

# BOSTON UNIVERSITY

July 1, 1960

To: Edward K. Graham, Dean, Graduate School and College of Liberal Arts

From: Robert S. Cohen, Chairman, Department of Physics

Subject: Annual Report for the Department of Physics, July 1, 1960

I wish to submit the following report for 1959-60.

## I. Faculty and Curriculum

### (A) Curriculum at the undergraduate level

1. Introductory courses. All undergraduate teaching laboratories have been satisfactorily equipped this year for the first time. We can now turn our attention to demonstration lecture equipment. Both of these essential tasks have been undertaken by Professor Stipe, with the assistance of Professor Rice and Professor Booth. We should also consider discussion sections for the large introductory course in descriptive astronomy, AS 101, 102. This will require four additional Teaching Fellows. Moreover the anticipated increase in enrollment of students from CMA, SED, and Sargent College during 1960-61 will only partially be provided for in the respective originating college budgets, and hence the entire policy of centralizing physics instruction in an all-University department seems to be in jeopardy. At present this is reflected in the great pressure upon us to provide Teaching Fellows for laboratory and discussion sections, but at some time this pressure will be upon us with respect to regular faculty duties and upon laboratory equipment. A complicating factor is the anticipated entrance of 100 pre-medical students in 1961-62, whose required physics course should be specially developed and staffed from new funds.
  
2. Some revisions have been made in the physics major curriculum. The year laboratory in the course in electricity and magnetism has been condensed into one semester, the second semester being entirely devoted henceforth to the development of electromagnetic theory, PY 205, 206. The optics course, PY 208, has been shifted to the Spring term so that the normal sequence of courses in the junior year will present the electricity laboratory in the Fall term and the optics laboratory in the Spring, the two laboratories using the same room. In addition the previous course in modern physics, PY 301, 302, has been revised so that it will be a fully graduate level course, serving as introduction to quantum theory. Undergraduates will henceforth take a new course in modern physics under the title Atomic and Nuclear Physics, PY 210.

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3. A decided improvement in the calibre of our undergraduate major students has been observed this year. Several have been admitted to excellent graduate schools. Two juniors will probably engage in research during their senior year. The improvement appears to be due mainly to Professor Rice's course in general physics which was introduced in its present form in 1958-59.

(B) Curriculum at the graduate level.

1. The change in the course in modern physics has been noted under (A). Several new courses will be offered during 1960-61. In connection with the new research program utilizing nuclear magnetic resonance phenomena, Professor Rice will offer a course in that subject. Professor O'Neill, in association with Dr. George Parrent, will offer an advanced seminar in modern optics. Visiting Associate Professor Roman will offer a course in modern field theory and the theory of elementary particles. Finally, Professor Siegel and Professor Stipe will initiate a required bi-weekly seminar on current topics in physics to which all M.A. candidates and most Ph.D. candidates will be contributing; we hope that this will instigate lively scientific discussions and the habit of serious reading of the current journals, and we expect that this seminar will make possible some faculty critique of our graduate students' teaching ability.
2. The performance of our Ph.D. candidates in this year's comprehensive examination was decisively better than any in recent years. This is the first group to have taken the examination since the major revision of the graduate course curriculum three years ago and the examining committee has reason to be pleased.
3. Our cooperative arrangement with the Raytheon Company will continue another year.

- (C) Summer Session Curriculum. In accord with experience in 1959, we have offered modern physics and two graduate courses as well as general physics. The enrollment in the graduate courses and in modern physics have been high. We anticipate offering graduate courses in the Summer henceforth. General physics has its normal enrollment of about 60 students and will also be continued.

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## (D) Faculty Research.

1. A number of research grants and contracts have been received or continued:

Professor E.C. Booth, National Science Foundation, grant for research in nuclear physics

Professor G.S. Hawkins, National Aeronautics and Space Administration, grant for research in meteor studies on tektites

Professor G.S. Hawkins, U.S. Air Force, grant for research on meteor dust

Professor G.S. Hawkins, National Bureau of Standards, grant to Harvard College Observatory for radio-astronomical studies of meteors

Professor R.K. Nesbet, National Science Foundation, grant for theoretical studies of molecular physics

Professor Michael Rice, National Institutes of Health, grant for research in nuclear magnetic resonance phenomena in connection with biological problems

Professor Michael Rice, Rebecca Rice Grant, for equipment and services in connection with biophysical research

Professor Armand Siegel, U.S. Air Force, grant for research in statistical physics, and for research on problems associated with the foundations of quantum mechanics

Professor Charles Willis, pending U.S. Air Force grant for research in plasma physics

Professor Robert Cohen, American Council of Learned Societies, grant for research in the history and philosophy of science

and in addition Professor Nesbet has received a Fellowship from the National Institutes of Health for research and study at the Institut Pasteur in the laboratory devoted to applications of wave mechanics to biological problems.

2. Publications:

Booth, E.C., "Nuclear Resonance Scattering of Bremsstrahlung", to be published in Nuclear Physics.

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Subject: Annual Report for the Department of Physics, page four.

- Hawkins, G.S., "A Glossary of Astronomical Terms", Collier's Encyclopedia.
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- Hawkins, G.S., and Southworth, R.B., and Stienon, F.A. J. 64 183 (1959). Recovery of the Andromedids.
- Hawkins, G.S. and Howard, W.E., Ap. J. 130, 1003, (1959). Decay of Light from a meteor train.
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- Cook, A.F. and Hawkins, G.S., Smith. Cont. Ap. 5, 1, (1960). The Meteor Head Echo.
- Hawkins, G.S., A.J. 64, 450 (1959). The Relation between Asteroids, Fireballs and Meteorites.
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- Hawkins, G.S., Astron. Journ. 65, June 1960. Asteroidal Fragments.
- Hawkins, G.S., and Wolfson, S.H., Nature, London, 185, June 1960. Solar Furnace Glass.
- Hawkins, G.S., (Abstract) Cleveland Meeting A.A.S., A.J. 65, 1960. The Redshift.
- Hawkins, G.S., I.R. 40, June 1959. Asteroids, Fireballs and Meteorites.
- Hawkins, G.S., and Lazarus, Donald, I.R. 41, November 1959. Meteor Ionization and the Mass of Meteoroids.
- Hawkins, G.S., I.R. 42, December 1959. Asteroidal Fragments.
- Hawkins, G.S., and Southworth, R.B., I.R. 44, May 1960. Statistics of Meteor Streams.
- Hawkins, G.S., and Wolfson, S.H., Research Report 1, August 1959. A Tektite Research Program.
- Hawkins, G.S., Research Report 3, Nov. 1959. Tektites and the Earth.
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- Hawkins, G.S., Rice, A.H. and Wolfson, S.H., Research Report 5, March 1960. Catalog of Tektites.
- Hawkins, G.S., Lewis, D.M. and Hecks, M.L., Research Report, Radio Meteor Project (Harvard Univ.), Feb. 1960. The Time of Transit of Radiants in the Sensitive Sectors of an Antenna.
- Hawkins, G.S., Boston University Graduate Journal, VIII, 2, Dec. 1959. Space Research.

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To: Dean E.K. Graham  
From: R.S. Cohen  
Subject: Annual Report for the Department of Physics, page five.

- Nesbet, R.K., and Watson, R.E., "Restricted and Unrestricted Hartree-Fock Calculations for Atomic Lithium", *Annals of Physics* 9, 260-271, (1960).
- Nesbet, R.K., Merryman, P., and Moser, C.H., "Lower Excited Electronic States of Carbon Monoxide", *Journal of Chemical Physics* 32, 631-632 (1960).
- Nesbet, R.K., "Ground State Electronic Wave Function of Methane", *Journal of Chemical Physics* 32, 1111-1122 (1960).
- O'Neill, E.L., "Noise, Entropy and Filtering in Photographic Optics", *Proceedings of the Fifth International Commission of Optics, Stockholm (Sweden), August 1959*.
- Siegel, A., "Differential-Operator Approximations to the Linear Boltzmann Equation", *Journal of Mathematical Physics*, in press.
- Warnock, R., "Angular Momentum Expansions in Relativistic Field Theory", *Physical Review*, in press.
- Cohen, R.S., "Alternative Interpretations of the History of Science", to appear in Spanish translation in Antología en la Sociología del Conocimiento, edited by Irving L. Horowitz (University of Buenos Aires Press, Buenos Aires, 1960).
- Cohen, R.S., "Dialectical Materialism and Carnap's Logical Empiricism", to appear in The Philosophy of Rudolf Carnap, vol. XI of The Library of Irving Philosophers, edited by Paul A. Schilpp.

3. My memorandum to the Dean of the Graduate School, dated March 21st, 1960, should be considered a part of this report. I quote here the relevant paragraphs.

In the course of negotiating with prospective new faculty members in the department of physics, I have been led to appraise the nature of the graduate program here in physics. The matter must be put bluntly so that we may make informed choices. We do not have an adequate program of research and teaching in experimental physics at Boston University. We are not merely faced with a danger for the immediate future; rather we must realize

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To: Dean E.K. Graham  
From: R.S. Cohen  
Subject: Annual Report for the Department of Physics, page six.

that at no time have we had an adequate program which could have justified the full doctorate.

Only Professor Edward Booth's investigations in nuclear physics have been supported in recent years. In this case, we have to recognize that his work has been limping badly and that it is overwhelmingly surpassed by experimental nuclear research programs in other medium-sized university physics laboratories. We can expect to receive support from government and private foundations but only when we can offer a sufficient laboratory basis. This has been lacking. We have neither a nuclear research device for producing nuclear phenomena nor the necessary instrumentation and fabricating laboratories to go with a device. We have in fact been entirely parasitic upon the instruments which have been made available from time to time by neighboring institutions.

We will be joined next year by two capable research physicists, Dr. Paul Roman from the University of Manchester in theoretical quantum physics, and Dr. Paul Chagnon from the University of Michigan in experimental nuclear physics. The quality of research undertaken by these men, the calibre of their students, the support which we are able to muster from University and outside sources, and the continuing research of the present faculty as indicated under (1) above, should make 1960-61 a decisive year in the growth of a satisfactory graduate physics program at Boston University.

## II. Reflections.

- RJ
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- (A) The entire graduate program appears to be more successful now than previously, and the research and teaching calibre of the faculty is very high indeed. Nevertheless it seems to me that the graduate program is marginal at best. (See part I-3 above).
  - (B) The status of the faculty in this department is excellent, with respect both to salary and work-load. The morale is good, but it is tempered by realization of the extraordinarily poor facilities, whether measured by large university standards or small private college standards. Without major research instruments, without an

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To: Dean E.K. Graham  
From: R.S. Cohen  
Subject: Annual Report for the Department of Physics, page seven.

adequate machine shop, electronics shop, without funds for supporting research students, without sufficient space for teaching laboratories or research laboratories, we are less well situated than the physics departments in many small colleges. The move into the building at 700 Commonwealth Avenue during 1960-61 should be accompanied by significant improvement in our situation.

- (C) Boston University has a world-wide reputation for research in optics. This arose at the time of the Physical Research Laboratories, but it continues largely due to the work of Professor O'Neill. Naturally we are pleased that he has accepted a full-time position as Associate Professor. I anticipate that we will undertake to bring together a small research group in theoretical optics to join him, and that negotiations during 1960-61 will permit such a group to be formed the following year. With Professor Roman, who has worked in this field, Dr. George Parrent, who collaborates with Dr. O'Neill although himself a member of the scientific staff at the Air Force research center in Bedford, and Dr. Willem Brouwer, now President of the precision optical firm Diffraction Limited and our own lecturer in optics on a part-time basis, Professor O'Neill will be able to consider forming a national center in optics.
- (D) The relative balance of research and teaching in physics seems to me to be good. Furthermore the balance between the major curriculum and the curriculum of courses offered as services to other departments in CIA and to other colleges of the University also appears to be a good one. Naturally we expect that the strengthened undergraduate major curriculum will attract more good students.
- (E) In my report for June, 1959 (page nine), I concluded with the following paragraph which appears to me to be still relevant:

We are particularly weak in experimental physics; we have a quite inadequate library; we have too few undergraduate majors of high capabilities, either as experimentalists or theoreticians; we are unable to attract a sufficiently large number of applications for graduate study to enable us to make a selection, and, related to this, we are dependent

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**To:** Dean E.K. Graham  
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**Subject:** Annual Report for the Department of Physics, page eight.

upon the granting of Teaching Fellowships to maintain a core of capable entering graduate students. These seem to be quite normal problems for a physics department which is in transition from mainly undergraduate teaching to a full range of curricula, degree offerings, and research activities. It is especially necessary to recognize that stimulating and successful teaching at every level from the general education course to the graduate seminar depends upon teachers who are actively engaged in scholarly research. This is one standard that we meet successfully and it should make us reasonably optimistic about the future. Not one of these problems could not be solved by sufficient space and money.

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Robert S. Cohen

RSC/b



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# BOSTON UNIVERSITY

March 21, 1960

**To:** Edward K. Graham, Dean, Graduate School  
**From:** Robert S. Cohen, Chairman, Department of Physics  
**Subject:** Experimental facilities in the Department of Physics

In the course of negotiating with prospective new faculty members in the department of physics, I have been led to appraise the nature of the graduate program here in physics. The matter must be put bluntly so that we may make informed choices. We do not have an adequate program of research and teaching in experimental physics at Boston University. We are not merely faced with a danger for the immediate future; rather we must realize that at no time have we had an adequate program which could have justified the full doctorate.

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I recommend that a special effort be made to solicit funds of approximately \$50,000 so that we might purchase a modest nuclear research device. It is reasonable to expect that contract and research grant support can be expected for subsequent years of use of the device. Moreover the associated income from students and contracts should be seen as a partial amortization of the cost. The alternative seems to me to be a most serious reappraisal of Boston University's concern with pure research in physics, and along with that a reappraisal of the legitimacy of our doctorate program.

I enclose for your information an informal memorandum from Professor Booth which discusses the relevant details.

RSC/b