

Richard M. Millard, Dean, C.I.A.
Richard S. Bear, Dean, G.R.S.

June 20, 1962

Robert S. Cohen, Chairman, Department of Physics

Annual Report of Department of Physics, 1961-62

This has been a reasonably satisfactory year. [We saw one of our best students receive the Ph.D. degree with an excellent, even exciting, thesis (Dr. Nazakat Ullah)], and we had several superior undergraduates graduate this year, among them a man of unusual promise, Mr. Elliot Krefetz. As I wrote a year ago, once again we have more and better graduate students, greatly improved physical facilities, and a faculty which is devoted both to educational responsibilities and to research. I will discuss faculty matters first, then general department problems, then matters primarily relevant to undergraduate affairs, then graduate affairs, and finally the major events of the year for each faculty member.

I. Faculty

A. Dr. Robert K. Nesbet resigned at the end of the academic year to accept an appointment in a research laboratory supported by the IBM Corporation at San Jose, California. His loss is severely regrettable for he has been intimately concerned with the development of the new graduate curriculum and atmosphere over the past 6 years.

Dr. Alan Woodcock has resigned as lecturer. He taught general physics for many years in our evening program.

Dr. Abner Shimony will return to his position at M.I.T. after a year as assistant research professor associated with Professor Siegel. During this year he completed his second doctorate, one in theoretical physics at Princeton.

Mr. David Kelland has resigned as laboratory curator to accept a position as instructor of physics at Simmons College. He will continue as a graduate student studying for the doctorate here.

B. Professor Paul Roman has returned as regular member of the faculty after a year at the University of Manchester. He is now a permanent resident of the United States.

In addition to our good fortune in having Roman, we are also very pleased about the appointment of assistant professor Bernard Chasan, and associate professors Mendel Sachs and John Moffat. Chasan is a young experimentalist in nuclear physics who has come to us from Harper College. Sachs works in theory of the solid state and also in foundations of quantum theory, and comes to us from the University of Montreal. Moffat is a theorist working in elementary particle physics at present and comes to us from the RIAS, Research Institute for Advanced Studies, in Baltimore.

Boston University now has an unusually fine group of research scientists in theoretical physics: Moffat, O'Neill, Roman, Sachs, Siegel, Willis.

II. General Department Problems

A. We are still lacking sufficient faculty in experimental physics. I hope that we can rectify this within the next year or two. There are very few experimentalists of high calibre who are willing to initiate their own and necessarily fairly small research programs in a relatively modest department. The appointments of Professors Franzen and Edmonds last year and of Professor Chasan this Spring, despite their undoubted importance in making our doctorate program feasible at all, still leave us with an unbalanced department. We need at least one more experimental program, involving one or two regular faculty, in order to provide normal diversity for our students and for ourselves.

B. The interest in astronomy and astro-physics continues to grow. Professor Hawkins cannot carry complete needs of graduate students, undergraduate majors in physics and astronomy, and undergraduate non-science majors, and with all this continue to carry out his several research programs. I will recommend the appointment of an additional faculty member in astronomy for 1963-64, and the addition of ~~4~~ four semester courses and one graduate course in various topics of astronomy and astro-physics.

C. I repeat from previous annual reports: Unlike every physics department known to our faculty we do not have a well equipped lecture room, suitable for scientific demonstration lectures, well lighted and able to hold 300-350 students in comfort. We now have 8 undergraduate courses, meeting at various hours of the academic year, including evening, which require such a lecture hall. We cannot provide the small preparation room adjacent to room 50 in the Stone Chemistry Building with the full range of demonstration equipment needed for these various courses. That preparation room is too small, most of the needed equipment is also needed in other courses and laboratories, and the time available to prepare demonstrations is severely limited due to the extraordinary number of courses which meet in room 50. Room 50 would be completely used, if we were to withdraw all of our needs for it. As a result of these circumstances, our undergraduate introductory courses, despite careful lecture preparation and fine text books and associated laboratory work, are the weakest of our curriculum in physics. The overwhelming majority of physics departments, including those in very small and very poor liberal arts colleges, teacher colleges, and junior colleges, have lecture facilities with spacious preparation rooms, which are far superior to ours, and almost always these lecture rooms are conveniently adjacent to the general physics equipment storage rooms. We badly need a lecture room to be constructed at the Physical Science Center, either as a wing projecting over the parking facilities or as a third floor.

by astrophysics *EWLN*
^

D. Budgetary Problems. [We are still limited by budgetary problems. We should pay a larger stipend to teaching fellows for we are competing with dozens of similar institutions for a quite limited number of able students. The new raise in stipend to \$2000 merely places us at the minimum in the national average for physics appointments.

We are sorely limited by the available funds for research, particularly the lack of any funds for appointing research assistants. We have had excellent response to applications for outside grants but we need further funds, for those projects where grants are unavailable or insufficient, and especially for research projects where immediate construction and activity are urgent. We are also severely limited by the lack of funds for secretarial assistance; here I have barely managed to piece together fractional amounts from various grants and special funds, but these have been stretched to the limit or even beyond. The faculty's research productivity is great and the needs for educational assistance are also great. The one secretary provided by CLA simply cannot provide the work for an active faculty of 17 teachers of whom 15 are engaged in research. Surely the doubling of the faculty, and the increase in research will have to be accompanied by allotments of secretarial funds by the University.]

E. Finally, it would be a matter of very great convenience generally, and of enormous urgency on certain occasions, if there were provided a small amount of cash money to be accounted for as petty cash disbursements are now. This should be linked with some kind of chairman's discrepancy fund, altogether perhaps an allotment of \$200, on a revolving basis.

III. Affairs Relevant to Undergraduates.

A. For some time, the course in Optics, FY 208, has been taught by a regular faculty member (Edmonds).

B. The experimental course for the 6 year CLA-MED students (FY 121-122) suffered a severe change of plan and faculty in early December 1961 at the joint decision of Dean Millard and myself. Professor Stipe has assumed direction of this new course for 1963-64.

C. A small group of the faculty has devoted several months to discussion of the undergraduate curriculum for physics majors. We hope that a new program of studies will be submitted to the Academic Policy Committee of CLA next winter for initiation in 1963-64, or possibly in late Spring for initiation a year later. Meanwhile, Professor O'Neill will offer the General Physics Course for science majors (FY 201-202) in 1962-63. His experience then, together with that of Professors Hawkins, Rice, Stipe, Prenowitz, and Cohen will be decisive in the new curriculum. The need for this is to be found in our unmanageable over-lap between present first year graduate courses and senior undergraduate courses, as well as in the impossibility of covering all the expected material in the present one year General Physics Course.

D. There has been a furor within several CLA committees over the science distribution requirement and especially over the value and role of Physical Science (FY 101-102). Several sides of these disputes are represented within the Physics faculty with little likelihood of agreement. I recommend that the Dean take an active part in settling general education policy in the sciences, including both a realistic appraisal of practical interests involved as well as a comparative and sympathetic analysis of the different assumptions and theories of education which are at issue.

E. Professor O'Neill wrote a brochure about physics for distribution to high school seniors last fall. In addition, a committee of science chairmen joined with Dr. Warner in preparing a general science brochure. These brochures are necessary but it still appears to be a most difficult problem to bring knowledge of the improved status of the sciences at Boston University to the attention of high school advisors, parents, and high school students.

F. Physics department courses of service to other departments and schools in the University continue at a high intensity. All students in Sargent College take a course in this department and many hundreds in SED and CBA also. Furthermore all students in CIT's aeronautical engineering program take our general course designed for science majors. The principal University service and income from physics probably derives from the teaching activities of a minority of the faculty who teach these introductory courses, including those administered through DCE and SUM.

IV. Graduate Affairs

A. Aside from the addition of several faculty members and initiation of their experimental work by Professors Edmonds and Franzen, the major change in the graduate activities are the approval of several new courses: an advanced course in solid state physics, a nuclear physics laboratory administered apart from the course in nuclear theory, a course in physics of the upper atmosphere, an advanced seminar in optical and magnetic resonance phenomena (Franzen and Rice), a similar seminar on fields and particles (Roman), and a seminar on the history of philosophies of nature (Cohen, offered in the philosophy department).

V. The following is a list of faculty activities for 1961-62 including publications:

A. Booth

Bull. Amer. Phys. Soc. 7, 33 (1962).

Resonance Scattering of Bremsstrahlung, Nuclear Physics 3 (in press).

Appointment as Research Associate, Department of Electrical Engineering, MIT.

B. Franzen

"The Generation of Uniform Magnetic Fields by Means of Air-Core Coils",
Rev. Scient. Inst. (in press).

Received research grant from the N.S.F. Oct. 1, 1961.

Elected to Board of Editors of the Rev. of Scientific Instruments for a
3-year term on Jan. 1, 1962.

Delivered colloquium talks at Lincoln Laboratory Oct. 1961,
Simmons College Feb. 1962.

Addressed research seminar of the Spectroscopy Laboratory of MIT Nov. 1961.

C. Hawkins

- Splendor in the Sky, Harper and Brothers, New York 1961.

- Satellite Environment, Handbook, Stanford Univ. Press, Review, Sky &
Telescope, 23, 100, 1962.

Proc. Lunar and Planetary Exploration Colloquium, North American

Aviation, 2, 5, 1961, 'Asteroidal Fragments'

(In press) Smithsonian Cont. Ap. 1962, The Harvard Radio Meteor Program

(In press) Smithsonian Cont. Ap. 1962, The Initial diameter of meteor trails.

Southworth, R. B., and Hawkins, G. S., (In press) Smithsonian Cont. Ap.

1962, The Statistics of Meteor Streams.

Lazarus, D. H., and Hawkins, G. S., (In press) Smithsonian Cont. Ap. 1962,

Ionizing Probability and Meteor Mass.

- Nuovo Cimento, 23, pp. 1104, 1962, The Nature of the Redshift.

- Cook, A. F., Hawkins, G.S. and Stienon, F.M., Meteor Trail Widths, *A.J.* 67,
158, 1962.

(In press) A. J. 1962, Radar determination of meteor orbits.

Final Report 1957-61, National Bureau of Standards, Contract CST 7282.

Research Report 13, April 1962, NSF Grant 20135, Radar determination of
meteor orbits.

Lectures: Belmont Rotary Club - Sept. 10, 1961.

Simmons College - Nov. 7, 1961

Harvard College Open Night - Nov. 7, 1961

Medical & Dental Assoc., Hartford, Conn. - Nov. 13, 1961

WGBH TV, Program "I've Been Reading", book review, Splendor

In the Sky - Oct. 16, 1961

WMAI, Northeastern University Program "Careers in the Sciences" -

Dec. 7, 1961.

Wheelock College - Jan. 16, 1962.

The Cruising Club, New York - Jan. 19, 1962.

E.U. Alumni Club, Lowell, Mass. - Feb. 28, 1962.

International Student Center, E. U. - March 7, 1962.

E.U. Club of the North Shore, Salem, Mass. - March 13, 1962.

College Clubs and the American Association of University Women,
Salem, Mass. - March 20, 1962.

Boy Scouts, Lexington, Mass. - March 27, 1962.

Air Force Cambridge Research Center, Colloquium - March 29, 1962.

Symposium address, American Astronomical Assoc. April meeting -
April 2, 1962.

D. Nesbet

- Approximate Methods in the Quantum Theory of Many-Fermion Systems,
Revs. Modern Phys. 33, 28 (1961).
- Molecular Model of the Heisenberg Exchange Interaction, Phys. Rev. 122,
1497 (1961).
- Quadrupole Moment of Li^7 and Quadrupole Coupling Constant of Li^7 .
Phys. Rev. Letters 6, 549 (1961). With S. I. Kahalas.
- A Calculation of the Potential Energy Curves for Some Electronic States of
Carbon Monoxide. J. Chem. Phys. 34, 1950 (1961). With H. Lefebvre-
Brion and C. M. Moser.
- Sur l'énergie de protonation des aza-dérivés des hydrocarbures conjugués
alternants. C.R. Acad. Sci. (Paris) 252, 2890 (1961). With S. Bunel,
O. Chalvet, R. Daudel, and F. Paradejordi.
- Ultra-Violet Spectra of Carbon Monoxide, J. Chem. Phys. 35, 1702 (1961).
With H. Lefebvre-Brion and C. M. Moser.
- Construction of Symmetry-Adapted Functions in the Many-Particle Problem.
J. Math. Phys. 2, 701 (1961).
- Theory of Superconductivity I. Electron-Lattice Interaction. Phys. Rev.
(1962). In press.
- Approximate Hartree-Fock Calculations for the Hydrogen Fluoride Molecule.
J. Chem. Phys. 36, 1518 (1962).
- Theory of the Heisenberg Exchange Interaction. Proceedings of the Inter-
national Conference on Magnetism and Crystallography, Kyoto, 1961.
- Interaction of Two Ethylene Molecules. Molecular Physics 5, 63 (1962)
- Two-Electron Heisenberg Exchange Interaction Between Neighboring Atoms.
Phys. Rev. 125, 1978 (1962). With A.J. Freeman, and R.E. Watson.
- Lectures: Applications of Group Theory in Quantum Mechanics. Institut
Henri Poincaré, Paris.
- Theory of the Heisenberg Exchange Interaction.
The Mathematical Institute, Oxford.
Bell Telephone Laboratories.
Chemistry Department, Duke University
Westinghouse Research Laboratory, Pittsburgh.
IBM Research Laboratory, San Jose, California
- Electronic Structure of the Hydrogen Fluoride Molecule
Chemistry Department, Princeton University.
Solid State & Molecular Theory Group, MIT.
- Construction of Symmetry-Adapted Functions. Centre de Mécanique
Ondulatoire Appliquée, Paris.
- Ab Initio Calculation of Properties of Atoms and Small Molecules.
Chemistry Department, Harvard University.
- Theory of Superconductivity
Solid State and Molecular Theory Group, MIT
Low Temperature Seminar, MIT
IBM Research Laboratory, Yorktown Heights, New York.
Physics Colloquium, Boston University

E. O'Neill

- Completed editing of the July 1960 General Electric Symposium "Communication and Information Theory Aspects of Modern Optics" - July 16, 1961
- Physics Today - "Coherence Properties of Electromagnetic Radiation", the Rochester Conference with I. Bradley.
- Co-author "On the Desirability of Establishing a National Institute of Modern Optics" - a memorandum submitted to the Optical Society of America at their Fall Meeting in Los Angeles.
- Completed editing booklet "Careers in Optics" for Optical Society of America. Feb. 1962.
- "The Role of Phase in Image Formation" with A. Walther submitted to Optica Acta - May 1962.
- Completed book "Introduction to Statistical Optics"; (to be published 1963). A series of 6 lectures at MIT (Research Lab. for Electronics) "Statistical Optics and Coherence Theory" - Fall 1961
- Series of lectures at Vidya, ITEK, and IBM in the Palo Alto, California area on "Statistical Problems in Image Formation". Oct. 1961
- Invited lecture - "Statistical Optics" at Johns Hopkins Applied Physics Laboratory - Nov. 1961
- Invited lecture - "The Role of Entropy in Coherence Theory" IBM Laboratory, Endicott, New York - Jan. 1962.
- Invited lecture - "Probability and Information Theory in Physics" at Simmons College - Feb. 1962
- A series of lectures at the University of Rochester on O'Neill book "Introduction to Statistical Optics" - April 1962
- Invited lecture - "Spatial Filtering in Optics" at Northeastern University - May 1962

F. Rice

Colloquium talk at Simmons College.

G. Roman

- "On the Gauge Invariant Theory of Elementary Particle Interactions" Nuovo Cimento 21, 747, 1961.
- "Correlation Theory of Stationary Electromagnetic Fields, Part IV: Second Order Conservation Laws." Nuovo Cimento, 22, 1005, 1961.
- "Some Implications of the Second Order Conservation Laws in the Correlation Theory of Electromagnetic Fields." Scientific Report No. 3, AF 19 (604) - 8022, 1961.
- Conference paper: "On some recent developments in the correlation theory of stationary random electromagnetic fields." (Symposium on Electromagnetic Waves and Antennas, Copenhagen.
- Contract with Addison-Wesley Publishing Co. to write a book on Advanced Quantum Theory (approx. $\frac{1}{2}$ ready)
- Reviews written for Mathematical Reviews
- Lectures and seminars given at the University of Manchester, England):
- Advanced Quantum Theory (course)
 - Introduction to Quantum Field Theory (course)
 - Recent developments in the theory of elementary particles (seminar)
 - Hyperon and meson resonances (seminar)

H. Siegel

- "Expansion of the Linear Boltzmann Operator" Progress of Theoretical Physics, Vol. 25, p. 1049 (1961).
- "A New Expansion of the Differential Operator for the Time Development of Fluctuation Distributions" Rarefied Gas Dynamics, Acad. Press., 1961
- "Re: 'Dialogue on Higher Education': Prepare the World Citizen" Bostonia, Summer 1961.
- "The FAS and the 'Feasibility of Nuclear War'", Federation of American Scientists Newsletter, Jan. 1962.

Lectures:

- "Security and Secrecy", Community Church of Boston, Feb. 28, 1962.
- "Social Responsibility of the Scientist", B.U. Hillel Foundation, March 14, 1962.
- "Arms Races: Forces Pro and Con" (Panel Participant), B.U. Students for Peace, May 3, 1962.

I. Stipe

At tail end of text - publishers expect to be in galley proof in the Fall.
Will attend Conference on Lunar Exploration - August 13-17, 1962.
Judge in State Science Fair finals.

J. Willis

Bull. Am. Phys. Soc., 6, 245 (1961).

Bull. Am. Phys. Soc. 7, 91 (1962).

Physics of Fluids 5, 219 (1962) "Kinetic Equation for a Plasma."

"Approach to Equilibrium of Quantum Mechanical Ensembles", to be published in Phys. Rev., 127, 4.

"Quantum Mechanical Liouville Equation for a System in Contact with a Thermal Reservoir", to be published in Phys. Rev.

Bull. Am. Phys. Soc., April, 1962, 7, 266.

Work in progress:

- Dispersion law for sound waves.
- Generalization of the Fluctuation Dissipation Theorem to the Stationary State.
- Solutions of our equations for dynamical shielding (see publication Physics of Fluids, above)
- Greens function formulation of our collective variables (see publication Physics of Fluids, above)

Colloquia:

- "Irreversibility" given at Lincoln Laboratories.
- "Approach to Equilibrium of Quantum Mechanical Systems" given at B.U.
- "Quantum Mechanical Master Equation" given at Yeshiva University.

K. Cohen

- Lectures, NSF Summer Institute in History & Philosophy of Science,
American University, Washington, D. C., July 1961
- Chairman of Boston Colloquia for Philosophy of Science
- Continuing on National Council of Emergency Civil Liberties Com.
- Member of Regional Com., National Woodrow Wilson Foundation, Dec. 1961-
Jan. 1962.
- June 1961 - Member of International Conference on Induction at Wesleyan
University, Middleton, Conn. (proceedings to be published Fall 1962).
- Sept. 5-9, 1961 Member of Conference on the History of Concepts of
Matter, University of Notre Dame (Contributed 2 papers; proceed-
ings to appear Spring 1963).
- October 3 Lecture "Kant's Theory of Knowledge" - MIT Humanities faculty
Seminar on Philosophy of Science at MIT - Fall Semester
- Series of lectures on History of Science at the Cambridge Center for
Adult Education - Winter Term
- Lecture, "Scientific Method in Psychoanalysis", Society for Medical
Psychoanalysts, N. Y. Academy of Medicine, New York, Oct. 1961
- Member of Executive Committee of Boston Area Faculty Group on Public Issues
- Lecture, "What is the Philosophy of Science?" given at Simmons College,
Nov. 14, 1961
- Lecture: "Why are Some Civilizations Scientific?"
Annual Meeting of American Association of Physics Teachers, Univ. of
Conn., Storrs, Conn., Nov. 18, 1961
Dartmouth College, April 5, 1962
Mt. Holyoke, April 17, 1962
- Lecture: "What is Nuclear Warfare?"
Payson Park Church, Belmont, Mass.
Debate (with Professor Thomas Shelling) at Harvard Medical School
B. U. Students for Peace, Feb. 9, 1962
Brockton Ministers Assoc., March 13, 1962
Temple Emanu-el, Marblehead, Mass.
- AAAS Conference, Denver, Colorado, Dec. 1961: 2 commentaries
Science and Ethics
Theory of Measurement in Quantum Mechanics
- Two lectures: Yale Medical School - January 25, 1962 "What is Science?
What is an Explanation?"
March 15, 1962 "Unity of the Sciences."
- Lecture at Merrimack College, North Andover, Mass.
- University Visiting Scientists Program of American Institute of Physics -
March 5-6, 1962
- Lecture: "Philosophy of Communism" given at Community Church, Boston -
March 19, 1962.

Cohen (cont.)

Lectures at Texas A. & M. College (College Station, Texas) , University
Visiting Scientists Program of American Institute of Physics, March 1962.

Lectures at Tuskegee Institute, Tuskegee, Alabama, Visiting Scientists
Program of American Institute of Physics, March 1962.

Commentary: Scientific Method and Pavlov's Theories, Harvard Medical School

Lecture: Hegel and Marx given at Wesleyan University, Middleton, Conn., March 1962.

Lectures: "The Logic of Relativity" and "The Nature of the Uncertainty
Principles" , April 17-18, 1962, Mt. Holyoke, South Hadley, Mass.

Lecture: An Appreciation of Ernie Meyerson, Colloquium on History of
Science at Harvard, April 24, 1962

Commentary: "Conventionalism in Physics and the Duhem Hypothesis"

Boston Colloquium for Philosophy of Science, April 26, 1962.

"Science and Religion", BU Religious Students Assoc., debate with
Professor H. de Wolf

Appointed Visiting Fellow: Polish Academy of Sciences in the Institute
of Philosophy and Sociology, Warsaw, Poland, and received supplementary
fellowships from International Affairs Program of the Ford Foundation
and from the Louis M. Rabinowitz Foundation (tenure; Fall 1962)

Invited to lecture in Philosophy of Science at the Universities of
Belgrade, Sarajevo, and Zagreb, by the Yugoslav Philosophical Assoc.
(tenure; late Spring 1963)