

Preface

The Symposium on Planetary Atmospheres and Surfaces, sponsored by International Scientific Radio Union (URSI) and International Astronomical Union (IAU), was held at Dorado, Puerto Rico, May 24 to 27, 1965. The need for the Symposium was recognized by members of Commission II, Radio Propagation in Non-Ionized Media, at the XIVth General Assembly of URSI held in Tokyo in September 1963. Through the initiative of Commission II, the sponsorship of URSI with the active participation of Commissions II and V, Radio and Radar Astronomy, and of the IAU, were secured. The Symposium had the financial support of the URSI.

Session topics, an invited speaker for each session, and a list of researchers active in the fields were selected by the Organizing Committee. The members of the Organizing Committee were:

Dr. J. C. Bolton, CSIRO, Radiophysics Division

Dr. F. du Castel, Centre National d'Etudes des Telecommunications

Prof. G. R. A. Ellis, University of Tasmania

Dr. J. V. Evans, M.I.T., Lincoln Laboratory

Akad. V. A. Kotelnikov, Institute for Radio Techniques and Electronics, Moscow, USSR.

Dr. C. D. Mayer, U.S. Naval Research Laboratory

Prof. D. H. Menzel, Harvard College Observatory

Dr. D. O. Muhleman, Jet Propulsion Laboratory

Dr. G. H. Pettengill, Arecibo Ionospheric Observatory

Dr. J. Voge, Centre National d'Etudes des Telecommunications

Dr. A. T. Waterman, Jr., Stanford University, Electronics Research Lab.

Prof. W. E. Gordon, Arecibo Ionospheric Observatory, Chairman

Each session consisted of the invited paper, shorter contributions and discussion. In this issue the invited papers appear in full, the shorter contributions appear in full or in summary, and the discussions appear summarized from notes prepared by the session chairmen who were respectively:

Prof. J. Warwick

Prof. G. L. Berge

Prof. F. D. Drake

Dr. Richard Goldstein

Dr. G. H. Pettengill

Mr. J. E. Gibson

The Editor of Radio Science offered this issue to the Committee, and has helped to speed its publication. Rapid publication of the proceedings was an important obligation of the Organizing Committee since the attendance was limited to invitees. The Committee is grateful to the Editor of Radio Science for his cooperation.

The Committee thanks Dr. T. Hagfors for his presentation of the J. V. Evans paper, Dr. A. E. Salomonovich for his presentation of the V. S. Troitsky paper, and Dr. S. Gulkis for his assistance with the manuscripts.

The Symposium highlighted several controversies, notably concerning the rotational period of the planet Mercury, the dielectric constant of the lunar surface layer, and the validity and meaning of radar echoes reportedly obtained from Jupiter. A lively discussion among the participants was generated on each of these topics.

All radar observers agree on the retrograde sense of the Venus rotation and Dr. I. Shapiro described, in an imaginative way, a possible reason for the sense of the rotation.

A highlight of the Symposium was the radar mapping of surface features of the planets Venus and Mars, the latter having an apparent relation with optical features, and of the craters of the Moon with a resolution equal to the unaided eye.

Although the word weather was not used specifically, several of the observations reported were related in a broad sense to the weather and its changes on the planets.

W. E. GORDON
Chairman

Contents

Preface

I Session: JUPITER, AS OBSERVED AT LONG RADIO WAVES

Page

A. Invited Paper

1. The Decametric Radio Emissions of Jupiter..... G. R. A. Ellis..... 1513
2. Discussion following Ellis' paper

B. Short Contributions

1. Results of Recent Investigations of Jupiter's Decametric Radiation..... T. D. Carr et al..... 1530
2. Discussion following Carr et al., contribution. 1536
3. Results from C.S.I.R.O., Sydney, Australia..... O. B. Slee and
C. S. Higgins..... 1536
4. Discussion following Slee and Higgins contribution.
5. Frequency and Polarization Structure of Jupiter's Decametric Emission on a
10-millisecond scale..... J. W. Warwick and
M. A. Gordon..... 1537
6. Discussion following Warwick and Gordon contribution

II Session: JUPITER, AS OBSERVED AT SHORT RADIO WAVES

A. Invited Paper

1. Jupiter, as Observed at Short Radio Wavelengths..... J. A. Roberts..... 1543
2. Discussion following Roberts' paper

B. Short Contributions

1. An Interferometric Study of Jupiter at 10 and 21 cm..... G. L. Berge..... 1552
2. Discussion following Berge's contribution
3. Dependence of Jupiter's Decimeter Radiation on the Electron Distribution in
its Van Allen Belts..... K. S. Thorne..... 1557
4. Observations of Jupiter at 8.6 mm..... J. E. Gibson..... 1560
5. Simultaneous Observations of Jupiter on Three Frequencies..... I. N. Kazes..... 1561
6. A Report of Measurements..... D. Barber and
J. F. R. Gower..... 1563

III Session: PASSIVE RADIO OBSERVATIONS OF VENUS, SATURN, MERCURY, MARS, AND URANUS

A. Invited Paper

1. Passive Radio Observations of Mercury, Venus, Mars, Saturn, and Uranus... A. H. Barrett..... 1565
2. Discussion following Barrett's paper

B. Short Contributions

1. Mars and Venus at 70-cm Wavelength..... H. E. Hardebeck..... 1573
2. Radio Observations of Mercury, Venus, Mars, Saturn, and Uranus..... K. I. Kellermann..... 1574
3. Discussion of Kellermann's contribution
4. The Observations of Radio Emission from the Planets Mercury, Mars, and
Saturn at wavelength of 8 mm..... A. E. Salomonovich..... 1576
5. Discussion following Salomonovich's contribution
6. A Search for the 1.36 cm Water Vapor Line in Venus..... F. D. Drake..... 1577
7. Discussion following Drake's contribution
8. Radiation of Venus at the 13.5 mm Water Vapor Line..... J. E. Gibson and
H. H. Corbett..... 1577
9. Observations of the 1.35 cm Water Vapor Line in Venus..... W. J. Welch..... 1580
10. Observations of Mars at 12.5 cm Wavelength..... D. O. Muhleman and
T. Sato..... 1580
11. On the Nature of the Cloud Layer of Venus..... A. E. Basharinov and
B. G. Kutuza..... 1580
12. An Analysis of Microwave Observations of Venus..... C. Sagan and
J. B. Pollack..... 1583
13. Discussion following Sagan and Pollack contribution

IV Session: PASSIVE RADIO OBSERVATIONS OF THE MOON

A. Invited Paper

1. Investigation of the Surfaces of the Moon and Planets by the Thermal Radia-
tion..... V. S. Troitsky..... 1585
2. Discussion following Troitsky's paper

B. Short Contributions

1. Polarization of Thermal Radiation of the Moon at 14.5 Gc/s..... P. G. Mezger..... 1612
2. Discussion following Mezger's contribution

	Page
3. Linear Polarization of Lunar Emission.....	R. D. Davies and F. F. Gardner..... 1613
4. The Effect of Roughness on the Polarization of Thermal Emission from a Surface.....	T. Hagfors and J. Moriello..... 1614
5. Measurements of Lunar Radio Brightness Distribution and Certain Proper- ties of its Surface Layer.....	A. E. Salomonovich..... 1616
V Session: RADAR OBSERVATIONS OF THE PLANETS	
A. Invited Paper	
1. A Review of Radar Studies of Planetary Surfaces.....	G. H. Pettengill..... 1617
B. Short Contributions	
1. Preliminary Venus Radar Results.....	R. M. Goldstein..... 1623
2. Preliminary Mars Radar Results.....	R. M. Goldstein..... 1625
3. Recent Arecibo Observations of Mercury.....	G. H. Pettengill..... 1627
4. Recent Arecibo Observations of Mars and Jupiter.....	R. B. Dyce..... 1628
5. Discussion following Dyce's contribution	
6. Radio Evidence on the Structure and Composition of the Martian Surface.....	C. Sagan and J. B. Pollack..... 1629
7. Radar Scattering from Venus and Mercury at 12.5 cm.....	D. O. Muhleman..... 1630
8. Application of Planetary Measurements to Planetary Radius and Rotation Rate Determinations.....	I. I. Shapiro..... 1632
9. Radar Observations of Venus in the Soviet Union in 1964.....	V. A. Kotelnikov..... 1634
VI Session: RADAR OBSERVATIONS OF THE MOON	
A. Invited Paper	
1. Radar Studies of the Moon.....	J. V. Evans..... 1637
B. Short Contributions	
1. Decameter-wave Radar Studies of the Lunar Surface.....	J. R. Davis et al..... 1659
2. Discussion following Davis' contribution	
3. Lunar Mapping by Coherent Pulse Analysis.....	T. W. Thompson..... 1667
4. Discussion following Thompson's contribution	
5. Interpretation of the Angular Dependence of Backscattering from the Moon and Venus.....	P. Beckmann and W. K. Klemperer..... 1669
6. Discussion following Beckmann and Klemperer contribution	
7. A Note on the Radio Reflectivity of the Lunar Surface.....	A. Giraud..... 1677
8. Moon Distance Measurement by Laser.....	A. Orszag..... 1681