those quantities or in others not listed in these documents.

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<sup>(1)</sup> « Working Paper concerning U.R.S.I. Resolution n° 5 », U.R.S.I. Proceedings of the XIIIth General Assembly, 1960, volume XII, part 1, pp. 75-87 ; or « Electronic quantities for international standardization », Monograph on Radioelectric Measurements and Standards, XIIIth General Assembly of U.R.S.I., London, 1960, B. DECAUX, pp. 50-59, Elsevier Publishing Company.

Your U.R.S.I. National Chairman is requested, via a copy of this letter, to lend his kind assistance in this effort to establish contact between the Standardization Laboratories of our two countries. »

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### **Commission III. — On Ionospheric Radio**

#### **IONOSPHERIC DATA**

The Istituto Geofisico e Geodetico, Università di Genova, has issued the « Ionospheric Data of Genova Monte Capellino Observatory » for the period January-December 1961.

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Attention is called to the paper « The representation of diurnal and geographic variations of ionospheric data » by William B. Jones and Roger M. Gallet. *Telecommunication Journal*, Vol. 29, n° 5 (May 1962).

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### **Commission VI**

#### **Ondes et Circuits Radioélectriques**

##### **BIBLIOGRAPHIE**

Nous attirons l'attention des lecteurs intéressés dans la Théorie des Circuits sur l'ouvrage ci-après :

*Sur certaines classes de circuits électriques*, par O. BEAUFAYS, Université de Bruxelles, Institut de Physique, Bulletin n° 8 du Service d'Electricité. Editions des Presses Académiques Européennes, Bruxelles, 1962.

L'auteur s'est proposé d'étendre la théorie classique des circuits électriques linéaires permanents à certaines autres classes de circuits.

Le premier chapitre est consacré à des définitions et des notations. Le second traite des méthodes que N. Wiener a développées depuis

une quinzaine d'années et qui constituent une théorie des systèmes non-linéaires permanents. On indique comment on peut modifier la théorie de Wiener pour traiter le cas des signaux transitoires. Ensuite, on applique ces méthodes aux systèmes linéaires non-permanents.

Dans le troisième chapitre, l'auteur étudie les circuits où les résistances sont constantes, mais où les inductances et les capacités varient linéairement en fonction du temps. Cette variation est supposée la même pour toutes les réactances du circuit. Le formalisme développé se base sur une transformation intégrale liée à celle de Mellin. On associe à tout circuit une « superimpédance » qu'on calcule comme une impédance et qui permet de déterminer le courant. On étudie la stabilité des circuits envisagés ; le critère obtenu se ramène au critère classique dans le cas des circuits permanents.

Le dernier chapitre, enfin, constitue une théorie mathématique rigoureuse des circuits logiques combinatoires.

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## **Committee on Space Radio Research**

### **BIBLIOGRAPHY**

Attention of the readers is called to I.U.C.A.F. Document n° 32 on Communication by orbiting dipoles (p. 57).

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## **Comité de l'U.R.S.I. pour les travaux du C.C.I.R.**

### **NOUVEAU PRÉSIDENT**

Le Dr J. H. Dellinger, Président de ce Comité depuis sa création en 1954, a remis sa démission. M. B. Decaux, membre du Comité, a accepté d'en assumer la présidence jusqu'à la prochaine Assemblée Générale de l'U.R.S.I.

Tous ceux que la coopération entre le C.C.I.R. et l'U.R.S.I. intéresse, connaissent bien le rôle joué par le Dr Dellinger en vue de la consolidation des liens entre les deux organisations.

## **U.R.S.I. Committee for C.C.I.R. Work**

### **NEW CHAIRMAN**

Dr. J. H. Dellinger who was Chairman of the Committee since its constitution in 1954, has handed his resignation. Mr. B. Decaux, member of the Committee, accepted to take this charge until the forthcoming General Assembly of U.R.S.I.

All those interested in the co-operation between C.C.I.R. and U.R.S.I. know the role played by Dr. Dellinger in strengthening the links existing between both organizations.

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## I.U.C.A.F.

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### **Inter-Union Committee for Frequency Allocations for Radio Astronomy and Space Science (U.R.S.I. — I.A.U. — C.O.S.P.A.R.)**

*Chairman* : Dr. J. F. DENISSE

*Secretary General* : Dr. R. L. SMITH-ROSE, 21, Tumblewood Road,  
Banstead, Surrey,  
United Kingdom.

**Doc I U C A F /31 — Report of a meeting of the Committee  
held at the Royal Netherlands Academy of Science, Amsterdam  
on Wednesday and Thursday, 11th and 12th April, 1962**

#### PRESENT

Dr. J. F. DENISSE (*Chairman*),  
Mr. A. H. CATÁ,  
Dr. R. EMBERSON,  
Dr. J. P. HAGEN,  
Colonel E. HERBAYS,  
Dr. A. P. MITRA,  
Professor J. H. OORT,  
Mr. J. A. RATCLIFFE,  
Dr. H. STERKY,  
Professor Dr. A. UNSÖLD,  
Professor H. C. VAN DE HULST,  
Dr. J. H. D. VAN DER TOORN,  
Dr. R. L. SMITH-ROSE (*Secretary General*).

1. — The Secretary reported apologies he had received from Drs. L. G. H. Huxley, V. Ilyin and V. V. Vitkevitch.

2. — The Secretary reported on his correspondence with the Director C.C.I.R. who had accepted the invitation to participate in the work of the Committee on the understanding that if he himself were unable to attend its meeting he would be permitted to

send a deputy to represent him. The Committee were very happy to agree to this arrangement, and the Secretary General would send all Committee papers to the Director C.C.I.R.

3. — The Committee approved the Report of the meeting held in London in October 1962 and previously circulated as Doc. I.U.C.A.F./26.

The report had been printed in the *U.R.S.I. Information Bulletin* n° 129 (November-December 1961) and reprints were distributed to the Committee.

4. — *Meeting of C.C.I.R. Study Group IV.*

The Chairman reported on the recent meeting in Washington of C.C.I.R. Study Group IV, at which he and the Secretary General had represented the I.U.C.A.F. They had presented a report (Doc. IV/89) on C.C.I.R. Question n° 218 (IV) which was accepted by the Study Group. This report contained two appendices; the first being an analysis of the radiation flux density which the radio astronomers are seeking to have protected. The second forms the beginning of a catalogue of the details of all radio astronomical observatories which use observing equipment of the highest sensitivity, as distinct from those observatories which are making observations for which a much lower (20 dB) sensitivity is adequate.

It was agreed by Study Group IV that this catalogue would be completed so far as possible by the International Frequency Registration Board (I.F.R.B.) in Geneva, with the co-operation of the 114 national members of I.T.U.

5. — *Recommendations to I.T.U.*

Dr. Smith-Rose informed the Committee that, in accordance with paragraph 7 of the Report of the previous meeting (Doc. I.U.C.A.F./26), 40 copies of the Recommendation contained in Doc. I.U.C.A.F./24 (revised) had been sent direct to the National administrations which are members of C.C.I.R. Study Group IV. In addition, about 140 copies of the same Recommendation had been distributed to the National members of U.R.S.I., I.A.U. and C.O.S.P.A.R. through members of the Committee in accordance with Appendix II of Doc. I.U.C.A.F./26. A copy of the covering

letter with the associated Recommendation is given in Doc. I.U.C.A.F./29.

It was reported that action had been taken by Sweden, Denmark, India and the United States to secure the onward transmission of the above Recommendation to the I.T.U.

With the view of securing the co-operation of the U. S. S. R. it was proposed that :

- (a) Dr. Sterky should approach Mr. Badalov concerning the inclusion of radio astronomy in the future discussions of I.T.U.
- (b) Dr. Denisse should send a telegram <sup>(1)</sup> to the U. S. S. R. Academy of Sciences regretting the inability of Drs. Ilyin and Vitkevitch to attend the meetings of the Committee and stressing the importance of the participation of the U. S. S. R. in all matters concerning the allocation of frequencies for radio astronomy.

#### 6. — *Approach to I.T.U. Administrative Council.*

In view of the fact that the Administrative Council of the I.T.U. will meet for several weeks from 5th May 1962 onwards to draw up the agenda for the 1963 Conference, it was agreed that a strong representation should be made to secure the inclusion of radio astronomy in I.T.U. Recommendation n° 36. Although Professor van de Hulst suggested that space research could be deemed to include radio astronomy, it was felt by other members that its omission from Recommendation n° 36 was intentional; and it was therefore necessary to take some action in the matter.

Accordingly, it was decided that members of the Committee should submit the two Recommendations (I and II) reproduced in Appendix II, to their own and other national administrations in order to ensure that at least 20 members of the Administrative Council should request this subject of radio astronomy to be placed on the agenda. (See I.T.U. Resolution n° 62). At the same time, Dr. Smith-Rose would send copies of these Recommendations to the Secretary General of I.T.U. and the Director of C.C.I.R.

It was further pointed out that the practice of the Council during its meeting would be to send a telegram to all administra-

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<sup>(1)</sup> This telegram, a copy of which is given in Appendix I, was transmitted from Amsterdam during the meeting.

tions seeking their agreement to the inclusion of items in the agenda of the 1963 Conference. Dr. Denisse agreed that he would be available to go to Geneva if necessary, to assist in the drafting of such a telegram; and that Drs. van der Toorn and Smith-Rose would consult with him on any further action necessary such as in the drafting of the telegram in a manner best suited to encourage a positive answer. Dr. Sterky pointed out that the telegram must be carefully worded so that no administration fears that all the bands requested for radio astronomy must be cleared forthwith; it was suggested that I.F.R.B. could advise as to which bands might be made available in stages over the next few years.

#### 7. — *Frequencies for Radio Astronomy and Interference.*

The Committee first discussed in general terms the various frequencies allocated to Radio Astronomy in the Geneva 1959 Radio Regulations. While with the exception of the hydrogen band at 1420-27 Mc/s, all these allocations were on a shared basis, little information seemed to be available as to the extent of the interference caused to radio astronomy by other users of the same frequencies. Dr. van der Toorn reminded the Committee that each case of interference should first be investigated by the appropriate national administration; who would then negotiate with other administrations concerned and with the I.F.R.B. on the basis of interference as defined in the Radio Regulations.

There is thus a responsibility on the radio astronomers themselves to demonstrate the extent of the interference to which they are subject in support of any application that is to be made internationally for better protection in the shared bands of frequencies. Dr. Emberson recalled that this would conform with the attitude of Dr. Petrov (U. S. S. R.) at the C.C.I.R. Study Group IV meeting, at which he virtually challenged radio astronomers to demonstrate that they are subject to harmful interference.

Professor Oort proposed that all radio astronomical observatories should be asked to report to Dr. Smith-Rose, (a) on the state of interference experienced by them in pursuit of their scientific work; and (b) on the result of any action taken by them with their own national administrations.

The results of a review of all the frequency bands allotted to Radio Astronomy by I.T.U. are given in Appendix III; it being

borne in mind that it was still desirable to have a series of frequencies in approximately harmonic relationship for research in radio astronomy (see C.C.I.R. Recommendation n° 314).

8. — *Radio Astronomy at Frequencies above 40 Gc/s.*

While the Geneva, 1959 I.T.U. Conference did not make any allocations at frequencies above 40 Gc/s, the desire for radio astronomers to extend the harmonic series relationship should be borne in mind for the future.

Attention is also drawn to the following table of frequencies associated with natural phenomena given in Doc. n° 104 of C.C.I.R. Study Group IV at its interim meeting in Washington, March 1962 : this document was, however, not adopted at the meeting.

<i>Source of radiation</i>	<i>Frequency band Gc/s</i>
OH	36.983- 36.994
O <sub>3</sub>	36.023- 37.832
N <sub>2</sub> O	100.492
CO	115.271
O <sub>3</sub>	118.364
O <sub>2</sub>	118.746
NO	150.176-150.644
There are also « windows » in the earth's atmosphere at :	30-35 and 80-90

9. — *Frequencies for Space Research.*

Mr. Ratcliffe suggested that there was a distinction between the radio frequencies required to conduct investigations in space, and those which are needed for the development of the techniques of telemetry, etc. associated with communications. Dr. Hagen considered that C.C.I.R. envisaged the reservation of frequencies for command and telemetry, and eventually the incorporation of these in the « communication » bands including those for meteorological and similar purposes. He pointed out that while frequencies are clearly required as part of the engineering services associated with space research, these could probably also be accommodated in the same or neighbouring bands. Professor van der Hulst was doubtful if it was necessary to seek separate bands of

frequencies for space science and for the development of communications techniques. In some cases it was necessary for the frequencies used for development to form the basis later of the practical applications.

Reference was made to Doc. I.U.C.A.F./28 entitled « Preliminary Views of the United States of America — Frequency Allocations for Space Radiocommunications ». Dr. Hagen considered that this document described the minimum requirements of frequencies for space research, telemetry, command and communications; and Mr. Ratcliffe, in supporting this view, emphasised the need of the space scientist for frequencies to conduct his own research programmes.

While for some experimental purposes protection from interference from ground transmitting stations using the same frequencies might be necessary only over limited distances of the order of 100 miles, other frequencies should be protected on a world-wide basis. The latter frequencies should be clearly identified.

Attention was also directed to the need to revise and supplement the relevant definitions in the Radio Regulations; and particularly to distinguish those relating to Communications or Meteorological Satellites, from the requirements of the « Space Research Service », which in the U. S. Doc. I.U.C.A.F./28 is defined as « A space service providing for the acquisition and transmission to earth stations, or between space stations, of scientific and technological information acquired by or pertaining to earth satellites or spacecraft ». Dr. Hagen suggested that this definition needs to be more restrictive so as to exclude application to communication satellites.

The Appendix IV lists the frequencies proposed in the above Document and shows their relationship to the Radio Regulations. It was agreed that further action should await any comments to be made at the forthcoming meeting of C.O.S.P.A.R. at Washington (May 1962).

#### 10. — *United Nations Resolution 1721.*

Dr. Smith-Rose referred to the correspondence he had had with Mr. G. C. Gross, Secretary-General of the I.T.U. and also with Professor J. van Mieghem, Secretary General of the I.C.S.U.,

on the U. N. Resolution 1721, entitled « International co-operation in the peaceful uses of outer space ». It was agreed that the only action required at the present was to inform the Secretary General of I.T.U. that the I.U.C.A.F. will have views on the frequencies to be allocated for communications in outer space, and that therefore the Committee would like to be consulted in any recommendations to the U. N. concerning such communications. The Committee also expressed their agreement with the letter of 20th March 1962 from the Executive Secretary of C.O.S.P.A.R. to the Secretary General of I.T.U., and confirmed the interest of I.U.C.A.F. in this subject.

11. — *Project West Ford.*

The Committee noted that Docs I.U.C.A.F./30 and /30a had now been printed in the *U.R.S.I. Information Bulletin*, n° 130, and reprints of this had been distributed. Reference was also made to publications in the *New Scientist* (2nd February and 1st March, 1962) and the *Monthly Notices of the Royal Astronomical Society*. There is also a paper (N.C.S.P./33 (62)) on the subject prepared by the United Kingdom Steering Group on Space Research.

In view of the possible harmful interfering effects of the belt of needles in reflecting radio waves back to earth, Dr. Hagen and Professor van de Hulst considered that it was very necessary :

- (i) to investigate the nature of the interference that was likely to be experienced as the result of the West Ford Project ;
- (ii) to stress the fact that on frequencies above about 3000 Mc/s, the test belt of dispersed dipoles will cause appreciable interference to radio astronomy ;
- (iii) to obtain some reliable estimate of the life-time of the belts of needles used in West Ford.
- (iv) to draw increased attention to the need to have adequate protection on a world wide basis, for the frequencies above 3000 Mc/s allocated in the future to the radio astronomy service.

It was pointed out that it was most desirable for some radio astronomers to make some measurements of the level of the flux

reflected to the earth from powerful ground transmitting stations over a range of radio frequencies. While not many radio astronomical observatories are at present equipped to make such measurements, all those in a position to do so should be encouraged to make quantitative observations in the future.

Any decision to proceed with the West Ford project must depend upon a full analysis of the results of the next launching.

Since the whole programme is closely associated with the U. S. Government Lincoln Laboratory, it was agreed to request this Laboratory to make complete study of the results of the next launching, and make its conclusions available to the interested scientists in all parts of the world. It was noted from Doc. I.U.C.A.F./30 and /30a, that pending the establishment of a test belt of dipoles, the Lincoln Laboratories were conducting experiments on the reflection of radio waves (at 8000 Mc/s) from the moon.

Dr. Denisse said he would endeavour to make a quantitative appreciation of the effects of such a belt.

12. — *European Conference of Postal and Telecommunications Administrations (C.E.P.T.).*

Dr. Denisse drew attention to the work of the above Conference particularly in collecting information on radio astronomy observatories. Dr. Sterky stated that the next Plenary meeting of this Conference was likely to be postponed until 1963.

13. — *Finance.*

A meeting of a Finance Sub-Committee comprising a representative from each of the three constituent bodies of I.U.C.A.F. and the Treasurer was held in Amsterdam.

14. — *Date of Next Meeting.*

It was agreed that the next meeting of this Inter-Union Committee (I.U.C.A.F.) should be held on 28th-29th November, 1962, if possible, in Geneva.

## APPENDICES

- I. Telegram addressed to the Astronomical Council, Moscow.
- II. Recommendations I and II adopted at the meeting of I.U.C.A.F. in Amsterdam, 12th April 1962.
- III. Review of Frequencies for Radio Astronomy.
- IV. Review of Frequencies for Space Research.

### APPENDIX I

*Draft of Telegram addressed to :*

The Astronomical Council,  
Moscow, U. S. S. R.

Regret absence Soviet members at I. U. C. A. F. meeting Amsterdam. Please inform U. S. S. R. Radio Administration on desirability of including radio astronomy in Agenda of next Extra-Ordinary Administrative Radio Conference, 1963. Letter follows.

DENISSE, *Chairman* I.U.C.A.F.  
12th April, 1962

### APPENDIX II

#### RECOMMENDATION I <sup>(1)</sup>

*(adopted at the meeting in Amsterdam on April 12, 1962)*

The Inter-Union Committee for Frequency Allocations for Radio Astronomy and Space Science *considering that :*

- (a) an Extra-ordinary Administrative Radio Conference is likely to be summoned for 1963 to consider frequency allocations for space communications and research,
- (b) all space communication systems will employ orbiting bodies and in some cases belts of orbiting dipoles,
- (c) space research devices will employ orbiting bodies,
- (d) all these orbiting bodies and dipoles will reflect to any one point on the earth the radio waves from transmitters over a wide area,

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<sup>(1)</sup> Recommendations I and II have been endorsed by the Board of Officers of U.R.S.I. at its meeting of April 17th.

- (e) waves reflected in this way would interfere with radio astronomical observations, which have to be made with antennas pointing to the sky and with extremely sensitive receiving apparatus,
- (f) the possibility that space communication and space research systems would interfere with radio astronomical observations was not envisaged when the agenda for the forthcoming conference was considered in Geneva in 1959,

*and bearing in mind that :*

- (g) both Radio Astronomy and Space Science, though aimed at different scientific objectives and not being able to share the same radio frequency bands, use very similar techniques,
- (h) these same techniques have now made it possible to consider the use of communication satellite relay systems,
- (i) it would seem illogical to discuss these new uses without providing at the same time for the possible continuation of the purely scientific developments which have been at the root of these developments,
- (j) both of these new fields of science are actively pursued in various parts of the world, and
- (k) at the time of the Geneva Conference in 1959 the full realization of the scope, magnitude and interrelation of these two new activities was not possible,

*recommends that :*

Radio Astronomy shall be included in the agenda of the forthcoming Extra-ordinary Administrative Radio Conference.

#### RECOMMENDATION II

*(Adopted at the meeting in Amsterdam on April 12, 1962)*

The Inter-Union Committee for Frequency Allocations for Radio Astronomy and Space Science *considering that :*

- (a) according to recommendation n° 32 of the 1959 Conference ; administrations are asked, when preparing for the next Ordinary Administrative Radio Conference, to consider further the question of frequency allocations for the radio astronomy service,

(b) some frequencies necessary for Radio Astronomy are already allocated to other services on a primary basis.

*recommends that :*

where no new frequency allocations can be made at the Extraordinary Administrative Radio Conference, actions should be directed at that conference towards a gradual improvement of the position for Radio Astronomy leading up to the reconsideration of adequate frequency allocations at the next Ordinary Administrative Radio Conference.

### APPENDIX III

#### **Review of Frequencies Assigned to Radio Astronomy in Radio Regulations, Geneva 1959**

(See also paragraph 10 of Doc. I.U.C.A.F./26 — London Meeting)

*Remark.*

Three regions are defined as follows :

Region I. — Bounded on east by Line A and west by Line B, but including all of Turkey and U. S. S. R., if outside the above.

Region 2. — East by B; west by C.

Region 3. — East by C; west by A.

Line A. — North pole, south along 40° E long. to 40° N lat., great circle to 60° E long., and Tropic of Cancer, thence south along 60° E long. to south pole.

Line B. — North pole, south along 10° W long. to 72° N lat., by great circle to 20° W long. and 40° N lat., thence by great circle to 20° W long. and 10° S lat., thence south along 20° W long. to south pole.

Line C. — North pole by great circle to 180° long., 65,5° N lat., thence by great circle to 165° E long. and 50° N lat., thence to 170° W long., 10° N lat.; eastward along 10° N lat. to 120° W long., south along 120° W long. to south pole.

No	Frequency Band Mc/s	Applicable to Regions	Reference in Radio Regulations Rec. = Recommendation F = Footnote	Remarks
1	Standard Frequency Guard Bands : 2.5, 5, 10, 15, 20 and 25	1, 2 and 3	Rec. No 31 F 204	Required to be protected for radio astronomy
2	Within the range 37-41 Mc/s : (a) $38.0 \pm 0.25$ (b) $40.68 \pm 0.25$	1, 2 and 3	Rec. No 32 F 234	Reaffirm need for protec- tion of one or both bands
3	73.0-74.6	2	F 523	Reaffirm and seek greater protection
4	79.75-80.25	1 and 3 except Korea, India & Japan	F 261	Reaffirm
5	150-153	1	F 286	Similar allocation required in Regions 2 and 3
6	322-329 (Deuterium line)	No allocation	F 310	Paragraph 10 (ii) of I.U.C.A.F./26 still applies

No	Frequency Band Mc/s	Applicable to Regions	Reference in Radio Regulations Rec. = Recommendation F = Footnote	Remarks
7	406-410	1, 2 and 3	F 317	Confirm 10 (iii) of I.U.C.A.F./26
8	606-614	1 and 3	F 332 Rec. No 2 - Stockholm, 1961	Protection recommended at European Broadcasting Conference, Region 1; and extension to Regions 2 and 3 by C.C.I.R.
9	1400-1427 (Hydrogen line)	1, 2 and 3	F 350	Seek removal of footnote, and extension of exclusive allocation to U. S. S. R. etc. Note also, Rec. No 3. — Stockholm 1961 — refers to need for harmonic protection from broadcasting at 470, 702 and 710 Mc/s
10	1645-1675 (OH line)	No allocation	F 354	Probably too near H line above to justify pressing for protection

No	Frequency Band Mc/s	Applicable to Regions	Reference in Radio Regulations Rec. = Recommendation F = Footnote	Remarks
11	1660-1690 3165-3195 4800-4810 5800-5815 8680-8700	No allocation	F 354	Used only in U. S. S. R. etc. and not required generally by radio astronomers
12	2690-2700	1, 2 and 3	F 365	Seek exclusive allocation as part of harmonic series
13	4990-5000	1, 2 and 3	F 365	— ditto —
14	Gc/s 10.68-10.70 15.35-15.40 19.3 -19.4 31.3 -31.5	1,2 and 3 1, 2 and 3 1, 2 and 3 1, 2 and 3	F 405 F 405 F 405 F 405	Seek exclusive allocation and deletion of footnote in future

## APPENDIX IV

## Review of Frequency Allocations for the Space Research Service (see paragraph 10 above)

No	Frequency Band Mc/s	Allocation (existing or proposed)	Reference in Radio Regulations F = Footnote	Remarks
1	10.003-10.005	Space research	F 215	Secondary allocation
2	19.990-20.010	Space research	F 221	Secondary allocation
3	39.986-40.002	Space research	F 235	Secondary allocation
4	136- 137	Space research and tracking	F 280	Primary allocation
5	137- 138	Space research and tracking	None	New proposal
6	183.1- 184.1	Space research	F 294	Subject to causing no harmful interference
7	400- 401	Space research	F 280	Primary allocation
8	1.427- 1.429	Space research	F 280	Primary allocation
9	1.525- 1.540	Space service (new proposal)	None	1525-35 for telemetry 1535-40 for command
10	1.700- 1.710	Space research	F 280	Secondary allocation
11	2.290- 2.300	Space research	F 280	Secondary allocation
12	3.700- 4.200	Space communications (new proposal)	None	New proposal; subject to causing no harmful interference

APPENDIX IV (continued)

No	Frequency Band Gc/s	Allocation (existing or proposed)	Reference in Radio Regulations F = Footnote	Remarks
13	5.250- 5.255	Space research	F 280	Secondary allocation
14	5.925- 6.425	Space communications (new proposal)	None	Transmission by earth stations only
15	6.425- 7.200	Space communications (new proposal)	None	Transmission by earth station or satellite
16	7.200- 7.650	Space communications (new proposal)	None	Transmission by satellite only
17	7.650- 7.700	Space communications (new proposal)	None	Transmission by satellite only
18	7.700- 7.900	Space communications (new proposal)	None	Transmission by earth stations only
19	7.900- 8.350	Space communications (new proposal)	None	Transmission by earth stations only
20	8.350- 8.400	Space communications (new proposal)	None	Transmission by earth stations only
21	8.400- 8.500	Space research	F 280	Secondary allocation
22	15.15- 15.25	Space research	F 280	Primary allocation
23	31.5 - 32.8	Space research	F 280	Primary allocation

**Comité Inter-Unions pour les Attributions  
de Fréquences pour la Radioastronomie  
et la Science Spatiale (I.U.C.A.F.)**

Recommandations adoptées à la Réunion tenue à Amsterdam  
le 12 avril 1962, et appuyées par le Bureau de l'U.R.S.I.  
le 17 avril 1962

(Traduction)

RECOMMANDATION I

Le Comité Inter-Unions pour les Attributions de Fréquences pour la Radio-Astronomie et la Science Spatiale, *considérant* :

- (a) qu'une Conférence Administrative Extraordinaire des Radio-communications sera vraisemblablement convoquée en 1963 pour examiner les attributions de fréquences pour les communications et recherches spatiales,
- (b) que tous les systèmes de communication dans l'espace utiliseront des corps orbitaux et, dans certains cas, des ceintures de dipôles sur orbite,
- (c) que les dispositifs pour recherches spatiales utiliseront des corps orbitaux,
- (d) que tous ces corps et dipôles orbitaux réfléchiront vers tout point de la terre les ondes radioélectriques provenant d'émetteurs situés sur une grande surface,
- (e) que les ondes ainsi réfléchies produiront des interférences avec les observations radioastronomiques qui doivent être faites avec des antennes dirigées vers le ciel, et avec des appareils de réception de très haute sensibilité,
- (f) que l'éventualité d'interférence des systèmes de communications et de recherches spatiales avec les observations radioastronomiques n'a pas été envisagée lors de l'examen, à Genève en 1959, de l'ordre du jour de la prochaine Conférence,

*et tenant compte* :

- (g) que la radioastronomie et la science spatiale, quoiqu'ayant des buts scientifiques différents et ne pouvant partager les mêmes bandes de fréquence radioélectrique, utilisent des méthodes fort semblables,

- (h) que ces méthodes ont permis maintenant d'envisager des utilisations de systèmes de communication à satellites relais,
- (i) qu'il semblerait illogique de discuter ces utilisations sans prendre en même temps des mesures pour permettre la poursuite des réalisations purement scientifiques qui ont été à la base des nouveaux développements,
- (j) que ces deux nouveaux domaines de la science sont explorés activement en différentes parties du monde, et
- (k) qu'au moment de la Conférence de Genève en 1959, il n'était pas encore possible de réaliser complètement l'étendue, la grandeur et les relations de ces nouvelles activités,

*recommande :*

que la radioastronomie figure à l'ordre du jour de la prochaine Conférence Administrative Extraordinaire des Radiocommunications.

#### RECOMMANDATION II

Le Comité Inter-Unions pour les Attributions de Fréquences pour la Radioastronomie et la Science Spatiale, *considérant :*

- (a) qu'en accord avec l'Avis n° 32 de la Conférence de 1959, les Administrations sont invitées, lors de la prise de dispositions pour la préparation de la prochaine Conférence Administrative des Radiocommunications, à examiner à nouveau la question des attributions de fréquences pour les services de la radioastronomie,
- (b) que certaines fréquences nécessaires à la radioastronomie sont déjà attribuées à d'autres services,

*recommande :*

que là où de nouvelles attributions de fréquences ne peuvent être faites par la Conférence Administrative Extraordinaire des Radiocommunications, des mesures soient prises, à cette conférence, pour une amélioration graduelle de la position de la radioastronomie conduisant à un nouvel examen des attributions adéquates des fréquences pour la prochaine Conférence Administrative Ordinaire des Radiocommunications.

## **The Need for Reporting Interference to Radio Observations**

by R. EMBERSON

The research scientist is traditionally a resourceful individual. He is accustomed to encountering unanticipated experimental problems, which he proceeds to solve in various ingenious ways. When he is making radio observations and encounters interference, he sometimes may solve the problem by tuning his equipment to a frequency where there is less interference; or he may reschedule his observing programme to times when the interference is not so great. What would his solution be if the interference continued, unabated, throughout the day, or if there were no nearby frequency band with less interference? This general question was discussed at the second meeting of the Inter-Union Committee on Allocations of Radio Frequencies, held in Amsterdam on April 11-12, 1962.

Present trends indicate that radio research programmes will encounter increasing levels of interference in bands not specifically protected for research purposes. On the other hand, research scientists have been slow to report on their use of the protected bands and of specific cases of interference in these bands. As a consequence, the responsible officials in some administrations are coming to the erroneous conclusions that the present protected bands are more than adequate and that there are no interference problems. I.U.C.A.F. must have factual information from many observatories in order to effectively correct these conclusions.

Specifically, research scientists have the duty and responsibility, for themselves and for future scientists, to attempt to use the protected frequency bands and to report promptly any interference encountered in the use of the bands. Reports of interference should furnish, as fully as possible, the pertinent information requested in the I.T.U. report from, Appendix 8 of the Radio Regulations (page 370, Geneva, 1959) which is reproduced below. For reference on frequency allocations, see Appendix III (Review of Frequencies Assigned to Radio Astronomy) and Appendix IV (Review of Frequency Allocations for Space Research Service) to the Report of the I.U.C.A.F. Meeting Amsterdam, April 11 and 12, 1962, p. 41 and p. 45 of this Bulletin.

In addition to forwarding reports through the formal channels of their national administrations, scientists will assist I.U.C.A.F. by sending copies of such reports to Dr. R. L. Smith-Rose, *Secretary General* of I.U.C.A.F., 21, Tumblewood Road, Banstead, Surrey, England.

APPENDIX 8

*Particulars concerning the station causing the interference :*

- A. Name or call sign and category of station .....
- B. Frequency measured .....
- C. Class of emission .....
- D. Bandwidth .....
- E. Field strength .....
- F. Nature of interference .....

*Particulars concerning the transmitting station interfered with :*

- G. Name or call sign and category of station .....
- H. Frequency assigned .....
- I. Frequency measured .....
- J. Class of emission .....
- K. Bandwidth .....
- L. Field strength .....

*Particulars furnished by the receiving station experiencing the interference :*

- M. Name of station .....
- N. Geographic location of station .....
- O. Dates and times of occurrence of harmful interference .....
- P. Other particulars .....
- Q. Requested action .....

RECOMMENDATION N° 36

*Relating to the Convening  
of an Extraordinary Administrative Radio Conference  
to Allocate Frequency Bands  
for Space Radiocommunication Purposes*

The Administrative Radio Conference, Geneva, 1959,

*considering :*

- (a) that several delegations participating in the Administrative Radio Conference have proposed to allocate frequencies for space research purposes only on the basis of the research requirements for the next few years ;
- (b) that the C.C.I.R. has already under study technical questions relating to radiocommunication with and between space vehicles ;
- (c) that the Administrative Radio Conference has recommended to the C.C.I.R. that the identification and control of space vehicle emissions be questions for study by the C.C.I.R. ;
- (d) that until the results of some space research programmes are available to the extent to which space radiocommunication services and other radiocommunication services may share frequencies, without harmful interference, cannot accurately be assessed ;
- (e) that additional research experience and the results of studies by the C.C.I.R., and other interested organizations, relating to space radiocommunications are essential before it will be feasible for the Union to take decisions on firm frequency allocations for space radiocommunication purposes ;

*and bearing in mind :*

That the Union is the specialized agency in the field of telecommunications and that it is necessary for the Union to provide adequate frequency allocations for all categories of space radiocommunications as soon as the results of research and studies by the C.C.I.R. and other interested organizations make this possible ;

*recommends :*

1. That an Extraordinary Administrative Radio Conference be convened, in principle during the latter part of 1963 with a duration of approximately one month and with an agenda which should include the following basic items :
  - 1.1. to examine the technical progress in the use of radiocommunication for space research and the results of technical studies by the C.C.I.R. and other interested organizations ;
  - 1.2. to decide, in the light of this examination, on the allocation of frequency bands essential for the various categories of space radiocommunication ;
  - 1.3. to consider whether there is a continuing need for the allocation of certain frequencies for space research purposes and, if so, to take appropriate action in this regard ;
  - 1.4. to adopt, if such action is considered desirable, new provisions revising the Radio Regulations to provide for the identification and control of radio emissions from space vehicles, taking into account possible Recommendations of the C.C.I.R. ;
2. That the Administrative Council review the situation during its 1962 and 1963 ordinary sessions on the basis of information received from Members and Associate Members of the Union, the C.C.I.R. and other interested organizations. Should the Administrative Council decide that there is sufficient justification for the convening of the Extraordinary Administrative Radio Conference in 1963, it shall recommend to Members and Associate Members of the Union the date and place for the Conference and its Agenda ;

*and invites :*

Those Members and Associate Members of the Union which launch satellites during the period of space research before the convening of the Extraordinary Administrative Radio Conference referred to above, to keep the Administrative Council, and the relevant technical organs of the Union, informed of the frequencies used and the technical progress achieved in the use of radiocommunication for space research purposes.

## **De la nécessité de signaler les interférences dans les observations radioélectriques**

par R. EMBERSON

*(Traduction)*

Le chercheur scientifique est de tradition une personne pleine de ressource. Il est habitué à rencontrer des problèmes expérimentaux imprévus qu'il essaie de résoudre de différentes façons ingénieuses. Lorsqu'il fait des observations radioélectriques et se trouve en face d'interférences, il peut parfois résoudre le problème en accordant ses appareils sur des fréquences pour lesquelles il y a moins d'interférences, ou bien il peut changer son horaire d'observation de façon à le faire correspondre à des moments où les interférences sont moindres. Quelle serait la solution qu'il envisagerait si les interférences persistaient sans répit pendant toute la journée, ou s'il n'y avait aucune bande de fréquence voisine subissant moins d'interférences ? Cette question générale a été discutée au cours de la deuxième séance de la réunion du Comité Inter-Unions pour les Attributions de Fréquences, tenue à Amsterdam les 11 et 12 avril 1962.

Les tendances actuelles montrent que les programmes de recherches radioélectriques rencontreront de plus en plus d'interférences dans les bandes non protégées de façon nette pour les buts scientifiques. D'autre part, les chercheurs scientifiques ont mis une certaine lenteur à faire connaître l'emploi qu'ils font des bandes protégées ainsi que les cas bien déterminés d'interférence dans ces bandes. En conséquence, dans certaines administrations, les autorités responsables arrivent à la conclusion fautive que les bandes protégées actuellement sont plus que suffisantes et qu'il n'y a pas de problèmes d'interférence. Pour réformer ces conclusions, l'I.U.C.A.F. doit disposer de renseignements précis provenant de nombreux observatoires.

En d'autres termes, les chercheurs scientifiques ont, pour eux-mêmes et pour les chercheurs futurs, le devoir et la responsabilité d'utiliser les bandes de fréquence protégées et de signaler rapidement toute interférence rencontrée dans l'emploi de ces bandes. Il convient que les rapports sur les interférences fournissent les renseignements demandés dans le formulaire de l'U.I.T., Annexe 8

du Règlement des Radiocommunications (p. 370, Genève, 1959).

Pour ce qui concerne les attributions de fréquences, voir Appendix III (Review of Frequencies Assigned to Radio Astronomy) et Appendix IV (Review of Frequency Allocations for Space Research Service) p. 41 et p. 45 de ce Bulletin.

Outre l'envoi des rapports par la voie officielle des administrations nationales, les chercheurs sont invités, pour aider l'I.U.C.A.F., à envoyer des copies de ces rapports au Dr R. L. Smith-Rose, *Secrétaire Général* de l'I.U.C.A.F., 21, Tumblewood Road, Banstead Surrey, England.

#### APPENDICE 8

##### *Caractéristiques de la station brouilleuse :*

- A. Nom ou indicatif d'appel et catégorie de la station .....
- B. Fréquence mesurée .....
- C. Classe de l'émission .....
- D. Largeur de bande .....
- E. Intensité de champ .....
- F. Nature du brouillage .....

##### *Caractéristiques de la station dont l'émission est brouillée :*

- G. Nom ou indicatif d'appel et catégorie de la station .....
- H. Fréquence assignée .....
- I. Fréquence mesurée .....
- J. Classe de l'émission .....
- K. Largeur de bande .....
- L. Intensité de champ .....

##### *Renseignements fournis par la station de réception qui a constaté le brouillage :*

- M. Nom de la station .....
- N. Coordonnées géographiques de la station .....
- O. Dates et heures du brouillage nuisible .....
- P. Autres détails .....
- Q. Mesures demandées .....

RECOMMANDATION N° 36

*relative à la convocation d'une Conférence administrative extraordinaire des radiocommunications chargée d'attribuer des bandes de fréquences pour les radiocommunications spatiales*

La Conférence administrative des radiocommunications, Genève, 1959,

*considérant :*

- a) que plusieurs délégations participant à la Conférence administrative des radiocommunications ont proposé d'attribuer des fréquences à la recherche spatiale en se fondant seulement sur les besoins de la recherche au cours des toutes prochaines années ;
- b) que le C.C.I.R. a déjà mis à l'étude certaines questions techniques relatives aux radiocommunications avec les véhicules spatiaux et entre ces véhicules eux-mêmes ;
- c) que la Conférence administrative des radiocommunications a recommandé à ce Comité de mettre à l'étude les questions d'identification et de contrôle des émissions des véhicules spatiaux ;
- d) que, jusqu'à ce que l'on dispose des résultats de quelques programmes de recherche spatiale, il ne sera pas possible d'évaluer de façon précise dans quelle mesure les services de radiocommunications spatiales peuvent partager des fréquences avec d'autres services de radiocommunication sans qu'il en résulte des brouillages nuisibles ;
- e) qu'il est indispensable d'avoir une plus grande expérience de la recherche spatiale et de connaître les résultats des études sur les radiocommunications spatiales entreprises par le C.C.I.R. et d'autres organisations intéressées, pour que l'Union puisse prendre des décisions quant à l'attribution définitive de fréquences pour les radiocommunications spatiales ;

*et tenant compte :*

de ce que l'Union est l'institution spécialisée dans le domaine des télécommunications et qu'il lui faudra attribuer des fréquences appropriées à toutes les catégories de radiocommunications spatiales dès que le permettront les résultats de la recherche et les études

menées par le C.C.I.R. ainsi que par d'autres organisations intéressées ;

*recommande :*

1. qu'une Conférence administrative extraordinaire des radiocommunications soit convoquée, en principe vers la fin de 1963, pour une durée d'environ un mois ; les questions fondamentales suivantes seraient inscrites à l'ordre du jour de cette conférence :

- 1.1. examiner les progrès de la technique réalisés dans l'utilisation des radiocommunications pour la recherche spatiale, ainsi que les résultats des études effectuées par le C.C.I.R. et d'autres organisations intéressées ;
- 1.2. décider, à la lumière de ces résultats, des bandes de fréquences qu'il est essentiel d'attribuer aux diverses catégories de radiocommunications spatiales ;
- 1.3. examiner s'il est toujours nécessaire de réserver certaines fréquences à la recherche spatiale et, dans l'affirmative, prendre à cet égard les mesures appropriées ;
- 1.4. adopter, si elle le juge utile, certaines dispositions nouvelles pour l'identification et le contrôle des émissions, en provenance des véhicules spatiaux, compte tenu des Avis qu'aura pu formuler le C.C.I.R. et réviser le Règlement des radiocommunications en conséquence.

2. que le Conseil d'administration examine la situation au cours de ses sessions ordinaires de 1962 et 1963 au vu des informations qu'il aura reçues des Membres et Membres associés de l'Union, du C.C.I.R. et des autres organisations intéressées. Si le Conseil d'administration décide que la convocation en 1963 d'une Conférence administrative extraordinaire des radiocommunications est suffisamment justifiée, il fera aux Membres et Membres Associés de l'Union une recommandation sur la date, le lieu et l'ordre du jour de cette conférence.

*et invite :*

Les Membres et Membres associés de l'Union qui lanceront des satellites artificiels durant la période de recherche spatiale précédant la Conférence administrative extraordinaire des radiocommunications dont il a été question plus haut, à faire connaître au

Conseil d'administration et aux organismes techniques compétents de l'Union les fréquences utilisées et les progrès techniques accomplis dans l'emploi des radiocommunications pour la recherche spatiale.

## **Communication by orbiting dipoles**

### **THE ROYAL SOCIETY**

(IUCAF Doc. 32)

*The Steering Group on Space Research, which advises Her Majesty's Minister for Science on the broad aspects of space research in the United Kingdom has received the following report from one of its Working Groups and has authorized its wider distribution*

### **West Ford Working Party**

REPORT TO THE STEERING GROUP ON SPACE RESEARCH  
6 FEBRUARY 1962

1. — The working party consisting of Mr. Ratcliffe, D.S.I.R. Radio, (convener), Sir Bernard Lovell, Radio Astronomy, Manchester, Professor Ryle, Radio Astronomy, Cambridge, Professor Blackwell, Optical Astronomy, Oxford, Mr. Stanesby, Post Office Radio, Mr. Caradoc Williams, Ministry of Aviation Radio, was set up by Minute 7 of the meeting of 26 May 1961 «to report to the Steering Group on the possible implications, other than usefulness for communications, of orbiting dipoles».

To strengthen the representation of optical astronomy Dr. R. Wilson (A.E.R.E.) was co-opted.

2. — The working party has taken the view that the « West Ford » experiment itself is only a preliminary and if it is successful there will follow a proposal to use a belt of « needles » to provide an operational communications system. They have therefore directed their attention to two possible situations :

(a) that in which the West Ford belt of needles might be launched but might stay in the sky indefinitely, and

(b) that in which belts of needles, more dense than the West Ford belt, might be launched repeatedly for operational use.

3. — As a result of considering the first problem they presented the following « Interim Report » :

*« Interim Report » of the West Ford Working Party  
of the Steering Group on Space Research*

Representations from learned bodies and international Scientific Unions have already made it clear that there is considerable doubt about the effect which the proposed launching of dipoles under Project West Ford will have on astronomical (visual and radio) observations. It is understood that the U. S. Government has decided to launch an experimental belt of dipoles to test this interference and has stated that this belt will have a short life of the order of a year. We regard such a short life as an essential guarantee against any possible unforeseen interference with astronomical observations. We note, however, that, unless the initial altitude and inclination of the belt are correct, to a considerable degree of accuracy, the belt is expected to last not one year, but tens of years. (Morrow, *Ast. J.* 66, 108, (1961)). The detailed calculations on which these statements about the life-time are based, are not available to us.

In view of these uncertainties, we recommend that the U. S. Government be urged to arrange that the dipoles be released from the launching vehicle on command, and only after it is known with certainty that it is already in the required orbit with sufficient accuracy to ensure the predicted short life. We also urge that the detailed calculations of life-time be made available to world scientists to study.»

4. — The Minister caused a request to be made to the U. S. Government along the lines of the Working Party's recommendation. In spite of this the satellite carrying the West Ford experiment was launched but it is now known that it went into the wrong orbit and the « dispenser » of the needles did not work. It is worth noticing that it was the panel's fear that the dipoles would not diffuse properly and then might stay in orbit indefinitely, which led to their recommendation.

5. — As a result of considering the second problem the panel have prepared two papers entitled :

« The effect on Radio Astronomy of a belt of dipole needles circling the earth » and

« The effect on Optical Astronomy of a belt of dipole needles circling the earth »

and it is proposed that they should be published together in a scientific journal, the former over the names of Lovell and Ryle and the latter over the names of Blackwell and Wilson. It is also proposed that advance copies of the two papers should be circulated widely to interested scientists, and to the Americans concerned with the West Ford project.

6. — The aim of the two papers is to establish, objectively and quantitatively, what the sensitivity of radio and optical astronomical equipment is likely to be in 10 or 15 years' time and then to calculate how far belts of « needles » of different densities would interfere with these equipments. The density of the proposed West Ford belt after it has diffused for 60 days (« the 60-day belt ») has been taken as a standard of comparison.

7. — *The main conclusions for Radio Astronomy* can be stated in terms of a « standard interfering transmitter » radiating a power of 10 kw from a mirror aerial with a diameter of 60 ft., on a frequency of 10,000 Mc/s, which is internationally assigned, on a secondary user basis, to radio astronomy.

- 7.1. A single standard transmitter irradiating the 60-day belt would cause very serious interference to a radio telescope with its main beam directed at the same place ;
- 7.2. It would cause interference to a radio telescope with a near side lobe directed towards the irradiated region ;
- 7.3. If the density of the belt were 10 times that of the 60-day belt and if any part of it above the horizon were irradiated by one standard transmitter then the far side lobes of a radio telescope would collect enough interfering energy to be damaging irrespective of the orientation of the radio telescope ;
- 7.4. 10 standard transmitters irradiating the 60-day belt above the horizon simultaneously would introduce important interference by way of the far side lobes of a radio telescope and

this interference would be present in whatever direction the telescope was oriented ;

- 7.5. If the dipoles spread all over the sky and if their surface density was 1/10 of that of the 60-day belt then 100 standard transmitters irradiating any part of the sky above the horizon of the telescope would produce serious interference however the telescope was oriented ;
- 7.6. The previous results apply to a frequency of 10,000 Mc/s. For other « radio astronomy » frequencies the product  $nN$  of the number ( $n$ ) of transmitters and the area density ( $N$ ) of the dipoles would have to be increased by the factors  $f$  given in the following table before serious interference occurred :

Frequency Mc/s	Factor $f$
10,000	1
4,995	20
2,695	300
1,420	5000

- 7.7. It might be thought that intermittent interference could be recognised, and suitably eliminated, by the radio astronomers. It must, however, be remembered that with the « Mills Cross » and « Aperture Synthesis » types of aerial successive scans of the sky are made on a large number of successive days and the final result is computed by suitably adding the results. Interference occurring at any time during the series of days causes inaccuracy in the final result.

8. — *The main conclusions for Optical Astronomy are that :*

The most serious effects which orbiting needles will have on optical astronomy will be caused by their scattering of sunlight towards an observer who is trying to measure the weak light from parts of the sky. To an observing instrument carried by an artificial satellite (as in the astronomy of the future) the illuminated 60-day belt will have a brightness equal to about 8 % of that of the darkest parts of the night sky. The polarization of the total

light received, from the sky and from the belt together, will be about 3 %. For densities other than that in the 60-day belt this figure must be multiplied by the ratio of the surface densities of dipoles.

Even such a small additional brightness as a few per cent could affect some astronomical experiments. For instance, an important problem in airglow is to decide whether or not there is a continuous component in the violet region of the spectrum. The addition of a further component with a complex spectrum (the spectrum of the light from the belt will be a Fraunhofer spectrum) is going to complicate this problem greatly. Further, a possible experiment to search for dust at the Lagrangian points of the Earth-Moon and Earth-Sun systems would require the detection of light fluxes of the same order as the test belt.

It is now possible to measure quite easily a night sky polarization of 0.3 per cent, i.e. one-third of the polarization of the belt. It is likely that in the future measurements of the polarization of the night sky will become important because they will be able to show directly the presence of corpuscular radiation from the sun, and the belt will, of course, increase greatly the difficulties of such measurement.

An extrapolation of the above considerations into the immediate future indicates that the effect of orbiting dipoles on optical astronomy will become more and more serious. Optical observations are increasing rapidly in refinement and fainter and fainter emissions will be investigated against the general background, both from the earth and from satellites. Our calculations have dealt only with the test belt, and any operational system will presumably consist of more numerous and denser belts. It is impossible to predict in detail the effect on optical astronomy, but an increase in density by a factor of 10 would certainly make impossible all work on faint extended sources coincident with the belt; for example, a dense equatorial belt would seriously affect work on the Zodiacal light and therefore impede one of the methods for studying the solar wind and the earth's environment in space.

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## SYMPOSIA

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### **Troisième Congrès International d'Electronique Quantique**

PARIS, 11 AU 15 FÉVRIER 1963

Nous avons le plaisir de vous informer que le Troisième Congrès International d'Electronique Quantique se tiendra à Paris, au Palais de l'Unesco, du 11 au 15 février 1963.

Cette manifestation est organisée conjointement par la Société Française des Electroniciens et des Radioélectriciens et par la Section Française de l'Institute of Radio Engineers (U. S. A.). Elle est patronnée par l'Office of Naval Research et la Fédération Nationale des Industries Electroniques et continue l'effort entrepris par les précédents Congrès consacrés à l'Electronique Quantique (New York, 1959, Californie 1961).

Le programme, dont le détail sera précisé ultérieurement, comprendra les Masers, Lasers et les problèmes de Cohérence qui s'y rattachent. Il s'étendra de la théorie aux applications de l'Electronique Quantique.

Comité d'Organisation :

Prof. N. BLOEMBERGEN, *Président du Comité Scientifique,*

B. DECAUX, *Président de la S. F. E. R.,*

Prof. P. GRIVET, *Président du Comité d'Organisation,*

P. E. HAGGERTY, *Président de l'I.R.E.*

Des renseignements peuvent être obtenus en s'adressant à Mme M. Cauchy, Secrétariat du Congrès, 7, rue de Madrid, Paris 8<sup>e</sup>.

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## SYMPOSIA

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### **Third International Symposium on Quantum Electronics**

PARIS, 11-15 FEBRUARY 1963

We are pleased to inform you that the Third International Symposium On Quantum Electronics will be held in Paris, at Unesco House, from February 11 to February 15, 1963.

This meeting is organised jointly by the Institute of Radio Engineers U. S. A. and the Société Française des Electroniciens et des Radioélectriciens. It is sponsored by the Office of Naval Research and supported by the Fédération Nationale des Industries Electroniques and continues the work undertaken by the past meetings on Quantum Electronics (New York 1959, California, 1961).

The exact programme will be announced later ; however, it will comprise papers on Masers, Lasers and Coherence Problems. The programme will encompass the subject from theory to applications of Quantum Electronics.

Organizing Committee :

Prof. N. BLOEMBERGEN, *President, Programme Committee,*

B. DECAUX, *S.F.E.R. President,*

Prof. P. GRIVET, *President, Organizing Committee,*

P. E. HAGGERTY, *I.R.E. President.*

Further information available by Mme Cauchy, Office Secretary,  
7, rue de Marid, Paris 8<sup>e</sup>.

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## International Conference on Cosmic Rays and the Earth Storms

### Proceedings

The Proceedings of the Conference (Kyoto, 4-15 September, 1961) have been published by the Physical Society of Japan, n° 342 Physics Building, Faculty of Science, University of Tokyo, Bunkyo-ku, Tokyo.

Copies are available at the Physical Society at the following price (postage included) :

	<i>Members</i>	<i>Non Members</i>
I. Earth Storm .....	\$ 3.00	\$ 4.50
II. Joint Sessions .....	\$ 6.00	\$ 9.00
III. Cosmic Rays .....	\$ 4.50	\$ 7.00
One Set of three Parts .....	\$ 12.00	\$ 18.00

These issues were published in March 1962.

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## UNION ASTRONOMIQUE INTERNATIONALE

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### Symposia

L'attention des radioastronomes est attirée sur les symposia ci-après, organisés par l'U.A.I. :

N° 18. — *Interprétation théorique des émissions dans la haute atmosphère*, Paris, 25-29 juin, 1962 ; seulement par invitation.

Le programme couvrira les points suivants :

- (i) Chimie et Composition de l'Atmosphère.
- (ii) Ionosphère et Emission Atmosphérique (Airglow).
- (iii) Dynamique de l'Atmosphère.
- (iv) Interprétation des Emissions Aurorales et Réflexions Radio.
- (v) Théorie des phénomènes primaires des Aurores.

Tous renseignements relatifs à ce Symposium peuvent être obtenus auprès de MM. J. W. Chamberlain (Yerkes Observatory, Williams Bay, Wisconsin, U. S. A.) et J. E. Blamont, président du comité local d'organisation, Laboratoire d'Aéronomie, Observatoire de Meudon, Meudon (Seine et Oise, France).

N° 19. — *Choix des Sites*, probablement à Rome du 1 au 6 octobre 1962 ; seulement par invitation.

Tous renseignements complémentaire peuvent être obtenus auprès de M. Roesch, Observatoire du Pic du Midi, Bagnères-de-Bigorre (H. P.), France.

N° 20. — *La Galaxie et les Nuages de Magellan*, en collaboration avec l'U.R.S.I., Sydney et Canberra (Australie) entre le 16 et le 29 mars 1963.

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## INTERNATIONAL ASTRONOMICAL UNION

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### Symposia

The attention of radioastronomers is called to the following symposia organized by I.A.U.

N<sup>o</sup> 18. — *Theoretical Interpretation of Upper Atmospheric Emissions*, Paris, June 25-29, 1962; by invitation only.

The subjects to be discussed are the following :

- (i) Atmospheric Chemistry and Composition.
- (ii) The Ionosphere and Airglow Emission.
- (iii) Atmospheric Dynamics.
- (iv) Interpretation of Auroral Emissions and Radio Reflections.
- (v) Theory of Auroral Primaries.

Further information about the Symposium may be obtained from Dr. J. W. Chamberlain, Yerkes Observatory, Williams Bay, Wisconsin, U. S. A., and Dr. J. E. Blamont, chairman of the local organizing committee, Laboratoire d'Aéronomie, Observatoire de Meudon, Meudon (Seine et Oise), France.

N<sup>o</sup> 19. — *Site Testing*, probably in Rome, October 1-6, 1962; by invitation only.

Full details about the Symposium may be obtained from Dr. J. Roesch, Observatoire du Pic du Midi, Bagnères-de-Bigorre (H. P.) France.

N<sup>o</sup> 20. — *The Galaxy and the Magellanic Clouds*, to be held in cooperation with U.R.S.I. in Australia (Canberra and Sydney) sometime between 16 and 29 March 1963.

**Liste des organisations internationales  
non-gouvernementales  
admises aux différentes catégories  
de relations avec l'Unesco**

**List of International Non-Governmental  
Organizations  
admitted to various categories  
of relations with Unesco**

**Extraits — Excerpts**

CATÉGORIE A (*relations de consultation et d'association*).

CATEGORY A (*consultative and associate relations*).

- Conseil des organisations internationales des sciences médicales.  
Council for International Organizations of Medical Sciences.
- Association internationale des Universités <sup>(1)</sup>.  
International Association of Universities <sup>(1)</sup>.
- Conseil international de la philosophie et des sciences humaines.  
International Council for Philosophy and Humanistic Studies.
- Conseil international des unions scientifiques <sup>(1)</sup>.  
International Council of Scientific Unions <sup>(1)</sup>.
- Fédération internationale de Documentation.  
International Federation for Documentation.
- Conseil international du cinéma et de la télévision.  
International Film and Television Council.
- Union des associations techniques internationales.  
Union of International Engineering Organizations.

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<sup>(1)</sup> On trouvera en annexe la liste des organisations internationales affiliées aux organisations marquées <sup>(1)</sup>.

<sup>(1)</sup> A list of international bodies affiliated to the organizations marked <sup>(1)</sup> will be found in annex.

CATÉGORIE B (*relations d'information et de consultation*).

CATEGORY B (*Information and consultative relations*).

- Association internationale des professeurs et maîtres de conférences des Universités.  
International Association of University Professors and Lecturers.
- Fédération Internationale d'aéronautique (1).  
International Astronautical Federation (1).
- Fédération internationale des sociétés pour le traitement numérique de l'information.  
International Federation of Information Processing.
- Organisation internationale de normalisation.  
International Organization for Standardization.
- Institut international de statistique.  
International Statistical Institute.
- Association scientifique du Pacifique.  
Pacific Science Association.
- Union des associations internationales.  
Union of International Associations.
- Entraide universitaire mondiale.  
World University Service.

CATÉGORIE C (*relations d'information mutuelle*).

CATEGORY C (*Mutual Information relationship*).

- Comité international de l'organisation scientifique.  
International Committee of Scientific Management.

#### Annexe — Annex

CATÉGORIE A.

CATEGORY A.

*Association internationale des Universités.*

*International Association of Universities.*

#### Membres internationaux — International members

Association des universités du Commonwealth britannique.

Association of Universities of the British Commonwealth.

Fédération des Universités catholiques.

Federation of Catholic Universities.

Union des Universités latino-américaines.

Union of Latin-American Universities.

*Conseil International des unions scientifiques.*

*International Council of Scientific Unions.*

**Membres internationaux — International members**

Union astronomique internationale.

International Astronomical Union.

Union géographique internationale.

International Geographical Union.

Union mathématique internationale.

International Mathematical Union.

Union radio scientifique internationale.

International Scientific Radio Union.

Union internationale de biochimie.

International Union of Biochemistry.

Union internationale des sciences biologiques.

International Union of Biological Sciences.

Union internationale de cristallographie.

International Union of Crystallography.

Union géodésique et géophysique internationale.

International Union of Geodesy and Geophysics.

Union internationale des sciences géologiques.

International Union of Geological Sciences.

Union internationale des sciences physiologiques.

International Union of Physiological Sciences.

Union internationale d'histoire et de philosophie des sciences.

International Union of the History and Philosophy of Science.

Union internationale de chimie pure et appliquée.

International Union of Pure and Applied Chemistry.

Union internationale de physique pure et appliquée.

International Union of Pure and Applied Physics.

Union internationale de mécanique théorique et appliquée.

International Union of Theoretical and Applied Mechanics.

CATÉGORIE B.

CATEGORY B.

*Fédération Internationale d'astronautique.*

*International Astronautical Federation.*

**Membres internationaux — International members**

Académie internationale d'astronautique.

International Academy of Astronautics.

International Institute of Space Law.

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## BIBLIOGRAPHIE

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### *Commission Electrotechnique Internationale*

*Publication 136-1. Première édition.* — Dimensions des balais et porte-balais pour machines électriques. Première partie : Dimensions principales et tolérances.

Prix : Fr. S. 6.— l'exemplaire plus frais de port.

*Supplément (mai 1962) au Catalogue des Publications de la C. E. I., 1961.*

Des exemplaires peuvent être obtenus gratuitement sur demande au Bureau Central.

*Publication 34-3. Deuxième édition.* — Machines électriques tournantes (à l'exclusion des machines pour véhicules de traction). Troisième partie : Valeurs nominales et caractéristiques des turbo-alternateurs triphasés à 50 Hz.

Prix : Fr. S. 7,50 l'exemplaire plus frais de port.

*Publication 79-2. Première édition.* — Matériel électrique pour atmosphères explosives. Deuxième partie. Enveloppes à suppression interne.

Prix : Fr. S. 4,50 l'exemplaire plus frais de port.

*Publication 131-1. Première édition.* — Interrupteurs à bascule. Première partie : Règles générales et méthodes de mesure.

Prix : Fr. S. 12.— l'exemplaire plus frais de port.

*Modification n° 1 à la publication 109.* — Recommandations pour résistances fixes non bobinées. Type II.

Prix : Fr. S. 1,50 l'exemplaire plus frais de port.

Ces publications sont en vente au Bureau Central de la Commission Electrotechnique Internationale, 1, rue de Varembe, Genève.

### *Union Internationale des Télécommunications*

L'U.I.T. vient de publier la 1<sup>re</sup> édition de la *Nomenclature des stations de radiodiffusion fonctionnant dans les bandes au-dessous de 5950 kHz.*

Cette Nomenclature comprend les stations de radiodiffusion fonctionnant dans les bandes au-dessous de 5950 kHz dont les assignations de fréquence figurent dans la liste internationale des fréquences, autre document publié par l'U.I.T. Elles sont publiées dans la forme prévue à l'Appendice 9 au Règlement des radiocommunications de Genève (1959).

Ce document trilingue (français, anglais, espagnol) d'environ 110 pages sera tenu à jour par des suppléments récapitulatifs semestriels. Chaque volume est accompagné d'une préface logée dans une pochette aménagée dans le dos de la nomenclature. Cette préface a été tirée séparément en français, anglais et espagnol et un exemplaire en une langue sera joint à chaque volume. Par contre, il n'est pas possible de livrer plus d'une préface par nomenclature.

Le prix de vente d'un exemplaire de cette publication a été fixé à 12. — *francs suisses*, ce prix comprend les frais de port pour envoi par la poste ordinaire dans le monde entier, l'emballage et l'abonnement aux suppléments semestriels qui paraîtront jusqu'à la prochaine édition dont la publication n'est pas envisagée avant 1964.

L'U.I.T. également vient de publier la 2<sup>e</sup> édition de la *Nomenclature des stations de navire*.

Cette Nomenclature qui, d'après les dispositions du Règlement des radiocommunications, doit être en possession des stations à bord des navires obligatoirement pourvus d'une station radiotélégraphique, peut aussi être d'une grande utilité pour d'autres stations de navire ainsi que pour les armateurs, les entreprises de sauvetage, de transport, etc.

*Ce document contient :*

La préface. Les états signalétiques des stations de navire, rangées à l'ordre alphabétique du nom de la station, sans considération de nationalité. Les renseignements portent sur le nom du navire, l'indicatif d'appel, le pays dont relève la station, les fréquences utilisées, les puissances et classes d'émission, la nature du service, les heures d'ouverture, les taxes perçues pour l'échange de la correspondance, le liquidateur des comptes et, suivant le cas, le propriétaire du navire, le nombre d'embarcations de sauvetage équipées d'appareils radioélectriques, etc. A la fin du volume se trouvent les observations relatives aux stations de navire.

Les titres des couvertures et les textes explicatifs sont rédigés dans les langues française, anglaise et espagnole.

Le prix de vente d'un exemplaire de cette publication, qui compte environ 540 pages, a été fixé à 4,75 *francs suisses*, ce prix comprend l'emballage et les frais de port pour envoi par la poste ordinaire dans le monde entier.

## BIBLIOGRAPHY

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### *International Electrotechnical Commission*

*Publication 136-1. First edition.* — Dimensions of brushes and brush-holders for electrical machinery. Part 1 : Principal dimensions and tolerances.

Price : Sw. fr. 6.— per copy, plus postage.

*Supplement to the current Catalogue of IEC Publications, 1961.*

Copies may be obtained free of charge on request, from the Central Office.

*Publication 34-3. Second edition.* — Rotating electrical machinery (excluding machines for traction vehicles). Part 3 : Ratings and characteristics of 3-phase 50 Hz(c/s) turbine-type generators.

Price : Sw. Fr. 7.50 per copy plus postage.

*Publication 79-2. First edition.* — Electrical apparatus for explosive gas atmospheres. Part 2 : Pressurized enclosures.

Price : Sw. Fr. 4.50 per copy plus postage.

*Publication 131-1. First edition.* — Toggle switches. Part 1 : General requirements and measuring methods.

Price : Sw. fr. 12.— per copy plus postage.

*Amendment n° 1 to Publication 109.* — Recommendations for fixed non-wirewound resistors Type II.

Price : Sw. Fr. 1.50 per copy plus postage.

These publications are on sale at the Central Office of the I.E.C., 1, rue de Varembe, Geneva.

### *International Telecommunications Union*

The I.T.U. has published the first edition of the *List of Broadcasting Stations in bands below 5,950 kc/s.*

This List includes the broadcasting stations working in the bands below 5,950 kc/s and having their frequency assignments in the International Frequency List, another document published by the I.T.U. They appear in the form prescribed in Appendix 9 to the Radio Regulations (Geneva, 1959).

This three-language document (in English, Spanish, and French) of some 110 pages will be kept up to date by recapitulatory supplements every six months. To each volume there will be a preface, contained in a little pocket inside the cover. The preface is issued separately in English, Spanish, and French, and one copy will accompany each volume. It shall not be possible to deliver more than one preface per List.

The price per copy will be *twelve Swiss francs*, including postage by ordinary mail to any address. This figure also includes the supplements which will appear every six months until the next edition (which will not be issued before 1964).

*List of Ship Stations*, 2nd edition 1961

The I.T.U. has published the *2nd edition of the List of Ship Stations*.

This List, which according to the Radio Regulations must be in the possession of stations on board ships that have to be fitted with a radio-telegraph station, can also be of great use to other ship stations and to ship-owners, life-saving bodies, transport companies, etc.

*This document contains :*

A preface. Particulars of ship station, in the alphabetical order of the names of stations regardless of their nationality. The data comprise the name of the ship, call sign, the country responsible for the station, frequencies used, powers and classes of emission, type of service, working hours, charges levied for the exchange of correspondence, the accounting authorities, and, where appropriate, the owners of the ship, the number of lifeboats fitted with radio apparatus, etc. There are observations about ship stations at the end of the book.

English, French and Spanish are used for the covers and explanatory texts.

The List, which contains about 540 pages, will cost *4.75 Swiss francs*, including packing and carriage costs by ordinary mail to any address in the world.

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