

MARCH 14, 1961

PROFESSOR LYMAN SPITZER, JR.  
PRINCETON UNIVERSITY OBSERVATORY  
PRINCETON UNIVERSITY  
PRINCETON, NEW JERSEY

DEAR PROFESSOR SPITZER:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U.S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED.

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:

Wagner ✓  
Sandage ✓  
Linsen ✓  
Gold ✓  
Kraus ✓  
Magall ✓  
Banks ✓  
Barnett ✓  
Matthews ✓  
Wiltjer ✓  
Blasius ✓  
Levy ✓  
Keller ✓

MARCH 14, 1961

DR. G. J. STANLEY  
DEPT. OF RADIO ASTRONOMY  
CALIFORNIA INSTITUTE OF TECHNOLOGY  
1201 E. CALIFORNIA ST.  
PASADENA 4, CALIFORNIA

DEAR DR. STANLEY:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U.S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE THAT YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED.

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:

MARCH 14, 1961

PROFESSOR A. E. LILLEY  
HARVARD COLLEGE OBSERVATORY  
60 GARDEN STREET  
CAMBRIDGE 38, MASSACHUSETTS

DEAR PROFESSOR LILLEY:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U.S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE THAT YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED.

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:

MARCH 14, 1961

MR. E. F. McCLAIN, HEAD  
RADIO ASTRONOMY BRANCH  
U. S. NAVAL RESEARCH LABORATORY  
WASHINGTON 25, D. C.

DEAR MR. McCLAIN:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U. S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE THAT YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED.

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:

MARCH 14, 1961

MR. CORNELL H. MAYER  
RADIO ASTRONOMY BRANCH  
U. S. NAVAL RESEARCH LABORATORY  
WASHINGTON 25, D. C.

DEAR MR. MAYER:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U. S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE THAT YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED.

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:

MARCH 14, 1961

PROFESSOR G. B. FIELD  
PRINCETON UNIVERSITY OBSERVATORY  
PRINCETON UNIVERSITY  
PRINCETON, NEW JERSEY

DEAR PROFESSOR FIELD:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U. S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE THAT YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED.

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:

MARCH 14, 1961

DR. RUDOLPH NINKOWSKI  
MT. WILSON AND PALOMAR OBSERVATORIES  
813 SANTA BARBARA STREET  
PASADENA, CALIFORNIA

DEAR DR. NINKOWSKI:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U. S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE THAT YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:

MARCH 14, 1961

PROFESSOR F. T. HADDOCK  
THE OBSERVATORY  
UNIVERSITY OF MICHIGAN  
ANN ARBOR, MICHIGAN

DEAR PROFESSOR HADDOCK:

THE ACADEMIES OF SCIENCES OF THE USA AND THE USSR, UNDER THE TERMS OF ARTICLE 7 OF THE EXCHANGE AGREEMENT BETWEEN THE TWO ACADEMIES, HAVE ORGANIZED A JOINT USA - USSR SYMPOSIUM IN RADIO ASTRONOMY. I WOULD LIKE TO INVITE YOU TO BE A U. S. DELEGATE TO THIS SYMPOSIUM, WHICH WILL BE HELD AT WASHINGTON AND GREEN BANK FROM MAY 15 THROUGH MAY 20, 1961. IF YOU ACCEPT THIS INVITATION, YOUR TRAVEL EXPENSES TO AND FROM THE SYMPOSIUM, AND PER DIEM WHILE EN ROUTE WILL BE PAID BY THE NATIONAL ACADEMY OF SCIENCES.

ENCLOSED IS A TENTATIVE PROGRAM FOR THE SYMPOSIUM, WHOSE BASIC SUBJECTS WILL BE RADIO EMISSION FROM SOURCES OUTSIDE THE SOLAR SYSTEM, AND THE CONSTRUCTION OF LARGE RADIO TELESCOPES. I HOPE THAT YOU WILL BE ABLE TO GIVE A PAPER AT THE SYMPOSIUM. IT IS EXPECTED THAT SUCH CONTRIBUTIONS WILL BE PUBLISHED TOGETHER IN A VOLUME OF SYMPOSIUM PROCEEDINGS.

LODGING IN WASHINGTON WILL BE ARRANGED BY THE NATIONAL ACADEMY OF SCIENCES. LODGING AND MEALS AT GREEN BANK WILL BE ARRANGED AT OBSERVATORY FACILITIES.

I HOPE THAT YOU WILL BE ABLE TO ACCEPT THIS INVITATION. IF SO, WE WOULD APPRECIATE IT IF YOU COULD NOTIFY US OF THIS AT YOUR EARLIEST CONVENIENCE. ALSO, PLEASE INFORM US OF THE TITLE OF ANY PAPER OR PAPERS YOU WOULD LIKE TO PRESENT, SO THAT THE FINAL PROGRAM MAY BE ORGANIZED.

SINCERELY YOURS,

O. STRUVE  
DIRECTOR

ENCL:



14 March 1961

Dr. H. A. Tuve  
Department of Terrestrial Magnetism  
The Carnegie Institute of Washington  
Washington, D. C.

Dear Dr. Tuve:

The Academies of Sciences of the USA and the USSR, under the terms of Article 7 of the Exchange Agreement between the two academies, have organized a joint USA - USSR Symposium in Radio Astronomy. I would like to invite you to be a U.S. delegate to this symposium, which will be held at Washington and Green Bank from May 15 through May 20, 1961. If you accept this invitation, your travel expenses to and from the symposium, and per diem while en route will be paid by the National Academy of Sciences.

Enclosed is a tentative program for the symposium, whose basic subjects will be radio emission from sources outside the solar system, and the construction of large radio telescopes. I hope that you will be able to give a paper at the symposium. It is expected that such contributions will be published together in a volume of symposium proceedings.

Lodging in Washington will be arranged by the National Academy of Sciences. Lodging and meals at Green Bank will be arranged at Observatory facilities.

I hope that you will be able to accept this invitation. If so, we would appreciate it if you could notify us of this at your earliest convenience. Also, please inform us of the title of any paper or papers you would like to present, so that the final program may be organized.

Sincerely yours,

O. Struve  
Director

Encl.

14 March 1961

Professor R. N. Bracewell  
Radio Propagation Laboratory  
Stanford University  
Stanford, California

Dear Professor R. N. Bracewell:

The Academies of Sciences of the USA and the USSR, under the terms of Article 7 of the Exchange Agreement between the two academies, have organized a joint USA - USSR Symposium in Radio Astronomy. I would like to invite you to be a U.S. delegate to this symposium, which will be held at Washington and Green Bank, from May 15 through May 20, 1961. If you accept this invitation, your travel expenses to and from the symposium, and per diem while en route will be paid by the National Academy of Sciences.

Enclosed is a tentative program for the symposium, whose basic subjects will be radio emission from sources outside the solar system, and the construction of large radio telescopes. I hope that you will be able to give a paper at the symposium. It is expected that such contributions will be published together in a volume of symposium proceedings.

Lodging in Washington will be arranged by the National Academy of Sciences. Lodging and meals at Green Bank will be arranged at Observatory facilities.

I hope that you will be able to accept this invitation. If so, we would appreciate it if you could notify us of this at your earliest convenience. Also, please inform us of the title of any paper or papers you would like to present, so that the final program may be organized.

Sincerely yours,

O. Struve  
Director

Enclosure:

14 March 1961

Dr. G. R. Burbidge  
Yerkes Observatory  
Williams Bay  
Wisconsin

Dear Dr. G. R. Burbidge:

The Academies of Sciences of the USA and the USSR, under the terms of Article 7 of the Exchange Agreement between the two academies, have organized a joint USA - USSR Symposium in Radio Astronomy. I would like to invite you to be a U.S. delegate to this symposium, which will be held at Washington and Green Bank from May 15 through May 20, 1961. If you accept this invitation, your travel expenses to and from the symposium, and per diem while en route will be paid by the National Academy of Sciences.

Enclosed is a tentative program for the symposium, whose basic subjects will be radio emission from sources outside the solar system, and the construction of large radio telescopes. I hope that you will be able to give a paper at the symposium. It is expected that such contributions will be published together in a volume of symposium proceedings.

Lodging in Washington will be arranged by the National Academy of Sciences. Lodging and meals at Green Bank will be arranged at Observatory facilities.

I hope that you will be able to accept this invitation. If so, we would appreciate it if you could notify us of this at your earliest convenience. Also, please inform us of the title of any paper or papers you would like to present, so that the final program may be organized.

Sincerely yours,

O. Struve  
Director

Enclosure

NATIONAL RADIO ASTRONOMY OBSERVATORY  
POST OFFICE BOX 2  
GREEN BANK, WEST VIRGINIA  
TELEPHONE MARLINTON 292

April 7, 1961

To all invitees to the USA - USSR Radio Astronomy Symposium

In order to make detailed arrangements for the symposium, we need to know as soon as possible your plans for attending the meeting. Therefore, we would appreciate it if you would fill in the enclosed questionnaire, and return it to us in the envelope provided at your earliest convenience. Some of you have already answered some of these questions in your letters of acceptance; however, it would help us if you would complete the entire questionnaire anyway.

We have received several interesting titles of papers to be given at the symposium. Our best information suggests that the USSR delegation will be relatively sizeable and that its contributions will be stimulating. As a result, we are looking forward to a good symposium.

Sincerely yours,



Otto Struve  
Director

Encls.

QUESTIONNAIRE

U.S. Delegates to USA - USSR Radio Astronomy Symposium

1. I will be able to attend the symposium on the following dates:

\_\_\_\_\_

I will not be able to attend \_\_\_\_\_

2. I would like a hotel reservation in Washington for the dates

\_\_\_\_\_

3. I would like travel reservations from Washington to Green Bank on the evening of May 15. \_\_\_\_\_

4. I would like travel reservations as follows on May 19: \_\_\_\_\_

\_\_\_\_\_

5. I would like to go on the cave trip May 18. \_\_\_\_\_

6. I will be able to give a paper, whose title and time to deliver will be \_\_\_\_\_

7. Please make other travel reservations for me as follows:

\_\_\_\_\_

8. Any other requests . . . . .

Signed \_\_\_\_\_

p/le

March 9, 1961

Messrs. Drake  
Pindley  
Callender  
Heeschen ✓  
Ehlerston

Subject: Radio Astronomy Symposium

Mr. Gleason telephoned on March 7 to say that:

1) Letters of invitation to American participants of the USA-USSR symposium are to be sent from the IRAO. These letters should mention that the symposium is being organized under the terms of Article 7 of the Exchange Agreement between the two academies. They should also state that the traveling expenses of the American participants would be paid by the National Academy of Sciences.

2) I shall send a cable to Vitykitch, requesting a list of names and titles from the USSR. Personal and private letters from our own staff members to radio astronomers in the USSR may be sent, suggesting that the Russians inquire from their own Academy whether they can be included among the Soviet delegation. In accordance with the agreement, the sending Academy pays traveling expenses of its own delegates.

3) Dr. Bronk has reserved the great hall of the NAS at 2101 Constitution Avenue for the afternoon and early evening of May 15. I do not know whether arrangements can be made to have a buffet supper in the Academy building. The entire group of American and Soviet participants would travel by train, leaving Washington at 10:30 PM and would be met the following morning at White Sulphur Springs for transportation to Green Bank.

4) Mr. Callender should make certain that either his office or the Academy office secures the necessary reservations on the train to White Sulphur Springs and for those who wish to return in the evening of Friday, May 19. The Academy will be responsible for having them visit the Department of Terrestrial Magnetism. There is no information on whether the foreign delegates will be permitted to see any part of the NRL.

file

NATIONAL RADIO ASTRONOMY OBSERVATORY

POST OFFICE BOX 2  
GREEN BANK, WEST VIRGINIA

BUSINESS OFFICE  
TELEPHONE MARLINTON 292

LABORATORY  
TELEPHONE CASS 65

March 11, 1961

MEMORANDUM TO: Messrs. Struve, Findlay, Heeschen and Drake

SUBJECT: Preliminary Budget Estimates - Russian-American Symposium  
on Radio Astronomy

Enclosed is a tentative budget estimate for the subject symposium. After internal review and discussion, and approval by the Director, I propose to discuss these figures (or the revised amounts) with representatives of the National Academy of Science on Thursday, March 16, 1961, this discussion to be followed by formal written request for funds from the Observatory to the Academy. Your early comments and advice would be most helpful.

Attached also is a list of non-NRAO American invitees to the symposium. If this list is incomplete please let me know for budget purposes. Finally, I enclose a suggested guest list of NRAO staff members for dinner on Tuesday and Thursday nights; they and their wives would be invited to dinner on Wednesday evening. Suggested additions to or deletions from this guest list should be taken up directly with Mr. Struve.

The enclosed estimates are based on the following assumptions:

- 1 - The cost of the program and entertainment in Washington on Monday, May 15 and again on Saturday, May 20, are to be borne directly by the Academy.
- 2 - The cost of transportation of Russians from Washington to White Sulphur and return is to be borne by the Russians.
- 3 - The cost of transportation of the NRAO staff to Washington and return is to be borne by regular NRAO funds.
- 4 - The travel expenses of non-NRAO American delegates are to be borne by Academy furnished symposium funds. These expenses to include transportation and per diem while enroute but no per diem while at the NRAO.
- 5 - Travel expenses of non-NRAO American delegates who are employees of the Government will be borne by the agency concerned.
- 6 - All costs from Tuesday morning May 16, 1961 to Friday evening, May 19, 1961 to be borne by Academy furnished symposium funds.
- 7 - The NRAO professional staff should have dinner with symposium delegates on Tuesday, Wednesday and Thursday nights, and the cost of these meals is a proper charge to symposium funds.
- 8 - The wives of the NRAO professional staff should be invited to dinner on Wednesday evening. Because of limited entertainment opportunities for delegates, a well planned affair of this kind should contribute materially to the general atmosphere of the week's program as a whole and would be a proper charge to symposium funds.

- 9 - It would be desirable to edit, print, and issue the proceedings of this symposium as an Observatory publication.
- 10 - Liquid refreshments appropriate to the occasion should be available before and perhaps after dinner on Tuesday, Wednesday and Thursday nights - the cost to be borne by entertainment funds provided by AUI to the Director and Departmental Chairmen (unless I can get the Academy to contribute). Based on a rough estimate, this cost would not exceed \$250.
- 11 - Any unexpended Academy furnished symposium funds would be returned to the Academy.

I have no feel whatsoever for publication costs. If the amount shown is way out of line in orders of magnitude please say so.

Housing will be a problem. I feel convinced that all participants can be housed on the site although this would entail a partial but not insurmountable inconvenience to some of the American delegates. Once I have your views on the enclosed information, I will prepare immediately a proposed housing and room assignment plan for your review and approval.

I assume that Mr. Struve will designate those members of the NRAO staff who will be expected to be in Washington on Monday, May 15, 1961 for the opening session.

Within the week I will make tentative reservations with the C & O Railroad for transportation from Washington to White Sulphur Springs and return. At the moment it appears that a minimum of two special cars will be required.



F. J. Callender



NATIONAL RADIO ASTRONOMY OBSERVATORY  
Preliminary Budget Estimates  
Russian-American Symposium on Radio Astronomy

Description	Travel	Food <sup>1/</sup>	Lodging <sup>2/</sup>	Other	Total
<u>Travel Food and Lodging</u>					
10 Russians	-0-	200	150	-0-	350
17 Americans	4,000	340	255	-0-	4,595
5 Observers <sup>3/</sup>	-0-	100	75	-0-	175
14 NRAO Staff <sup>4/</sup>	-0-	84	-0-	-0-	84
24 NRAO Staff <sup>5/</sup>	-0-	72	-0-	-0-	72
<u>Transportation</u>					
6 Rental Cars					
4 days @ \$10.00				240	240
730 miles - @ <sup>6/</sup>				58	58
<u>Publication Costs</u>					
Proceedings - 200 Pages @ \$30				6,000	6,000
<u>Other</u>					
General clerical, office expense, special equipment rental, etc.				500	500
Sub Total	4,000	796	480	6,798	12,074
Overhead @ 15% of direct costs					1,811
Total					13,885

- <sup>1/</sup> Food - 4 days @ \$5.00 per day.
- <sup>2/</sup> Lodging - 3 nights @ \$5.00 per night
- <sup>3/</sup> National Academy of Science, National Science Foundation, etc.
- <sup>4/</sup> Dinner - Tuesday and Thursday @ \$3.00 per meal.
- <sup>5/</sup> Banquet (with wives of NRAO professional staff) - Wednesday @ \$3.00
- <sup>6/</sup> 6 cars - round trip White Sulphur Springs/Green Bank - 130 miles @ \$6 per mile
- 6 cars - 25 miles per day on or near Observatory @ \$6 per mile

Approximate List of non-NRAO American Sponsored Delegates

Russian-American Symposium on Radio Astronomy

Name	Institution	Tentative Travel Costs <sup>1/</sup>
McClain	NRL	-0- <sup>2/</sup>
Mayer	NRL	-0- <sup>2/</sup>
Lilley	Harvard	160
Haddock	Michigan	160
Spitzer	Princeton	125
Field	Princeton	125
Minkowski	--	400
Sandage	Mt. Wilson	400
Weaver	California	400
Stanley	Cal Tech	400
Swenson	Illinois	150
Kraus	Ohio State	125
Gold	Cornell	160
Mayall	Kitt Peak	400
Durbidge	--	400
Bracewell	Stanford	400
Burke	DTM	75
TOTAL		\$ 3,880

<sup>1/</sup> These are only approximate - will have more accurate figures within a few days.

NRAO Guest List

for 1/

Dinner on Tuesday, Wednesday and Thursday

Name

Mr. Struve  
Mr. Heeschen  
Mr. Drake  
Mr. Wade  
Mr. Lynds  
Mr. Menon  
Mr. Kahn  
Mr. Findlay  
Mr. Orhaug  
Mr. Hvatum  
Mr. Vinokur  
Mr. Emberson  
Mr. Callender  
Mr. Riffe

1/ Wives to be invited to dinner on Wednesday evening.

Copies to: Messrs. Findlay, Emberson, Heeschen, Drake and Callender.

COPY

MOUNT WILSON AND PALOMAR OBSERVATORIES

813 Santa Barbara St.  
Pasadena, Calif.

March 24, 1961

Dr. Otto Struve  
National Radio Astronomy Observatory  
Post Office Box 2  
Green Bank, West Virginia

Dear Dr. Struve:

Thank you very much for your invitation to the joint USA-USSR Symposium in Radio Astronomy. I accept with pleasure. But you must realize that I know next to nothing about radio astronomy and will gain very much more from the symposium than the symposium will gain from me. I would rather not give a paper.

The timing brings up the problem of our prospective visit to Green Bank which you arranged last fall. Would the following be satisfactory from your standpoint? My wife, son, and I will be in Washington on May 10 and 11 to attend a function of the Carnegie Institution. We had planned to come to Green Bank by car directly from Washington arriving on either Friday or Saturday, May 12 or 13. You mentioned earlier the possibility of a family accommodation for the 10-day period stipulated by the contract. If this is satisfactory, I could either leave Mary at Green Bank and travel back to Washington for the opening session on May 15 or could stay in Green Bank and attend the proceedings starting on Tuesday May 16. My period in residence at NRAO could then begin after the symposium is over, presumably starting on May 22. Is this OK from your end?

It will be nice seeing you again. Hope Minkowski will be at the Symposium so he can present his optical results on NGC 1275.

Sincerely yours,

Allan Sandage

AS:lm

*md Treacher*

NATIONAL ACADEMY OF SCIENCES  
NATIONAL RESEARCH COUNCIL  
OF THE UNITED STATES OF AMERICA

*file*

OFFICE OF INTERNATIONAL RELATIONS

March 27, 1961

Dr. Otto Struve  
National Radio Astronomy Observatory  
Post Office Box 2  
Green Bank, West Virginia

Dear Dr. Struve:

We have been informed by the Department of State that visa applications recently were made at the American Embassy in Moscow for seven Soviet radio-astronomers to participate in the joint US-Soviet symposium at Green Bank in May. Their names and affiliations are as follows:

Syurakan Astrophysical Observatory, Syurakan, Academy of Sciences,  
Armenian SSR.

V. A. Samoylov

Gorkiy State University in, V. I. Lebedevskiy, Gorkiy, Ministry of  
Higher Education, USSR.

B. N. Gershman

Physics Institute in, P. N. Lebedev, Moscow, Academy of Sciences,  
USSR:

F. D. Kalashov

A. B. Kuznetsov

K. L. Gerasimov

S. I. Syrovatskiy

V. V. Vitkevich

Sincerely yours,

*Lawrence E. Mitchell*  
Lawrence E. Mitchell  
East-West Exchange Program

file

STANFORD UNIVERSITY  
STANFORD, CALIFORNIA

RADIOSCIENCE LABORATORY

April 10, 1961.

Dr. O. Struve  
National Radio Astronomy Observatory  
Post Office Box 2  
Green Bank, W.Va

Dear Dr. Struve,

I wish to thank you for your kind invitation to the Symposium at Green Bank. The title of my contribution would be "Guiding Principles leading to the Design of a Radio Telescope with a one-minute Beam".

My mind has been occupied with this subject for a long time now, first as a member of the NRAO committee, later while meeting with the Pierce committee, and more recently on my trip to the Soviet Union. On the way back from this trip I visited the Benelux cross group at Leiden. And of course, high angular resolution is our bread and butter: right now Swarup and Kakinuma are down to a minute of arc resolution on the sun. Through thinking and talking about a one-minute beam with the group now here at Stanford, I have arrived at a feasible plan that could lead to such an instrument in five to ten years' time.

There are a number of principles, already more or less familiar, that can be used to eliminate the possibilities. One of these is to the effect that a design suitable for the future will have to be capable of growing. Thus we cannot continue to build new instruments afresh each time an increase in area is needed, for the costs are already at a level incurring the attention of national governments. Since the future surely will require increasing areas, it follows that we must now change over to instruments that can grow. This in turn means assemblages of identical elements.

The problems of making echelon configurations of antenna elements have been well and truly discussed, and they are formidable. One is the difficulty of compensating the large jumps in phase path from one element to the next. Another is the occurrence of the multiple responses associated with periodic structures. It seems, however, that these are the problems that we will have to control in the future, once it is accepted that iterated structures have to be accepted. We already have experience with the phase control problem here (Swarup and Yang's papers) and I have been studying ways of holding down or eliminating the higher order responses. Shortly we shall be able to demonstrate by a radio star record that it can be done. The trick is to compensate the periodic defects in the vector spacings available within a periodic aperture, by introducing a further, but complementary, set. Ways of doing this have been discussed, in fact I have published one myself, but it is also important to have the compensation tolerant to mechanical

Dr. Struve

April 10, 1961

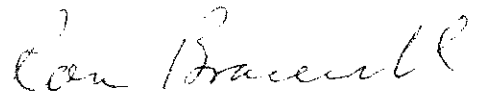
or electrical beam steering, and now I believe this is solved in principle.

However, the result is much more complex electrically than one is accustomed to in a single-focus instrument. Apparently this is the price to be paid for pushing beyond the reasonable limit for a single paraboloid. There are also other electronic complications. One inescapable conclusion, that Seeger has emphasized, and has incorporated in the Benelux cross, is that the instrument must lay down multiple beams.

A considerable team would be required to carry through the project I have in mind, and NRAO would certainly be the appropriate organization. However, there is a substantial program of development of electrical details before design of a full-scale instrument could begin, and I am interested in applying the abilities of my present group to the construction of a model. I would like to do this as quickly as possible and complete, in say two years, a pilot project that would demonstrate the feasibility of the one-minute-and-beyond instrument. From the beginning such a project should be conducted with a view to future liaison with NRAO, I believe, but it would be well to have it proceed as freely and speedily as possible.

I have discussed these ideas with Keller a few days after they first crystallized and I would like to present them in detail to the NRAO group. The Symposium seems to provide a suitable occasion; I also look forward to having a conversation with you about it in Oklahoma City next week.

Yours sincerely,



R.N. Bracewell.

Copies to : Dr. Keller  
Mr. Seeger  
Mr. Swarup.







NATIONAL RADIO ASTRONOMY OBSERVATORY  
POST OFFICE BOX 2  
GREEN BANK, WEST VIRGINIA  
TELEPHONE MARLINTON 292

May 5, 1961

To All Delegates to Joint USA - USSR Radio Astronomy Symposium;

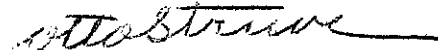
Enclosed is a copy of the preliminary scientific program for the symposium. Included are only the known USA contributions, since a list of titles from the USSR has not yet arrived. We hope to keep the program flexible, so that papers may be arranged in proper juxtaposition -- therefore, requests for changes in the arrangement of papers or additions to the program will be given all due consideration.

The National Academy of Sciences presently wishes to publish the papers presented at the Symposium. The discussion of papers will not be published. It is requested that speakers bring with them to the symposium manuscripts of their talks. An abstract suitable for publishing will be a satisfactory substitute from those authors who do not wish to have their full papers published.

Planned social activities include a symposium banquet on May 16, and a visit to a non-commercial cave for those interested and athletically inclined on the evening of May 17. It is hoped that the Soviet delegates will have an opportunity to visit in some of the NRAO staff members' homes on the evening of May 18. On May 19 the Soviet delegates will return to Washington via automobile and the Skyline Drive.

If we can be of any assistance in connection with your attendance at the symposium, please call on us.

Sincerely yours,



O. Struve  
Director

Encl.

Program

Joint USA - USSR Radio Astronomy Symposium

Monday, May 15  
Great Hall, the National Academy of Sciences  
Washington, D. C.  
3:00 - 5:00 P. M.

- Detlev W. Bronk: Welcome to delegates.
- O. Struve: Welcome to the National Radio Astronomy Observatory.
- V. V. Vitkevitch: Greeting from Astronomical Council of Academy of Sciences of Soviet Union.
- V. A. Sanamyan: Greetings from Academician Ambartsumian
- F. D. Drake: Review of History, Present Status, and Course of Radio Astronomy in the United States.
- V. V. Vitkevitch: Review of History, Present Status, and Course of Radio Astronomy in the Soviet Union.

Tuesday, May 16  
National Radio Astronomy Observatory  
Green Bank, West Virginia  
10:00 - 12:00 A. M.

Tour of the National Radio Astronomy Observatory

2:00 - 5:00 P. M.  
Observatory Conference Room  
Chairman: J. W. Findlay

- B. F. Burke, J. W. Firor, and M. A. Tuve: Hydrogen Line Studies.
- A. Blaauw: 21-cm Evidence on Interstellar Cloud Structure.
- C. L. Seeger: 408 mc. Observations of the Polarized Component of the Nonthermal Galactic Background Radiation.
- A. D. Kuzmin and A. E. Salomonovich: Radio Emission of Taurus A at a wavelength of 8 mm.
- R. L. Sorochenko: Preliminary Results of Observations at 21-cm of the Milky Way Region with the Center R.A. =  $20^{\text{h}}18^{\text{m}}$  Dec. =  $+42^{\circ}30'$ .

Wednesday, May 17  
9:00 - 12:00 A.M.  
Chairman: G. B. Field

C. H. Mayer, T. P. McCullough, R. M. Sloanaker: Radio Source Polarization Measurements.

A. H. Barrett: Observations of Radio Sources at 1.8-cm Wavelength.

A. D. Kuzmin: Spectra of Radio Sources Observed with the 22-meter Radio Telescope of the Lebedev Physical Institute.

T. K. Menon: The Density Distribution in Emission Nebulae.

F. D. Kahn: Dynamics of HII Regions.

Y. N. Parijsky: On the Connection between Hydrogen Lines Radiation and Radio Emission of Gaseous Nebulae.

A. D. Kuzmin, R. I. Noskova: Identification of Exciting Stars and Determination of Emission Nebula Parameters on the Basis of Radio Astronomical Data.

2:00 - 5:00 P. M.  
Chairman: F. T. Haddock

A. D. Kuzmin: Concerning the Discrete Source of Radiation at R.A. =  $18^{\text{h}}53^{\text{m}}7$  Dec. =  $+1^{\circ}16'$ .

A. E. Lilley: Results of the Harvard Hydrogen Line Maser Program.

C. M. Wade: The Structure of Some Bright Galaxies.

G. J. Stanley: Measurements of Radio Source Diameters at the Owens Valley Observatory.

T. A. Matthews: The Determination of Accurate Positions of Radio Sources and the Problems of Identification.

D. S. Heesch: The Spectra of Some Extragalactic Radio Sources.

A. G. Little, D. D. Cudaback and R. N. Bracewell: Structure of the Central Component of Centaurus A.

L. Woltjer: Some Remarks on Supernova Remnants.

5:00 P.M. - Study Groups on Source Polarization and 21-cm Line Studies.

Thursday, May 18

9:00 - 12:00 A. M.

Chairman: V. V. Vitkevitch

- G. M. Tovmasthan, R. K. Shachbazyan: On the Equality of Cosmic Sources.
- R. Minkowski: Radio Sources, Galaxies, and Clusters of Galaxies.
- A. R. Sandage: On the Possibility to Choose Between Cosmological World Models from Observations of Distant Radio Clusters of Galaxies.
- V. L. Ginzburg: On the Nature of Radio Galaxies.
- G. B. Field: On Shklovsky's Early Picture of the Cygnus A Source.
- G. R. Burbidge: Recent Ideas Concerning the Origin of the Strong Extragalactic Radio Sources.
- V. A. Razin: On the Spectra of Nonthermal Radio Emission of the Galaxy and Metagalaxy.
- G. G. Getmantsev: On the Origin of Non-thermal Galactic Radio Emission and of Primary Cosmic Rays.
- S. I. Syrovatsky: On the Spectrum of the Galaxy and Solar Cosmic Rays.

2:00 - 5:00 P. M.

Chairman: E. F. McClain

- J. D. Kraus: Design Considerations and Preliminary Performance Data for the Ohio State University 260-foot Radio Telescope.
- G. W. Swenson, Jr.: The University of Illinois Radio Telescope.
- C. R. Lynds: The NRAO Flare Star Telescope.
- J. W. Findlay: The NRAO 300-foot Transit Telescope.
- V. A. Sanamyan: On the Work of the Large Interference Radio Telescope at the Byurakan Observatory.

5:00 P. M. - Study Groups on Discrete Sources and Large Telescopes.

Friday, May 19  
9:00 - 12:00 A. M.  
Chairman: J. W. Fidor

- G. J. Stanley: The Owens Valley Interferometer and its Applications to Problems of Aperture Synthesis.
- V. V. Vitkevitch and P. D. Kalachev: The Large Cross Radio Telescope of the Lebedev Physical Institute. Possible Ways to Construct Large Radio Telescopes.
- R. N. Bracewell: Guiding Principles Leading to the Design of a Radio Telescope with a One-Minute Beam.
- C. L. Seeger: On the Design of the Giant Benelux Radio Telescope.
- F. D. Drake: Some Economical Designs for High-Performance Radio Telescopes.

Invitees to the USA - USSR  
Radio Astronomy  
Symposium

Dr. G. J. Stanley  
Dept. of Radio Astronomy  
California Institute of Technology  
1201 E. California St.  
Pasadena 4, Calif.

Prof. A. E. Lilley  
Harvard College Observatory  
60 Garden St.  
Cambridge 38, Mass.

Mr. E. F. McClain, Head  
Radio Astronomy Branch  
U. S. Naval Research Laboratory  
Washington 25, D. C.

Mr. Cornell H. Mayer  
Radio Astronomy Branch  
U. S. Naval Research Laboratory  
Washington 25, D. C.

Prof. G. B. Field  
Princeton University Observatory  
Princeton University  
Princeton, New Jersey

Dr. R. Minkowski  
Astronomy Dept.  
U. Of Wisconsin  
Madison, Wisconsin

Prof. F. T. Haddock  
The Observatory  
University of Michigan  
Ann Arbor, Mich.

Dr. M. A. Tuve  
Dept. of Terrestrial Magnetism  
Carnegie Institute of Washington  
Washington, D. C.

Prof. R. N. Bracewell  
Radio Propagation Laboratory  
Stanford University  
Stanford, Calif.

Dr. G. R. Burbidge  
Yerkes Observatory  
Williams Bay, Wisconsin

Dr. Harold F. Weaver  
University of California  
Berkeley 4, California

Dr. Allan R. Sandage  
Mt. Wilson and Palomar Observatories  
813 Santa Barbara St.  
Pasadena 4, California

Dr. G. W. Swenson  
University of Illinois Observatory  
Urbana, Ill.

Dr. J. D. Kraus  
Radio Observatory  
Dept. of Electrical Engineering  
Ohio State University  
Columbus 10, Ohio

Dr. Bernard F. Burke  
Carnegie Institution  
5241 Broad Branch Rd., N.W.  
Washington 15, D. C.

Dr. Alan H. Barrett  
The Observatory  
University of Michigan  
Ann Arbor, Mich.

Dr. Thomas Matthews  
Dept. of Radio Astronomy  
California Institute of Technology  
Pasadena 4, California

Dr. L. Woltjer  
Institute for Advanced Study  
Princeton, New Jersey

Dr. A. Blaauw

Mr. C. L. Seeger  
Radio Astronomy Institute  
Stanford University  
Stanford, California

NOTICE

The National Academy of Sciences is sponsoring a Joint USA - USSR Radio Astronomy Symposium, to be held at Washington and Green Bank, West Virginia, May 15 - 29, 1961. The opening session of this symposium will be held at the Great Hall of the National Academy of Sciences, Washington, from 2:30 to 5:00 P.M. on May 15. Members of your scientific staff are cordially invited to attend this opening session.

The program will be as follows:

Chairman: D. S. Heesch, National Radio Astronomy Observatory.

Detlev W. Bronk, President, National Academy of Sciences: Welcome to Soviet delegates.

F. D. Drake, National Radio Astronomy Observatory: A Review of the History, Present Status, and Course of Radio Astronomy in the United States.

V. V. Vitkevitch, Lebedev Physical Institute, Moscow: A Review of the History, Present Status, and Course of Radio Astronomy in the Soviet Union.

O. Struve, Director, National Radio Astronomy Observatory: Welcome to the National Radio Astronomy Observatory.

Report on the Joint USA-USSR Radio Astronomy Symposium  
held at Washington and Green Bank, May 15-19, 1961

I. A joint USA-USSR Radio Astronomy Symposium, arranged under Article 7 of the exchange agreement between the Academies of Sciences of the USA and USSR was held at Washington and Green Bank, May 15 through May 19, 1961. The host institution was the National Radio Astronomy Observatory. The Opening Session was held at the National Academy of Sciences, Washington on the afternoon of May 15, when welcoming and introductory addresses were given. Technical Sessions were held at the National Radio Astronomy Observatory, May 16 through 19.

II. Participants in the symposium were as follows:

USSR

G. G. Getmantsev, Radiophysical Institute of Gorky University  
P. D. Kalachev, Lebedev Physical Institute  
A. D. Kuzmin, Lebedev Physical Institute  
V. A. Sanamyan, Byurakan Astrophysical Observatory  
R. L. Sorochenko, Lebedev Physical Institute  
V. V. Vitkevitch, Lebedev Physical Institute

USA

A. H. Barrett, University of Michigan  
A. Blaauw, Vanderbilt University  
R. N. Bracewell, Stanford University  
G. R. Burbidge, Yerkes Observatory  
B. F. Burke, Department of Terrestrial Magnetism, Carnegie Institution  
of Washington  
F. D. Drake, National Radio Astronomy Observatory  
G. B. Field, Princeton University  
J. W. Findlay, National Radio Astronomy Observatory  
J. W. Firor, Department of Terrestrial Magnetism, Carnegie Institution  
of Washington  
F. T. Haddock, University of Michigan  
D. S. Heeschen, National Radio Astronomy Observatory  
F. D. Kahn, National Radio Astronomy Observatory  
G. Keller, National Science Foundation  
J. D. Kraus, Ohio State University  
A. E. Lilley, Harvard University  
C. R. Lynds, National Radio Astronomy Observatory  
C. H. Mayer, Naval Research Laboratory  
E. F. McClain, Naval Research Laboratory  
T. K. Menon, National Radio Astronomy Observatory  
R. Minkowski, University of Wisconsin  
A. R. Sandage, Mount Wilson and Palomar Observatories  
C. L. Seeger, Stanford University  
G. J. Stanley, California Institute of Technology  
O. Struve, National Radio Astronomy Observatory  
G. W. Swenson, University of Illinois  
C. M. Wade, National Radio Astronomy Observatory  
H. F. Weaver, University of California  
L. Woltjer, Institute for Advanced Study



The symposium interpreter was Mrs. S. Edmundson, of the USA National Academy of Sciences. Appendix A is a photograph of most of the symposium participants.

### III. The Symposium Program.

The Symposium Program was opened by Detlev W. Bronk, President of the U. S. Academy of Sciences, who welcomed the delegates, and by V. V. Vitkevitch, who brought greetings from the Astronomical Council of the Academy of Sciences of the Soviet Union. V. A. Sanamyan presented greetings from Academician Ambartsumian, and O. Struve welcomed the delegates to the National Radio Astronomy Observatory. Introductory papers reviewing the history, present status, and the course of radio astronomy in the United States and in the Soviet Union were then presented by F. D. Drake and V. V. Vitkevitch.

The Technical Program. Below is given a list of the technical papers presented at the symposium, with a brief description of the subject matter of each.

B. F. Burke, J. W. Firor, and M. A. Tuve: Hydrogen Line Studies. A report of cloud structure of interstellar hydrogen at high galactic latitudes, as found with a multi-channel radiometer.

A. Blaauw: 21-cm Evidence on Interstellar Cloud Structure. The results of attempts to portray 21-cm profiles as sums of gaussian components.

C. L. Seeger: 408 mc Observations of the Polarized Component of the Non-thermal Galactic Background Radiation. Excellent evidence for the existence of polarization in the galactic background radiation, with a preliminary map of the orientation and percentage polarization found.

A. D. Kuzmin and A. E. Salomonovich: Radio Emission of Taurus A at a wavelength of 8 mm. Observations of Taurus A at high resolution which give evidence for a second source very close to the Taurus A source.

R. L. Sorochenko: Preliminary Results of Observations at 21-cm of the Milky Way Region with the Center R. A. =  $20^{\text{h}} 18^{\text{m}}$  and Dec. =  $+42^{\circ}30'$ . 21-cm profiles showing absorption features connected with the source Cygnus X, and indicating its location in the Milky Way.

C. H. Mayer, T. P. McCullough, R. M. Sloanaker. Radio Source Polarization Measurements. Polarization measurements of six sources, of which only Taurus A presently gives clear cut evidence of polarization.

A. H. Barrett: Observations of Radio Sources at 1.8-cm Wavelength. Extension of the spectra of several radio sources to 1.8-cm wavelength.

A. D. Kuzmin: Spectra of Radio Sources Observed with the 22-meter Radio Telescope of the Lebedev Physical Institute. A critical comparison of spectra obtained with the 22-meter telescope with older spectral data.

T. K. Menon: The Density Distribution in Emission Nebulae. The density distribution in the Orion Nebula and NGC 2244, as found from radio observations.

F. D. Kahn: Dynamics of HII regions. A critical discussion of the observational data showing there are violent contradictions in theory which may be resolved only by making extreme assumptions regarding the evolutionary stage of the subject HII regions.

Y. N. Parijsky: On the Connection between Hydrogen Lines Radiation and Radio Emission of Gaseous Nebulae. A means of determining the distance to emission nebulae from optical and radio observations, with the results of the application of the method to 32 nebulae.

A. D. Kuzmin, R. I. Noskova: Identification of Exciting Stars and Determination of Emission Nebulae Parameters on the Basis of Radio Astronomical Data. A proposal of a new method of identifying exciting stars and measuring nebula parameters using radio observations and optical spectral data only. Application to many HII regions gives very encouraging results.

A. D. Kuzmin: Concerning the Discrete Source of Radiation at R. A.  $18^{\text{h}} 53^{\text{m}} 7$ , Dec. =  $+1^{\circ} 16'$ . Data from the 22-meter telescope is given which indicates that the source is a non-thermal source similar to IC443.

A. E. Lilley: Results of the Harvard Hydrogen Line Maser Program. Both negative and positive results of a search for 21-cm line and continuum radiation from galaxies is given.

C. M. Wade: The Structure of Some Bright Radio Galaxies. The double emission regions in Fornax A, Centaurus A, and Cygnus A is emphasized as a significant feature of intrinsically bright radio sources, and the complex low intensity structure of M87 described.

G. J. Stanley: Measurements of Radio Source Diameters at the Owens Valley Observatory. A summary of the statistical data on source brightness distributions found at Owens Valley, which show that a majority of the intrinsically bright radio sources are probably double.

D. S. Heeschen: The Spectra of Some Extragalactic Radio Sources. A summary of the extensive observations of source spectra, which show that the normal galaxies and abnormal radio galaxies fall respectively on two well defined sequences in a color magnitude diagram, and that some of the bright sources have distinct curvatures in their spectra.

A. G. Little, D. D. Cudaback, and R. N. Bracewell: Structure of the Central Component of Centaurus A. The central component of Centaurus A is shown to consist of two components of unequal strength, in two possible orientations.

L. Woltjer: Some Remarks on Supernova Remnants: It is suggested that the central star in the Crab Nebula is an extraordinary object which emits much of its energy in the form of energetic particles. The source 3C48 may be an example of an older version of the same object.

G. M. Tovmasthan, R. K. Shachbazyan: On the Equality of Cosmic Sources. A statistical analysis of a number of source catalogs was made which indicated that radio sources tend to occur in clusters of galaxies, and they tend to be connected with double galaxies.

R. Minkowski: Radio Sources, Galaxies, and Clusters of Galaxies. A summary of the most recent results obtained from the optical identification of radio sources.

A. R. Sandage: On the Possibility to Choose Between Cosmological World Models from Observations of Distant Radio Clusters of Galaxies. An analysis of the quality of observations needed to distinguish between different cosmological world models.

V. L. Ginzburg: On the Nature of Radio Galaxies. It is shown that large numbers of relativistic electrons could be produced in the early stages of the evolution of a galaxy when high material velocities exist.

G. B. Field: On Shklovsky's Early Picture of the Cygnus A Source. A discrepancy between the positions of the stellar and halo components of the source is shown, which seems to militate strongly against this early picture.

G. R. Burbidge: Recent Ideas Concerning the Origin of the Strong Extragalactic Radio Sources. A suggestion by Hoyle that radio galaxies are the result of an enormous flare phenomenon in the central regions of galaxies is discussed. It is shown that this demands extreme parameters of the radio galaxies. A new idea is presented that radio galaxies are the result of a chain reaction of supernovae in the galactic nucleus.

V. A. Razin: On the Spectra of Nonthermal Radio Emission of the Galaxy and Metagalaxy. It is shown that if the exchange of relativistic particles between the galactic plane and halo is impeded, the spectrum of radio emission from the halo should be steeper than the radiation from the flat subsystem. Extragalactic radiation should have a still steeper spectrum.

G. G. Getmantsev: On the Origin of Non-thermal Galactic Radio Emission and of Primary Cosmic Rays. Arguments are given in favor of the idea that the relativistic particles giving rise to halo emission originate in the halo during the early history of a galaxy. Supernovae are probably a source of relativistic electrons only for the flattened subsystem. The exchange of cosmic rays between the halo and flat subsystem is almost absent.

C. R. Lynds: Application of the Image Orthicon to Astronomical Problems. Observations made with an image orthicon on the 36" Kitt Peak telescope were presented, and the advantages (high quantum efficiency) and the limitations (image distortion) of the image orthicon described.

J. D. Kraus: Design Considerations and Preliminary Performance Data for the Ohio State University 360-foot Radio Telescope. A description of the 360-foot telescope, accompanied by a theoretical analysis of various aspects of telescope performance, and actual measurements which are closely consistent with the theoretical analysis.

G. W. Swenson, Jr.: The University of Illinois Radio Telescope. A description of the design of the telescope, accompanied by a progress report on the construction of the instrument.

J. W. Findlay: The NRAO 300-foot Transit Telescope. A description of the design of the telescope, and demonstration of a model of it.

V. A. Sanamyan: On the Work of the Large Interference Radio Telescope at the Byurakan Observatory. A detailed description of the seven element interferometer at the Byurakan Observatory, with examples of the high quality of observation possible with it.

G. J. Stanley: The Owens Valley Interferometer and its Applications to Problems of Aperture Synthesis. A resume of experience gained from the Owens Valley Interferometer, with some suggestions as to how to extend the instrument so as to increase its observing capabilities.

V. V. Vitkevitch and P. D. Kalachev: The Large Cross Radio Telescope of the Lebedev Physical Institute. Possible Ways to Construct Large Radio Telescopes. A description of the design of the large cross telescope, and the progress made in its construction. Discussion of several novel proposals for the construction of very large reflector type telescopes.

R. N. Bracewell: Guiding Principles Leading to the Design of a Radio Telescope with a One-Minute Beam. A discussion of the philosophy that should guide future designs for large telescopes, with emphasis on resolution limiting and the advantage of building an instrument which can be expanded. A design which meets the criteria, using a number of cylindrical parabolas, was presented.

C. L. Seeger: On the Design of the Giant Benelux Radio Telescope. A resume of the problems encountered in the design of very large cross type telescopes, and a discussion of various approaches which might solve these problems.

F. D. Drake: Some Economical Designs for High-performance Radio Telescopes. A description of several versions of a telescope which combines reflecting elements with the Mills Cross principle to give high performance at low cost.

Informal Discussion. Because of the limited number of papers on the program, and the small number of participants, it was possible to devote much time fruitfully to informal discussion. To aid in this, informal study groups were organized outside the formal symposium program to discuss the following special topics:

- Source Polarization Studies
- 21-cm Line Studies
- Discrete Sources
- Design parameters for Large Telescopes

#### IV. Social and Sightseeing Activities.

The following social and sightseeing activities were arranged for the symposium:

- 1) A symposium dinner, attended by all delegates.
- 2) Dinner parties in the homes of NRAO staff members for members of the Soviet delegation.
- 3) A visit to some nearby caverns by a portion of the American and Soviet delegations.
- 4) A return trip to Washington by automobile for the Soviet delegation, via a route which included the Shenandoah Valley and the Skyline Drive.
- 5) Sightseeing in Washington, including a visit to the White House and most other points of interest.

#### V. Other Scientific Visits made by the Soviet Delegation.

Arrangements were made for the Soviet Delegation to visit the Department of Terrestrial Magnetism of the Carnegie Institute of Washington, and the Radio Observatory of the University of Michigan. The Soviet delegation was very pleased that it was possible, on short notice, to make these visits.

## VI. Suggestions for future symposia.

As a result of the experience gained from this symposium, we would like to make the following suggestions regarding future Symposia:

- 1) An interpreter was provided at this conference. This turned out to be very useful, and contributed very significantly to the success of the venture. There is a severe language problem with most delegates, making an interpreter extremely desirable at future symposia.
- 2) Hotel accommodations provided the Soviet delegates in Washington were below average in quality, and did not reflect well on the U.S. or American hospitality. Better accommodations should be provided in the future.
- 3) Every effort should be made to determine well in advance of the symposium the places, other than the symposium location, the Soviet delegation wishes to visit while in America. Since many places are closed to Soviet citizens, and arrangements to visit the permitted places take time to make, the Soviet desires need to be known well in advance so that side-trips can be arranged, where possible, in an efficient way.

## VII. Evaluation of the Effectiveness of the Symposium.

It is felt that the technical program was well balanced and stimulating, and that its scope and length were very nearly optimum. In the discussions held in connection with the formal program and outside it, there was a free and enthusiastic flow of information between the two delegations. Because of this, major steps were made in gaining a knowledge of the progress made in radio astronomy in the two countries, and the problems now considered important in each. Since the attainment of such mutual understanding was a primary goal of the conference, it is felt that the symposium was highly successful.

At the request of the Director of the National Radio Astronomy Observatory, the undersigned organized the Symposium and prepared this report.



---

F. D. Drake  
Associate Astronomer  
July 18, 1961

APPENDIX A

The accompanying photograph shows most of the symposium participants.

Key:

(Left to Right)

First Row (seated): G. G. Getmantsev, F. T. Haddock, M. S. Wade, S. Edmundsen (interpreter), R. Minkowski, V. V. Vitkevitch, O. Struve, R. L. Sorochenko, J. W. Firor, G. Keller, A. D. Kuzmin, R. N. Bracewell, F. D. Drake.

Second Row: C. M. Wade, E. F. McClain, V. A. Sanamyan, P. D. Kalachev, G. J. Stanley, A. H. Barrett, H. F. Weaver, G. W. Swenson, Jr., C. H. Mayer, D. S. Heeschen, J. D. Kraus.

Third Row: G. B. Field, T. K. Menon, C. L. Seeger, L. Woltjer, A. R. Sandage, A. E. Lilley, A. Blaauw, F. D. Kahn, B. F. Burke.

Absent: G. R. Burbidge, J. W. Findlay, C. R. Lynds.

USA - USSR JOINT SYMPOSIUM ON RADIO ASTRONOMY

GREEN BANK, MAY 1967

Otto Struve

Fred Haddock

Cornell Mayer

John Kraus

Edmund Hillery

J. Hillier

Alan H. Barrett

F.D. Kalra

J.K. Menon

George B. Field

Wangfane Wade

C.M. Wade

F.D. Drake

M.W. Swenson, Jr.

J.G. Callender

W.H. Anderson

G. Kowalski

A. Blau

Bennett + Bush

B. Bruntner

D. J. Ables

Rapin

Tommasini

A. Sheffer

B. Comas-Forgas

Allan Sandage

R. Ninkovic

Harold Weaver

L. W. Wilson

A. Klem

Steffen Edmundson

Geoffrey Burdidge

R. Bracewell