

REPORT OF STATUS OF PROJECTS OF THE RESEARCH
COMMITTEES IN PHYSICS, ASTRONOMY AND MATHEMATICS.

NOVEMBER 15, 1920.

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Under the Special Rockefeller grant for the research committees of the Division of Physical Sciences there have been formed in the period between October 1919 and July 1920 sixteen (16) committees in all. Funds have been allocated to these committees which have ranged from \$1500. to the small amounts necessary to pay traveling expenses to cover the railroad fares of some of the members attending a meeting to discuss the feasibility of organizing a research committee. In some instances it was decided not to form committees until after further consideration. Definite allotment of funds, ranging from \$1500. to \$500. each, was made in fourteen cases.

The number of physicists, astronomers and mathematicians associated in these various committees is 93. Since the members are widely scattered from Maine to California the committees have been formed with a view of grouping men, so far as possible, to avoid undue expense in travel to meetings. In one instance an eastern and a western section of one of the large committees have been formed.

The committees have been formed for the discussion of the larger outstanding problems only. They have had in mind the formulation of plans for co-operative attack on these problems, the publishing of their conclusions for the purpose of assisting those interested in the problem who may not be members of the committee, and in presenting the problem to workers who may be engaged in work of a less fundamental character.

Fundamental problems in the following fields are being considered by the appropriate committees:

Physics - Acoustics, Atomic Structure, Electrodynamics of Moving Media, Luminescence, Magnetism, Photo-electric Effects, Physical Methods and Technique, Quantum Theory, Spectroscopy, Thermo-

and Magneto-Electric Effects, X-ray Spectra.

Astronomy - Orbit Theory, Parallaxes.

Mathematics - Algebraic Numbers.

It has been the policy of both the former and the present Chairman of the Division of Physical Sciences to proceed slowly with the formation of these research committees and to husband the fund for the support of what experience may show to be the most promising fields of work and the most productive committees rather than to allot all of the fund to as many committees as might be supported. Because of this policy the work of the various committees listed above is in all stages; from practical completion (in the cases of X-ray Spectra and of Atomic Structure) to the first formulation of plans in the cases of some of the committees recently formed.

Another cause has worked to bring it about that the reports of these committees are not so far along at the end of the first year as may have been anticipated when the project received the support of the Rockefeller board; - The members of the various committees are nearly all college professors whose teaching duties have been very much augmented during the past year because of the unexpectedly great increase in attendance in our colleges and universities. It must be remembered that research in pure science has always been carried on in the free time of the teachers and during the past year there has been less free time for the research worker than in former years. Considering the difficulties, the enthusiasm of the members of the various committees, their attendance on committee meetings and their individual labor on the work of their committees show very clearly that the funds of the Rockefeller grant are being used to supply a real need of the research worker by making it possible for him to meet with his fellow workers. However, during the past year, because of the crowded schedules it has not been possible for the committees to meet so often as it was hoped they might, and the work has progressed less rapidly than was anticipated.

These conditions should be kept in mind in judging the results of the work of the committees. These results are:

Completed: #1. The work of the Committee on X-ray Spectra.

Committee: Duane (Harvard), Chairman, and three other members all active workers in the subject.- Four separate reports already printed or in press for the Bulletin series of the National Research Council. The report of the Chairman, already printed, is almost indispensable to any worker in the field.

Cost for five meetings of the Committee, publication of four monographs in editions of 2000 copies each and distribution of the same will not exceed \$1500.

" #2. Growing out of the work of one of the Committees -(Quantum)-

there has been prepared, published and about to be distributed in an edition of 1200 copies a comprehensive study of the publications which have appeared during the war in enemy and neutral countries on the most recent of the general hypotheses of Physics. This report will serve as a portion of the final report of the Quantum Theory Committee but it has been possible to arrange for its preparation, publication and distribution without the expenditure of any of the Rockefeller Fund.

Nearly Completed: #1. The work of the Committee on Atomic Structure.

Committee: Saunders (Harvard), Chairman, and six other members. The report of the Committee has been prepared by one of the members (Dr. Page, Yale) after numerous meetings of the Committee. If possible this Committee should be kept together even after the publication of its report as its opportunities for usefulness as a committee on the most fundamental question in Science are obvious.

Cost of four meetings and the publication and distribution of the report in an edition of 2000 will not exceed \$1500.

Nearly Completed:

- #2. The work of the Committee on Parallaxes.

Committee consists of nine members.

Final report will consist in the publication (without cost to the Committee) of the list of about fifty stars.

Cost \$1000. This sum is being spent in wages to computers.

- " #3. The work of the Committee on Photo-Electric Effects.

Committee consisting of Millikan (Chicago), Chairman, and four other members, has had several meetings and is preparing a report of about 100 pages. It is estimated that the \$1000. allocated to this Committee will cover the cost of the meetings, the preparation, printing and distribution of the report of the Committee.

- " #4. The work of the Committee on Acoustics.

Committee consisting of Stewart (Iowa) and six other members was organized in February 1920. The cost of the meetings to date has been about \$500. One final meeting will be held the end of December, and the report will be ready for publication very soon thereafter. This report will contain numerous suggestions as to needed research, promising lines of research in Sound. Since the equipment needed for much of this work is already possessed by many of the smaller college laboratories which are not well equipped for work in other lines, it is believed that the report of this Committee will stimulate research work in Physics among both teachers and students of the smaller colleges.

- " #5. The work of the Committee on Luminescence.

Committee consisting of Merritt (Cornell) and three other members

has a report in three parts (about 30 pages) under way which will contain a bibliography of all research work done since the appearance of the classical work of Kayser on the subject. There is little hope that Kayser will bring out a new edition of his work, and therefore this Committee report should meet a need which is very much felt by research workers in this subject. Cost - estimated at \$900. - includes expenses of necessary meetings of Committee, payment of clerical assistance in preparing bibliography, and publishing and distribution charges for an edition of 2000 copies of the report.

Especially Active.

The Committee on Physical Methods and Technique.

Chairman Williams (Columbia) and five other members; although this Committee was only formed in June 1920, its work is progressing very rapidly because of the fact that its members devoted a large portion of their summer vacations to committee work (of course without remuneration). The object which the committee has set itself is the preparation of a manuscript of a book of about 500 pages which will make available to every research worker in physics the many special techniques which have been developed in the various university and technical research laboratories. Entirely without intention these have become almost as restricted as "trade secrets" are and a great deal of valuable time is wasted by research workers (which might be more profitably employed) in discovering over again methods and techniques which some other worker has discovered but failed to describe.

The work of this Committee has consisted largely in visiting institutions which are active in physical research and

obtaining the "trade secrets" of these laboratories, making a critical comparison of the various methods and technique, obtaining short special descriptions of novel features from their authors and preparing the whole for publication under appropriate topics. The chief item in the cost of the work of this Committee is traveling expenses of its members in their visits to the various laboratories. About \$700. has been spent in the last five months and it seems probable that about \$2000. in all will be needed to prepare the volume for publication. There will be sufficient demand for the volume to cover the cost of publication.

The chief items of cost for the maintenance of the committees are: 1st, Traveling Expenses; 2nd, Cost of Publication; 3rd, Distribution. It is possible to give approximate figures for the average cost of the first item from data at hand from the Committees listed in the following table, viz.:

Committee	No. of Members	No. of Meetings	Spent	Cost per Meeting per Member.
Acoustics	7	3	\$475.00	\$23.00
Atomic Structure	7	3	300.00	14.00
Luminescence	3	1	100.00	33.00
Magnetism	5	2	352.00	35.00
Technique	6	4	783.00	33.00
Spectroscopy	5	1	203.00	41.00
X-ray Spectra	4	4	460.00	28.00

It will be seen that the cost per meeting per member is running from \$14.00 to \$41.00 with the average not far from \$30. It seems probable that the average committee will require about five meetings before its report is ready, and^{as} there are about eighty (80) members in all on the active committees the estimate of the entire cost of meetings to complete the work already started is $30 \times 5 \times 80 = \$12,000$.

It is possible to accurately estimate the 3rd item as we know the cost of distribution of each issue of 2000 copies of a bulletin. About fifteen (15) commit-

tees will prepare report so that this item should be in the neighborhood of \$1200.

The second item is more difficult to estimate for the reason that it is impossible to estimate the probable cost of printing more than a month or so ahead, and also it is not possible to tell in advance the exact length of each of the reports. If all are as long as the two now in press (X-ray Spectra and Quantum) the cost of publication would be about \$6,000. (This probably is an upper limit as many of the reports now being prepared in manuscript will certainly be shorter than those in the hands of the printer).

By adding these items we obtain a sum which is about equal to the appropriation for the current year, and since the item of the cost of printing is probably slightly too big there is the assurance that with the funds already provided the work of the committees already formed may be brought to a satisfactory conclusion.

As already stated above, the work will not be completed by the end of the fiscal year (December 31st, 1920) so that if it is decided not to continue the experiment beyond that date funds will have to be allocated to the Committee Chairmen to cover the remaining cost of the Committee work.

The Chairman of the Division of Physical Sciences very strongly urges the officers of the Rockefeller Foundation to continue the experiment beyond December 31st, 1920, for the reason that more committees should be formed (in particular in borderland problems such as those in Bio-Physics), also because the work of a few of the committees already formed, in the opinion of the members of the Division of Physical Sciences, has been so successful that the committees should not be disbanded after their present program is completed but rather should be extended. The Chairman of the Division of Physical Sciences would respectfully urge that the unexpended balance on December 31st, 1920, which may easily be kept above \$5,000., be allowed to revert to the Rockefeller Foundation, and that a grant of \$15,000. for the year January 1, 1921 - December 31, 1921, be made by the Foundation for

the continuance of the project of the Research Committees. In this way the completion of the work already begun will be assured and it will be possible next year to continue those committees in existence which have proved fruitful of work and to add a few new committees in place of some of those whose work will be finished in the course of the coming year.

Respectfully submitted,

Augustus Trowbridge, Chairman,
Division of Physical Sciences.