Chapter Eleven

NSF Science Development Grant
Peter Weiss (1964-1972)

Rutgers University

In the 1960's the University flourished under the leadership of its popular President, Mason Gross. It was a time of phenomenal growth in the academic programs. The number of doctoral programs increased from 29 to more than 50, and there was a significant enhancement of research opportunities with substantial federal grant support.

The decade was also a time of political action and social awareness connected with black student demands and student protests over the Vietnam War. President Gross was a voice of calm and reason in those turbulent times. He took an unpopular stand on academic freedom when he refused to dismiss a member of the history faculty, Eugene Genovese, for proclaiming that he would welcome a Vietcong victory in the struggle in Southeast Asia. His action in defense of academic freedom was recognized by the American Association of University Professors, which presented the University with the ninth annual Meiklejohn Award in 1966.[1]

There was a major building program at the University, made possible by State bond issues in 1959, 1964, and 1968, which provided a total of $162 million for construction at the University. There were new building projects on every campus. By 1964, there were more than twelve thousand full-time undergraduate students. In that year, Rutgers acquired 540 acres of the former Camp Kilmer army base, which provided an opportunity to establish a new college for the projected increase in student enrollment.[2]

The proposal to establish a new college opened for discussion the question of the academic structure for the undergraduate colleges in New Brunswick. Until 1957 the Colleges of Arts and Sciences, Engineering,

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[1]"Presidents," *Journal of the Rutgers University Library*, v. 53, p. 34, June 1991.
[2]Ibid., p. 33, 34.

Agriculture, and the School of Education had been referred to collectively as the Colleges for Men. In 1957, while Mason Gross was Provost, the term "Colleges for Men" was replaced by "Rutgers College" in the new *Catalogue*, without fanfare or explanation. At that time, Gross put forward a plan for the reorganization of the University, suggesting that the "Colleges for Men," renamed "Rutgers College," had shared interests, such as the intercollegiate athletic program, the Commons, the dormitories, and the program of student life. No formal action was taken on his proposal.[3]

Following the decision to establish a new college at the Camp Kilmer site, there was considerable discussion about the academic structure for the new and old colleges. Committees focused, in particular, on the question of whether each college would have its own faculty, or whether there would be single disciplinary departments serving the various colleges. Douglass College had important input, strongly favoring the continuation of academic departments within the colleges. At that time, the single disciplinary Department of Physics was somewhat of an anomaly. There was also contention about whether the Federated College Plan that was being developed would be a federation of residential liberal arts colleges, or a federation of multi-purpose colleges.

Following a number of committee reports and considerable faculty discussion, President Gross, at a meeting in February 1967, obtained the approval of the Board of Governors for a Federated College Plan. In September 1967, Henry Winkler was named Dean of the Faculty of Liberal Arts, and Arnold Grobman was made Dean of Rutgers College. The newly constituted Rutgers College Faculty met for the first time in December 1967. Disagreements arose over the formula for representation, and in November 1969, the College of Agriculture and Environmental Science faculty walked out, never to return. By September 1970, there was official recognition that the professional colleges had resumed full autonomy. With this somewhat shaky Federated College Plan in place, Livingston College, the new college on the Camp Kilmer site, opened in 1969, with Physics Professor Ernest Lynton as its first Dean. Livingston College came to be associated, in the minds of some, with turmoil and

[3]McCormick, *Academic Reorganization in New Brunswick*, 3-35.

tension, reducing the earlier enthusiasm for creating additional experimental colleges at the Camp Kilmer site.

In 1968-69 seven New Brunswick Departments were organized, in addition to the New Brunswick Physics Department, which already existed. The following year there were no new New Brunswick Departments, and by the end of the year there were indications that the Federated College Plan was falling apart. In January 1970, Dean Winkler began a six-month replacement for Provost Schlatter, and never returned to the position of Dean of the Faculty of Liberal Arts. By 1971 the position Dean of the Faculty of Liberal Arts had withered away, and the Federated College System was nearly defunct.[4]

Mason Gross retired in 1971, and died in 1977, at the age of sixty-six. The Board of Governors selected Edward J. Bloustein (1925-1989) as the seventeenth President of Rutgers. Like President Jones, Bloustein had been President of Bennington College before coming to Rutgers. He was a native of New York City, served in the United States Army, attended Oxford University as a Fulbright scholar, and went to Cornell where he earned a Ph.D. in philosophy and a law degree. After a stint as law clerk, he served on the faculty of the New York University Law School before going to Vermont as President of Bennington College.[5]

Before coming to Rutgers, Bloustein was approached by physicist George Horton for help in starting the Rutgers Community Health Plan, the first HMO in New Jersey. This effort turned out to be very successful, and Horton eventually received credit for an important contribution to the community. A year after Bloustein came to Rutgers, Rutgers College finally became coeducational, in a change that was long overdue. One year later the University made a commitment to move its sports program up to division 1a, a decision that was both supported and criticized by faculty members.[6]

The faculty had first proposed the transformation of Rutgers College to a coeducational college in 1881, and the Board of Trustees rejected that proposal. The question of coeducation was raised again, and

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[4]"Presidents," *Journal of the Rutgers University Library*, v. 53, p. 33, 34, June 1991; McCormick, *Academic Reorganization in New Brunswick*, 3-35.

[5]"Presidents," *Journal of the Rutgers University Library*, v. 53, p. 36, June 1991.

[6]Physics Department Archives.

rejected, prior to the establishment of N.J.C. in 1918. In 1968 the Planning Committee of Rutgers College proposed a resolution favoring coeducation, and calling for the admission of 250 women in the fall of 1969. The faculty approved the resolution unanimously with one abstention. There was considerable discussion of the proposal, with some initial opposition from the Rutgers College students, and considerable opposition from faculty and students at Douglass College. In October 1970, the Board of Governors rejected the proposal to admit women to Rutgers College, but reversed itself the following year, and 475 women were admitted to Rutgers College in the fall of 1972. By 1975 there were 2,638 women students at Rutgers College.[7]

Under President Bloustein, the Federated College Plan was renovated and revived as an element in a major reorganization of the administrative structure of the University that was approved by the Board of Governors in March 1972. Provosts were created in New Brunswick, Newark, and Camden. The New Brunswick Provost had general jurisdiction over the academic affairs of the colleges in New Brunswick. Kenneth Wheeler, formerly Dean of University College, was appointed Provost in New Brunswick. He announced that the New Brunswick Chairpersons would report to the Provost, as well as all the College Deans. Wheeler became something like the Dean of the Faculty of Arts and Sciences in the earlier plans.

There were some changes in the Federated College Plan, allowing students to take any course in any college, and to take a major in another college, if it was not offered in his own college. There came to be a total of 27 New Brunswick-wide Departments. There also continued to be review, debate, and controversy about the Federated College Plan for the next several years.

During this period, the Rutgers Chapter of the American Association of University Professors (AAUP) was an active voice in University affairs. Members of the Physics Department were active in the AAUP. Robbins, Kruse, and Horton, each served for a year as President. Peter Lindenfeld was active on various committees, and Paul Leath was instrumental in drawing up a proposal for a more flexible faculty salary scale at Rutgers, that was soon adopted. The State of New Jersey passed

[7]Poulson, *A Quiet Revolution*.

legislation enabling faculties at the State institutions of higher education to select collective bargaining agents if they so desired. The faculty at Rutgers became one of the first faculties at a major university in the United States to become "organized", voting to make the AAUP its collective bargaining agent.

The AAUP entered into a new relationship with the Rutgers Administration, bringing some dissension into that relationship. During an early collective bargaining process, the faculty orchestrated a vote of no confidence in President Bloustein. Faculty grievance committees took on a more important role. The AAUP, however, is generally credited with having advanced faculty salaries at Rutgers, although a very significant advance in faculty salaries had occurred just prior to collective bargaining. Allen Robbins was President of the AAUP at the time when the salary scale at Rutgers was advanced from the level of C to A on the AAUP salary scale.[8]

Physics and Astronomy

Figure 36 Peter Weiss

In 1964 Peter Weiss replaced Henry Torrey as Chairman of the Physics Department. He was the fourth member of the MIT Radiation Lab-

[8]Physics Department Archives.

oratories group to serve as Chairman of the Department, following Dunnington, Whitmer, and Torrey. While Peter Weiss was Chairman, the NSF Science Development Grant came to have a great impact on the development of the Department.

There was considerable change in the composition of the faculty during the period in which Weiss was Chairman. In 1964 Elihu Boldt left the Department after six years, going to the Goddard Space Flight Center at Greenbelt, Maryland. Several new faculty members joined the Physics Department in the fall of 1964. John G. Taylor was hired as Professor. He had a remarkable record of publications and was a recognized leader in mathematical physics. In his first year in the Department, he generated considerable interest in his field from graduate students and faculty. Frederick Eisler came as Associate Professor to join the high-energy physics group, and Jorrit DeBoer came as Assistant Professor to work in experimental nuclear physics. David Harrington came as Assistant Professor to work in high-energy theory, Dermot Bredin became Lecturer, working with the experimental nuclear physics group, and Toshihiko Tsuneto came for a year as Visiting Professor to work in solid-state theory.

In the fall of 1964, there were 28 full-time faculty members in the Physics Department. These included: Eisler, Meyer, and Plano in high-energy physics; Bredin, deBoer, Koller, Kruse, Robbins, and Temmer in nuclear physics; Carr, Torrey, and Weidner in magnetic resonance; Lindenfeld, Lynton, McLean, Rothberg, and Serin in solid-state physics; Barshay, Harrington, Rockmore, and Taylor in high-energy theory; Abrahams, Horton, Tsuneto, and Weiss in solid-state theory; and Dunnington, Freeman and Wigner in instruction.

Considerable attention was given to the undergraduate and graduate programs. A revised undergraduate curriculum was introduced in 1964-65, providing for a new three-semester introductory course for physics majors. The upper-level undergraduate physics courses were also revised. The laboratory parts of the upper-level modern physics course were revamped and modernized with the help of a grant from the NSF and from University funds. Another NSF grant facilitated improvement of the laboratory for the introductory Analytical Physics course. An honors program was initiated, involving six of the physics majors. In addition, the graduate curriculum was changed to reflect, more accurately, the various fields of research in the Department, and to try to get the graduate students

started on their thesis research sooner. Ten Ph.D. degrees were awarded to physics graduate students at the June commencement.

Figure 37 Physics Department in 1965

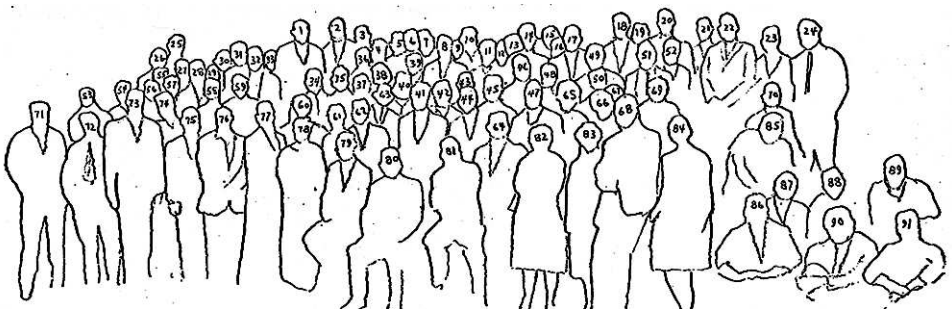

Figure 38 Legend for Picture of Physics Department in 1965

1. L. Dubeck; 2. D. Brinkmann; 3. T. McConville; 4. L. DelVecchio; 5. A. Demko; 6. J. Harris;
7. R. Cohen; 8. D. Bredin:, 9. S. Fiarmin; 10. R. Wessely; 11. L. Cole; 12. E. LaBelle;
13. G. Siemons; 14. J. Brown; 15. A. Tomka; 16. A. Ahlstrom; 17. R. Flam; 18. A. Fiory;
19. G. Lenskold; 20. J. TenEyck; 21. D. Boyd; 22. J. Trefny; 23. A. Kleinfeld; 24. L. Larsen;
25. P. Freud; 26. E. Frankel; 27. H. Fenichel; 28. P. Kramer; 29. R. Ehrlich; 30. M. Helke;
31.D. Hays; 32. S. Skalski; 33. J. Yurdin; 34. G. Lenz; 35. M. Rabin; 36. B. Teitelman;
37. L. Feldman; 38. J. Feldman; 39. B. Maxfield; 40. H. Blech; 41. T. Kruse; 42. W. Worobey;
43. C. Feldman; 44. G. Temmer; 45. S. Dolce; 46. C. D'Ambrosio; 47. E. Ludwig; 48. O. Dunai;
49. J. Simon; 50. P. Stoler; 51. S. Marateck; 52. E. Kanegsberg; 53. N. Cadmus; 54. W. Cutting;
55. T. Cole; 56. R. Dickerson; 57. R. Soulen; 58. T. Greenslade; 59. J. Karra; 60. D. Brown;
61. A. Gerve; 62. R. Plano; 63. D. Markowitz; 64. B. Serin; 65. M. Wilson; 66. K. Knolmayer;
67. D. Krishnamurthy; 68. G. Horton; 69. R. McConnell; 70. R. Feldman; 71. G. Rothberg;
72. E. Lynton; 73. A. Robbins; 74. G. Hunter; 75. W. Derby; 76. A. Hornbeck; 77. G. Huested;

78. M. Gunawardene; 79. P. Weiss; 80. H.Torey; 81. R. Weidner; 82. D. Miller; 83. N. Bosov; 84. N.. Koller; 85. E. Wilson; 86. H. Carr; 87. P. Lindenfeld; 88. C. Latham; 89. M. Kuc; 90. R. Longley; 91. M. Altman.

In 1965 Peter Lindenfeld proposed, and received approval for, new degree programs, Master of Arts for Teachers (MAT) and Master of Science for Teachers (MST). These programs were designed for secondary school teachers who wished to earn an advanced degree by further study concentrated in their teaching field. The programs provided greater flexibility in courses, including a larger number of undergraduate courses. In the same year, the NSF sponsored an in-service institute for secondary school teachers of physics. Peter Lindenfeld taught a course in solid-state physics in that institute, and Richard Weidner taught a course in advanced experimental physics.

In 1965 Henry Torrey returned from a year's leave of absence to become Dean of the Graduate School, and Ernest Lynton became Dean of the new Livingston College. Mary Wigner, who came to the Douglass College Physics Department in 1959, and who had joined the combined College of Arts and Sciences Physics Department in 1961, ended her service at Rutgers after six years. Antonio Pagnamenta joined the Department as Assistant Professor in high-energy theory and mathematical physics.

There were additions to the computer systems in the Department. The National Science Foundation, Bell Telephone Laboratories, and Rutgers supported a $600,000 SDS Sigma-7 computer system for use at the tandem Van de Graaff accelerator. The NSF also supported additions to the DEC PDP-6 computer system for high-energy physics research. The total values of the new computing facilities in the Physics Department were in excess of $1,000,000.

In 1965-66 the undergraduate program for physics majors was expanded with the addition of a second-year course, modern physics. An undergraduate physics club was initiated, with David Harrington as faculty adviser. The undergraduate physics majors included 14 in the class of 1966, 18 in the class of 1967, 23 in the class of 1968, and over 40 in the class of 1969. Planning was begun on the design of a new building to house the instructional laboratories and offices for staff and graduate students.

Peter Weiss (1964-1972)

Some time in 1964, all universities were advised by the National Science Foundation that in order to produce more universities that would be recognized centers of scientific excellence, the NSF was embarking on a new program entitled the University Science Development Program. Rutgers University invited each of its science departments to submit their ideas and supporting data on what kind of proposal the University should make to the NSF. The Physics Department submitted its proposal, and a decision was made to submit a proposal for mathematics, physics and chemistry, since these departments formed a nucleus for the development of science at the University, and had shown significant improvement with the limited resources at their disposal. A five-year proposal was submitted in January 1965. It was anticipated that the NSF would fund the first three years, and that a subsequent proposal would be submitted to the NSF for an extension for an additional two years.[9]

Figure 39 Nuclear Physics Laboratory

At some point subsequent to the submission of the proposal in 1965, the NSF requested evidence from the University that the State of New Jersey understood that they were making significant financial commitments under this Grant, and that they were responsible for picking up the lines and dollars involved in the proposal. The NSF also pointed out to the University that the University salary scale was inadequate to recruit

[9]Physics Archives; Interviews with Henry Torrey and Peter Weiss.

the quality faculty members envisaged in the proposal. A joint resolution of the New Jersey State Legislature was passed and signed by Governor Richard Hughes, announcing the Legislature's support of the proposal and their understanding of the commitments that had been made. Furthermore, negotiations in Trenton produced an expanded faculty salary scale for the University that proved to be acceptable to the NSF.

After the submission of the 1965 proposal, some of the equipment listed in that proposal was obtained from the science section of the NSF, including $242,000 for the expansion of the PDP-6 computer. A revised equipment list was submitted, in the amount of $1,689,000 for physics. This revised list included: $162,000 for magnetic resonance equipment; $151,950 for solid-state physics equipment; $549,650 for nuclear physics equipment associated with the tandem Van de Graaff accelerator, including a heavy ion injector, beam polarizer, and magnetic spectrograph; $592,500 for high-energy physics equipment, including expansion of the PDP-10 computer, PEPR (precision encoding and pattern recognition machine), and spark chamber development; and $180,000 for equipment for new staff.

The proposal to the NSF indicated that the new staff would work in areas which included the optical properties of solids, properties of liquid metals, study of fluctuation phenomena in the neighborhood of transition temperatures, and the general area of atomic physics which included the excitation of atoms by atoms and the charge transfer between ions in collisions.

In May 1966, the National Science Foundation awarded a grant of $3.7 million to University, $2.7 million for the Physics Department and $1.0 million for the Mathematics Department. The Chemistry Department was not included in the final award. The award demonstrated the high regard of the NSF and the outside panel of reviewers for the Physics and Mathematics Departments. This Grant was to have a major impact on the development of the Physics and Mathematics Departments in the years to come. Outstanding new faculty members were recruited, and there were significant visiting faculty and postdoctoral research appointments. The intellectual climate of the Department was enriched, and it was well on its way to become one of the outstanding physics departments in the country. The NSF Science Development Grant contributed significantly to this development.

Peter Weiss (1964-1972)

In 1966 Frederick Eisler left the Department after two years to go to Argonne National Laboratory, and Gerald Rothberg left the Department after seven years to go to Stevens Institute of Technology. Several new appointments were made to the faculty. C. J. Adkins and J. P. F. Sellschop were appointed Visiting Professors, Bruno Lüthi, who received his Ph.D. from Zürich in 1959, was hired as Associate Professor in solid-state physics, and Dan Tycko came as Associate Professor in experimental high-energy physics.

The Department was finally able to recruit a nuclear theorist when Larry Zamick was hired as Associate Professor in 1966. He had received his Ph.D. degree from MIT in 1961, and came to Rutgers from Princeton. Joe Pifer was hired as Assistant Professor in magnetic resonance, having received his Ph.D. degree from Illinois in 1966. Robert Ehrlich was hired as Assistant Professor in high-energy physics, and Tsu Yao joined the Department as Adjunct Assistant Professor in high-energy theory. Altogether, there were 45 faculty and postdoctoral research associates in the Department in 1966-67. At the 1967 commencement 14 bachelors degrees, 20 masters' degrees, and 11 Ph.D. degrees were awarded to physics students.

By 1967 the Science Development Grant was providing the resources for an active program of faculty recruiting. In 1967 Stuart Meyer left the Department for Northwestern University after four years in the Department, Daniel Tyko left the Department for SUNY Stony Brook after one year, and John Taylor left after three years for Queen Mary College in London. The NSF appointed Akito Arima, one of the outstanding nuclear theorists of Japan, Senior Visiting Foreign Scientist to the Physics Department. He was later Minister of Education in Japan. Also joining the Department as Adjunct Professor was Shiro Yoshida, another outstanding nuclear theorist from Japan. After a year, he decided to stay in the Department. John Barclay Adams, a high-energy theorist, joined the Department as Assistant Professor, and replaced George Horton as advisor to Douglass College. Arthur W. Martin, III, an elementary-particle theorist, came to the Department from Stanford, as Visiting Associate Professor, and Gerald DeWitt, an experimentalist in nuclear magnetic resonance, came from McMaster University.

An important appointment in high-energy physics was made when Thomas Devlin came from Princeton to join the Department as Associate

Professor. He was considered one of the leading experts in wired spark chambers. His area of research complemented the work in experimental elementary particle physics under way at Rutgers with the bubble chamber experiments.

Also joining the Department as Assistant Professors were two promising young solid-state theorists, David Langreth, who came to the Department from Cornell, and Paul Leath, who received his Ph.D. degree at Missouri and spent a year at Oxford. Alan Klein was another condensed-matter theorist who joined the Department as Assistant Professor, and Maurice Bazin joined the Department as Associate Professor in January 1968, having received his Ph.D. in elementary-particle physics from Stanford and served as an assistant professor at Princeton. He had experience in high-energy physics using the bubble chamber techniques and had an interest in the PEPR machine, which Richard Plano was setting up.

The Science Development Grant made it possible to hire these new faculty members in the Department, and some eight new postdoctoral research associates. The postdocs included Pedro Federman and Yoel Tikochinsky, nuclear theorists, Jan Trooster, and experimentalist engaged in research using the Mösbauer effect, F. Haenssler, an experimentalist in solid state physics, and Guy Deutscher, Pierre Papon, and Michael Klein, theorists in solid state physics. These appointments brought to nineteen the total number of postdocs in the Department. It was truly an exciting time in the Department.

Also adding to the excitement in the Department were the seven research collaborators from Bell Telephone Laboratories, working with the nuclear physics group at the tandem van de Graaff accelerator. These physicists included, Walter Brown, Paul Donovan, Walter Gibson, John MacDonald, Laurie Miller, James Mollenauer, and Daniel Murnick, a group that added significantly to the research interests at the accelerator. This collaboration was a quite unique synthesis of industrial and university research, which had not previously been seen in the U.S.

In 1968 Frank Dunnington retired after 31 years in the Department, and Saul Barshay left the Department for the Niels Bohr Institute in Copenhagen, after five years in the Department. Joining the Department in 1968 were several new faculty members. Michael Stephen came from Yale to accept a position as Professor to strengthen the work in theoretical

solid-state physics. There were also several promising new Assistant Professors. William Glaberson came from the University of Oregon to continue his studies of liquid helium, Robert Esterling came from the University of Chicago to work with Tom Devlin in elementary-particle physics, and Michael McCaughey came from the University of Connecticut to initiate research at Rutgers in atomic physics.

Graduate students faced a change in the regulations regarding the draft, which threatened their ability to continue their graduate studies. A number of the teaching assistants were made Assistant Instructors, two-thirds time. Three-quarters of these Assistant Instructors received 2-A deferments and remained in the Department.

In 1969 four faculty members left the Department and five new faculty members joined the Department. John Adams and Arthur Martin left the Department after two years, Tsu Yao after three years, and Jorrit deBoer after five years. In 1969 Bogdan Maglic joined the Department as Professor, joining Devlin and Esterling in elementary-particle physics using counter and spark chamber techniques. Maglic was a national figure in high-energy physics. He received his Ph.D. degree from MIT in 1959, and then spent several years at Berkeley and CERN before coming to Rutgers. He was author or coauthor of over one hundred publications on pi-meson scattering and polarization, antiproton experiments, and short-lived mesons. He was especially known for his work on the omega minus meson. He continued his high-energy physics research at Rutgers, and was able to demonstrate the usefulness of his missing-mass spectrometer at the Princeton-Penn accelerator and at the Argonne accelerator.

Also joining the Department in 1969, as Assistant Professor, was Charles Glashausser, who came to work with the nuclear physics group at the tandem Van de Graaff accelerator. After receiving his Ph.D. degree from Princeton in 1966, he spent several years at Saclay and at the Lawrence Radiation Laboratory. He used beams of polarized protons to study nuclear structure properties.

Also joining the Department in 1969 was John Huang, who came as Assistant Professor in condensed-matter physics, having received his Ph.D. degree from Cornell in 1969, and Peter Yamin, who came to Rutgers as Assistant Professor, after receiving his Ph.D. degree from MIT in elementary-particle physics in 1966, and spending three years at Brookhaven National Laboratory. Aram Mekjian brought additional

strength to the Department in nuclear theory. He had received his Ph.D. from Maryland in 1968, and after postdoctoral work at Rutgers and Heidelberg, he joined the Physics Department at Rutgers as Assistant Professor in January 1970.

Figure 40 Physics Lecture Hall

In 1969 the undergraduate curriculum for physics majors was revised again. In the previous years there had been an emphasis on improving the physics major program for those intending to go on to graduate school and seeking a professional career in physics. The Department had upgraded the laboratory equipment in the courses in that program and added to the faculty assigned to those courses. Following these changes, the number of physics majors increased, and senior physics majors had success in entering and doing well in graduate school.

In a step that would substantially expand the undergraduate physics major program, the Department turned its attention to broadening the physics major program in order to include the goals of students who were not moving towards graduate work in physics. These students included those interested in teaching at a secondary school level, those working in a laboratory as a high-level technician, as well as those interested in physics without a professional goal in view.

New courses were added to meet these goals. These included a course in modern measuring techniques with a laboratory, a course in astrophysics, a course in introductory mathematical physics containing a large amount of classical physics, and an extension of thermodynamics to include kinetic theory and introductory statistical mechanics. It became

possible for a student to have a joint major in physics and some other areas such as biology, political science, chemistry, etc. The Department also experimented with mini-courses in an effort to reach students in the humanities. The Department made an effort to improve the contacts with Douglass and Livingston Colleges by arranging for physics faculty members to have a more formal representation on their faculties.

The Department, which had not taught astronomy since Franklin Miller left in 1948, finally moved to teach astronomy again. In 1969 the Department approved an advanced undergraduate course in astrophysics that was first listed in the 1972 Rutgers Undergraduate Catalogue. This was a course treating the modern problems in astrophysics stellar structure, systems of stars, and systems of galaxies.

Meanwhile, the Department of Geology picked up instruction in the introductory course in descriptive astronomy, which Robert Walter had taught at Douglass College until 1967. In 1968 the Geology Department brought in Kenneth Franklin of the Hayden Planetarium to teach the course. He had received his Ph.D. in astronomy from the University of California in 1953, worked at the Lick and Leuchner Observatories, and then the Carnegie Institution, before going to the Hayden Planetarium in 1963. A specialist in radio astronomy, Franklin came to Rutgers as Visiting Professor. John Caldwell, who came to Rutgers in 1973 and taught the descriptive astronomy course until 1977, succeeded Franklin. Caldwell received his Ph.D. in astronomy from Wisconsin in 1971, and was a Research Associate in Astrophysics at Princeton for five years while teaching at Rutgers. A specialist in planetary atmospheres, Caldwell went to SUNY Stony Brook in 1977.[10]

The Science Development Grant had a major impact on the growth of the Physics Department in the period 1966-69. The original plan provided that the grant would terminate in 1969 after three years, and that the Department could apply for a renewal of the grant for an additional two years. Although substantial new hires were made, the money in the original grant was spent at a slower rate than had been originally anticipated. Accordingly, the Department proposed that the termination date for the original grant period be extended to June 1971, with no additional cost

[10]*American Men and Women of Science*, 13th and 14th editions; *Rutgers College Catalogues*.

to the NSF. The Department in furthering the objectives of the grant would use the unspent funds in the grant. It was proposed that the University would pick up one-third of the commitment on July 1, 1969, a second third of the commitment on July 1, 1970, and the final portion of the commitment on July 1, 1971 at the expiration of the extended grant. The NSF accepted this proposal and the State made special appropriations to pick up these Science Development Grant commitments as a distinct part of the University budget during each of these three years.

In 1970 Ira Freeman retired after 23 years at Rutgers, and Antonio Pagnamenta left the Department for the University of Illinois, Chicago Circle, after five years at Rutgers. Terence Watts joined the Physics Department as Associate Professor in 1970, having received his Ph.D. degree from Yale in 1963, and spent five years at MIT as Assistant Professor. He worked with Richard Plano in setting up the PEPR scanning equipment for the bubble-chamber pictures that were used in the elementary-particle physics research.

In 1971 the Departments of Mathematics and Physics submitted a written proposal to the NSF for support for an additional two years as envisaged in the original Science Development Grant proposal. That proposal described some of the research accomplishments by members of the Department during the period of the SDG. Some of these accomplishments are mentioned here.

In solid-state physics, Lüthi carried out experiments on dynamical effects at magnetic phase transitions, at a time when great interest was being generated in the theory of phase transitions. Serin, Lindenfeld, and McLean obtained experimental results on the transport properties of Type II superconductors while the theory of these superconductors was being developed. Abrahams and Stephen made important contributions to the theory of fluctuation phenomena in superconductors. Leath unified two apparently unconnected approaches to the theory of disordered alloys, and Langreth published a paper on the dielectric constant of metals that gave first principle criteria for the choice of approximations for that quantity.

In nuclear physics, a joint Rutgers-BTL effort (Temmer and Gibson) led to the first determination of nuclear lifetimes of the order of 10^{-18} sec, where the shortest lifetimes measured previously had been of the order of 10^{-14} sec. These experiments involved aspects of nuclear, atom and solid-state physics, and crystallography. Temmer also discovered

exceedingly narrow (~100 eV) resonances at high excitation energies (~10 MeV) in experiments on forbidden transitions in isobaric analog states. Mekjian contributed to the theory of analog states with an explanation of the magnitude and systematics of the spreading widths of isobaric analog states. In a clever Mössbauer measurement of the temperature dependence of the isomer shift in tin, she obtained both the sign and magnitude of the change in nuclear radius, settling a controversy over the predictions of the shell model. An interesting theoretical-experimental collaboration (Koller, MacDonald, and Zamick) produced another shell model test with positive results, by measuring the magnetic moment of excited states of ^{54}Fe.

In high energy physics, the bubble chamber group (Plano, Bazin, Watts, and Yamin) made the first observation of a possible new resonance, the $\Sigma(1285)$, and they were able to confirm the inapplicability of the one-pion exchange model from a Regge pole fit to the $pp\pi^+\pi^-$ final state. In neutron-proton exchange experiments at the Princeton Pennsylvania Accelerator, Devlin found a new structure near the one-pion production threshold that excited the theorists. In examining the missing-mass spectrum of protons from the $p^+p \rightarrow p+MM$, Maglic obtained results, which shed light on the coupling constant for strong interactions.

In recognition of the substantial improvements that had been made in the Mathematics and Physics Departments, the NSF awarded Rutgers University an additional $1,000,000 for these departments for 1971-73, with the understanding that the University was assuming an additional commitment of $300,000 on June 30, 1973. In the Physics Department's proposal for renewal of the Science Development Grant, there was an emphasis on the Department moving into new areas of research, and improving the quality of its graduate program.

At the time of the original proposal in 1964, it was expected that an effort would be made to increase the number of graduate students in order to meet the expected need in society for more highly trained Ph.D.'s in physics. In the succeeding years, the situation changed, and there no longer appeared to be a need for a large number of additional physics Ph.D.s. The employment opportunities for new Ph.D.s were not as good as they had been, and there was a decrease in the availability of funds for research, including the support of graduate research assistants. As a result, the total graduate student enrollment in the Department had remained at approximately 100 students, approximately 50 fewer than had been

projected. It was proposed that some of the new funds would be used for expansion of the Department into new areas of research, such as astrophysics, biophysics, geophysics, or the history and philosophy of physics. There was special note of the exciting research opportunities in astrophysics and cosmology.

In 1971 Robert Esterling left the Department for the Rutherford Laboratory in England, after three years at Rutgers, and there were substantial additions to the Department in elementary-particle theory. Claud Lovelace came to the Department, as Professor. He had worked at the CERN research center in Geneva, after study and research at Imperial College, London. Also in elementary-particle theory, John Bronzan came to Rutgers as Associate Professor. He had received his Ph.D. degree from Princeton in 1963 and served on the faculty at MIT from 1965-71. Joel Shapiro received his Ph.D. from Cornell in 1967, and after postdoctoral research at Berkeley and Maryland, he came to Rutgers as Assistant Professor in 1971. In elementary-particle experiment, Kenneth Cohen and Felix Sannes joined the Department. Cohen received his Ph.D. degree from MIT in 1967, and did postdoctoral work at Hamburg and Rutgers. Sannes received his Ph.D. degree from McGill in 1968 and did postdoctoral work at Rutgers before joining the faculty as Assistant Professor in 1971.

In nuclear theory, Philip Goode joined the Department in 1971, after receiving his Ph.D. degree from Rutgers in 1969, and doing postdoctoral work at Rochester. Lillian Hoddeson represented a somewhat unusual appointment, as a part of the Department's efforts to expand its areas of interest. She received her Ph.D. degree from Columbia in solid-state theory in 1966, and then taught at the Bronx Community College, Barnard College, and Robert Louis Stevenson High School. She was interested in the history and philosophy of physics, and in the more general area of science, technology and society. She came to the Department in 1971 as Assistant Professor.

Although the Science Development grant facilitated a major development of the Physics Department, the additional faculty members created strains on the available space in the new building. In 1971 there were some 60 Ph.D.'s, including faculty members, postdoctoral research associates, and visitors. The Physics Building had some 45 offices, which usually held only a single person. It was clear that additional space was

required for the newly expanded Department and urgent appeals for that space were made. It was to be some time, however, before those appeals resulted in additional space.

While expanding the research efforts in the Department, attention was given to the instructional program. After spending a year at MIT, Bernard Serin returned to Rutgers and introduced a self-pacing method for some of the students enrolled in the General Physics course, the large introductory physics course, and in a semester long course, Science, Technology and Society.

The self-pacing method dispensed with the formal requirement for attending lectures and recitations. Students were offered tutorial help from faculty members and undergraduate students who had already passed the course. These tutorial sessions were available at any of eight sessions spread throughout the week. In the course of a semester there were twelve units, which outlined the material to be covered and practice problems to be solved. When the student felt that he or she had mastered the material, the student would take a test. If the student passed the test, he or she would move on to the next unit. Otherwise, the student would spend more time on the unit until it was mastered.

The method was used successfully the first semester for some fifty students in the General Physics course and some one hundred students the second semester. The method was also used with success for some one hundred students in the Science, Technology and Society course. Herman Carr, Lillian Hoddeson, and Philip Goode all helped with the self-pacing program. This type of instruction was so successful that it has continued to the present day.[11]

Other new courses were introduced in 1971. Professor Lindenfeld taught a course, Insights into Physics, designed for those students not intending to major in any science field. Professor Harrington taught a one-semester course in astrophysics for seniors, expanding the Department's offerings in astronomy, and Professor Bazin taught a course in Science and the Peoples of the Third World at Livingston College.

In 1972 Michael McCaughey left the Department after four years, and Henry Kugel joined the Department. Kugel had received his Ph.D.

[11]Physics Archives.

from Notre Dame in 1967, and served as a research associate at Wisconsin and Rutgers before joining the faculty as Assistant Professor.

In 1972 Peter Weiss stepped down after eight years as Chairman of the Physics Department. He had taken advantage of the resources made available by the NSF to orchestrate a major development of the Department. The Department, which had become a physics research center at the end of World War II, advanced under the leadership of Peter Weiss to the ranks of the major physics departments in the country. In 1972-73 Weiss took a well-deserved leave of absence and then returned to the Department.

Figure 41 Bernard Serin

From the time of the reorganization of the Physics Department at the end of World War II, the Department had selected its Chairman from within the Department, entirely from the group of physicists who came to Rutgers from the MIT Radiation Laboratories. When Peter Weiss informed the Department of his intention to step down as Chairman, the Department was unable to agree on someone from within the Department. Bernard Serin agreed to serve as Acting Chairman for a year, while the Department conducted a national search for someone from outside the Department, who would have stature in the physics community and would have administrative experience.

As Serin took over administrative responsibility for the Department, the Science Development Grant was in its final year. He was confronted with a number of problems connected with integrating the advances made under the Grant into the ongoing operation of the Department. Prior to the award of the Science Development Grant, the State Legislature made commitments to pick up the ongoing support for the new faculty hired under the Science Development Grant. Following the extension of the original grant, the State made special appropriations to meet these commitments, as a part of the University budget in 1969, 1970, and 1971. Although the necessary money was provided in these special appropriations, it was expected that sometime after July 1, 1971, the University and the State would move to create the necessary faculty and staff lines for these positions. It was understood that these additional dollars and lines came to the University only because of the Science Development Grant, and this fact was recognized in the base budget of the University. At that time the University was working with an incremental budget, i.e., an asking budget in which it was not necessary to defend the lines that already existed in the University, but only to explain any new lines that were being requested as a result of increased enrollment or new programs.

Under any circumstances, there might have been concern about the University and State meeting its ongoing commitments for the Science Development Grant, but the situation became critical when the State moved the University to a zero base budget, in which the University did not automatically receive the existing number of lines, but had to defend all lines, based on projected enrollments. Under the previous system, the commitments to the Mathematics and Physics Departments were built into the budget. Under the new system, the University's commitments to these Departments appeared to be at the expense of other departments. It was clear, however, that a loss of prestige to both the State and University would result from withdrawing the support for the advances made in the Departments of Mathematics and Physics.

There was considerable tension surrounding the issue of the commitments to the Mathematics and Physics Departments, and Arnold Grobman, Dean of Rutgers College, threatened to transfer some of the resources in the Mathematics and Physics Departments to other departments. As a result, in February 1972, Provost Henry Winkler informed Dean Grobman

that, in recognition of the commitment made to the Departments of Mathematics and Physics for the development of the disciplines throughout the New Brunswick complex, the positions generated from the Science Development Grant were being transferred to the Graduate School.

The lines assigned to the Graduate School were designated for use predominantly in Rutgers College, but also for Douglass College, Livingston College, and perhaps Cook College. The lines, which included 16 faculty lines and 5 teaching assistant lines for physics, would not be counted as part of the faculty of the colleges, but the student credit hours generated by these lines would be included in the totals for the colleges. It was understood that the arrangement would be reevaluated before the end of 1973-74. If the combination of the Physics Departments at Douglass and Rutgers Colleges was the first step towards the creation of single academic departments in New Brunswick, this reassignment of lines was certainly a second step in strengthening the role of the Mathematics and Physics Departments as New Brunswick-wide departments.

In addition to the faculty and teaching-assistant lines transferred to the Graduate School budget, there were also some 30 other lines transferred to the Graduate School budget. These lines were for research specialists, research assistants, postdoctoral research fellows, and non-academic personnel, associated with research, and whose support originated with the Science Development Grant. In addition to the lines supported by the University, there were about 48 non-faculty lines in the Department funded by individual research grants. All of these lines represented a major commitment to research.

In January 1973, Bernard Serin submitted to Provost Wheeler a Master Plan for Physics. Serin referred to the creation in 1946 of a Physics Research Budget, which provided half-time support for physics faculty members, and which provided that the physics faculty members would have a half-time teaching load. He proposed that the 1946 arrangement be extended to the new faculty lines generated under the Science Development Grant. He further proposed that there continue to be a single Physics Department in New Brunswick, with a Chairman reporting to the Provost, who would have authority over the Department budget. Although the Department continued to represent physics in New Brunswick as a single department, the issue of budgetary responsibility

was not satisfactorily resolved, and it continued to be a source of contention. Unfortunately, in the years to come, many of the resources acquired from the Science Development Grant were lost in periodic budget crises.

At the end of the academic year Bernard Serin retired after 26 years of service in the Department. At Rutgers, he had initiated a program of research in low-temperature physics that brought international recognition to him and great distinction to the Physics Department and to Rutgers University. His quiet dedication contributed enormously to the growth of the Physics Department, and he graciously took up the administrative burden in his final year. Upon his retirement from Rutgers, he accepted a position as Reader at the Manchester Institute of Science and Technology in England, which enabled him to continue his research. He had barely settled into that position when, on June 18, 1974, he suffered a heart attack while commuting from his home to his laboratory. He died at the age of 52, the first of the builders of the post-war Physics Department to pass away.