

DIRECTOR'S REPORT

IN-SERVICE INSTITUTE

For Junior High School Teachers of Science and Mathematics

Academic Year 196¹/₂ - '6²/₈

GEORGETOWN UNIVERSITY - DEPARTMENT OF PHYSICS

E1/2/2500

Director - Rev. M. P. Thekkakara, S. J.

1. INSTITUTE PROGRAM

The overall plan of the Institute, as explained in the original program, was to give a basic course in physics to junior high school teachers of science and mathematics. The plan was adhered to very closely. There are 169 junior high schools in the Washington Metropolitan area where a course in physical science is being taught. The majority of the teachers hold a Bachelor of Science degree, but very few of them have had physics as the major during their undergraduate course. The Washington Metropolitan area has a high concentration of scientifically-minded people, thanks to the various federal agencies for scientific research. Hence, the children in the junior high schools naturally show a keen interest in problems of modern science. The teacher has to stimulate this interest and should, therefore, have a fairly good knowledge of the subject. It was felt that a course in general physics, with emphasis on recent developments, would be very useful to the teachers.

As the course progressed, we realized that the mathematical background of most of the teachers was not adequate for a course at the same level of sophistication as required by physics majors of the College. Furthermore, at the junior high school level the topics of interest are light, heat, sound, and mechanics. Electricity and magnetism are often considered too difficult for junior high schools. We also realized that some attention had to be paid

to the way one would adapt the topics of general physics to the junior high school level. Hence, during the second semester a few minor changes were introduced in the lecture sessions.

The group of teachers met in the McNeir Auditorium every Saturday morning at 9:15 A.M. for the lecture session. The lecture lasted for about an hour and a quarter. A large number of demonstration experiments were performed throughout the course. For the demonstrations, the abundant supply of material available in the physics laboratory proved to be of very great advantage.

The lecture session was immediately followed by a coffee break. The Department of Physics met the expenses of the coffee break. The consensus of opinion seems to be that the coffee break was a trifle too long. It would also seem that since the cafeteria is in a separate building, a certain amount of valuable time was wasted in going back and forth.

After the coffee break the entire group split into two sections. One section returned to the McNeir Auditorium for a quiz session during which numerical problems were solved or the teachers sought further clarification on points of special difficulty. The other section went to the physics laboratory where the teachers themselves performed an experiment of the general physics level. These two sections alternated between the lab session and the quiz session in successive weeks.

The following is a list of experiments which were performed during the Institute:

1. The Vernier and Micrometer Calipers
2. The Resolution and Addition of Vector Quantities
3. The Measurement of Mass and Density
4. Gravitational Acceleration
5. Centripetal Force
6. Torques
7. Moments of Inertia
8. Young's Modulus
9. Specific Gravity
10. Simple Harmonic Motion
11. Specific Heat

12. Resonance of Air Columns
13. Ohm's Law: Ammeter-Voltmeter Method of Resistance Measurement
14. The Wheatstone Bridge
15. The Potentiometer
16. Electrolysis
17. Electromagnetism
18. Triode Characteristics
19. Photometry and the Efficiency of Lamps
20. The Spherical Mirror
21. Lenses
22. The Spectrometer
23. The Diffraction Grating

Since the setup of the experiments in the laboratory changed every week, each of the two sections had a chance of performing only half the total number of experiments.

The textbooks used in the Institute were:

Jay Orear, Fundamental Physics, (John Wiley and Sons, Inc., New York, 1961)

Frank Verbrugge, Experiments in General Physics, (Burgess Publishing Co., Minneapolis, Minn., 1961)

In addition the participants of the Institute had full access to the departmental library. Each of them took from the department on loan a General Physics textbook at a more advanced level for the whole period of the Institute. Several reprints published by The American Association for the Advancement of Science and a large number of paper-back books were also distributed to the participants. These latter were helpful for the term papers which several of the participants prepared during the Spring Semester.

The course started in the Fall of 1961 with 55 registrants. Since the original proposal had been for only 50 participants, the five extra teachers were prepared to forego the stipend. The University waived all tuition and other fees for them.

At the end of the Fall Semester the registration dropped to fifty. During the Spring semester there were a few more withdrawals from the course. The In-Service Institute closed with a total of 42 registrants.

In the original announcement of the Institute we had stated that no credits would be allowed for the course. The reason was that the course was not at a level for which graduate credit could be given, and we did not think that the junior high school teachers would have any use for undergraduate credit. However, several of the participants pointed out to us that undergraduate credit would serve a useful purpose because they had a deficiency of undergraduate science credits to be made up for their Master's, or because they were working towards a degree where this physics course was required. Hence we made an application to the College of Arts and Sciences, Georgetown University, to recognize the course for credit. In the College Catalogue of 1962-63 the following course description has been published for the course given in the In-Service Institute:

"Physics 007,008 - A refresher course in general physics, incorporating the major aspects of the physics of the Twentieth Century; intended for secondary school science teachers. Six Credits."

2. STAFF ASSIGNMENTS

Dr. Edward J. Finn, Assistant Professor, Department of Physics, was responsible for the instructional part of the Institute. Since 1952, Dr. Finn has been engaged in teaching and research in physics. His major work in the research field in recent years has been on the theoretical study of molecular structure. As part of his regular teaching schedule he has handled most of the courses taught in the College, but his main interest has been in presenting general physics to beginning students.

The Director of the Institute was Rev. M. P. Thekaekara, S. J., Associate Professor and Acting Chairman, Department of Physics. Fr. Thekaekara's research field is atomic and molecular spectroscopy. He is the Director of the Summer Conference for College Professors on "Recent Advances in Astrogeophysics" held during the summers of 1960 and 1961. He will also direct a similar Conference to be held in August 1962, an Undergraduate Research Participation Program from September '62 till '63, an In-Service Institute to be held during the Academic Year 1962-63, and a Graduate Fellowship Program under the sponsorship of the Department of Education, Health and Welfare for three years in Atomic and Molecular Spectroscopy.

The Demonstration Experiments which formed a distinctive feature of our Institute were prepared by Ralph A. Regalbuto, Practical Physicist, Department of Physics. Mr. Regalbuto had previously been Lecturer's Assistant at Columbia University, 1929-1947, and later Laboratory Supervisor, University of Chicago, 1947-1956. His many years of experience in developing original demonstration models for College physics classes proved to be a great asset for the In-Service Institute.

Mr. Davis Thattil was the Instructor for the laboratory sessions of the Institute. He holds a Master's degree in physics from the University of

Madras and is well advanced towards his Ph.D. degree at Georgetown. His several years of experience in conducting lab sessions made him a very-well liked instructor, and he elicited high praise from all the participants of the Conference.

3. SELECTION EXPERIENCE

Our first publicity efforts were made towards the end of the Spring Semester when the printed brochures were mailed out. But, apparently, the brochures did not reach the right persons or if they did, they did not elicit sufficient response. In the second week of September 1961 we had only some ten teachers enrolled for the Institute, and even among them a few were not sure that they would attend.

We soon realized that direct telephoning with the schools could achieve speedily and economically a great deal more than the printed brochures. The principals of the schools and the science teachers receive daily quantities of second class mail, and most of such mail receives scant attention. Unless a teacher is already familiar with the Institute program the brochure is not likely to get him interested.

Dr. Edward J. Finn and Fr. M. P. Thekaekara personally contacted by telephone a certain number of the grade schools and high schools in the Washington Metropolitan area. The principals were immediately interested. No elaborate selection procedure was called for since any teacher who is qualified to teach general science at the junior high school level is also qualified to attend the Institute. After the entire quota was filled, we received a certain number of inquiries from other science teachers. They opted either to come without the usual N.S.F. stipend or to wait for one more year for the next year's Institute. On the opening day of the Institute, fifty-five teachers were present.

4. PARTICIPANT ROSTER

The following list gives the name of each participant and current home address together with information as to: (a) teaching assignment (school and subject) during the Institute; (b) degrees held at time of application; and (c) credits earned in the Institute. All credits are at the undergraduate level. No sequential program for teachers has yet been started at Georgetown University.

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Aufderbeck, Grace Catherine, S.C., 4214 Saul Road, Kensington, Md.	Holy Redeemer, Kensington, 7th Grade, including Math and Gen. Sc.	-	0/0
Bergdoll, Clare 1500 St. Camillus Drive Silver Spring, Md.	St. Camillus, Silver Spring, 8th Grade, including Math and Gen. Sc.	B.S.	0/0
Biays, Mary Celeste, O.S.P. 310 - 8th Street, S. E. Washington 3, D. C.	St. Cyprian's, Washington, 7th Grade, including Math and Gen. Sc.	-	3/3

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Coyle, Mary Annina, S.C. 4214 Saul Road Kensington, Md.	Holy Redeemer, Kensington, 8th Grade, including Math and Sc.	-	0/0
Daley, Marie Ellene, S.S.N.D. 7500 Marlboro Pike Washington 28, D. C.	Mt Calvary Grammar School, Washington, 7th Grade, in- cluding Math and Gen. Sc.	-	3/3
Dempsey, Grace Michael 5702 Sargent Road Chillum, Md.	St. J. B. de La Salle, Chillum, 8th Grade, includ- ing Gen. Sc.	B.S. Ed.	0/0
Desmond, Francis Anne St. Martin's Convent 116 T. Street, N. E. Washington 2, D. C.	St. Martin's, Washington, 8th Grade, including Math and Gen. Sc.	Teach. Certif.	Dropped
Donovan, Marie Jerome, S.C. 4214 Saul Road Kensington, Md.	Holy Redeemer, Kensington, 7th Grade, including Math and Gen. Sc.	-	0/0
Dougherty, Bernhard 941 North Capitol St. Washington 2, D. C.	St. Aloysius, Washington, 8th Grade, including Math and Gen. Sc.	-	0/0
Fahy, Thomas St. Anselm's Priory Washington 17, D. C.	Priory School, Washington, 7th Grade Algebra and 10th Grade Geometry	A.B. Eng. S.T.L.	3/3
Fitzmaurice, Thomas Mary 3125 - 38th Street, N.W. Washington 16, D. C.	Annunciation School, Wash- ington, 8th Grade, including Math and Gen. Sc.	-	Dropped
Ford, Jane Theresa 4229 - 71st Avenue Landover Hills, Md.	Springbrook High, Landover Hills, 9th Grade Algebra and Gen. Sc.	B.S. Chem.	0/Dropped
Gass, Martin Louise, S.C. 5702 Sargent Road Chillum, Md.	St. J. B. de La Salle, Chillum, 7th Grade General Sc.	B.S. Ed.	0/0
Geipe, M. Norman 7510 Marlboro Pike Washington 28, D. C.	Mt. Calvary Grammar School, Washington, 8th Grade, in- cluding Math and Gen. Sc.	B.S. Ed.	3/3
Gillen, Marie Patricia 1500 St. Camillus Drive Silver Spring, Md.	St. Camillus, Silver Spring, 7th Grade, including Math and Gen. Sc.	B.S. Ed.	0/0

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Gorman, Mary Elise 6301 Jason Street Cheverly, Md.	St. Ambrose, Cheverly, 8th Grade, including Math and Gen. Sc.	B.S., Ed. Dropped M.A., Eng.	
Gorski, Mary Jennifer, S.N.D. 2024 N. Randolph St. Arlington 7, Virginia	St. Agnes, Arlington, 8th Grade, including Math and Gen. Sc.	B.S. Chem.	0/0
Hunt, William Marie 5702 Sargent Road Chillum, Md.	St. J. B. de La Salle, Chillum, 6th Grade, in- cluding Math and Gen. Sc.	B.S. Ed.	0/0
Jacobs, Mary Jude Thaddeus, 2024 N. Randolph St. (S.N.D.) Arlington 7, Virginia	St. Agnes, Arlington, 6th Grade, including Math and Gen. Sc.	B.S. Ed.	Dropped
Jenairo, Amelita Romauldez 1420 Ivanhoe Street Alexandria, Va.	Blessed Sacrament, Alexandria, 7th and 8th Gen. Sc.	A.B. Fr.	0/Dropped
Kerney, Margaret Michael 2812 Penna. Ave., S. E. (S.N.D.) Washington 20, D. C.	St. Francis Xavier, Wash- ington, 8th Grade, inc- luding Math and Gen. Sc.	-	3/3
Kirby, Mary Alberta, R.S.M. 3513 N. Street, N. W. Washington 7, D. C.	Holy Trinity, Washington, 8th Grade, including Math and Gen. Sc.	B.S. Ed.	0/0
Kirk, Patrick Daniel St. Anselm's Priory 14th & S. Dakota Ave., N.E. Washington 17, D. C.	Priory School, Washington, 8th Grade Gen. Sc., and 11th Grade Biology	A.B. Phil.	3/3
Kovalik, Regina Socorro Villa Maria Broad & Spring Streets Falls Church, Va.	St. James, Falls Church, 8th Grade, including Math and Gen. Sc.	A.B. Math	0/0
Leber, Mary Jayne, S.N.D. 2024 N. Randolph Street Arlington 7, Virginia	St. Agnes, Arlington, 7th Grade, including Math and Gen. Sc.	B.S.E.	0/Dropped
Lilly, Mary Edward 11811 Claridge Road Wheaton, Md.	St. Catherine Laboure, Wheaton, 5th Grade, inc- luding Math and Gen. Sc.	A.B. Sc.	0/0
Malovrh, Mary Philomeen 4755 Whitehaven Pkwy. (S.N.D.) N.W. Washington 7, D. C.	Our Lady of Victory, Washington, 8th Grade including Math and Gen. Sc.	M.A. Social Studies	0/0

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
McArdle, Zoe 11811 Claridge Road Wheaton, Md.	St. Catherine Labouré, Wheaton, 8th Grade, including Math and Gen. Sc.	M. Ed.	0/0
McCormack, Regina Angele Broad & Spring Streets Falls Church, Va.	St. James, Falls Church, 7th Grade, including Math and Gen. Sc.	-	0/0
McEvay, Christopher Marie, R.S.H.M., 2807 Glebe Road, North Arlington 7, Va.	Marymount, Arlington, 10th, 11th, & 12th, Science	-	3/3
McNamara, Mary Vincent Convent of Notre Dame 941 N. Capitol Street Washington 2, D. C.	St. Aloysius, Washington, 7th Grade, including Math and Gen. Sc.	-	0/0
Mehring, M. Francis Joseph 7500 Marlboro Pike, S.E. Washington 28, D. C.	Mount Calvary, Washington, 8th Grade, including Math and Gen. Sc.	B.A. His.	3/3
Neale, Mary Erneste 1409 V. Street, S.E. Washington 20, D. C.	St. Theresa, Washington, 7th Grade, including Math and Gen. Sc.	-	3/3
O'Brien, Kathleen 2812 Penn. Avenue, S.E. Washington 20, D. C.	St. Francis Xavier, Washington, 7th Grade, including Math and Gen. Sc.	-	3/3
O'Haren, Mary Michel Villa Maria Convent Falls Church, Va.	St. James, Falls Church, 7th Grade, including Math and Gen. Sc.	-	0/0
Poland, Florence Walton 2412 South Eads Street Arlington 2, Va.	Williamsburg Junior High, Arlington, 8th & 9th Grades, Gen. Sc.	B.S. Chem.	0/3
Preto, Mary Ritamse, S.N.D. 4755 Whitehaven Pkwy., N.W. Washington 7, D. C.	Our Lady of Victory, Washington, 7th Grade, including Math and Gen. Sc.	-	Dropped
Pritchard, Barbara Anne 5702 Sargent Road Chillum, Md.	St. J. B. de La Salle, Washington, 7th Grade, including Math & Gen. Sc.	-	0/0
Quinlan, Geraldine Francis 116 T. Street, N.E. Washington 2, D. C.	St. Martin's, Washington, 7th Grade, including Math & Gen. Sc.	B.S. Ed.	0/0

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Richards, Marie 6301 Jason Street Cheverly, Md.	St. Ambrose, Cheverly, 6th Grade, including Math and Gen. Sc.	B. A. Eng.	0/dropped
Richter, Mary Joyce 5702 Sargent Road Chillum, Md.	St. J.B. de La Salle, Chillum, 7th Grade, inc- luding Math and Gen. Sc.	-	0/0
Rutkauskis, M. Benedict 3740 Ely Pl., S. E. Washington 19, D. C.	Washington, including Math and Gen. Sc.	B. S. Ed.	0/0
Schott, Louis N. 1317 - 8th Street, N.W. Washington 1, D. C.	Immaculate Conception, Washington, 6th Grade, inc- luding Math and Gen. Sc.	B. Ph.	Dropped
Shaheen, Mary Juliette 5702 Sargent Road Chillum, Md.	St. J. B. de La Salle, Chillum, 8th Grade, inc. luding Math and Gen. Sc.	B. S. Ed. A. B. Eng.	0/0
Sullivan, Marie Ellen 4344 Wisconsin Ave., N.W. Washington 16, D. C.	Immaculata, Washington, 7th & 8th Grades, including Math and Gen. Sc.	B. A. Eng.	0/Dropped
Surbaugh, Ray Claude 105 Alabama Drive Herndon, Va.	Kenmore Junior High, Arlington, 8th Grade, Gen. Sc.	M. S. Sc.	3/0
Tracy, Melvin R. 1413 V Street, N. W. Washington 9, D. C.	Mackin High, Washington, 9th, 10th, 12th Grades, Math and Physics	B. A. Phil.	3/3
Vanhoy, Charles 4344 Wisconsin Ave., N.W. Washington 16, D. C.	Immaculata, Washington, 5th & 6th Grades, Inc- luding Math and Gen. Sc.	B. A. Eng.	0/Dropped
Volzer, Mary Jude, S.N.D. 4457 Whitehaven Pkwy., N.W. Washington 7, D. C.	Our Lady of Victory, Wash- ington, 7th Grade, includ- ing Math and Gen. Sc.	B.S.E.	0/0
Walsh, Mary Brigid Broad & Spring Streets Falls Church, Va.	St. James, Falls Church, 7th Grade, including Math and Gen. Sc.	-	0/0
Watson, Roberta Marie, S.N.D. 941 North Capitol Street, N.E. Washington 2, D. C.	Notre Dame Academy, Wash- ington, 10th, 11th & 12th Math	M. A. Sp.	3/3

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Whelan, Marie Bernard 7510 Marlboro Pike Washington 28, D. C.	Mt. Calvary Grammar School, Washington, 8th Grade, including Math and Gen. Sc.	-	3/3
Wilkes, Mary Jourdain 1618 Monroe Street, N.W. Washington 10, D. C.	Sacred Heart Academy, Wash- ington, 10th, 11th, & 12th, Bio. Biology and Chemistry	B.A.	3/3
Wry, John Leonard 3125 - 39th Street, N.W. Washington 16, D. C.	Annunciation School, Wash- ington, 7th Grade, including Math and Gen. Sc.	-	Dropped
Zollars, Mary Louise 11811 Claridge Road Wheaton, Md.	St. Catherine Laboure, Wheaton, 8th Grade, including Math and Gen. Sc.	-	0/0

5. ADMINISTRATION

The major part of the advising was done during the coffee break and quiz session following the lectures.

The Optics Kit sponsored by the Commission on College Physics was loaned to each of the participants. They took the kit to their respective schools and worked the experiment. Many also performed several instructive experiments for the students.

Two of the lecture sessions were devoted to the Linus Pauling film. The film was indeed excellent; it well deserves the national reputation which it has. But we think that films should be used in programs of this type only with adequate preparation and extreme care. The topic of the film did not fit in too well with the subject matter of the course. The film covered too much material in too short a time.

The paper-back books which were distributed to the participants proved to be very popular. The teachers took them to their own classes and some of the better students also read them.

A picnic was organized towards the end of the Spring Semester. It was thoroughly enjoyed. The group also visited the Georgetown College Observatory and familiarized themselves to a certain extent with the telescopes, the high-dispersion spectrographs, the computer, and the various pieces of equipment used in automatic data reduction.

6. EVALUATION

In certain respects the Institute achieved fully what we had expected of it. About fifty science teachers who had had little or no formal instruction in physics underwent an intensive training in the subject. Unless the teacher has a thorough knowledge of the subject it is impossible for

him to give a clear and accurate presentation to this class. Wrong concepts and fallacies implanted at an early stage will not easily be corrected. Thus the primary purpose of the Institute was achieved.

Georgetown University also reaped a certain amount of benefit from the program. For a large number of teachers Georgetown had been just a name for an exclusive area of the city and the University an historic institution which belongs rather to the whole nation than to this Metropolitan area. Since we have no Department of Education nor any regular teacher training program, the contacts between the University and the schools in the area have to be fostered by special programs of this type. Such contacts can be naturally beneficial to the schools and to the University.

In the manner of presenting the course, some improvements seem to be called for. The General Physics course cannot be properly handled without a certain amount of mathematics. For most of the teachers who attended the Institute the background in mathematics was far too insufficient. Several of the teachers remarked that the course had been at a higher level than they could handle and that they were not able to follow all of the lectures.

Towards the end of the Spring Semester a brief questionnaire was distributed to the participants. A detailed analysis of the replies is, in our opinion, the best possible evaluation of the Institute.

Question: What was your source of information about the Institute?

Answer: Folder received in personal mail - 9%; telephone calls to the school principal - 64%; other sources, namely; information received through the superintendent of one of the school systems, or other officials of the educational department - 27%.

Question: Was the timing of the lectures convenient for you?

Answer: Yes - 100%.

Question: Did your travel expense exceed the N.S.F. travel allowance?

Answer: Yes - 11%; No - 89%. This reply came to us as a happy surprise. It showed that the great amount of time we had spent at the beginning of the Institute to locate each participant on a map of the area and to arrange for car pools had been extremely worthwhile. Every car arrived with three to six participants.

Question: Do you feel that the time was correctly apportioned between lectures, lab sessions, and quiz sessions?

Answer: Yes - 84%; No - 16%. Those who said no would have liked longer lab sessions.

Question: Mention three or four topics which you thought most profitable for your own teaching.

Answer: Most teachers picked out the lectures on light as the most profitable. Many mentioned also heat and sound; gravitation, wave concept, the electromagnetic spectrum, etc. were also pointed out by several.

Question: Comment briefly on the lab sessions - what you thought most profitable or least profitable.

Answer: Most of the answers were very enthusiastic. Here are a few samples:

"The teacher was excellent, but too much time had to be spent teaching fundamentals, which left only a short time for work."

"The lab sessions were very helpful. This seems to be the result of the preparation of the lab professor."

Some would have preferred a shorter coffee break and more time for the experiments. A closer correspondence between topics of the lectures and the lab sessions would have been helpful.

Question: Mention one or two demonstrations which you think were most helpful.

Answer: Here again the answers were quite enthusiastic. Most of the demonstrations were singled out by one or another of the teachers. Many stated that they would be able to duplicate the experiments for their classes. The demonstrations on refraction of light, polarized light, magnetism, gravitation, etc., produced the most lasting impression.

Question: What areas in physics would you have liked to be stressed more?

Answer: The answers covered a very wide spectrum. Almost every area in general physics, mechanics, heat, light, sound, electricity and magnetism, atomic theory, nuclear physics, was singled out by at least one of the teachers. Heat and energy were mentioned by several since these are of importance to the junior high school teacher. There was a sizeable volume of opinion against our having skipped electricity and magnetism. It was interesting to note that a very large number of teachers requested a detailed treatment of problems of space physics. The physics background of the average teacher is all too inadequate to give a satisfactory answer to the many questions which the school children ask about satellites and what they are trying to do for physics. The topic is a live one at the present time.

Question: What areas should have been stressed less?

Answer: Nearly half of the respondents left this question unanswered, which would seem to show that the program was, on the whole, well-balanced. Among those who did reply to the question, opinion was equally divided against too much time given to optics and against too much stress on the mathematical

methods in physics. The complaint against the mathematical approach to the subject was expressed in rather strong terms by several teachers. The main advantage which we college teachers of physics should draw from the questionnaires is to realize this basic difficulty of many of the teachers. Physics for junior high school teachers must necessarily have a very different approach from what we are accustomed to in the college classes.

Question: Have you any suggestions for improving the informal program?

Answer: The answers were, on the whole, very enthusiastic. A few suggested that the coffee break might have been shorter.

Question: How well do you think this Physics Institute has achieved the general aims of the N.S.F. in sponsoring Institutes of this type?

Answer: Almost every one of the replies is worth quoting. Four typical replies are given below:

(1) "In all probability we should be more resourceful in our subsequent teaching and it should prove more interesting to our pupils."

(2) "I would say very well, because personally I have learned very much, and a new interest to impart to my pupils what I have learned has been created. At first I looked upon physics as something dreadful; now I have a great appreciation for it."

(3) "I think you have done a very valuable service for (sic!) the N.S.F."

(4) "This Institute increased the awareness of the value and need for continued in-service training in the field of science."

Question: Will you be interested in enrolling in a similar program in other areas of science or mathematics?

Answers: The answers were all yes. As for the areas they would be most interested in, the majority expressed a preference for modern mathematics. Among other areas which the teachers mentioned, the choice was divided more or less equally between further study in physics, and biology and chemistry.

7. RECOMMENDATIONS FOR THE FUTURE

More effort should be made to familiarize the principals of schools and the science teachers with the In-Service Institute program. This can be done partly by the colleges establishing better contacts with the schools in each area. More nationwide publicity will also be helpful.

The courses should be better adapted to the needs of the teachers. The college teachers are generally so accustomed to students of a particular age group that they do not always realize the problems of a group of men and

women who are more advanced in age, are more heterogenous in their academic background, have more mature minds but less ability to absorb quickly new ideas and methods.

Perhaps a case can be made for making the In-Service Institute financially a little more attractive to the participants. Doubtless, there are valid reasons why the budget provision per participant should be less at an In-Service Institute than at a Summer Institute; however, one would wonder whether the disproportion should be so very great. The regular salary of many of the teachers is inadequate and they seek to augment their income through extra work on Saturdays. Attendance at an In-Service Institute would entail for them the loss of this added income. If for the Summer Institutes the justification for the stipend and dependency allowance lies in the loss of the summer salary, the same justification exists to a certain extent also for the In-Service Institute.

8. ADDITIONAL COMMENTS

In this last section of the Report, we think it would be appropriate to let the participants themselves tell us what they think of the In-Service Institute. They are all teachers with several years of experience. Their analysis of the problems of their students and of their own felt needs in the area of science teaching is highly informative. A few selected excerpts from the statements made by the teachers are given below. The underlining is ours in each of the excerpts.

"Participating in the In-Service Institute for Physical Science Teachers will be an opportunity which I will welcome because I enjoy studying science and I have had but a thin smattering of Physics. The list of my courses doesn't look too impressive but I feel it is sufficient to prevent the Institute from over-whelming me. Besides the actual knowledge of Physics there will come to me the boon of associating with interested and enthusiastic teachers of science and this not for a few brief weeks but for an entire school year. Our course of study in science is heavily laden with Biology but in view of the progress of modern science it will probably be rounded out to include more physical science. When this occurs, I hope to be able to meet the needs of the students."

"Although I have been teaching elementary science as long as I have been in the profession, still I feel that my preparation for teaching this subject is becoming less adequate as the years progress. The scientific advances made in recent years have been so numerous that I find myself wondering what they're all about. Therefore, I should like to participate in this In-Service Institute to become familiar with what is new in the field. In this way, I may be able to help Johnnie when he asks 'Why is this?' and 'What is that?'. Perhaps, in being able to clear up some of his problems, I may be instrumental in steering his interests to a future career in science."

"I appreciate this opportunity of keeping abreast, if only in a limited degree, with the latest developments of science. I realize my obligation to increase my knowledge and understanding of the physical sciences in order the better to evaluate events and situations, and the better to grasp the tremendous impact each new discovery has on our way of life. I feel that as educators we have a double duty, as keepers of a sacred trust, to introduce our youth to the thrill, adventure and excitement of new knowledge, especially in the field of science; to stimulate their imagination and increase their

desire to know more and better understand this wonderful world of ours with all of its hidden potentialities."

"At the present time even our youngest students are introduced to a great mass of scientific knowledge by means of television programs, magazines and motion pictures. A course in Physical Science will afford me contact with qualified and professional scientists so that I will be able to clarify many points for my students and sharpen my own intellectual grasp on this subject."

"I am a science teacher in the Arlington County Public School System and find this position a rewarding experience as well as a challenging one in which to give my students the best general science background possible. General science, covering such a tremendous scope, is perhaps one field where we would all recognize our limitations. My physics background has definitely been inadequate and, although, I think I am a conscientious teacher and try to make up this deficiency, it leaves much to be desired in my opinion. I teach 8th grade general science and the 9th grade enriched program at Williamsburg Junior High in Arlington. I believe the N.S.F. Institute is a program that would better prepare me for my challenge."

"Having taught in a Washington area school for the past five years, I can readily appreciate the need for well informed science teachers. The teacher must be able to keep abreast of changes in this field, and ahead of her students. In an area so infested with science attractions and projects this is sometimes a little on the difficult side. Children, so often, have a parent or relative working on such a project, and so have all types of written literature, as well as first hand information from the participant. This means a teacher sometimes receives her information from one of her own students. While the student may not realize he is enriching his teacher's background, nevertheless, the teacher would like to be the one who enriches his."

"The children whom I teach are bursting with enthusiasm at the prospect of some day becoming great scientists. Therefore, a sense of responsibility tells me that I must be a competent and prepared teacher in the field of science. The program you are offering affords me this opportunity, and I am convinced that the many benefits derived from this particular course will produce lasting results."

"Our American system of education seems to be bearing the brunt of our failure to 'be first' in scientific explorations and achievements and be the blame rightly placed or not, the fact remains that science is here to stay in our elementary and junior high schools. For many teachers, myself included, this is the first time we have had a formal textbook and course of study placed in our hands and to say that we feel inadequate would be an understatement. Frequently, our students are being called upon to take part in Science Fairs and look to us for instruction and guidance that we are not prepared to give. The main benefit that I would wish to obtain from participating in these classes would be to gain a knowledge of science sufficient to be able to teach children in the eighth grade class and to guide them in any scientific undertakings that they might wish to do or be required to do."

"As teacher and educator it is my ambition and desire to further my education in science. In teaching junior high, general science plays a major role in the curriculum. As an educational major I feel that I am lacking much as far as the scientific world is concerned. In view of the space age and the many changes about us I am anxious and happy to be among those who have the opportunity to receive a more extensive background of the modern age. As a result I am certain that I will benefit much and will be more equipped to present to my students a modern approach to the scientific world."

"Teaching eighth graders is a challenging task in our science oriented world of today. A Junior High teacher, through his own interests and knowledge, can be most instrumental in encouraging his students to develop his talents in scientific fields. Realizing the necessity of proper motivation I feel that this particular institute will be of immeasurable value in increasing my own knowledge, thereby making me a more effective teacher in the field of science. With man's many new endeavors in the field of science, it is imperative that a teacher of science be equipped to 'keep pace' with the age in his instructions to his students. Another task of the Junior High science teacher is to offer advice and encouragement to those students who are participants in Science Competitions which are of great value in the stimulation of scientific careers. To answer the questions of eager minds, to enkindle a spark of interest and to provide adequate instruction, are the reasons why I am grateful for the opportunity to participate in this institute."

"The reason I wish to participate in this particular Institute is that it offers me an excellent opportunity to advance towards my degree, and will also help me professionally by giving me some new insights into the world of Mathematics. As ours is definitely a scientific age, I would like to be able to help both myself and my pupils advance in this area as much as possible."

~~Departmental file copy~~ *Personal Copy*
~~please return to~~

NSF FORM 9C-20 C
SEP. 1960

Budget Bureau No. 99-R073.2 *MP Thekaekara*
Approval Expires 6-30-61
Dec 1960

SUMMARY SHEETS for a Proposal to the National Science Foundation for Support of an In-Service Institute for Teachers of Science and Mathematics

See "Suggestions and Forms for Preparing a Proposal for an In-Service Institute for 1961-62." All information applicable to the proposed institute should be supplied in the format shown.

I. GEORGETOWN UNIVERSITY Washington 7, D. C.
(Name and address of institution submitting proposal)

II. Prof. Dr. Mr. (Rev.) Matthew P. Thekaekara, S.J. : Acting Chairman
(Underline) (Other) (Name of institute director) (Director's academic title)

PHYSICS DEPARTMENT
(Director's department or other address)

(Director's office phone) (Director's home phone)

III. Length of institute: 9 months; SEPT. 20, 1961 through MAY 30, 1962
(Beginning date) (Ending date)

IV. Location of institute, if not on campus: _____

V. Number of participating teachers: 50 Secondary School Teachers
_____ Elementary School Personnel

VI. Areas of science instruction for which appropriate institute course would be offered, with approximate number of teachers in each course:

Biological Sciences	_____	Chemistry	_____
Earth Science	_____	Mathematics	_____
General Science	_____	Physics	<u>50</u>
Physical Science	_____		_____

VII. Typical credit obtainable: NONE Quarter-hours Graduate Credit
(No.) Semester-hours Undergraduate Credit
(Underline appropriate terms)

VIII. Degree(s), if any, toward which credit can be applied: NONE

IX. Total amount requested from the National Science Foundation: \$11,924.42

X. _____
(Signature of director)
Matthew P. Thekaekara, S. J.

December 15, 1960
(Date of submission)

(Name, title, and signature on one copy, of an official authorized to sign for the host institution)
Joseph F. Cohalan, S.J.
University Treasurer

BUDGET for Proposed 9 Month In Service Institute at
(No.)GEORGETOWN UNIVERSITY
(Institution)A. Support of Participants

1.	<u>50</u>	Travel Allowance at an average of	\$ 28.14 each . . .	\$1407.00	
2.	<u>50</u>	Book Allowance at	\$ 10.00 each . . .	500.00	
*3.	<u>No</u>	Required Fees for Health Services, etc., at	\$ each . . .	0.00	
				<u>\$1907.00</u>	\$1907.00

B. Direct Operational Cost1. Administrative Costs

a.	Director (administrative salary only)	\$ 100.00	
b.	Secretarial and clerical (<u>10 %</u> time)	420.00	
c.	Office supplies, publicity, communications.	350.00	
*d.	Retirement contributions <u>8 %</u>	380.80 298	
*e.	Other administrative costs		
	Sub-total.		<u>\$1250.80</u>

2. Instructional Costsa. Instructional Staff:

*1)	Local staff (itemize on page 3).	\$4340.00	
*2)	Special lecturers (including travel.	800.00	
*3)	Student assistants	1200.00	
b.	Laboratory and Instructional Materials.	1000.00	
c.	Field Trips (if any)	120.00	

*d.	Other Instructional Costs		
	Sub-total		<u>\$7460.00</u>

Total Direct Operational Costs \$8710.80

C. Allowance for Indirect Costs (not to exceed 15% of B). \$1306.62

D. Total Operational Costs (B plus C) \$10017.42

*E. Tuition and Fees (registration, credit fees, laboratory fees, etc.). \$

F. Total Operational Costs in excess of Tuition and Fees: (D minus E). \$

G. Total Cost of Institute: (A plus D, or, A plus E plus F) \$11924.42

*H. Contributions from university or other source toward the special costs listed above \$

J. Total amount requested from National Science Foundation: (G minus H). \$11924.42

*Starred items in particular must be itemized, elaborated, or explained on page 3.

K. Operational Cost per participant per year course: \$200.35

BUDGET DETAILS (On this sheet please make any essential or desired explanations or elaborations. Use additional page if necessary.)

- A.1 Thirty-five weekly meetings estimated. Of 50 participants, 15 are estimated to use public transportation (10 \$.50 per round-trip and 5 \$.74 per round-trip); an estimated 25 will drive their own cars a total of 10 miles or less per round trip (25 \$.70 per round-trip); and 10 will drive an estimated 20 miles (10 \$1.40 per round-trip). Total per week - \$40.20.
- A.2 The two books to be used will retail at \$16.50. With a 20% educational discount and \$10.00 from the grant, the participants will be asked to pay \$3.20 for the two texts.
- A.3 A Health Service is available for all part-time students at a cost of \$10.00 per semester. These participants wishing the service will be allowed to subscribe.
- B.1 a. The Director will spend approximately one per cent of his time for the Institute.
- b. 8% salaries of local staff and the secretary (8% of \$4760.00, \$380.80).
- B.2 a. Instructional Staff
1. Edward J. Finn, Assistant Professor, will be teaching the course and is expected to spend at least (50%) of his time on this project. His salary for nine months in 1961-62 will probably be ~~\$6400~~ 7200
 (50% \$6400, \$3200.00) 2560
- Ralph Regalbuto, Practical Physicist, will contribute 10% of his time to the project.
 (10% of \$7400, \$740.00)
- Charles Beckel, Ralph Henderson, William Thaler, and LeRoy Furlong, All members of the Physics Faculty, will be giving one lecture each per semester. Overtime payment is rated at \$50 per hour.
 (\$50 per hour x 8 - (400.00)
- Total for local staff ... \$4,340.00
2. Special lecturers, about one per month, rated at \$100 per lecture.
 \$100 per hour x 8 - (\$ 800.00)
3. One of the Senior University Fellows will be assisting Professor Finn in conducting the laboratory assignments. He will contribute 50% of his time to the institute.
 (50% of \$2400, \$1,200.00)
- b. The cost for breakage and and replacement of expendable material is estimated to be \$10.00 per student per semester. (\$20 x 50 - \$1,000.00)
- c. Four field trips are estimated. Bus rented will be \$30.
 (30 x 4 - \$ 120.00)

- E. The University feels it is not necessary to delineate tuition and fees. At the regular rate of the University (\$15.00 for registration and fees and \$99.00 for tuition per student, per semester) the total cost would be \$11,400.00 which is in excess of the total operational cost by \$1,382.58.
- F. If itemized, D minus E would be minus \$1,382.58.

NARRATIVE PORTION OF A PROPOSAL FOR A GRANT TO
GEORGETOWN UNIVERSITY FOR AN IN-SERVICE INSTITUTE

1. MAJOR OBJECTIVES

The Washington, D.C. metropolitan area has the largest concentration of scientists per capita than any other similar area in the country. With such a large number of scientifically-minded people, it seems obvious that many of the children in the Washington area will have an interest in science from an early age. Considering the present and estimated increasing need for scientists, these children should be afforded every opportunity to study in the scientific fields. Thus, the education in science given in the Washington area should be a model for the school systems throughout the country.

The Joint Board of Science Education, a group working under the auspices of the National Science Foundation, is interested in the science taught at all levels in the Greater Washington area. During a telephone conversation with the Supervising Director of Science for the District of Columbia Schools and a member of the Joint Board of Science Education, Mr. Keith Johnson, he urged that an In-Service Institute be set up for the teachers of the Physical Science courses taught at the Junior High School level. Of the 188 high schools in the Washington area, 63 are explicitly public Junior High Schools, 100 are public Junior-Senior High Schools, 44 are public High Schools, 31 are Catholic High Schools and 21 are private High Schools. Thus, there are 169 schools in the area where a Physical Science course is taught. According to Mr. Johnson, the majority of the teachers of these courses hold a Bachelor of Science degree, but not in Physics.

With all these facts in mind, Georgetown University has set out to establish an In-Service Institute for secondary school teachers of the Physical

$$\begin{array}{r} 1.4 \\ 55 \overline{) 75} \\ \underline{55} \\ 200 \\ \underline{200} \\ 0 \end{array}$$

$$\begin{array}{r} 1.4 \\ 8 \\ \hline 11.2 \end{array}$$

Science courses. In its initial year the Institute will give a series of weekly lectures, utilizing primarily the Physics Department Faculty, the tenor of which will be aimed especially at the group mentioned above that has had a minimal amount of instruction in Physics.

At Georgetown, teaching at a high level is a tradition. The University will extend itself to inspire the teaching of the secondary school teacher enrolled in the Institute. Furthermore, the University is renowned for its Georgetown Forum which has as a primary purpose the establishing of a dialogue between scientists and non-scientists. The Forum has been locally broadcast over television for the past 490 consecutive weeks and is rebroadcast over radio on 175 stations across the country. The radio series is about one and a half times as old as the television program. During the past few years the University has been increasing its service to the teachers of science as is evidenced in the Summer Institutes in Mathematics and Physics as well as in Astro-Physics. The Annual Science Fairs for Washington schools have found a very willing and interested host in Georgetown. Father Francis Keyden, S.J., Chairman of the Astronomy Department, is a member of the Science Advisory Council of the Greater Washington Education Television Association and is connected with the "Science for Today" television program. With the completion of the New Science Building in mid-1962, Georgetown is looking forward to the beginning of a great era of scientific cooperation with the world at large, but particularly with the Washington Metropolitan area. This will include, in the field of teacher training, not only a combined In-Service Institute of the various disciplines, but also a source of information for demonstrations and teaching methods.

II PROGRAM OUTLINE

The proposed Institute will commence in the latter part of September, 1961, and meet Wednesday evenings from 7:30 P.M. to 10:00 P.M. The final

lecture will be given during the last week of May, 1962. The lectures will all be in the area ordinarily called "Physics" and will be concerned with a number of points considered essential:

1. Fundamental Formal Instruction in Basic Physics

It is anticipated that textbooks covering a course in General Physics at the college level and a course in Modern Physics at the same level will be the source from which the lectures will derive their topics. Problems will be done during the lectures. Some problems will be suggested to the participants for personal solution.

2. Laboratory Assignments in Basic Physics

The Physics Department laboratories will be utilized by the participants in order to get them to handle equipment with which they are probably not familiar. The General Physics laboratory, as well as the laboratories associated with the College's Optics, Electricity and Magnetism, and Modern Physics courses will be used.

3. Removal of Gross Misconceptions and Errors

Both during lectures and laboratory assignments, the organizing professor will be careful to spot any individual or collective error that may have become part of the participant's repertoire. Such misconceptions as "mass is the amount of matter a body contains" or "Newton's Second Law is a precise definition" will be corrected as soon as it occurs.

4. Demonstration Lectures Primarily to Aid Physical Intuition

A number of times during the year, the last hour of the weekly session will be given over completely to Lecture Demonstration. Not only will various principles be shown by these demonstrations, but the participants will see the work put into setting up the demonstration equipment. Also, the participants will be given instruction in the production of similar demonstration apparatus. Demonstrations will also be incorporated in the lecture sessions.

5. Integration of Mathematics into Physics Courses

A strong point of every lecture will be to show the participants how the use of Mathematics will enable them to get across to their students the basic Physical principles. Thus, the participants will be taught to develop in their students an interest in Mathematics along with an interest in Physics.

6. Blending of 20th Century (Modern) Physics with Earlier (Classical) Physics.

The textbooks chosen will enable the lectures to skip back and forth between Classical and Modern Physics so that units such as Mechanics will include the Theory of Relativity, Electricity will include the e/m and Millikan Oil Drop experiments, and Quantum Theory will be incorporated into the Thermodynamics and Physical Optics section. The texts proposed to be issued to the participants are:

"Physics for Scientists and Engineers by R.G. Fowler and D.I. Meyer
(Allyn and Bacon)

"Elementary Modern Physics" by R.T. Weidner and R.L. Sells
(Allyn and Bacon)

III STAFF MEMBERS

The course will be organized and run by Edward J. Finn of the Georgetown University Physics Department. The demonstration lectures and laboratory experiments will be set up and run by Mr. Ralph Regalbuto also of the Georgetown University Physics Department. The other members of the Physics Department Faculty will be called upon from time to time, as will eminent scientists from the area. The outside people have not been contacted, but more than one famous name will be chosen to take part in the Institute.

Some information on the Director of the proposed Institute, the organizing Professor, and the other staff members is here given:

The Director, Rev. Matthew P. Thekaekara, S.J., Ph.D. Johns Hopkins University, Associate Professor and Chairman of the Physics Department has been teaching in both the Physics and Astronomy Departments of the University since 1957. During the past summer, Fr. Thekaekara was the Director of a Summer Conference for college professors on the subject of recent advances in Astro-Physics. This conference was sponsored by the National Science Foundation. Fr. Thekaekara has taught eight years in India and later at Johns Hopkins.

The organizing Professor, Mr. Edward Finn, M.S. Catholic University, has been teaching in the Physics Department as an Assistant Professor since 1956. Mr. Finn also has three previous years of teaching experience as an Instructor of Physics at Georgetown University and St. Vincent College, Latrobe, Pa. He is on leave of absence 1960-61, completing his dissertation for the Ph.D. degree.

The demonstration and laboratory instructor, Mr. Ralph Regalbuto, Practical Physicist, has been associated with the Physics Department since 1955. Mr. Regalbuto has been in charge of the acquisition, repair, and preparation of all laboratory equipment, including that for the research laboratories and the demonstration experiments for the General Physics courses. His previous experience includes similar positions held at the University of Chicago and Columbia University. Mr. Regalbuto is the Secretary of the Chesapeake Section of the American Association of Physics Teachers.

The other staff members of the Institute that will come from the Physics Department faculty have the following experience:

Dr. Charles Beckel, Ph.D. Johns Hopkins University. Dr. Beckel is an Associate Professor of Physics and has been with the Department since 1953. During the 1947-58 academic year he held a Fulbright Lectureship in Physics at Peshawar University, Pakistan.

Dr. LeRoy Furlong, Ph.D. Catholic University. Dr. Furlong joined the Faculty in 1957, as an Assistant Professor of Physics.

Dr. Ralph Henderson, Ph.D. Harvard University. Dr. Henderson is an Associate Professor and has been with the Department since 1955. Dr. Henderson has had previous teaching experience at William and Mary College as well as in Turkey. In the summer of 1959, Dr. Henderson was the Director of a Summer Conference for college Physics teachers, under the sponsorship of the National Science Foundation. During this academic year, a National Science Foundation Science-Faculty grant has allowed him to take advanced studies at Columbia University.

Dr. William Thaler, Ph.D. Catholic University. Dr. Thaler has joined the Faculty this past year as a Professor of Physics. He is well known for his administration of the Government's "Project Argus" and the back-scatter radar project.

All of the members of the Physics Faculty listed above, excepting Mr. Regalbuto and Dr. Thaler have had a minimum of four years experience teaching graduate and undergraduate courses. The Physics Department policy has been to allow a professor to teach each year at least one course not previously taught. The policy has also been, whenever possible, that a professor will not teach the same subject three years in succession. Thus, the listed Faculty members have each taught a majority of the undergraduate courses and at least two graduate courses during the past five years.

IV. PROCEDURES FOR SELECTION OF PARTICIPANTS

The participants of the Institute will be selected from the Junior High School Physical Science teachers of the Washington Metropolitan area. The size of the Institute will be limited to approximately 50 participants. Applications will be mailed individually to every Physical Science teacher

in the area and from the returned forms the selection will be made by the Director and Mr. Finn with the assistance of the other staff members according to the following criteria:

1. Is the applicant a Junior High School teacher of Physical Science?

An answer of "Yes" will be necessary.

2. Does the applicant hold a degree in Physics?

An answer of "No" will be necessary.

3. Does the applicant have a degree in Science?

An answer of "Yes" is wanted, but not necessary.

4. Does the applicant have an interest in attending an Institute that will cover topics mainly in the field of General Physics?

An answer of "Yes" will be necessary.

Preference will be given to those who show least formal instruction in Physics and shortest teaching experience. If these criteria and preferences do not reduce the number to the maximum that can be handled efficiently, then participation will be allocated on a geographical and student population basis. That is, if a distribution of this sort is called for and 40% of the students in the Metropolitan area get their instruction in the District of Columbia schools, then 40% of the participants will be selected from the District Physical Science teachers. From the criteria and preference mentioned above, it may be seen that the Georgetown In-Service Institute will attempt to help the inadequately prepared teachers in the Metropolitan area so that they will better understand what they are teaching. A science background is considered desirable since the participants will be required to read a considerable amount of Physics by themselves.

V. ACADEMIC CREDIT

No degree and no academic credit will be given since the course is not at the graduate level and the participants will have no need for undergraduate credit. A certificate of satisfactory attendance will be issued at the conclusion of the Institute.

VI. FACILITIES

The lectures and demonstrations will be given in the McNeir Lecture Hall and laboratory instruction will be run in the Physics Department's North and South laboratories. The Physics Department library as well as the entire University library will be available to all participants. The weekly sessions will be composed of an hour lecture followed by a half hour "coffee break" with informal discussion, questions and answers, etc. The final hour will be utilized as a laboratory period, for additional lectures, or for continuing group discussions. Outside speakers, such as Dr. Karl Herzfeld of the Catholic University speaking on the History of Physics, are planned to be utilized on a basis of one a month (more or less depending on availability of outstanding persons as they visit the Washington area). Selected field trips, such as to the Naval Research Laboratory's research reactor, are contemplated. Due to the day time schedule of the participants, a representative sampling of all the scientific facilities in the Washington area will be impossible.

Dec 15, 1961

SUMMARY SHEETS for a Proposal to the National Science Foundation for Support of an In-Service Institute for Teachers of Science and Mathematics

See "Suggestions and Forms for Preparing a Proposal for an In-Service Institute for 1962-63." All information applicable to the proposed institute should be supplied in the format shown.

- I. GEORGETOWN UNIVERSITY, Washington 7, D. C.
(Name and address of institution submitting proposal)
- II. Name and title of Head of Institution: Very Rev. Edward B. Bunn, S. J.
President
- III. Title of proposed institute: In-Service Institute in Physics for Junior High School Teachers
- IV. Prof. Dr. Mr. (Rev.) Matthew P. Thekkarakara, S.J. : Acting Chairman
(Underline) (Other) (Name of institute director) (Director's academic title)
Department of Physics
(Director's department or other address)
Director's office phone No.: FE 7-3300 ext. 670 ; home phone No.: FE 7-3300
- V. Length of institute: 9 months; Sept. 20, 1962 through May 30, 1963
(Beginning date) (Ending date)
- VI. Location of institute, if not on campus: _____
- VII. Number of participating teachers: _____ High School Teachers (grades 9-12)
50 Junior High School Teachers (grades 7-9)
_____ Elementary School Personnel (grades 1-6)
- VIII. Areas of science instruction for which appropriate institute courses would be offered, with approximate number of participants in each area:
Biological Sciences _____ Chemistry _____
Earth Science _____ Mathematics _____
General Science _____ Physics _____
Physical Science 50 _____
- XI. Typical credit obtainable: 6 Quarter-hours Graduate Credit
(No.) Semester-hours Undergraduate Credit.
(Underline appropriate terms)
- X. Degree(s), if any, toward which credit can be applied: B. S.
- XI. Total amount requested from the National Science Foundation: \$ 10,152.85
- XII. _____
(Signature of director) (Name and title of official authorized to sign for the host institution, with signature on one copy)
December 13, 1961 Rev. Joseph F. Cohalan, S. J.
(Date of submission) Treasurer, Georgetown University

BUDGET for Proposed 9 -Month In-Service Institute at Georgetown University
(No.)

A. Support of Participants

*1.	<u>50</u>	Travel Allowances at an average of	\$ 28.14 each	..	\$1,407.00
2.	<u>50</u>	Book Allowances at	\$ 10.00 each	..	500.00
*3.	<u>No</u>	Required Fees for Health Services, etc., at		each	.. -0-
					\$1,907.00

B. Direct Operational Costs

1. Administrative Costs

a.	Director (administrative salary only)	..	\$ 100.00
b.	Secretarial and clerical (<u>12%</u> time)	..	483.60
c.	Office supplies, publicity, communications	..	350.00
*d.	Retirement contributions at <u>8%</u>	..	86.70
*e.	Other administrative costs	..	-0-
			Sub-total ..
			\$1,020.30

2. Instructional Costs

a. Instructional Staff:

*1)	Local staff (itemize on page 3)	..	\$3,730.00
*2)	Special lecturers (including travel)	..	100.00
*3)	Student assistants	..	1,200.00
b.	Laboratory and Instructional Materials	..	1,000.00
c.	Field Trips (if any)	..	120.00
*d.	Other Instructional Costs	..	-0-
			Sub-total ..
			\$6,150.00

Total Direct Operational Costs \$7,170.30

*C. Contributions from university or other source toward the specific costs listed above \$ -0-

D. Net direct operational costs requested (B minus C) \$ 7,170.30

E. Allowance for Indirect Costs (not to exceed 15% of D) \$ 1,075.55

F. Total net Operational Costs requested (D plus E) \$ 8,245.85

*G. Tuition and Fees (registration, credit fees, laboratory fees, etc.) \$
(List only if so required)

H. Total net Operational Costs in excess of Tuition and Fees (F minus G) \$ 8,245.85

J. Total amount requested from National Science Foundation \$10,152.85
(A plus F; or, A plus G in lieu thereof)

*Starred items in particular must be itemized, elaborated, or explained on page 3.

K. Operational Cost per participant per semester-hour credit: \$27.48

BUDGET DETAILS (On this sheet please make any essential or desired explanations or elaborations. Use additional page if necessary.)

- A.1 We expect to hold 35 weekly meetings. Of the 50 participants, we estimate that 15 will use public transportation (10 at \$0.50 per round trip and 5 at \$0.74 per round trip); an estimated 25 will drive their own cars, a total of 10 miles or less per round trip (25 at \$0.70 per round trip) and 10 will drive about 20 miles (10 at \$1.40 per round trip). Total per week \$40.20.
- A.3 A health-service is available for all part-time students at a cost of \$10.00 per semester. There is no obligatory health-service for part-time students. Hence no funds are requested in the grant for this purpose.
- B.1a This amount will be paid to the Director for work done during the summer to prepare for the Conference. His contributions to the Institute during the academic year are on a released time basis and hence there will be no special remuneration.
- B.1b The salary of the departmental secretary in 1961-62 will be \$4,030.00, of which 12% is debited to the Institute.
- B.1d Retirement is calculated at 8% of \$1,083.60 (\$483.60 for Secretary and \$700.00 for Practical Physicist). The Director is not on the retirement plan of the University.
- B.2a Instructional Staff
1. Matthew P. Thekaekara, Acting Chairman, department of physics will be giving the course. He will devote 30% of his time to this project. (30% of \$10,100.00, \$3,030.00).

Ralph L. Regalbuto, Practical Physicist, will contribute a little less than 10% of his time to the project. His salary will be \$7,600.00 for the next academic year, and \$700.00 will be paid from the grant for his released time.
- B.2a.2 We plan to invite two special lecturers, one each Semester, and they will be paid a remuneration of \$50.00 per lecture.
- B.2a.3 One of the Senior University Fellows will be assisting the Director for setting up and conducting the lab sessions. He will contribute 50% of his time to the Institute (50% of \$2,400.00, \$1,200.00).
- B.2b The cost for breakage and replacement of expendable material is estimated to be \$10.00 per student per semester. (\$20 x 50, \$1,000.00).
- B.2c Four field trips are planned. Bus rental will be \$30 per trip. (4 x \$30, \$120.00).
- G. The University feels it is not necessary to delineate tuition and fees. At the regular rate of the university, \$34.00 per credit and \$15.00 for registration, the total cost would be \$10,950.00. It is in excess of the total operational cost, \$8,245.85, requested in the grant by \$2,704.15.
- H. If Tuition and Fees were to be listed, F minus G would be minus \$2,704.15.

NARRATIVE PORTION OF A PROPOSAL FOR A GRANT TO
GEORGETOWN UNIVERSITY FOR AN IN-SERVICE INSTITUTE

1. MAJOR OBJECTIVES

The Washington, D. C. metropolitan area has a larger concentration of scientists per capita than any other similar area in the country. With such a large number of scientifically-minded people, it seems obvious that many of the children in the Washington area will have an interest in science from an early age. Considering the present and estimated increasing need for scientists, these children should be afforded every opportunity to study in the scientific fields. Thus, the education in science given in the Washington area should be a model for the school systems throughout the country.

The Joint Board of Science Education, a group working under the auspices of the National Science Foundation, is interested in the science taught at all levels in the Greater Washington area. We have discussed our program of the In-Service Institute with several members of the Joint Board of Science Education. The Supervising Director of Science for the District of Columbia Schools and a member of the Joint Board of Science Education, Mr. Keith Johnson, urged that an In-Service Institute be set up for the teachers of the Physical Science courses taught at the Junior High School level. Of the 188 high schools in the Washington area, 63 are explicitly public Junior High Schools, 100 are public Junior-Senior High Schools, 44 are public High Schools, 31 are Catholic High Schools and 21 are private High Schools. Among these there are 169 schools in the area where a Physical Science course is taught. The majority of the teachers of these courses hold a Bachelor of Science degree, but not in Physics.

With all these facts in mind, Georgetown University set out to establish an In-Service Institute for secondary school teachers of the Physical Science courses. The Institute was conducted for the first time in 1960-61. The number of applicants were far more than 50 and hence we decided that a proposal should be made to the National Science Foundation to hold a similar Institute for 1961-62. The

Institute will give a series of weekly lectures the tenor of which will be aimed especially at the group mentioned above that has had a minimal amount of instruction in Physics.

While preparing for the In-Service Institute of 1961-62, two of the members of the Physics faculty at Georgetown, contacted by telephone a large number of principals of Junior high schools of the Washington metropolitan area. We found that a telephone conversation was far more effective than printed folders in acquainting teachers about the program. We also learned what the teachers look for in a course like this. Physics apparently is more difficult than other subjects like chemistry and biology for the average school teacher. Teachers find that trying to learn physics by oneself from text-books is all too ineffective. Besides, physics today is so very different from what the teachers were exposed to in their student days. Hence a college level course in physics, with formal lectures, problem sessions and laboratory is of the utmost importance.

At Georgetown, teaching at a high level is a tradition. The University will extend itself to inspire the teaching of the secondary school teacher enrolled in the Institute. Furthermore, the University is renowned for its Georgetown Forum which has as a primary purpose the establishing of a dialogue between scientists and non-scientists. The Forum has been locally broadcast over television for the past 540 consecutive weeks and is rebroadcast over the radio from 175 stations across the country. The radio series is about one and a half times as old as the television program. During the past few years the University has been increasing its service to the teachers of science as is evidenced in the Summer Institutes in Mathematics and Physics as well as in Astro-geophysics. The Annual Science Fairs for Washington schools have found a very willing and interested host in Georgetown. Father Francis Heyden, S.J., Chairman of the Astronomy Department, is a member of the Science Advisory Council of the Greater Washington Education Television Association and is connected with the "Science for Today"

television program. With the completion of the New Science Building in the summer of 1962, Georgetown is looking forward to the beginning of a great era of scientific cooperation with the world at large, but particularly with the Washington Metropolitan area. This will include, in the field of teacher training, not only a combined In-Service Institute of the various disciplines, but also a source of information for demonstrations and teaching methods.

II. PROGRAM OUTLINE

The proposed Institute will commence in the latter part of September, 1961, and meet Saturday mornings from 9:15 to 12:15. Each session will be broken into two periods of 75 minutes each, with a thirty-minute coffee break in between. The last lecture will be given during the last week of May, 1962. The lectures will all be in the area ordinarily called "Physics" and will be concerned with a number of points considered essential:

1. Fundamental Formal Instruction in Basic Physics

It is anticipated that textbooks covering a course in General Physics at the college level and a course in Modern Physics at the same level will be the source from which the lectures will derive their topics. Problems will be done during these lectures. Some problems will be suggested to the participants for personal solution.

2. Laboratory Assignments in Basic Physics

The Physics Department laboratories will be utilized by the participants in order to get them to handle equipment with which they are probably not familiar. The General Physics laboratory, as well as the laboratories associated with the College's Optics, Electricity and Magnetism, and Modern Physics courses will be used.

3. Demonstration Lectures Primarily to Aid Physical Intuition

A number of times during the year, the last hour of the weekly session will be given over completely to Lecture Demonstration. Not only will various

principles be shown by these demonstrations, but the participants will see the work that goes into setting up a demonstration experiment. Also, the participants will be given instruction on the production of similar demonstration apparatus. Demonstrations will also be incorporated in the lecture sessions.

4. Integration of Mathematics into Physics Courses

A strong point of every lecture will be to show the participants how the use of Mathematics will enable them to get across to their students the basic Physical principles. Thus, the participants will be taught to develop in their students an interest in Mathematics along with an interest in Physics.

5. Blending of 20th Century (Modern) Physics with Earlier (Classical) Physics

The textbooks chosen will enable the lectures to skip back and forth between Classical and Modern Physics so that units such as Mechanics will include the Theory of Relativity, Electricity will include the e/m and Millikan Oil Drop experiments, and Quantum Theory will be incorporated into the Thermodynamics and Physical Optics section. The texts proposed to be issued to the participants are:

A few selected paperbacks at relatively low cost.

Jay Orear, Fundamental Physics (John Wiley and Sons, Inc.,
New York, 1961) \$ 6.75

III. STAFF MEMBERS

The course will be organized and run by Rev. Matthew P. Thekaekara, Acting Chairman, Physics Department, Georgetown University. The demonstration lectures and laboratory experiments will be set up and run by Mr. Ralph Regalbuto, also of the Georgetown University Physics Department. The other members of the Physics Department Faculty will be called upon from time to time. Two outside lecturers will also be invited.

Some information on the staff members is here given:

The Director, Rev. Matthew P. Thekaekara, S.J., Ph.D. Johns Hopkins University, Associate Professor and Acting Chairman of the Physics Department, has

been teaching in both the Physics and Astronomy Departments of the University since 1957. During the summer of 1960 and of 1961 Fr. Thekaekara was the Director of a Summer Conference for college professors on the subject of Recent Advances in Astro-geophysics. This conference was sponsored by the National Science Foundation. Fr. Thekaekara had taught previously eight years in India and later at Johns Hopkins University.

The demonstration and laboratory instructor, Mr. Ralph Regalbuto, Practical Physicist, has been associated with the Physics Department since 1955. Mr. Regalbuto has been in charge of the acquisition, repair, and preparation of all laboratory equipment, including that for the research laboratories and the demonstration experiments for the General Physics courses. His previous experience includes similar positions held at the University of Chicago and Columbia University. Mr. Regalbuto is the Secretary of the Chesapeake Section of the American Association of Physics Teachers.

The other staff members of the Institute that will come from the Physics Department faculty have the following experience:

Dr. Charles Beckel, Ph.D. Johns Hopkins University.

Dr. Beckel is an Associate Professor of Physics and has been with the Department since 1953. During the 1947-58 academic year he held a Fulbright Lectureship in Physics at Peshawar University, Pakistan.

Dr. Ralph Henderson, Ph.D. Harvard University.

Dr. Henderson is an Associate Professor and has been with the Department since 1955. Dr. Henderson has had previous teaching experience at William and Mary College as well as in Turkey. In the summer of 1959, Dr. Henderson was the Director of a Summer Conference for college Physics teachers, under the sponsorship of the National Science Foundation.

Dr. William Thaler, Ph.D. Catholic University. Dr. Thaler has joined the Faculty this past year as a Professor of Physics. He is well known for his administration of the Government's "Project Argus" and the backscatter radar project.

All of the members of the Physics Faculty listed above, excepting Mr. Regalbuto and Dr. Thaler have had a minimum of four years' experience teaching graduate and undergraduate courses. The Physics Department policy has been to allow a professor to teach each year at least one course not previously taught. The policy has also been, whenever possible, that a professor will not teach the same subject three years in succession. Thus, the listed Faculty members have each taught a majority of the undergraduate courses and at least two graduate courses during the past five years.

IV. PROCEDURES FOR SELECTION OF PARTICIPANTS

The participants of the Institute will be selected from the Junior High School Physical Science teachers of the Washington Metropolitan area. The size of the Institute will be limited to approximately 50 participants. Applications will be mailed individually to every Physical Science teacher in the area and from the returned forms the selection will be made by the Director with the assistance of the other staff members according to the following criteria:

1. Is the applicant a Junior High School teacher of Physical Science?

An answer of "Yes" will be necessary.

2. Does the applicant hold a degree in Physics?

An answer of "No" will be necessary.

3. Does the applicant have a degree in Science?

An answer of "Yes" is wanted, but not necessary.

4. Does the applicant have an interest in attending an Institute that will cover topics mainly in the field of General Physics?

An answer of "Yes" will be necessary.

Preference will be given to those who show least formal instruction in Physics and shortest teaching experience. If these criteria and preferences do not reduce the number to the maximum that can be handled efficiently, then participation will be allocated on a geographical and student population basis.

That is, if a distribution of this sort is called for and 40% of the students in the Metropolitan area get their instruction in the District of Columbia schools, then 40% of the participants will be selected from the District Physical Science teachers. From the criteria and preference mentioned above, it may be seen that the Georgetown In-Service Institute will attempt to help the inadequately prepared teachers in the Metropolitan area so that they will better understand what they are teaching. A science background is considered desirable since the participants will be required to read a considerable amount of Physics by themselves.

V. ACADEMIC CREDIT

The In-Service Institute course in physics has been approved by the Dean of the College of Arts and Sciences, Georgetown University, to carry a total of six undergraduate credits, three per semester. Participants who take the course for credit, will have to turn in weekly assignments and lab reports and will take the semester exams, as is customary in other undergraduate physics courses of the College.

The course is at the undergraduate level and hence no graduate credit will be given. The undergraduate credit is helpful for two categories of junior high school teachers, those who are working towards a bachelor's degree with science major, or those who seek admission to a Master's program and need more undergraduate credits in science to qualify for the program.

The departments of Mathematics, Biology and Chemistry are also interested in this In-Service Institute program. Some preliminary steps have been taken for offering similar programs in these other areas. However, during the academic year 1962-63, the University will be able to offer a program in physics only. During the summer of 1962 the four departments are to move into the new \$4.1 million Science Building. The process of transfer will strain the existing faculty to the utmost, all the more so since we foresee a rapid development of the

research program in all four areas. During 1963-64 one or more of the other departments will also be in a position to offer an In-Service Institute program.

There is a heavy demand from science teachers of the area for programs of this type at Georgetown University.

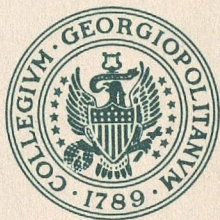
VI. FACILITIES

The lectures and demonstrations will be given in the Physics Lecture Hall of the new Science Building and laboratory instruction will be run in the Physics Department's laboratories on the fifth floor. The Physics Department library, as well as the entire Science Building library will be available to all participants. The first half of the weekly session will be followed by a half hour "coffee break" with informal discussion, questions and answers, etc. The final hour will be utilized as a laboratory period, for half the number, and for continuing group discussions, solving problems, setting up demonstrations, etc. for the other half. Selected field trips, such as to the Naval Research Laboratory's research reactor, are contemplated. Due to the day time schedule of the participants, a representative sampling of all the scientific facilities in the Washington area will be impossible. The University has authorized funds for expenses to be incurred for two group picnics and for the coffee-break of each Saturday session.

The facilities of the new Science Building will be available for the In-Service Institute. In drawing up the plans for the physics lecture hall and the laboratories, special care has been taken to include all that education in physics would require today in the line of lab experiments and class room demonstrations. The planning of the building and of the interior fittings was supervised at every stage by the physics faculty. Some of the inconveniences we are experiencing in this year's In-Service Institute will be removed when we meet next year in the new building.

IN-SERVICE INSTITUTE

For Teachers of Physics and General Science



Georgetown University • Washington 7, D. C.

FOR THE ACADEMIC YEAR 1962-1963

SPONSORED BY

THE NATIONAL SCIENCE FOUNDATION

- Fifty tuition-free grants available.
- A six-credit-course in general physics and modern physics.
- Emphasis on applications to Space Physics.
- Lecture room demonstrations and laboratory experiments.
- Travel stipends and book allowances.

Please mail applications to, and for further information call,

REV. M. P. THEKAEKARA, S.J.
 GEORGETOWN UNIVERSITY
 WASHINGTON 7, D. C.
 Telephone FE 7-3300, ext. 670

PLEASE POST OR CIRCULATE

IN-SERVICE INSTITUTE IN PHYSICS
 GEORGETOWN UNIVERSITY
 WASHINGTON 7, D. C.

NON PROFIT ORG.
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 WASHINGTON, D. C.
 Permit No. 3901

Note: Please use this routing slip to forward this copy to teachers who would be interested in this Institute.

From: _____

To: _____

From: _____

To: _____

From: _____

To: _____

College or university education:

INSTITUTION	SCHOOL OR DEPT.	YEARS		DEGREE	MAJOR SUBJECT	MINOR SUBJECT(S)
		FROM	TO			

Teaching Schedule: List complete teaching schedule for the academic year 1961-62. Periods are _____ minutes.

COURSE OR OTHER ASSIGNMENT	GRADE OR LEVEL	PERIODS PER WEEK

Please use additional sheet if necessary.

Date _____

Signature _____

IN-SERVICE INSTITUTE IN PHYSICS

OBJECTIVES

The Department of Physics of Georgetown University offers for the second year in succession an In-Service Institute in Physics under the sponsorship of the National Science Foundation.

The Washington, D. C., metropolitan area has a larger concentration of scientists per capita than any other similar area in the country. Hence, it is natural that many of the school children in the area develop an interest in the physical sciences from an early age. The average teacher whose formal instruction in the Sciences was completed many years ago, needs to keep abreast of the rapidly developing subject in order to inspire and motivate his charges. He or she needs an academic stimulus beyond what is given by a heavy schedule of teaching familiar topics.

Aspects of recent progress have elicited popular interest to an unprecedented degree. Rockets and satellites have yielded a wealth of information which, through earth-bound instruments and theoretical analysis, the painstaking research of earlier times could only vaguely predict. The scientific accuracy of some of the widely publicized accounts of the Space Age is not what the professional science teacher would like it to be. In classroom discussions, questions come up which teachers often feel they cannot handle adequately with their more conventional training. The current progress of Physics is such that textbooks become rapidly obsolete, and media of mass communication supplant textbooks and journals even for the professional scientist.

The In-Service Institute has been planned to meet these deficiencies. It will cover the area ordinarily referred to as "General Physics." The course will try to blend classical physics with modern physics, and will lay due emphasis on the achievements and problems of the Space Age and the satellites. The formal lectures will be supplemented by class room demonstrations, laboratory assignments in basic physics, and sessions for group discussions and for solving problems. A minimum of mathematics will be expected from the participants of the Institute.

ELIGIBILITY

Fifty teachers of general science and physics are eligible. The course is intended primarily for teachers of the Junior High School in the public school system, or of the seventh and eighth grades and the first year high in the private school system. Applicants from Washington, D. C., and adjoining counties in Maryland and Virginia will be preferred since the total travel allowance budgeted per week is \$40.00 only.

ALLOWANCES

Tuition: Each participant is granted a scholarship which covers tuition and other fees.

Travel: A travel allowance of up to seven cents a mile per round trip from his home to the University will be given out of funds provided by the National Science Foundation.

Books: The National Science Foundation also provides \$10.00 per participant to cover the cost of textbook and laboratory manual.

In addition, the University has authorized funds for expenses to be incurred for two group picnics and for the coffee break of each Saturday session.

FACILITIES

The new \$4.1 million Basic Science Building of Georgetown University will be ready for occupancy early in September 1962. The lectures will be held in the Physics Auditorium of the Science Building. The laboratory periods will be in the General Physics Lab on the fifth floor of the same building. The facilities for laboratory assignments and lecture demonstrations have been considerably increased by moving the Physics Department from the Healy basement to the new quarters. There is ample parking space available near the building.

THE ACADEMIC PROGRAM

The Institute will meet every Saturday morning at 9:15, from October 6, 1962 until the end of May 1963. After a lecture session of about 75 minutes and a coffee break, the participants will be divided into two groups, one for the laboratory experiments and the other for the quiz period. These two groups will alternate during successive weeks.

The participants may take the course for credit if they choose to do so. The course carries a total of six undergraduate credits, three per semester.

STAFF

Rev. M. P. Thekaekara, S.J., Associate Professor of Physics; Ph.D., Johns Hopkins University, 1956; has taught in the Department of both Physics and Astronomy at Georgetown University since 1957; directed the N.S.F. Summer Conference for College Professors on Recent Advances in Astro-Geophysics during the Summers of 1960, '61 and '62; Specialty, Spectroscopy and Space Physics; will be conducting the lecture sessions and the quiz sessions of the In-Service Institute.

Mr. Ralph A. Regalbuto, Practical Physicist; has been associated with the Physics Dept., Georgetown University since 1955; Secretary, Chesapeake Section of the American Association of Physics Teachers; Specialty, Practical Physics demonstrations and teaching aids; will be in charge of setting up the demonstration experiments for the lectures and planning the lab experiments for the Institute.

Mr. Paul E. Dalbec, M.S., University of Notre Dame, 1959; University Fellow, Dept. of Physics, Georgetown University; will be conducting the laboratory sessions for the Institute.

APPLICATIONS

An Application Blank is provided on the end panels of this folder. Please tear it off and mail it to:

Rev. M. P. Thekaekara, S.J.
Georgetown University
Washington 7, D. C.

no later than September 17, 1962.

Selection of participants will be announced on September 24th. Registration will be on October 6th.

APPLICATION FORM for In-Service Institute in PHYSICS—1962-63

Name and Address: _____

Social Security Number: _____

Date of Birth: _____

Minimum one way distance from residence to Georgetown University _____ miles

Employment Record—List professional experience of the Past 5 years in teaching and work related to teaching. (Add separate sheet if necessary):

DATE	EMPLOYER	NATURE OF ACTIVITY

PLEASE SEE REVERSE SIDE

IN-SERVICE INSTITUTE IN PHYSICS - 1962-63

GEORGETOWN UNIVERSITY-WASHINGTON 7, D. C.

- ALBERTA, R.S.M., Sr. Mary, Holy Trinity Convent, 3513 N St., N.W., Washington 7, D. C.
BAILOR, S.S.N.D., Sr. M. Peter Canisius, Our Lady of Perpetual Help Convent, 1602 Morris Road, S.E., Washington 20, D.C.
BLACK, Mr. (Charles) Drexel, 9410 Rhode Island Ave., College Park, Maryland
BROWN, Mrs. Virginia C., Richmond County High School, Warsaw, Virginia
CANNON, Mr. Rufus R., 5144 8th St., N. E., Washington 11, D. C.
CARNELL, Miss Jan, 1913 G St., N. W., Washington 6, D. C.
CAUGHEY, Mr. David G., 709 Chalfonte Drive, Alexandria, Virginia
CONTEE, Mr. Carl T., 2639 Bowen Road, S.E., Washington 20, D. C.
CORBIN, Miss Elizabeth K., 3940 Penna. Ave., S. E., Washington 20, D. C.
COUNTS, Mr. Richard Monroe, 1389 F St., N.E., Washington 2, D.C.
DALEY, S.S.N.D., Sr., Marie Ellena, 7512 Marlboro Pike, Washington 28, D. C.
DARNABY, Jr., Mr. John J., 1602 Dunwich Garth, Lutherville, Maryland
DONOVAN, S.C., Sr. Maria Jerome, 4214 Saul Road, Kensington, Maryland
du BOIS, Miss Ethyl M., 6211 64th Ave., Apt. 2, East Riverdale, Maryland
EYL, R.N., Sr. Joseph Beatrice, Saint Mary's Academy, Leonardtown, Maryland
EULER, Mrs. Elvira A., 4400 Lee Highway, #113, Arlington 7, Virginia
FRANTZ, Mr. Robert F., 6013 Carter Ave., Baltimore 14, Maryland
GEORGE, Mr. Ray L., 7304 Ballard Drive, Clinton, Maryland
GOREN, Mr. Homer B., 3020 Manhattan Ave., Baltimore 15, Maryland
GREEN, Mr. Donald C., 744 Girard St., N. W., #209, Washington 1, D. C.
GROSSMAN, Mr. Norman, 3543 Flannery Lane, Baltimore 7, Maryland
HAYES, Miss Dolores S., 2705 13th St., N.E., Washington 18, D. C.
HENDON, Mr. Billie G., 229 S. Aurara St., Easton, Maryland
HICKS, Mrs. Mary E., 307 N. Howard St., Apt. 201, Alexandria, Virginia
HOFFMAN, Mr. Frenis, 13004 Grenoble Drive, Rockville, Maryland
HORVATH, Mr. Joseph F., 3320 W. Rogers Ave., Baltimore 15, Maryland
HUGHLETT, Mr. Robert Emmett, 3810 Glenarm Ave., #6, Baltimore, Maryland
HUTCHESON, Mr. Emmett A., 460 Glen Carlyn Drive, Falls Church, Virginia
JACKSON, Mr. Earl B., 732 Dennis St., Salisbury, Maryland
JOHNSON, Miss Betty Jean, Box 149, Woodson High School, Crisfield, Maryland
JOSEPHA, R.S.H.M., Mother M., Marymount School, 2807 N. Glebe Rd., Arlington, Virginia
KIRK, Rev. Daniel, St. Anselm's Abbey, 14th and S. Dakota Ave., N.E., Washington 17, D.C.
KNIGHT, Mr. Lawrence Edwin, Rts. 3, Box 303, Arundel-on-the-Bay, Annapolis, Maryland
KOSCO, Mr. Francis Robert, Box 245 B., Easton, Maryland
LAW, Miss Ruth S., 3302 Springdale Ave., Baltimore 16, Maryland
LEDDON, Mr. Jack, 4371 Shamrock Ave., Baltimore 6, Maryland
LIEBECK, S.S.N.D., Sr. Mary Joleen, 7512 Marlboro Pike, Washington 28, D. C.
LINZ, S.S.N.D., Sr. Mary Annicia, 7512 Marlboro Pike, Mt. Calvary School, Washington 28, D.C.
LOUISE, S.C.N., Sr. Teresa, St. Mary's Academy, Leonardtown, Maryland
LUNDEGARD, Miss Marjerie, 609 Blair Rd., Falls Church, Virginia
LYLES, Mr. Charles B., 302 Tennessee Ave., N.E., Washington 2, D. C.
MARIA, S.S.N.D., Sister, St. John Convent, 112 E. Second St., Frederick, Maryland
MARYANN, S.S.N.D., Sister, St. John Convent, 112 E. Second St., Fredrick, Maryland
McCRAY, Mr. Werton R., 713 Exeter Hall Ave., Baltimore 18, Maryland
McCREA, Miss Margaret R., Porpoise Creek Farm, Trappe, Maryland
McMILLAN, Miss Flora J., 2935 Presbury St., Baltimore 16, Maryland
MICHAEL, S.N.D., Sr. Catherine, 941 N. Capitol St., Washington 2, D. C.
MILLER, Mr. Marcellus C., Kennard High School (Queen Anne's County Schools), Centerville, Md.
MOORE, Mr. Norman, 6 Adams Ave., Lexington Park, Maryland
PERKINS, Mr. Louis R., 810 Kennedy, N.W., #102, Washington 11, D.C.
PHILLIPS, S.S.N.D., Sr. Mary Ruth, 7512 Marlboro Pike, Washington 28, D. C.

- RING, Mrs. Phyllis, 114 Kennedy St., Alexandria, Virginia
▲ RULA, Miss Dona Hale, 3112 Chesterfield St., Richmond, Virginia
▲ SCHULTZ, Mr. William R., 1907 Fendall Avenue, Charlottesville, Virginia
SELLMAYER, Mr. Edward G., Bardon Rd. & Summer Hill Drive, Phoenix, Maryland
SHAHAN, Mr. Donald B., Route #5, Hagerstown, Maryland
SHEEHAN, Mrs. Helen Cecilia, 3810 Wexford Drive, Kensington, Maryland
SHERRY, Sr. Anne Richard, Seton High School, 2800 N. Charles St., Baltimore 18, Maryland
SWEENEY, Sr. Pauline, Seton High School, 2800 N. Charles St., Baltimore 18, Maryland
TIGANI, Miss Grace J., 707 Hudson Avenue, Takoma Park 12, Maryland
WATSON, S.N.D., Sr. Roberta Marie, 941 N. Capitol St., Washington 2, D. C.
WHELAN, Sr. Marie Bernard, 7512 Marlboro Pike, Washington 28, D. C.
* WILLIAMS, Miss Clara, 4705 Hunt Ave., Chevy Chase 15, Maryland
WINGROVE, Mr. James, 2803 Keith St., Washington 21, D. C.
WISNER, Mr. Thomas A., c/o A. J. Fortin Sr., Hollywood Shores, Hollywood, Maryland
WOODHOUSE, Mr. Lorenzo A., 1431 Roxanna Rd., N.W., Washington 12, D. C.
* MORAND Sr. Rose Martin, Holy Redeemer Convent, 4214 Saul Rd. Kensington, Md.
▲ REGINA, Sr. S.C., 4212 Saul Road, Kensington, Md.
▲ RUTHER, Sister Dorothy Mary, S.C., 4214 Saul Road, Kensington, Md.
SCHLAIRET, Sister Marie Paul, C.S.C., 5811 Riverdale Rd. Riverdale, Md.
KAVAL, Mother Cecile, R.S.H.M., 2807 N. Glebe Road, Arlington 7, Va.

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NSF FORM
SEP 1962 9C-20 C

SUMMARY SHEETS for a proposal to the NATIONAL SCIENCE FOUNDATION for support of an
(Title): In-Service Institute in Physics
for Secondary School Teachers of Physics and General Science.

A. NAME and address of institution: GEORGETOWN UNIVERSITY, Washington 7, D. C.

B. Grant should be made to: Georgetown University, Washington 7, D. C.

C. Director of institute: Prof. (Dr.) Mr. (or: _____) M. P. Thekaekara, S.J.

Director's business mail address: Georgetown University, Washington 7, D. C.

Director's academic title: Assoc. Prof.; Department: Physics

Director's office phone: area code 202, exch. & No. FE 7-3300, ext. 670

Director's home phone: area code 202, exch. & No. FE 7-3300

D. Location of institute: On campus Off-campus at: _____

Operating dates: from Sept. 28, 1963 to May 30, 1964. Length 9 months.

E. Number of participating teachers: 25 High School Teachers (grades 9-12)
25 Junior High School Teachers (grades 7-9)

F. Indicate areas of instruction for which appropriate institute programs would be offered, with approximate number of participants in each program:

Biological Science	_____	Mathematics	_____
Chemistry	_____	Physical Science	_____
Earth Science	_____	Physics	<u>50</u>
General Science	_____		_____

H. Typical No. of (^{semester}/_{quarter}) hours of (^{undergraduate}/_{graduate}) credit obtainable: 6

I. The proposed program is for a:

(1) Unitary institute ; Part of a sequential program, to be the _____ part of the sequence.

(2) New institute _____; Renewal of institute previously supported for _____ years.

(3) Year(s) for which support is requested: 1963-64

J. Total amount requested from NSF for 1963-64: \$ 16,051.30

Operational cost per participant per semester-hour credit: \$ 30.60

K. Signature of director: _____ Date: December 12, 1962

M. P. Thekaekara, S.J.

Name and title (and on one copy, signature) of official authorized to sign for host institution: (Rev.) Joseph A. Haller, S.J.

Name of president (unless listed on line above): (Rev.) Edward B. Bunn, S.J.

BUDGET for Proposed 9 -Month In-Service at Georgetown University
 No.

A. Support of Participants

*1.	<u>50</u>	Travel Allowances at an average of	\$ 165.00 each . . .	\$ 8,250.00
2.	<u>50</u>	Book Allowances at	\$ 10.00 each . . .	500.00
*3.	_____	Required Fees for Health Services, etc. at	\$ each . . .	_____
				<u>\$8,750.00</u>

B. Direct Operational Costs

1. Administrative Costs

a.	Director (administrative salary only)	\$ 100.00
b.	Secretarial and clerical (<u>12</u> % time)	507.60
c.	Office supplies, publicity, communications	400.00
*d.	Retirement contributions at <u>8</u> %	106.21
*e.	Travel to directors' meeting (See instructions)	- 0.-
f.	Other administrative costs	- 0.-
		<u>\$ 1,113.81</u>

2. Instructional Costs

a.	Instructional staff:	
	*1) Local staff (itemize on page 3)	\$3,850.00
	*2) Special lecturers (including travel)	100.00
	*3) Student assistants	1,800.00
*b.	Laboratory and Instructional Materials	1,000.00
*c.	Field trips (if any)	120.00
*d.	Travel to off-campus centers	
*e.	Other Instructional Costs	
		<u>\$ 6,870.00</u>

Total Direct Operational Costs \$7,983.81

*C.	Contributions from university or other source toward the specific costs listed above	\$ -0.-
D.	Net direct operational costs requested (B minus C)	\$7,983.81
E.	Allowance for Indirect Costs (not to exceed 15% of D).	\$1,197.57
F.	Total net Operational Costs requested (D plus E)	\$9,181.38
*G.	Tuition and Fees (registration, credit fees, laboratory fees, etc.) (List only if so required)	\$
H.	Total net Operational Costs in excess of Tuition and Fees (F minus G)	\$9,181.38
J.	Total amount requested from National Science Foundation (H. plus F; or, A plus G in lieu thereof)	\$16,051.38

*Starred items in particular must be itemized, elaborated, or explained on page 3.

K. Operational Cost per participant per semester-hour credit: \$ 30.60

BUDGET DETAILS (On this sheet please make any essential or desired explanations or elaborations. Use additional page if necessary.)

- A. 1 We had 73 applicants for the In-Service Institute of 1962-63. The average one way distance of the residence of the applicants from the University was about $33 \frac{2}{3}$ miles. The distribution of applicants according to mileage distance was as follows: 8 applicants between 1 and 5 miles; 24 between 6 and 10 miles; 10 between 10 and 25 miles; 15 between 26 and 50 miles; 11 between 51 and 100 miles; 5 over 100 miles. The total for the 73 applicants was 2,458 miles. We expect the same distribution among the applicants for 1963-64.

Since no other Institute in our special field with emphasis on Modern Physics and Space Physics is likely to be offered in Maryland and Virginia areas, we think the distance of the applicant's residence should not be a criterion for selection. The travel allowance is of considerable importance for the teachers. Hence, we are proposing to pay travel allowance at the maximum allowable rate of seven cents per mile for the round trip from home to the institute. No bridge, tunnel, or ferry tolls are applicable. We plan to hold 35 weekly meetings.

The average travel allowance per participant per year, assuming the same distribution of distance among applicants is $(2,458 \times 0.14 \times 35)/73 = \164.99 , which is rounded off to \$165.00.

- A.3 A health-service is available for all part-time students at a cost of \$10.00 per semester. There is no obligatory health-service for part-time students. Hence no funds are requested in the grant for this purpose.
- B.1a This amount will be paid to the Director for work done during the summer to prepare for the Conference. His contributions to the Institute during the academic year are on a released time basis and hence there will be no special remuneration.
- B.1b The salary of the departmental secretary in 1961-62 will be \$4,230.00, of which 12% is debited to the Institute.
- B.1d Retirement is calculated at 8% of \$1,327.60 (\$507.60 for Secretary and \$820.00 for Practical Physicist). The Director is not on the retirement plan of the University.
- B.2a Instructional Staff
1. Matthew P. Thekaekara, Associate Professor, Department of Physics, will be giving the course. He will devote 30% of his time to this project. (30% of \$10,100.00, \$3,030.00).

Ralph L. Regalbuto, Practical Physicist, will contribute 10% of his time to the project. His salary will be \$8,200.00 for the next academic year, and \$820.00 will be paid from the grant for his released time.

- B.2a.2. We plan to invite two special lecturers, one each Semester, and they will be paid a remuneration of \$50.00 per lecture.
- B.2a.3. Two of the Senior University Fellows will be assisting the Director in setting up and conducting the lab sessions. The Physics Department Budget provides \$3,000.00 on an average per Fellow, \$900.00 for tuition, and \$2,100.00 for stipend. Two Fellows will each contribute 30% of their time to the institute (30% of \$3,000.00 is \$900.00; and for two Fellows, \$1,800.00).
- B.2b The cost for breakage and replacement of expendable material is estimated to be \$10.00 per student per semester. (20×50 , \$1,000.00).
- B.2c Four field trips are planned. Bus rental will be \$30 per trip. (4×30 , \$120.00).
- G. The University feels it is not necessary to delineate tuition and fees. At the regular rate of the University, \$34.00 per credit and \$15.00 for registration, the total cost would be \$10,950.00. It is in excess of the total operational cost, \$9,181.38 requested in the grant by \$1,768.62.
- H. If tuition and fees were to be listed, F minus G would be minus \$1,768.62.

Note: Under Section A. 1, page 3, was explained the reasons for the average travel allowance of \$165.00 per person. This should, however, be considered as an optimum. If the applicants from distant parts of Virginia, Southern Maryland, and the Eastern Shore are disallowed, the Institute can well operate with an average travel allowance of \$115.00 per person. Hence item A. 1 of the budget should be \$5750.00 and the total budget should be \$13,551.38.

NARRATIVE PORTION OF A PROPOSAL FOR A GRANT TO
GEORGETOWN UNIVERSITY FOR AN IN-SERVICE INSTITUTE

PART I

1. THE HOST INSTITUTION

Georgetown University will be the host institution for the In-Service Institute and the staff of the Department of Physics will direct its academic activities. The Georgetown University, founded in 1789, is the oldest Catholic institution of higher learning in the United States. The stately Healy tower of the main building of the University overlooks a picturesque campus around, the Potomac river to the south, and the Nation's Capital which has grown around and beyond historic Georgetown. The Physics Department occupies the newly built Science Center, which was opened in the Fall of 1962.

The University comprises the College of Arts and Sciences, Graduate School, School of Medicine, Law School, School of Dentistry, School of Foreign Service, School of Nursing, Institute of Languages and Linguistics, School of Business Administration, Summer School, Astronomical Observatory, and Seismograph Station. The total enrollment is approximately eight thousand. Course offerings lead to Bachelor's, Master's, and Doctor's degrees in most areas. There is an additional enrollment of 2,400 in the Summer School of the University.

Several Institutes and Conferences, designed for the benefit of teachers, have been conducted by the University in recent years. Particular mention may be made of the In-Service Institute in Physics in 1961-62 and 1962-63; Summer Institute in Mathematics every summer since 1959; Summer Conferences for College Professors during 1960, 1961, and 1962; a Teacher Training Pro-

gram for Italian-Colombian Teachers of English, sponsored by the Department of Health, Education, and Welfare; a Conference for Native Teachers of French, under the N.D.E.A.

2. MAJOR OBJECTIVES

The Washington, D. C. metropolitan area has a larger concentration of scientists per capita than any other similar area in the country. With such a large number of scientifically-minded people, it seems obvious that many of the children in the Washington area will have an interest in science from an early age. Considering the present and estimated increasing need for scientists, these children should be afforded every opportunity to study in the scientific fields. Thus, the education in science given in the Washington area should be a model for the school systems throughout the country.

The Joint Board of Science Education, a group working under the auspices of the National Science Foundation, is interested in the science taught at all levels in the Greater Washington area. We have discussed our program of the In-Service Institute with several members of the Joint Board of Science Education. Of the 188 high schools in the Washington area, 63 are explicitly public Junior High Schools, 100 are public Junior-Senior High Schools, 44 are public High Schools, 31 are Catholic High Schools, and 21 are private High Schools. Among these there are 169 schools in the area where a Physical Science course is taught. The majority of the teachers of these courses hold a Bachelor of Science degree, but not in Physics.

With all these facts in mind, Georgetown University set out to establish an In-Service Institute for secondary school teachers of the Physical Science courses. The Institute was conducted in 1961-62 and again in 1962-63. The number of applicants for the 1962-63 Institute was 73, more than we could accommodate. Hence we decided that a proposal should be made to the National

Science Foundation to hold a similar Institute for 1963-64. With our experience of the past two years, we now know how to direct our publicity to the teachers who really want and need an Institute of this type. The demand is greater than we can supply. The Institute will give a series of weekly lectures the tenor of which will be aimed especially at the group mentioned above that has had a minimal amount of instruction in Physics.

The basic plan of this Institute was drawn up in a series of informal conferences between the faculty members of the Physics Department and certain other Science Departments. The theme of the Institute has grown out of a Conference for College Professors on Recent Advances in Astro-geophysics, which we have held for three consecutive summers and the two previous In-Service Institutes.

The major objective is the upgrading of science teaching in secondary schools of the area. Physics, apparently, is more difficult than other subjects for the average school teacher. Teachers find that trying to learn physics by oneself from textbooks is all to ineffective. In the present Space Age, the interest and curiosity of the secondary school student have been sufficiently aroused in the problem of physics, and questions arise in the classroom which the teacher cannot well answer with his conventional training. The scientific accuracy of some of the widely publicized accounts of physics and space studies is not what a professional physicist would like it to be. A thorough grasp of the basic principles of physics today and of their applications to problems of space will certainly help to make the science teacher more effective and inspiring for the students.

The store of knowledge in the teacher is, we believe, more important than adequacy of buildings and facilities, or abundance of visual aids, or even a large number of method courses. Through an Institute of this kind we are pro-

posing, we think we can be of the greatest assistance to the poorly prepared teacher whose background is weak or whose training was completed long ago.

The course will be in the area of General Physics and Modern Physics. Special emphasis will be placed on applications to Space Physics. What we are planning is not a repetition of the course in General Physics given to freshman college students who have less mature minds but more manipulative skills in mathematics. All the basic topics in General Physics should be thoroughly studied but a great deal more attention should be paid to the developments of twentieth century physics since this is going to be a terminal course in physics for the teachers. Problems and achievements of the current Space Age can be readily treated as the logical outcome of Classical and Modern Physics. In view of the current massive effort of the Nation in space conquest, an orientation of the physics curricula in schools in this direction is of importance, all the more so in the Washington area where so much of the space effort is concentrated.

While preparing for the In-Service Institute of 1961-62, two of the members of the Physics faculty at Georgetown, contacted by telephone a large number of principals of Junior High Schools of the Washington metropolitan area. We found that a telephone conversation was far more effective than printed folders in acquainting teachers about the program. We also learned what the teachers look for in a course like this. Physics, apparently, is more difficult than other subjects like chemistry and biology for the average school teacher. Physics today is so very different from what the teachers were exposed to in their student days. Hence a college level course in physics, with formal lectures, problem sessions and laboratory is of the utmost importance.

At Georgetown, teaching at a high level is tradition. The University will extend itself to inspire the teaching of the secondary school teacher enrolled in the Institute. Furthermore, the University is renowned for its Georgetown Forum which has as a primary purpose the establishing of a dialogue between scientists and non-scientists. The Forum has been locally broadcast over television every week for the past twelve years and is rebroadcast over the radio from 175 stations across the country. The radio series is about one and a half times as old as the television program. During the past few years the University has been increasing its service to the teachers of science as is evidenced in the Summer Institutes in Mathematics and Physics as well as in Astro-geophysics. The Annual Science Fairs for Washington schools have found a very willing and interested host in Georgetown.

PART II THE ACADEMIC PROGRAM

1. SELECTION OF PARTICIPANTS

The participants of the Institute will be selected from the Secondary School Physical Science teachers of Washington, D. C., and surrounding areas in Maryland and Virginia. The size of the Institute will be limited to approximately 50 participants. Applications will be mailed individually to every Physical Science teacher in the area and from the returned forms the selection will be made by the Director with the assistance of the other staff members according to the following criteria:

1. Is the applicant a Secondary School teacher of Physical Science?

An answer of "Yes" will be necessary.

2. Does the applicant hold a degree in Physics?

An answer of "No" will be necessary.

3. Does the applicant have a degree in Science?

An answer of "Yes" is wanted, but not necessary.

4. Does the applicant have an interest in attending an Institute that will cover topics mainly in the field of General and Modern Physics?

An answer of "Yes" will be necessary.

Preference will be given to those who show least formal instruction in Physics and shortest teaching experience. Every attempt will be made to keep the class homogenous.

2. PROGRAM OUTLINE

The proposed Institute will commence in the latter part of September, 1963, and meet Saturday mornings from 9:15 to 12:15. Each session will be broken into two periods of 80 minutes each, with a twenty-minute coffee break

in between. The last lecture will be given during the last week of May, 1964. The lectures will all be in the area ordinarily called "Physics" and will be concerned with a number of points considered essential:

1. Fundamental Formal Instruction in Basic Physics

It is anticipated that textbooks covering a course in General Physics at the college level and a course in Modern Physics at the same level will be the source from which the lectures will derive their topics. Problems will be done during these lectures. Some problems will be suggested to the participants for personal solution.

2. Laboratory Assignments in Basic Physics

The Physics Department laboratories will be utilized by the participants in order to get them to handle equipment with which they are probably not familiar. The General Physics laboratory, as well as the laboratories associated with the College Optics, Electricity and Magnetism, and Modern Physics courses will be used.

3. Demonstration Lectures Primarily to Aid Physical Intuition

A number of times during the year, the last hour of the weekly session will be given over completely to Lecture Demonstration. Not only will various principles be shown by these demonstrations, but the participants will see the work that goes into setting up a demonstration experiment. Also, the participants will be given instruction on the production of similar demonstration apparatus. Demonstrations will also be incorporated in the lecture sessions.

4. Integration of Mathematics into Physics Courses

A strong point of every lecture will be to show the participants how the use of Mathematics will enable them to get across to their students the

basic Physical principles. Thus, the participants will be taught to develop in their students an interest in Mathematics along with an interest in Physics.

5. Blending of 20th Century (Modern) Physics with Earlier (Classical) Physics

The textbook chosen will enable the lectures to skip back and forth between Classical and Modern Physics so that units such as Mechanics will include the Theory of Relativity, Electricity will include the e/m and Millikan Oil Drop experiments, and Quantum Theory will be incorporated into the Thermodynamics and Physical Optics section. The texts proposed to be issued to the participants are:

A few selected paperbacks at relatively low cost.

Jay Orear, Fundamental Physics (John Wiley and Sons, Inc., New York, 1961) \$6.75.

Frank Verbrugge, Experiments in General Physics (Burgess Publishing Co., 1962) \$2.50.

Throughout the course emphasis will be placed on the applications to problems of the Space Age, and the main findings of the rockets, satellites, and space probes will be developed along with the topics of Modern Physics.

The course will carry a total of six credits, three per semester.

3. STAFF

The course will be organized and run by Rev. Matthew P. Thekaekara, Associate Professor, Physics Department, Georgetown University. The demonstration lectures and laboratory experiments will be set up and run by Mr. Ralph Regalbutto, also of the Georgetown University Physics Department. The other members of the Physics Department Faculty will be called upon from time to time. Two outside lecturers will also be invited.

Some information on the staff members is given below:

The Director, Rev. Matthew P. Thekaekara, S.J., Ph.D. Johns Hopkins University, Associate Professor, Physics Department, Acting Chairman, 1960-62, has been teaching in both the Physics and Astronomy Departments of the University since 1957. During the summers of 1960, 1961, and 1962, Fr. Thekaekara was the Director of a Summer Conference for College Professors on the subject of Recent Advances in Astro-geophysics. This conference was sponsored by the National Science Foundation. He directed the In-Service Institute in 1961-62, 1962-63; and will be directing the Summer Institute on the same subject in the Summer of 1963. He is also a consultant at the Goddard Space Flight Center, NASA, on problems of solar simulation. Fr. Thekaekara had taught previously eight years in India and later at Johns Hopkins University.

The demonstration and laboratory instructor, Mr. Ralph Regalbuto, Practical Physicist, has been associated with the Physics Department since 1955. Mr. Regalbuto has been in charge of the acquisition, repair, and preparation of all laboratory equipment, including that for the research laboratories and the demonstration experiments for the General Physics courses. His previous experience includes similar positions held at the University of Chicago and Columbia University. Mr. Regalbuto was the Secretary of the Chesapeake Section of the American Association of Physics Teachers for the two year term 1960-62.

The other staff members of the Institute that will come from the Physics Department faculty have the following experience:

Dr. Charles Beckel, Ph.D. Johns Hopkins University.

Dr. Beckel is an Associate Professor of Physics and has been with

the Department since 1953. During the 1957-58 academic year he held a Fulbright Lectureship in Physics at Peshawar University, Pakistan.

Dr. Ralph Henderson, Ph.D. Harvard University.

Dr. Henderson is an Associate Professor and has been with the Department since 1955. Dr. Henderson has had previous teaching experience at William and Mary College as well as in Turkey. In the summer of 1959, Dr. Henderson was the Director of a Summer Conference for College Physics Teachers, under the sponsorship of the National Science Foundation.

Dr. William Thaler, Ph.D. Catholic University.

Dr. Thaler joined the faculty in 1960 as a Professor of Physics and is at present the Chairman of the Department. He is well known for his administration of the Government's "Project Argus" and the back-scatter radar project.

All of the members of the Physics Faculty listed above, with the exception of Mr. Regalbuto and Dr. Thaler, have had a minimum of eight years' experience teaching graduate and undergraduate courses. The Physics Department policy has been to allow a professor to teach each year at least one course not previously taught. The policy has also been, whenever possible, that a professor will not teach the same subject three years in succession. Thus, the listed faculty members have each taught a majority of the undergraduate courses and at least two graduate courses during the past five years.

4. DEGREES

The In-Service Institute course in physics has been approved by the Dean of the College of Arts and Sciences, Georgetown University, to carry

a total of six undergraduate credits, three per semester. Participants who take the course for credit will have to turn in weekly assignments and lab reports and will take the semester exams, as is customary in other undergraduate physics courses of the College.

The course is at the undergraduate level and, hence, no graduate credit will be given. The undergraduate credit is helpful for two categories of secondary school teachers, those who are working towards a Bachelor's Degree with science major, or those who seek admission to a Master's program and need more undergraduate credits in science to qualify for the program.

The Department of Mathematics, Biology, and Chemistry are also interested in this In-Service Institute program. Some preliminary steps have been taken for offering similar programs in these other areas. During the summer of 1962 the four departments moved into the new \$4.1 million Science Building. The process of transfer has strained the existing faculty to the utmost, all the more so since we are in the process of a rapid development of the research program in all four areas. During subsequent years one or more of the other departments will also be in a position to offer an In-Service Institute program.

There is a heavy demand from science teachers of the area for programs of this type at Georgetown University. Courses of this type are essential for the teachers for raise in their grades and salaries.

5. FACILITIES

The lectures and demonstrations will be given in the Physics Lecture Hall of the new Science Building and laboratory instruction will be run in the Physics Department's laboratories on the fifth floor. The Physics

Department library, as well as the entire Science Building library, will be available to all participants. The first half of the weekly session will be followed by a "coffee break" with informal discussion, questions and answers, etc. The final hour will be utilized as a laboratory period, for half the number, and for continuing group discussions, solving problems, setting up demonstrations, etc. for the other half. Selected field trips, such as to the Naval Research Laboratory's research reactor, are contemplated. Due to the day time schedule of the participants, a representative sampling of all the scientific facilities in the Washington area will be impossible. The University has authorized funds for expenses to be incurred for two group picnics and for the coffee-break of each Saturday session. These informal sessions have proved to be very helpful in the two previous Institutes.

The facilities of the new Science Building will be available for the In-Service Institute. In drawing up the plans for the physics lecture hall and the laboratories, special care was taken to include all that education in physics would require today in the line of lab experiments and classroom demonstrations. With the completion of the New Science Building, Georgetown is looking forward to the beginning of a great era of scientific cooperation with the world at large, but particularly with the Washington Metropolitan area. This will include, in the field of teacher training, not only a combined In-Service Institute of the various disciplines, but also a source of information for demonstrations and teaching methods.

It was partly because we have these new facilities that, under the auspices of the In-Service Institute of 1962-63, we conducted a full-day Seminar on October 27, 1962, on Curriculum Developments in Science and

Mathematics. During the morning session Professor Gardner Lynn, Head, Department of Biology, Catholic University of America, discussed "AIBS Biological Sciences Curriculum Study" and Mr. Robert Silber, Educational Secretary, American Chemical Society, discussed "The Chemical Bond Approach." Both lectures were accompanied by movies of the respective topics. The afternoon session was devoted to "Curriculum Developments in High School Mathematics" by Dr. Malcolm Oliphant, Head, Department of Mathematics, Georgetown University, and "The P.S.S.C. Program in Physics" by Dr. Robert L. Detenbeck, Director, In-Service Institute, University of Maryland. A lively panel discussion concluded the day's program. Considering the large number of science teachers and officials of the school systems of the area who were present at the Seminar, in addition to the participants of the Institute, we believe the Seminar achieved a great deal. We plan other similar functions for the next year's Institute as well.

DIRECTOR'S REPORT

IN-SERVICE INSTITUTE
FOR JUNIOR HIGH SCHOOL TEACHERS OF SCIENCE AND MATHEMATICS
Academic Year 1963 - '64

GEORGETOWN UNIVERSITY - DEPARTMENT OF PHYSICS

E2/2/3118

Director - Rev. M. P. Thekaekara, S. J.

1. INSTITUTE PROGRAM

The overall plan of the Institute, as explained in the original program, was to give a basic course in physics to junior high school teachers of science and mathematics. The plan was adhered to very closely. There are a very large number of junior high schools in the Washington Metropolitan area and in nearby Maryland and Virginia where a course in physical science is being taught. The majority of the teachers hold a Bachelor of Science degree, but hardly any of them have had physics as a major during their undergraduate course. There is a high concentration of scientifically-minded people, thanks to the various federal agencies for scientific research. Hence, the children in the junior high schools naturally show a keen interest in problems of modern science. The teacher has to stimulate this interest and should, therefore, have a fairly good knowledge of the subject. It was felt that a course in general physics, with emphasis on recent developments, would be very useful to the teachers.

The group of teachers met in the Physics Auditorium every Saturday morning at 9:15 for the lecture session. The lecture lasted for about an hour and a quarter. A large number of demonstration experiments were performed throughout the course. For the demonstrations, the abundant supply of material available in the physics laboratory proved to be of very great advantage.

The lecture session was immediately followed by a coffee break. The Department of Physics met the expenses of the coffee-break. Profiting by our last year's experience, we had the coffee-break in the physics laboratory and not in the cafeteria. One of the members of the Institute, with the help of the two Instructors, made all the necessary arrangements for the coffee-break.

After the coffee-break the entire group split into two sections. One section returned to the Auditorium for a quiz session during which numerical problems were solved or the teachers sought further clarification on points of special difficulty. The other section went to the physics laboratory where the teachers themselves performed an experiment of the general physics level. These two sections alternated between the lab session and the quiz session in successive weeks.

The following is a list of experiments which were performed during the Institute:

1. The Vernier and Micrometer Calipers.
2. The Resolution and Addition of Vector Quantities.
3. Torques.
4. The Measurement of Mass and Density.
5. Centripetal Force.
6. Simple Harmonic Motion.
7. Gravitational Acceleration.
8. Moments of Inertia.
9. Young's Modulus.
10. Specific Gravity.
11. Specific Heat.
12. Expansion of Gases.
13. Resonance of Air Columns.
14. Ohm's Law: Ammeter-Voltmeter Method of Resistance Measurement.
15. The Wheatstone Bridge.
16. The Potentiometer.
17. Electrolysis.
18. Electromagnetism.
19. Computer Session - The E 101.
20. Triode Characteristics.
21. The Spherical Mirror.
22. Lenses - I.
23. Lenses - II.
24. Photometry and Efficiency of Lamps.
25. The Spectrometer.
26. Half-life of Indium.
27. The Diffraction Grating.
28. Computer Session.

Since the setup of the experiments in the laboratory changed every week, each of the two sections had a chance of performing only half the total number of experiments.

The topics covered in the lecture sessions were the following:

Oct. 6 - Introduction: What is physics? Units, mathematics and physics, science and society.

Oct. 20 - Kinematics: Velocity, acceleration, compound motion, vectors, projectile motion, centripetal acceleration, earth satellites, checking of units.

Nov. 3 - Dynamics: Newton's laws of motion, the conservation of momentum, force, the inclined plane, Atwood's machine, the simple pendulum and simple harmonic motion.

Nov. 10 - Gravitation: Gravitational mass, weight and weightlessness, Kepler's laws, Newton's universal law of gravitation, derivation of Kepler's laws.

Nov. 17 - Angular Momentum and Energy: Conservation of angular momentum, center-of-mass, statics, energy, potential energy, conservation of energy, gravitational potential energy, conservation of heavy particles.

Dec. 1 - The Kinetic Theory: Density, pressure, hydrostatics, atoms and molecules, the perfect gas law, temperature, Avogadro's law, the kinetic theory of heat, changes of state, the bubble chamber, statistical mechanics.

- Dec. 15 - Electrostatics: Electronic structure of matter, concept of charge, Coulomb's law, electrostatic induction, electric field, lines of force, charge distributions, electric potential energy, electric potential.
- Jan. 5 - Electromagnetism: Electric current, force between currents, magnetic field, force on a current, Ampere's law, theory of magnetism.
- Jan. 12 - Electromagnetism: Faraday's law of induction, Maxwell's equations, electro-magnetic radiation.
- Jan. 19 - Electrical Applications: Practical units, Ohm's law, circuit theory, electronic vacuum tubes, radio and television, high energy accelerators.
- Jan. 26 - Semester Exam.
- Feb. 2 - Wave Motion and Light: Electromagnetic waves, the electromagnetic spectrum, interference.
- Feb. 10 - Wave Motion and Light: Double slit interference, the diffraction grating, geometrical optics.
- Feb. 16 - Relativity: The principle of relativity, the problem of the ether, the Lorentz contraction, time dilation, the twin paradox.
- Feb. 23 - Relativity: Einstein addition of velocities, relativistic mechanics, general relativity, Mach's principle, cosmology.
- Mar. 2 - Quantum Theory: Summary of classical physics, the photoelectric effect, wave-particle duality, electron diffraction, the uncertainty principle.
- Mar. 9 - Atomic Theory: The electron waves in a box, the hydrogen atom.
- Mar. 16 - Atomic Theory: The hydrogen spectrum, the Bohr model, atomic structure.
- Mar. 23 - Atomic Theory: The periodic table of the elements, X-rays.
- Mar. 30 - The Structure of Matter: Molecular theory, crystalline solids, Fermi gas of electrons, thermionic emission, barrier penetration, electrical conductivity, superfluidity, semiconductors.
- Apr. 6 - Nuclear Physics: Properties of nuclei, radioactive decay, radioisotopes, biological effects of radiation.
- Apr. 20 - Nuclear Physics: The nucleon-nucleon force, structure of the nucleus, nuclear fission.
- Apr. 27 - Nuclear Physics: Nuclear fusion, cosmic rays, social responsibility of scientists.
- May 4 - Particle Physics: Introduction, beta decay and the weak interaction, antimatter.
- May 11 - Particle Physics: Anti-particle symmetry, the thirty elementary particles, nonconservation of parity.
- May 18 - Particle Physics: Summary of the conservation laws, problems for the future.
- May 25 - Semester Exam.

The textbooks used in the Institute were:

Jay Orear, Fundamental Physics, (John Wiley and Sons, Inc., New York, 1961).

Frank Verbrugge, Experiments in General Physics, (Burgess Publishing Co., Minneapolis, Minn., 1961).

The participants of the Institute had full access to the departmental library. Several reprints published by The American Association for the Advancement of Science and a large number of paper-back books were distributed to the participants. These latter were helpful for the term papers which several of the participants prepared during the Fall Semester.

The course started in the fall of 1961 with 59 registrants. At the end of the fall semester the registration dropped to 39. During the semester there were a few more withdrawals from the course. The In-Service Institute closed with a total of 33 registrants.

On October 13 was the Dedication of the New Science Building and hence no lecture session could be held. Two laboratory sessions were conducted on that day. On October 27 was held a Seminar for teachers of physical science and science supervisors of the Washington Metropolitan Area. Four distinguished speakers were invited from the outside to address the participants of the Institute as well as the guest teachers who attended the Seminar on four major topics of science education: The new biology courses, the new chemistry courses, the new mathematics program, and the new physics program. During the afternoon was held a panel discussion when the teachers had occasion to raise questions concerning the topics treated in the morning session.

All those who completed the course satisfactorily during either semester were given three undergraduate credits per semester. These credits can be applied towards their teacher certification or for making up deficiencies in their undergraduate science curriculum.

2. STAFF ASSIGNMENTS

The Director of the Institute and the Lecturer for the morning sessions was Rev. M. P. Thekaekara, S. J., Associate Professor, Department of Physics. Father Thekaekara's research field is atomic and molecular spectroscopy. He was the Director of the Summer Conference for College Professors on "Recent Advances in Astro-geophysics" held during the summers of 1960, 1961 and 1962. He is also directing an Undergraduate Research Participation Program under the National Science Foundation sponsorship for two years, a program under the sponsorship of the Department of H. E&M for three years in atomic and molecular spectroscopy and a Summer Institute in Physics, sponsored by the National Science Foundation for science teachers during the Summer of 1963.

The Demonstration Experiments which formed a distinctive feature of our Institute were prepared by Ralph A. Regalbuto, Practical Physicist, Department of Physics. Mr. Regalbuto had previously been Lecturer's Assistant at Columbia University, 1929-1947, and later Laboratory Supervisor, University of Chicago, 1947-1956. His many years of experience in developing original demonstration models for college physics classes proved to be a great asset for the In-Service Institute.

The laboratory sessions were conducted by two Instructors, Mr. Louis E. Hays (B.S., Clarkson College) and Mr. Louis I. Darry (B.S., Providence College). Each Instructor had under his direction for a given experiment a group no larger than 14, so that a great deal of personal

attention could be given to the participants. Mr. Massa and Mr. Derry are graduate assistants in the Physics Department. For grading the weekly assignments, the Institute had part-time help from another graduate assistant, Mr. Paul E. Dalbec (M. S., University of Notre Dame).

Since ours was a concentrated course in physics, it was not considered advisable to devote any of the Saturday sessions to visiting lecturers. We had planned to cover a good deal of difficult material during the limited number of days, and hence the lecture sessions were held every available Saturday.

3. SELECTION EXPERIENCE

Brochures about the In-Service Institute were mailed out to all teachers of physics and of general science in the Washington Metropolitan Area, in nearby Maryland and Virginia. A total of 2300 brochures were distributed through the mailing service of the National Science Teachers Association (1201 - 16th St., N. W., Washington 6, D. C.). This form of publicity proved highly satisfactory.

We received about 100 inquiries about the Institute. Of these, 73 sent in applications. On the registration day only 59 were present, but 6 of them dropped out during the first three weeks, one because the course was not sufficiently advanced, and the others because it was too advanced.

Of the 59 who registered for the course, 5 did not have any degree qualification, but had taken several summer courses, 43 had a Bachelor's Degree, and 11 had a Master's Degree. The subject-field distribution among the 54 who had a degree was as follows: Administration - 1; Biology - 13; Chemistry - 5; Education - 13; English - 5; General Science - 10; Home Economics - 1; Languages - 1; Mathematics - 2; Nursing - 1; Philosophy - 1; Zoology - 1. Thus, of the 59 fall registrants only 49 percent had a degree in any area of physical science, though all the registrants were actually teachers of physics or general science.

Many of those who registered for the program were from rather distant places in Western or Eastern Maryland, from Baltimore, from Southern Maryland and Virginia. The car pools were not always easy to arrange. We had a large number of drop-outs from among these who came from long distances.

One major drawback was that in the budget originally proposed to the National Science Foundation we had asked for 50 Travel Allowances at an average of \$28.00 each. This amount was approved in full by the N.S.F. A more realistic figure would have been \$165.00 per participant. We had 73 applicants. The average one-way distance of the residences of the applicants from the Georgetown University was 33.7 miles. The distribution of applicants according to mileage distance was as follows:

Between 1 and 5 miles	-	8 applicants
Between 6 and 10 miles	-	24 applicants
Between 11 and 25 miles	-	10 applicants
Between 26 and 50 miles	-	15 applicants
Between 51 and 100 miles	-	11 applicants
Over 100 miles	-	5 applicants

We had stated in the brochure that applicants from Washington, D. C. and adjoining counties in Maryland and Virginia would be preferred, since the

total travel allowance budgeted per week had been \$40.00 only. There should have been a better assessment of the needs of the teachers in a larger circumferential area. If so, we would have elicited more applications and there would have been fewer drop-outs.

4. PARTICIPANT ROSTER

The following table gives the name of each participant and current home address together with information as to: (a) teaching assignment (school and subject) during the Institute; (b) degrees held at time of application; and (c) credits earned in the Institute. All credits are at the undergraduate level. No sequential program for teachers has yet been started at Georgetown University.

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Sr. M. P. Canisius Bailor, S.S.N.D., 1602 Morris Rd., S.E., Wash. 20, D.C.	Archdiocese of Wash., Elementary Sch. Teacher	-	3/3
Sr. Catherine Michael Barna, S.N.D., 941 N. Capitol St., Wash. 2	Noxfolk Catholic High, Wash., Math Teacher	B.S.	3/3
Sr. Maria Burgan, S.S.N.D. 112 E. Second St., Frederick, Md.	St. John High School, Frederick, Md., 7th Gr., Science and Math.	B.S.-M.A.	3/0
Jan Carnell, 1913 G.St., N.W., Wash. 6, D.C.	Hebrew Academy of Wash. Jr. H. S. Science	B.A.	0/0
David G. Caughey, 709 Chalfonte Dr., Alex., Va.	Arlington Public Schools, Arl., Va. 8, Gen. Science	M.A., B.S.	0/0
St. Maryann Chichester, S.S.N.D., 112 E. 2nd St. Frederick, Md.	St. John's School, Frederick, Md., Gen. Science, 7, 8, 9 grades.	B.S.	3/3
Carl T. Contee, 2639 Bowen Rd., S.E., Wash., D.C.	D.C. Recreation Dept. Recreation Specialist General Science	B.S.	3/3
Eliz. K. Corbin, 3940 Penn Ave., S.E., Wash. D.C.	Alice Deal Jr. High, Wash., D.C., 7, 8 grades, general science	B.A.	3/3
Richard Monroe Counts, 1389 F. St., N.E., Wash. 2, D.C.	Hart Junior High Sch. Wash., D.C., General Science	B.S.	3/0
Sr. Marie Ellene Daley, S.S.N.D., 7512 Marlboro Pike, Wash. 28, D.C.	Parochial school system, Wash., D.C., Grade 7.	B.A.	0/0

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
John J. Darnaby, Jr., 1602 Dunwich Garth, Lutherville, Md.	Baltimore County Bd. of Edu. Science and Math, 8, 9 gr.	B.S.-M.Ed.	3/3
Sr. Marie Jerome Donovan, S.C., 4214 Saul Rd., Kensington, Md.	Holy Redeemer School, Kensington, Md., 7 gr.	B.A.	0/0
Sr. Joseph Beatrice Eyle, R.N., Leonardtown, Maryland	St. Mary's Academy, Leonardtown, Md., Summer Sch. at C.U., Chemistry	B.S.	3/3
Robert F. Frantz, 6013 Carter Ave., Balt. 14, Md.	Talmudical Academy of Balto. Science, 7, 8 and 9.	B.S.	3/3
Homer B. Goren, 3020 Manhattan Ave., Balto. 15, Md.	Balto. Pub. Schools #90, Gen. Science, 7 - 8 grades	B.S.	3/3
Donald C. Green, 744 Girard St., N.W., Wash. 1, D.C.	D. C. School System, Gen. Science, 7 - 9.	B.S.	0/0
Norman Grossman, 3543 Flannery Lane, Balto. 7, Md.	The Summer Science Center, Science for Children	B.S.	3/3
Billie G. Hendon, 229 S. Aurara St., Easton, Md.	Talbot County Bd. of Edu., Easton, Md., - Science.	B.S.	3/3
Frenis W. Hoffman, 13004 Grenoble Dr., Rockville, Md.	Montgomery County Bd. of Edu. Jr. H.S. Science, 7, 8, 9 gr.	B.S.	0/0
Joseph F. Horvath, 3320 W. Rogers Ave., Balto. 15, Md.	Balto. County Bd. of Edu., Science, 10, 11, 12.	B.S.	3/3
Robert E. Hughlett, 3810 Glenarm Ave., Balto, Md.	Balto. County Dept. of Edu., Science, 9.	B.S.	3/3
Emmett A. Hutcheson, 460 Glen Carlyn Dr., Falls Church, Va.	Fairfax County School Board, Va., Ch. of Dept., 8th grade science.	A.B.	0/0
Earl B. Jackson, 732 Dennis St., Salisbury, Md.	Wicomico County Bd. of Edu., Salisbury, Md., H. S. Science and Math.	B.A.	3/3
Sr. Mary Alberta Kirby, R.S.M., 3513 N. St., N.W., Wash. 7, D. C.	Holy Trinity School, Wash., D.C., 8 grade, Science.	B.S.	0/0
Mother Cecile Kaval, R.S.N.M. 2807 N. Glebe Rd., Arlington, Va.	Marymount Junior School, Arlington, Va., 6, 7, 8 gr. science	-	3/0
Rev. Daniel Kirk, 14th & S. Dakota Ave., N.E., Wash. 17, D.C.	Priory School, Gen. Science, 3.	A.B.	0/0

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Mother M. Josephs Klausberg, R.S.H.M., 2807 N. Glebe Rd., Arlington, Va.	Marymount School, Diocese of Richmond, Gen. Science	B.A.	3/0
Lawrence E. Knight, Rt.3, Box 303, Arundel-on-the Bay, Annapolis, Md.	Pub. Schools of Anne Arundel Co., Science 9.	B.S.	0/0
Francis R. Kosco, Box 245B, Easton, Maryland	Talbot County Bd. of Edu., Md., Gen. Science 9.	B.S.	0/0
Ruth S. Law, 3302 Springdale Ave., Balto, Md.	Bd. of Ed., Balto.Co.,Md. Gen. Science 8.	B.S.-M.Ed.	0/0
Jack Leddon, 4371 Shamrock Ave., Balto. 6, Md.	Balto. County Bd. of Edu., Md., Parkville Jr. H. S. Gen. Science 8.	B.S.	3/3
Judith B. Lewis, 1307 Leesburg Court, Alex., Va.	Alex. City Sch. Bd., Gen. Science and Physics, 9,10.	B.S.	0/0
Sr. M. Joleen Liebeck, S.S. N.D., 7512 Marlboro Pike, Wash. 28, D.C.	Parochial School System, Wash., D. C., Science, Elementary	-	0/0
Sr. M. Annicia Linz, S.S.N.D., 7512 Marlboro Pike, Wash. 28, D.C.	Parochial School System, Wash., D. C., Mt. Calvary School, Science, Elementary	-	0/0
Marjorie Lundegard, 609 Blair Rd., Falls Church, Va.	Flint Hill Private School, Va., Physics, Math., 8, 11 and 12.	B.S.-M.S.	3/3
Werton R. McCray, 713 Exeter Hall Ave., Balto., Md.	Balto. County Bd. of Edu., Hereford Jr.-Sr. H. S., Science 7.	B.S.	3/3
Margaret R. McCrea, Porpoise Creek Farm, Trappe, Md.	Talbot County School Board, Md., General Science 7.	B.S.	3/3
Flora J. McMillan, 2935 Presbury St., Balto, Md.	Bd. of Edu., Balto. County, Md., Science and Math. 7, 8.	B.S.	0/0
Sr. Rose Martin Horand, 4214 Saul Rd., Kensington, Md.	Archdiocese of Wash., Holy Redeemer, Kensington, Md., Science 8.	-	0/0
Louis R. Perkins, 810 Kennedy, N.W., Wash., D.C.	Dunbar High School, Wash., D. C., Physics 11, 12.	B.S.-M.S.	0/0
Sr. M. Ruth Phillips, S.S. N.D., 7512 Marlboro Pike, Wash. D. C.	Parochial School System, Wash., D.C., Elementary Science	-	0/0
Phyllis M. Ring, 114 Kennedy St., Alex., Va.	Alex. School Bd., Science 9.	A.B.-Ed.M.	3/3

<u>Name and Address</u>	<u>Teaching Assignment</u>	<u>Degrees Held</u>	<u>Credits Earned</u>
Sr. Regina Ritter, S.C., 4212 Saul Rd., Kensington, Md.	Holy Redeemer School, Kensington, Md., (G.6 subjects)	B.S.-B.A..	0/0
Sr. Dorothy M. Ruther, S.C. 4214 Saul Rd., Kensington, Md.	Holy Redeemer School, Grade 7. Science	B.S.-M.S.	0/0
Sr. Marie Paul Schlairet, C.S.C., 5811 Riverdale Rd., Riverdale, Md.	St. Bernard's School, Science, 7 and 8.	"	3/3
Edward G. Sellmayer, Bar- don Rd. & Summer Hill Dr., Phoenix, Md.	Dept. of Edu., Balto. County, Md., Head, Science Dept. #42.	B.S.	3/0
Donald B. Shahan, Route #5, Hagerstown, Md.	Wash. Co., Md., Bd. of Edu. Science 7.	B.S.	3/0
Helen C. Sheehan, 3810 Wexford Drive, Kensington, Md.	Holy Redeemer School, Md., Gen. Science 7.	"	0/0
Sr. Anne Richard Sherry, 2800 N. Charles St., Balto, Md.	Seton High School, Balto, Md., Physics 12.	B.A.	0/0
Sr. Pauline Sweeney, 2800 N. Charles St., Balto, Md.	Seton High School, Md., Gen. Science 9.	B.S.	0/0
Grace J. Tigani, 707 Hudson Ave., Takoma Park, Md.	Montgomery County Bd. of Edu. Earth Science 8.	B.S.-M.D.	0/0
Olive Van Doren, Box 221, Route 4, Vienna, Va.	Fairfax County Thoreu Inter- mediate Sch., Gen. Science 7 and 8.	B.S.	3/3
Sr. Teresa Louise Walker, S.C.N., Leonardtown, Md.	St. Mary's Academy, Leonard- town, Md., Gen. Science 9	B.S.-M.Ed.	3/3
Sr. Roberta Marie Watson, S.N.D., 941 N. Capitol St., Wash., D.C.	Notre Dame Academy, Wash., D.C., Math 10, 11, 12.	A.B.-M.A.	3/3
Sr. Marie Bernard Whelan, 7512 Marlboro Pike, Wash. D.C.	Parochial School System, Science 8.	B.A.	0/0
Clara Williams, 4705 Hunt Ave., Chevy Chase, Md.	Montgomery Co. Bd. of Edu. Jr. High Science.	B.S.-Ed.	0/0
Thomas A. Wisner, c/o A.J. Fortin, Sr., Hollywood Shores, Md.	Hollywood Jr. High, Science 9.	B.A.	3/0
Lorenzo A. Woodhouse, 1431 Roxanna Rd., N.W., Wash.D.C.	Bd. of Edu., Balto, Md., Gen. Science 8.	B.S.	3/3

5. ADMINISTRATION

The participants were on the campus only one day per week in the morning. Hence the opportunities for advising were limited. The major part of advising was done during the informal coffee-break after the lecture session.

After the coffee-break, the participants divided into two groups. The group which remained on the fifth floor for the experimental session had with them three instructors, who were readily available for further discussion on any of the topics discussed during the lecture. The other group, which gathered in the lecture hall for the quiz session and discussion period with Fr. Thekackara, also had abundant opportunities for informal discussion.

One of the special features of the program was a Seminar in the new high school courses in mathematics and science which was held in the Auditorium of the new Science Building at Georgetown University on Saturday, October 27, 1962. The purpose of the meeting was to acquaint teachers with the new developments in the teaching of science and mathematics, their genesis and objectives, and any matter the invited speakers may deem appropriate.

There was a formal presentation of about one hour followed by a short discussion period on each of the four subjects: mathematics, physics, chemistry, and biology. The formal talks were given by the following speakers, men who were intimately familiar with the varied aspects of the new developments:

PHYSICS:	Dr. Robert L. Detenbeck Physics Department, University of Maryland
BIOLOGY:	Dr. Gardner Lynn Biology Department, Catholic University
MATHEMATICS:	Dr. Malcolm Oliphant Mathematics Department, Georgetown University
CHEMISTRY:	Dr. Robert Silber American Chemical Society, Washington, D.C..

The meeting began at 9:30 A.M. Dr. Lynn and Dr. Silber spoke at the morning session; Dr. Oliphant and Dr. Detenbeck in the afternoon. About 50 teachers and school supervisors of the Washington Metropolitan Area and 50 participants of the In-Service Institute attended the Seminar. The Seminar was co-sponsored by the In-Service Institute and by the Department of Education of the Archdiocese of Washington.

On April 20, 1963 we had a combined field trip and picnic, when the participants paid a visit to the Goddard Space Flight Center. The exhibits, special lectures, and movies which the Space Center had arranged for the day proved particularly valuable, since emphasis on space physics was a special feature of our academic program.

Two of the lab sessions were devoted to the Burroughs E 101 computer. The participants gained some familiarity with the working of a computer.

6. EVALUATION

In certain respects the Institute achieved fully what we had expected of it. About 40 science teachers who had had little or no formal instruction in physics underwent an intensive training in the subject. Unless the teacher has a thorough knowledge of the subject, it is impossible for him to give a clear and accurate presentation to this class. Wrong concepts and fallacies implanted at an early stage will not easily be corrected. Thus the primary purpose of the Institute was achieved.

Georgetown University also reaped a certain amount of benefit from the program. For a large number of teachers, Georgetown had been just a name for an exclusive residential area of the city and the University an historic institution which belongs rather to the whole nation than to this Metropolitan area. Since we have no Department of Education or any regular teacher training program, the contacts between the University and the schools in the area have to be fostered by special programs of this type. Such contacts can naturally be beneficial to the schools and to the University.

Toward the end of the Spring Semester a brief questionnaire was distributed to the participants. A detailed analysis of the replies is, in our opinion, the best possible evaluation of the Institute.

Question: What was your source of information about the Institute?

Answer: Folder received in personal mail - 61%; N.S.F. Brochure - 23%; Other sources, namely: information received through the superintendent of one of the school systems, or other officials of the educational department - 16%.

Question: Was the timing of the lectures convenient for you?

Answer: Yes - 100%.

Question: Did your travel expense exceed the N.S.F. travel allowance?

Answer: Yes - 55%; No - 45%.

Question: Do you feel that the time was correctly apportioned between lectures, lab sessions, and quiz sessions?

Answer: Yes - 100%.

Question: Mention three or four topics which you thought most profitable for your own teaching.

Answer: The replies were quite varied. The structure of the atom; all of the topics, especially the second semester; atomic theory, wave motion and light; electronics and nuclear physics; quantum mechanics and relativity; satellite orbits and other applications of mathematical physics. Almost every major topic was singled out by one or another. On the whole the preference was for topics in modern physics.

Question: Mention one or two demonstrations which you think were most helpful.

Answer: The answers were quite enthusiastic. One said all about light, electricity, atomic structure, just about all the demonstrations. But another mentioned the demonstrations in classical physics. Those

about simple harmonic motion seemed more readily adaptable. One said that he has already adapted several of the experiments for his classes. Another said, "I have obtained the high school abridged sound records and hope to get an oscilloscope. Many demonstrations I liked require equipment which, at present, is lacking in our school."

Question: What areas in physics would you have liked to be stressed more?

Answer: The answers covered a very wide spectrum. Almost every area in general physics, mechanics, heat, light, sound, electricity and magnetism, atomic theory, nuclear physics, was singled out by at least one of the teachers. Several would have liked a more detailed treatment of optics and sound. Some regretted that the problems in electricity and magnetism were passed over so rapidly. The majority of the teachers showed a strong preference to modern physics, especially physics of the nucleus and of elementary particles. It was a revelation to note that two of the teachers wanted mechanics to be treated in greater detail.

Question: What areas should have been stressed less?

Answer: Nearly half of the respondents left this question unanswered, which would seem to show that the program was, on the whole, well balanced. Several said that they found all the topics sufficiently important. A few mentioned that they would have preferred less emphasis on classical physics. One wrote, "To take more time for electricity, electronics and modern physics. The introductory chapters on length, time, and easier classical physics could have been stressed less."

Question: Have you any suggestions for improving the informal program?

Answer: The answers were, on the whole, enthusiastic. Several didn't have any suggestions for improving the informal program. A few said the coffee-break and the parking facilities and the rest were very satisfactory. One wrote, "Just re-employ Mrs. Van Doren and Mr. Massa as cookie-baker and coffee-maker. They were perfect." But to balance the picture, another wrote, "Doughnuts go better than cookies at that time of day. The cookies were excellent, however."

Question: How well do you think this Physics Institute has achieved the general aims of the N.S.F. in sponsoring Institutes of this type?

Answer: Almost every one of the replies was worth noting. A few typical replies are given below:

"Perhaps more demonstrations and/or experiments that could be used in a high school course in physics would appeal more to high school teachers."

"Very well. The subject matter was very well adapted to the teacher of science."

"Very well. One of the most profitable and enjoyable I have experienced."

"As the general aim of the N.S.F. is to increase background knowledge, I think this Institute did very well."

"I was very pleased with this Physics Institute since it brought me up to date on many topics of modern physics."

"I believe the goal of the N.S.F. is improvement in the teaching of science. I do not see how anyone could take the course and not do a much better job in his teaching."

"Better than most. This Institute really explained to us what we wanted to know."

7. RECOMMENDATIONS FOR THE FUTURE

More effort should be made to familiarize the principals of schools and the science teachers with the In-Service Institute program. This can be done partly by the colleges establishing better contacts with the schools in each area. More nationwide publicity will also be helpful.

The courses should be better adapted to the needs of the teachers. The college teachers are generally so accustomed to students of a particular age group that they do not always realize the problems of a group of men and women who are more advanced in age, are more heterogenous in their academic background, have more mature minds but less ability to absorb quickly new ideas and methods.

Perhaps a case can be made for making the In-Service Institute financially a little more attractive to the participants. Doubtless, there are valid reasons why the budget provision per participant should be less at an In-Service Institute than at a Summer Institute; however, one would wonder whether the disproportion should be so very great. The regular salary of many of the teachers is inadequate and they seek to augment their income through extra work on Saturdays. Attendance at an In-Service Institute would entail for them the loss of this added income. If for the Summer Institutes the justification for the stipend and dependency allowance lies in the loss of the summer salary, the same justification exists to a certain extent also for the In-Service Institute.

8. ADDITIONAL COMMENTS

In this last section of the Report, we think it would be appropriate to let the participants themselves tell us what they think of the In-Service Institute. They are all teachers with several years of experience. Their analysis of the problems of their students and their own felt needs in the area of science teaching, is highly informative. A few selected excerpts from further comments which they offered are given below:

"Just to say that you and your staff did an excellent job and I am most grateful for the time and effort you spent on my behalf."

"This course was most beneficial to me. I enjoyed the lectures and the lab experiments. I enjoyed hearing about recent advances in the field of physics."

"This course has been very profitable. However, I felt that with my assignment this year, I did not have sufficient time to give to the physics course."

"I feel this course was of great advantage to me in that it brought my knowledge up to date in recent developments in physics. I was particularly impressed with the facilities and lectures offered in this course."

"The course was really most interesting and profitable and well worth the effort and time. The instruction was excellent. (Often they were lectures with not too much chance to ask questions). The instructor had excellent command of the subject matter and infinite patience. He made learning an adventure, was particularly adept in making the complex relatively simple and understandable. My teaching has improved measureably as a result of this course. Thank you for this opportunity."

As a final comment, one might add that the In-Service Institute fills a real need. The teachers need to bring their knowledge up to date. Physical sciences are advancing at a very rapid rate. The textbooks they had used when at school are now out of date. There is a very poorly paid profession, but most teachers are dedicated to their jobs. They seize avidly opportunities which are offered them for self-improvement. Even working against heavy handicaps, sacrificing their well-earned weekend rest or foregoing the additional income which they may get from part-time work, they come for these Institutes. And because they are so intent on improving their knowledge, they get a great deal out of the course. The In-Service Institute is very necessary for the strengthening of science education in our schools.

* * * * *

IN-SERVICE INSTITUTE IN PHYSICS

For Service Teachers of Secondary Schools



Georgetown University • Washington 7, D. C.

FOR THE ACADEMIC YEAR 1963-64

SPONSORED BY

THE NATIONAL SCIENCE FOUNDATION

OBJECTIVES

The Department of Physics of Georgetown University offers for the third year in succession an In-Service Institute in Physics under the sponsorship of the National Science Foundation.

The Washington, D. C., metropolitan area and nearby States have a larger concentration of scientists per capita than any other similar area in the country. The average teacher whose formal instruction in the Sciences was completed many years ago, needs to keep abreast of the rapidly developing subject in order to inspire and motivate his charges. He or she needs an academic stimulus beyond what is given by a heavy schedule of teaching familiar topics.

Note: Please use this routing slip to forward this copy to teachers who would be interested in this Institute.

From: _____

To: _____

From: _____

To: _____

From: _____

To: _____

IN-SERVICE INSTITUTE IN PHYSICS
GEORGETOWN UNIVERSITY
WASHINGTON, D. C., 20007

NON PROFIT ORG.
U. S. POSTAGE
PAID
WASHINGTON, D. C.
Permit No. 3901

College or university education:

INSTITUTION	SCHOOL OR DEPT.	YEARS		DEGREE	MAJOR SUBJECT	MINOR SUBJECT(S)
		FROM	TO			

Teaching Schedule: List complete teaching schedule for the academic year 1963-64. Periods are _____ minutes.

COURSE OR OTHER ASSIGNMENT	GRADE OR LEVEL	PERIODS PER WEEK

Do you need a car pool? Yes _____ No _____

Can you help form a car pool? Yes _____ No _____

Please use additional sheet if necessary.

Date _____

Signature _____

Aspects of recent progress have elicited popular interest to an unprecedented degree. The scientific accuracy of some of the widely publicized accounts of the Space Age is not what the professional science teacher would like it to be. In classroom discussions, questions come up which teachers often feel they cannot handle adequately with their more conventional training. The current progress of Physics is such that textbooks become rapidly obsolete, and media of mass communication supplant textbooks and journals even for the professional scientist.

The In-Service Institute has been planned to meet these deficiencies. The course will try to blend classical physics with modern physics, and will lay due emphasis on the achievements and problems of the Space Age and the satellites. The formal lectures will be supplanted by class room demonstrations, laboratory assignments in basic physics, and sessions for group discussions and for solving problems. A minimum of mathematics will be expected from the participants of the Institute.

ELIGIBILITY

All teachers of general science or physics are eligible. The course for teachers of the Junior and Senior High Schools in the public school system, or of the seventh and eighth grades and the High School in the private school system. The academic level of the course is that of a first year college course in physics, but with a much wider coverage of subject matter and less stress on mathematical deductions.

Only 50 stipends are available. Teachers who are not determined to take the course for both semesters should not apply, lest others deprived of their chance for participating in the institute.

ALLOWANCES

Tuition: Each participant is granted a scholarship which covers tuition and other fees.

Travel: A travel allowance of up to seven cents a mile per round trip from his home to the University will be given out of funds provided by the National Science Foundation.

The total amount budgeted will be adequate for paying full travel stipend for participants from the District of Columbia, the States of Maryland and Delaware and from most areas of Virginia.

The Institute will arrange car pools for those commuting from long distances.

Books: The National Science Foundation also provides \$10.00 per participant to cover the cost of textbooks and laboratory manual.

In addition, the University has authorized funds for expenses to be incurred for two group picnics and for the coffee break of each Saturday session.

FACILITIES

The lectures will be held in the Physics Auditorium of the Science Building. The laboratory periods will be in the General Physics Lab on the fifth floor of the same building. The facilities for laboratory assignments and lecture demonstrations have been considerably

increased by moving the Physics Department from the Healy basement to the new quarters in the \$4.1 million Basic Science Building which was opened in the fall of 1962. There is ample parking space available near the building.

THE ACADEMIC PROGRAM

The Institute will meet every Saturday from 9 a.m. until 12:30 p.m. The first meeting will be on October 12th.

Topics for the first Semester will include Mechanics, Satellite Orbits, Kinetic Theory, Electricity and Magnetism, Electrical Applications.

During the second Semester the course will deal with Wave Motion and Light, Relativity, Quantum Theory and Wave Mechanics, Atomic Physics and Spectroscopy, Physics of the Solid State, Nuclear Physics and Particle Physics.

The text book for the course is *Fundamentals of Physics* by Jay Orear (John Wiley). Additional mimeographed notes and selected reprints from "Scientific American" will also be provided.

After a lecture session of about 90 minutes and a coffee break, the participants will be divided into two groups, one for the laboratory experiments and the other for the quiz period. These two groups will alternate during successive weeks.

The participants may take the course for credit if they choose to do so. The course carries a total of six undergraduate credits, three per semester.

STAFF

Rev. M. P. Thekaekara, S.J., Associate Professor of Physics; Ph.D., Johns Hopkins University, 1956; has taught in the Department of both Physics and Astronomy at Georgetown University since 1957; directed the N.S.F. Summer Conference for College Professors on Recent Advances in Astro-Geophysics during the Summers of 1960, '61 and '62; and two In-Service Institutes in '61-'62 and '62-'63; Specialty, Spectroscopy and Space Physics; will be conducting during the lecture sessions of the In-Service Institute.

Mr. Ralph A. Regalbuto, Practical Physicist; has been associated with the Physics Dept., Georgetown University since 1955; Specialty, Practical Physics demonstrations and teaching aids; will be in charge of setting up the demonstration experiments for the lectures and planning the lab experiments for the Institute.

Two senior teaching assistants of the physics department will assist at the lab and quiz sessions.

APPLICATIONS

An Application Blank is provided on the end panels of this folder. Please tear it off and mail it to:

Rev. M. P. Thekaekara, S.J.
Georgetown University
Washington 7, D. C.
Telephone FE 7-3300, ext. 670

no later than September 24, 1962.

Selection of participants will be announced on September 30th. Registration will be on October 12th.

APPLICATION FORM for In-Service Institute in PHYSICS-1963-64

Name and Address _____ School Phone No. _____ Home Phone No. _____

Will you take the course for both semesters? Yes _____ No _____

Social Security Number _____ Minimum one way distance from residence to Georgetown University _____ miles

Date of Birth _____

Employment Record—List professional experience of the Past 5 years in teaching and work related to teaching. (Add separate sheet if necessary):

DATE	EMPLOYER	NATURE OF ACTIVITY

IN-SERVICE INSTITUTE IN PHYSICS - 1963-64

GEORGETOWN UNIVERSITY-WASHINGTON 7, D.C.

The following is a provisional list of participants. Those from the same area have been grouped together. After each name are given in parentheses two telephone numbers, those for school and home respectively.

- CARNELL, Miss Jan, 2006 N. St. N.W., Washington 6, D.C. (TU 2-1622;
338-2644)
- MAGUIRE, R.S.M., Sr. Joseph Mary, 3513 N St. N.W., Washington 7, D.C.,
(FE 7-2848; FE 7-2488)
- PERPETUA, R.S.M., Sr. Mary, 3513 N. St. N.W., Washington 7, D.C.,
(FE 7-2848; FE 7-2488)
- WHELCHER, Mr. Bronel Richard, 3435 Holmead Pl. N.W., Washington 10, D.C.,
(no phone)
- WATSON, Mrs. Deborah Elizabeth, 445 Kenyon St. N.W., Washington 10, D.C.,
(RI 3-7651; RA 3-8157)
- EARLES, Mrs. Marion D., 123 Peabody St. N.W., Washington 11, D.C.,
(NA 8-6000; TU 2-8505)
- CROWLEY, Miss Patricia, 5528 Hawthorne Place N.W., Washington 16, D.C.,
(Office-982-4526)
- RODEX, Sister Mary Antoinette, Sta. Paul and Augustine Convent, 1715
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- COLLINS, Mr. Paul L., 1006 Douglas St. N.E., Washington, D.C.,
(NA 8-6000; 529-2209)
- SMITH, Mrs. Elizabeth S., 1103 Valley Ave. S.E., Washington, D.C.,
(NA 8-6000; 562-2741)
- CUMINGS, William V. S.J., Georgetown Prep. School, Garrett Park, Maryland,
(942-4900; same)
- BRYANT, Miss Bettie, 7303 River Road, Bethesda, Maryland, (365-5300; same)
- FUERZER, Sister M. Genevieve, 9601 Old Georgetown Road, Bethesda, Maryland,
(Home- OL 6-8153)
- POWERS, Sister Mary Victor, 9601 Old Georgetown Road, Bethesda, Maryland,
(Home- OL 6-8153)
- DENIS, Sister Joseph S.N.J.M., 711 Pershing Drive, Silver Spring, Maryland,
(Home JU 5-3493)
- CHAPPELL, Mr. John H., 838 Northampton Drive, Silver Spring, Maryland,
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- O'BRIEN, S.N.D., Sister Florence Joanne, 5300 43rd Ave., Hyattsville, Md.,
(School- UN 4-2061)
- SWAUGER, Mr. Charles Thomas, 6839 Riverdale Road, East Riverdale, Md.,
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- FUNKE, O.S.B., Sister Marita, 6301 Jason St., Cheverly, Maryland,
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- THOMAS, Mr. James Harvey, 1630 Ruxton Ave., Baltimore 16, Md.,
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- SLABINSK, Mr. Edmund J., 29 A Oak Grove Drive, Baltimore 20, Md.,
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(AT 4-4747; 477-3653)
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- BURKE, Mr. John Francis, 3030 Moreland Ave., Baltimore 34, Maryland,
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- BEALE, Mr. Paul L., Route 2, Emmitsburg, Maryland, (PL 6-6345; HI 7-5493)
- BOYLE, Mrs. Janet, 1003 Wilson Place, Frederick, Maryland,
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- MARY, S.S.N.D., Sister Sean, 112 East Second Street, Frederick, Maryland,
(Home MD 2-2623)
- STANLEY, Mr. Everett Edward, R.D. 7, Box 252, Westminster, Maryland,
(Home- 848-7297)

IN-SERVICE INSTITUTE IN PHYSICS - 3

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HOFFACKER, Mr. William Franklin, Corbett Road % Monkton P.O. Md.,
(Home GR 2-2647)
BASSETT, Mr. Floyd, Baysinger Traylor Park, Salisbury, Maryland,
(PO-587; 742-3654)
KING, Mrs. Martha Scott, P.O. Box 338, Princess Anne, Maryland,
(465; 431)
GLENN, Miss Manie H., 1800 Robert Small Road, Annapolis, Md.,
(OR 4-3931; CO 8-8641)
LONIE, Mr. Richard, 17 Church St., North East, Md., (Home Northeast 5481)
BOGGS, Mr. Ray L., P.O. Box 292, Seaford, Delaware, (629-4584; 629-8011)
BLOSE, Mr. Maurice R., Box 93, Cedar Grove Road, Milford, Del.,
(422-8619; 422-9373)
FAGAN, O.S.B., Sister Jean Marie, St. Elizabeth Convent, 803 S. Broad St.
Wilmington, Delaware, (OL 6-3369; OL 6-8832)
WERNER, O.S.B., Sister Marita, Our Lady of Etinia Convent, 100 W.
Grant Ave., Wilmington, Delaware, (Home EA 8-5397)
JOSEPH, C.S.C., Sister Marian, Blessed Sacrament Convent, Alexandria, Va.,
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MOORE, Mrs. Mary Margaret, 937 Spring Lane, Falls Church, Va.,
(CL 6-8080; 481-7245)
SILVER, Mr. Charles H., 2202 N. 2nd Street, Arlington, Va.,
(JA 7-7600; JA 7-8940)
GILL, Mr. Earl W., 7507 Gresham St., Springfield, Va., (Home CL 6-2313)
BOURNE, Mr. Gordon R., 6807 Elder Ave., Springfield, Va., (JA 7-7600;
354-1997)
MASSEY, Miss Mary Ball, 401½ North Grant Ave., Manassas, Virginia,
(368-4931; School)
McAVOY, Mr. Raymond Joseph, John S. Mosby Academy, Front Royal, Va.
(no phone)
KIMPT, Mr. Feriha F., St. Margaret's School, Tappahannock, Va.,
(HI 3-2962; HI 3-4943)
MORRIS, JR., Mr. John L., Route #3 c/o Mrs. Iweis Pendleton, Mineral, Va.,
(Mineral 3231; Mineral 2395)
WILLIAMS, Mr. Perry, 59 3rd Avenue, Ettrick, Virginia, (732-5883; RE 3-6716)
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BRADSFER, Mr. Frank C., 1200 Seventh Street, Lynchburg, Virginia,
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In-Service Institute in Physics 1963-64

Georgetown University

Ago						Martin					
Bassett						Massey					
Banghman						McGuire					
Beale						McNair					
Blake						Moore					

Blose						Morris					
Boggs						Mullineaux					
Bourne						O'Brien					
Boyle						Olson					
Brown						Osborn					

Bryant						Pierro					
Buchanan						Powers					
Burke						Puerzer					
Cain						Purnell					
Carnell						Rodez					

Chappell						Romagnoli					
Collins						Saunders					
Crowley						Sevigny					
Cummings						Silver					
Diggs						Slabinski					

Earles						Smetanick					
Fagan						Smith					
Funke						Stanley					
Garland						Stimmel					
Gill						Swauger					

Glenn						Thomas					
Hoffacker						Torrence					
Holmes						Trautwein					
Howerton						Tweddle					
Jenkins						Waiker					

King						Watson					
Kreisel						Werner					
Kunt						Welchel					
Lonie						Williams					
Maguire						Woodburn					

1. Name of institution Georgetown University
2. Address of institution (city and state) Washington, D. C. 20007
3. Broad code discipline of program (see page 9) Physics
4. Detailed code discipline of program (see page 9) General
5. No. of junior-senior majors currently enrolled in discipline 20
6. No. of majors graduated in last five years 41
7. No. of graduates entering graduate school in the last five years 50
8. No. of participants during each period of proposed program: 6

No. of Wks.	Summer		Academic Year	No. of Part.	\$	Total \$
	No. of Wks.	No. of Part.				
1964	10	6	1963-1964			
1965	10	6	1964-1965	6	\$4,200	\$12,600.00
1966			1965-1966	6	\$4,200	\$12,600.00

9. Total NSF Support requested (round to nearest \$10.00).....\$25,200.00
10. NSF Undergraduate Science Education grants previously made for this department:

<u>Grant Number</u>	<u>Starting and Termination Dates</u>	<u>Director</u>
G-22809	October 1, 1962 to May 31, 1964	M. P. Thekaekara, S.J.

11. Georgetown University, Washington, D. C. 20007
Official name of institution to which grant should be made
12. Very Rev. Edward B. Bunn, S.J., President
Name and title of chief administrative officer
13. Rev. M. P. Thekaekara, S.J., Physics
Name and department of director of proposed program

Signature FE 7-3300 X670 FE 7-3300 X752
Phone (office) Phone (home)

14. Rev. Joseph A. Haller, S.J., Treasurer
Name and title of official authorized to sign for institution

Signature

15. October 25, 1963
Date of Submission
16. June 1, 1964
Starting date for proposed program

NARRATIVE PORTION

1. DEPARTMENT'S EXPERIENCE IN UNDERGRADUATE RESEARCH PARTICIPATION

The Physics Department initiated in 1956 a program of participation of undergraduates in research projects. Under this program, every year a number of physics majors of the junior and senior classes were selected to work on a project. A project was assigned to each group of two students. The students worked under the supervision of one of the faculty members. The results of the project were summarized in a paper which the students presented to the Physics Club of the College. The Physics Club is an affiliate of the Student Section of the American Institute of Physics. Almost every year one or another of the projects yielded results of sufficient quality so that the department sponsored the students attending the annual meeting of the Eastern Colleges Science Conference and the presenting of the paper on the project at that Conference.

This departmental program consisted of separate projects, each project being a unit by itself. No attempt had been made to fit these projects into an overall program or to link them with the research which was being carried out by the graduate school. The students received no financial remuneration for working on this departmental program. All expenses for equipment, etc., including attendance at the Eastern Colleges Science Conference, were met from the budget of the Physics Department.

Some of our students have also worked, on a full-time basis during summers, on a large Astronomy Department research program for mapping the moon and for data reduction in geodesy. The Astronomy Department has few majors at the undergraduate level and, hence, draws on the physics majors for phases of its research program which require semi-skilled undergraduate cooperation. The students received adequate remuneration for this type of full-time summer work.

This informal program in the Physics Department developed into a more formal program of Undergraduate Research Participation, at the beginning of the academic year 1963, with a grant from the National Science Foundation. Six students were selected for the program in its three areas.

A supplementary grant was obtained from the Union Carbide Corporation which enabled us to increase the number of participants from six to eight. The Union Carbide grant was for one academic year and one summer only and it was to be divided among the Mathematics, Chemistry, and Physics Departments. No special conditions were set as to how the grant should be used. The Director of the N.S.F. Undergraduate Research Participation program made a recommendation to the administration and to the Mathematics, Chemistry, and Physics Departments that the amount might be utilized to enlarge the Undergraduate Research Participation program of the Physics Department and to initiate similar programs in the other two departments. This recommendation was accepted and put into effect by the Academic Vice-President and the Dean of the College of Arts and Sciences. The Union Carbide grant was utilized entirely for stipends for the six students. The grant terminated in September 1963, but a renewal application is now being made by the College of Arts and Sciences.

The two Physics Department students who were selected under the Union Carbide grant were assigned, one each, to Atomic and Molecular Spectroscopy and to Infrared Spectra of the Planets.

With the Undergraduate Research Participation program sponsored by the National Science Foundation and supplemented by the Union Carbide grant, the Department of Physics has been able to develop a more complete participation by the undergraduates in the overall research program of the department. In two research areas, Atomic and Molecular Spectroscopy and Infrared Spectra of the Planets, the undergraduates worked alongside faculty members and senior graduate students.

These programs involved rather heavy expenses, which were provided from other sources. The third research area, Phase Contrast Telescropy, was being newly started and it was intended solely for undergraduates.

The cost of program allowance provided in the N.S.F. grant was utilized mostly for this program, for buying new items of equipment, and for the summer salary of the Research Supervisor, Dr. M. L. Vatsia.

2. LIST OF RESEARCH AREAS FOR UNDERGRADUATE PARTICIPATION

I. ATOMIC AND MOLECULAR SPECTROSCOPY

a. The research on which the undergraduates will work is part of a rather large program in spectroscopy. We have already developed several semi-automatic techniques for rapid reduction of spectroscopic data. With three newly acquired pieces of equipment, the telecordex, the telereadex, and the Burroughs E 101 computer, many time-saving features have been introduced. Electrodeless discharge tubes provide efficient laboratory sources of radiation. The relative advantages of these sources, compared to conventional arc and spark sources, have been demonstrated by our work and by that of several other investigators. The techniques of making such tubes are being perfected by members of the Physics Department. Several spectra of astrophysical interest need to be studied. A great deal of work still needs to be done in connection with the accurate determination of energy levels. The semi-automatic techniques which we have developed in interferometry permit such work to be accomplished rapidly, economically, and with a sufficiently high degree of precision. The problems which we are interested in are of a very basic nature. These are problems which will familiarize the students with many different types of instruments and with many different aspects of physical theory. Of particular interest to the undergraduates will be their learning how to operate a small E 101 computer for spectroscopic data reduction.

As a research tool a small computer offers a special attraction. Its low cost enables a research group to work independently of a central computing laboratory. The results are available immediately. The students themselves are responsible for all stages of the work and do not have to wait their turn for a larger computer and its programming staff.

The University has two Burroughs E 101 computers, one at the Observatory and the other in the Physics Department. The latter is being used a great deal by the undergraduates in the spectroscopy program.

Other pieces of equipment available for spectroscopy are: two Wadsworth type mounting spectrographs; three concave gratings, each six inches wide with a twenty-one foot radius of curvature; a Littrow spectrograph with quartz optics; and a vacuum interferometer. These are located at the Observatory and are available for any extensive, high dispersion spectrographic program which our group may have.

Several items of equipment are available in the Spectroscopy Lab of the Physics Department for routine work. These have been installed during the past two years and one of the major responsibilities of the students in the Undergraduate Research program was to assemble all the necessary accessories and to familiarize themselves with the operation of the apparatus. The equipment includes a half-meter Jarrell-Ash grating monochromator with two gratings, one for the visible and the other for the near infrared; a small Paschen spectrograph; a vacuum system for making discharge tubes; a microwave oscillator; a comparator; a complete set of filters; and a prism spectrograph with photographic attachment.

The problems on which the undergraduates will work are chosen from those of current interest to the spectroscopy group. Since the time which the undergraduates can devote to the projects is rather limited, small well-defined projects will be selected for them. Problems of current interest are spectra of Titanium I,

Titanium II, Zirconium and Yttrium, molecular spectra of yttrium compounds, faint lines in the solar spectrum, the filter differential method for spectral irradiance, calibration of total energy sensors, setting up of secondary standards for spectral irradiance, absolute intensity measurements of spectral lines, and determination of transition probabilities of atomic lines.

Major support for the spectroscopy program is from a grant to the Georgetown College Observatory from the National Science Foundation, two Title IV fellowships from the Department of Health, Education and Welfare, and one fellowship from the National Science Foundation. Funds are also provided annually in the Physics Department budget for the research program. These funds are used for faculty salaries, maintenance of equipment, and for the purchase of new equipment. The Littrow spectrograph, located at the Observatory, and the half-meter grating Jarrell-Ash monochromator were purchased with funds provided in the Physics Department budget.

b. The present phase of the spectroscopy program began several years ago with the development of the electrodeless discharge tubes by the National Bureau of Standards spectroscopy group. These tubes were first announced in a paper published in the Journal of the Optical Society of America, 43, 398 (1953), by Corliss, Bozman and Westfall. At that time the first two were part-time students in the Department of Astronomy at Georgetown. Our work with these new sources has resulted in a series of papers published in the Journal of the Optical Society of America and the Astrophysical Journal.

Hence, our spectroscopy research is a well-established program. The undergraduates will devote their attention to specified areas within the program. Our experience during the past year shows that with proper direction they can profit a great deal and, at the same time, make valuable contributions to the program.

c. The staff supervisor for this research area will be Reverend Matthew P. Thekaekara, S.J. Reverend Thekaekara did his earlier graduate work at the University of Madras. He was Chairman of the Department of Physics at a Jesuit College in India when Johns Hopkins University selected him for a research position. He took his Ph.D. in experimental spectroscopy at Johns Hopkins. Later he joined Georgetown University where for three years he was co-investigator with Dr. Carl C. Kiess in the spectroscopy research program. From September 1960 to July 1962 he was Acting Chairman of the Department of Physics. His work in spectroscopy has been reported in monographs published by the Johns Hopkins University and by the Georgetown College Observatory and in articles in the Physical Review, the Journal of the Optical Society of America, and the Astrophysical Journal. Reverend Thekaekara was the Director of the Summer Conference for College Professors on Recent Advances in Astrogeophysics during the summers of 1960, 1961, and 1962; of the In-Service Institute for High School Teachers for three academic years from 1961; and of the Summer Institute in 1963. These three programs were sponsored by the N.S.F. He also directs an N.D.E.A. Title IV Program sponsored by the Department of H.E.W. in atomic and molecular spectroscopy.

d. Two undergraduate physics majors will be selected for this program. They will work from June 1, 1964, to May 31, 1966.

II. INFRARED SPECTRA OF THE PLANETS

a. The research area which will be pursued by the undergraduate students is part of the overall program in Infrared Spectra of the Planets. This program has four major tasks:

1. Theoretical research will be conducted to apply the techniques of information and communication theory to permit quantitative analysis of the infrared data obtained experimentally.

- ii. Experimental research will be conducted using an infrared spectrophotometer available in the Physics Department to obtain infrared data in the 5 to 15 micron region on solar radiation reflected from the moon as well as laboratory black body sources. This task will be performed concurrently with task (i) and the results will determine our treatment of the infrared data from the planets.
- iii. Experimental research will be conducted using a Beckman I R-7 Prism Grating Infrared Spectrophotometer. This instrument has sufficient sensitivity and resolving power to permit spectrum resolution and Doppler shift resolution required in the study of the I R spectra of the planets.
- iv. Experimental and theoretical research will be conducted using the techniques and instrumentation developed in the above tasks to determine the nature and the total amounts of the molecular constituents of the atmospheres of the planets.

The undergraduate students will assist in the implementation of task (ii) with existing equipment, facilities, reference materials, and financial support within the Physics Department.

b. The project began with departmental support in September 1960. A survey of the literature was made and an overall plan of work was formulated. The Beckman I R-7 Prism Grating IR Spectrophotometer has been acquired by the department and all its defective parts have been repaired. The instrument is now in excellent condition for routine measurements.

The contribution of the two undergraduate research participants has been to design and build an infrared double-beam double-pass spectrometer. It is to be mounted behind a short focus parabolic mirror. The dispersing element is a sodium chloride prism. The instrument was originally intended for manual operation and it is now being converted to automatic recording. A considerable amount of work

still needs to be done on making this instrument a versatile, high precision, wide range spectrophotometer.

c. The staff supervisor for this research area will be Dr. William J. Thaler. Dr. Thaler took his B.S. from Loyola College, Baltimore, in 1947; his M.S. in 1949; and his Ph.D. in 1951 from the Catholic University of America. In 1951 Dr. Thaler joined the Office of Naval Research as a physicist in the Acoustics Branch. He was responsible for the planning and implementing of a basic research program in underwater acoustics and ultrasonics conducted by universities and industrial contractors. Late in 1952 Dr. Thaler was transferred to the Field Project Branch of the ONR. He was in charge of the Navy participation in nuclear weapons effects test programs conducted at the AEC proving grounds. He directed two well-known projects for the Defense Services, Project ARGUS and Project TEPEE. Under Project ARGUS, which is sometimes called the "greatest scientific experiment of all time" three atomic bombs were fired from shipboard and detonated 375 miles above the South Atlantic, creating a shell of electrons which enveloped the earth for several days. The project revealed much about the earth's magnetic field and the behavior of radiation in the upper atmosphere.

The list of Dr. Thaler's publications includes the following: Distortion of Progressive Ultrasonic Waves, Phys. Rev. 74, 107-108 (1958); Study of Turbulence by Light Diffraction, Phys. Rev. 74, 708-709 (1948); Intensity as a Factor in Precision Measurements in Ultrasonics, Bull. Am. Phys. Soc., April 29, 1948; A New Method of Measuring Sound Velocity, Am. J. Phys., 6, (1950); A High Intensity Short Duration Spark Light Source, J. App. Phys. 21, 1269-1271 (1950); Absorption and Dispersion of Sound in Oxygen as a Function of the Frequency-Pressure Ratio, J. Acoust. Soc. Am. 24, 15 (1951); Ultrasonics - A Tool for Biological Research, Research Reviews, Jan. 1952; Effects of Ultrasonic Waves on the Refractive Media of the Eye; AMA Archives of Ophthalmology 47:2; 204-219, Feb.,

1952. Numerous additional publications from 1952 to 1960, in connection with nuclear weapons research and ballistic research, are classified.

In September 1960 Dr. Thaler joined the faculty of the Physics Department of Georgetown University as professor in physics. In July 1962 he was appointed Chairman of the Department of Physics.

Since the Spring of 1963, Dr. Thaler is the Principal Investigator of a NASA sponsored research program which includes the assistance of four other faculty members and six graduate students. The group conducts fundamental studies on the thermal balance of spacecraft. The equipment includes a solar simulator; space simulator chamber; and associated data recording equipment. Initial studies are being made on the absorptivity-emissivity ratio for various metals, semi-conductors, and solid state materials. The long-range objective is to increase fundamental knowledge of the absorption and emission properties of materials. It is hoped that this will lead to design and construction of controllable absorptivity-emissivity surfaces for future spacecraft application.

d. Two undergraduate physics majors will participate in this area of research for the whole period, June 1, 1964, to May 31, 1966.

III. PHASE CONTRAST TELESCOPY

a. The third area for undergraduate research participation is a relatively new field of optics - phase contrast telescope. We have set up laboratory and portable models of the phase contrast telescope to study the detailed structure of extended transparent media. Visual observation, photography, and photoelectric recording are used for the investigations of transparent media, like atmospheric turbulence, shock waves, gas flames, ultrasonic waves in liquids, etc.

The phase contrast technique enables visual observation of absolutely transparent objects, the details of which differ only in thickness or refractive index. In principle, the transparent details of the object are converted into differences

of intensity in the image. This method produces an image which is a more accurate representation of object details than the images obtained in any previously used practical methods of Schlieren, oblique dark-ground, and central dark-ground illumination. Furthermore, the phase contrast method is much more sensitive than the earlier methods mentioned above.

F. Zernicke, the Dutch physicist, discovered the phase contrast method in 1935 and the phase contrast microscope has become an important and valuable piece of equipment for research and industry in the post World War II period. The phase contrast technique was introduced in telescropy by the optics group at the University of Florida in 1954, the year after F. Zernicke obtained the Nobel Prize for his phase contrast method.

Studies of transparent media, using the phase contrast technique, at the University of Florida have been published in the Journal of Applied Physics, Volume 27, 1955.

The Department of Physics at Georgetown University possesses a number of optical benches, a complete line of light sources, a Michelson interferometer, and the usual optical instruments for an undergraduate optics laboratory. A lathe-bed type precision optical bench with accessories, manufactured by the Gaertner Scientific Corporation, an Omega enlarger, a Richard print washer and dryer, an Oscar Fisher stainless steel sink and temperature control unit, and a complete line of accessories for photographic work, were added from funds provided by the Physics Department budget. Several accessories required for making phase contrast plates and for making observations with them were also acquired out of funds provided in the Undergraduate Research Participation grant of 1962 to 1964.

b. Our program in phase contrast telescropy is relatively new and, in the initial stages, it is being planned almost entirely for the benefit of the undergraduate physics curriculum. This research area is considered a necessary complement to the rather large research programs which we are having in spectroscopy and astronomical optics.

Dr. M. L. Vatsia, the research supervisor, and the two students from the Undergraduate Research Participation program have already set up an efficient phase contrast system. Techniques were developed for making linear phase plates of variable depth and absorption by vacuum deposition of aluminum on microscope slide covers. The thickness of the film is in the order of 80 to 200 angstrom units. About 100 phase plates have been prepared and their thicknesses were measured by means of Fizeau interference fringes. The optical system is now in perfect alignment and is being used to study turbulence in air caused by flames and temperature gradients caused by air-conditioners, cooling fans, and heaters.

Future plans call for using this delicate piece of apparatus for optical transmission properties of turbulent atmosphere. Three types of measurements will be undertaken: cell size of turbulence by phase contrast telescoping, fluctuations in velocity by a hot-wire anemometer, and degradations of photographic images of N.B.S. calibration charts due to the turbulent atmosphere through which the charts are viewed.

c. The phase contrast telescoping program was initiated and will be supervised by Dr. M. L. Vatsia. He obtained his B.Sc. (Honours) degree from the University of Delhi and worked for five years as a research assistant in the Optics Division of the National Physical Laboratory of India. While there he participated in designing and building various optical and electronic instruments; such as, the Twyman Green interferometer, photoelectric multiplier type photometer, various power supplies, and a vacuum metal-film depositing unit. In the Fall of 1954 he was awarded a graduate fellowship by the University of Florida, where he obtained his M.S. degree in 1955 and his Ph.D. degree in 1958, in the field of phase contrast telescoping and atmospheric optics. In his graduate program, during 1955-58, he worked as an investigator on U.S. Air Force and Army research contracts. During 1958-61 Dr. Vatsia taught physics and mathematics at the Inter-American University of Puerto Rico, where he was Chairman of the Department of Physics and Mathematics. Dr. Vatsia

joined the Department of Physics at Georgetown University in the Fall of 1961. Parts of his research work have been published in the Journal of the Optical Society of America and The Quarterly Journal of the Florida Academy of Sciences. Dr. Vatsia attended a Summer Institute on the History and Philosophy of Science and Mathematics and a Summer Conference on Recent Advances in Astrogeophysics, both under N.S.F. sponsorship.

d. Two undergraduate students are planning to participate in the phase contrast telescopy program during the whole period of the program from June 1, 1964, to May 31, 1966.

3. PLANS FOR STUDENT ROLE IN THE PROGRAM

I. In Atomic and Molecular Spectroscopy, the students will first learn the energy level scheme of the atoms and molecules under study. They will also learn how to program for the E 101 computer. Use of the large spectrographs, such as the Wadsworth or the Ebert monochromator, will come at a later stage.

Specific projects will be assigned to the students, taking into consideration the techniques they have learned and the limited time at their disposal.

At the beginning of the program the undergraduate student will be working alongside one of the graduate students and under the immediate supervision of the faculty member. Progressively, he will be fully responsible for his limited projects.

II. In the area of Infrared Spectra of the Planets, it is planned to begin student research participation by having the student become well-versed in infrared optics through use of the existing infrared spectrophotometer at the laboratory. This phase will progress from optical alignment, care and handling of components, etc., through the actual taking of rudimentary data, using laboratory sources and standard gas cells, to the final application of measurement of the infrared spectra of the earth's atmosphere and identification of its molecular components using reflected sunlight from the moon.

III. In the field of Phase Contrast Telescopy, the students will be asked to study the literature on optical setups for the observation of transparent optical media. They will then be in a position to build a phase contrast system for study of transparent media like flames, glass, plastics, turbulent atmosphere, shock waves, etc. The students will learn how to align the optical systems needed for the work and how to build phase plates of various specifications. They will, in progressive stages, familiarize themselves with the photographic process and sensitometric techniques for the interpretation of the results. The "visual" observation of otherwise invisible objects gets the interest of the students aroused and, with a certain amount of training, they will themselves devise new methods in this field.

4. PROCEDURES FOR SELECTION AND CRITERIA OF ELIGIBILITY

The chief criterion for selection will be the seriousness of purpose and proven ability of the student to become an academic and professional physicist.

The participants in the program will be chosen from among the physics majors of the junior or the sophomore class. Seniors will not, generally, be eligible partly because they will not be available beyond one academic year and partly because the course load of physics majors in the senior year would not normally permit an active research program. However, if a senior student shows very keen interest in the research program, and his previous record gives promise of his being able to carry the research load without affecting his course work, he will be eligible.

In selecting students for the research program the staff supervisors will be guided by the recommendations of the College Admissions Office and of the members of the physics staff who are in charge of the freshman General Physics course. The Admissions Office screens, rather carefully, the applicants for the physics major program. An average grade of B, or higher, a College Entrance Exam score well above the average, and at least three years of high school math and one

year of high school physics are required of the freshmen physics majors. The freshman course in General Physics is a major hurdle for many would-be physics majors. The weekly lab reports, the biweekly quizzes, the weekly problem assignments, the quarter tests and semester exams, all help to give a clear idea of the student's talent, industry, and ability. Applicants for the research program should give clear proof of their being able to continue with the physics major program of the College. They should also show an aptitude for experimental work.

Since, during the last several years, most of our physics majors obtained graduate fellowship awards from leading Universities for work towards a Ph.D. program, we feel there will be little difficulty in finding six students capable of handling the research participation program.

There are nearly 3800 students enrolled in the five Undergraduate Schools of Georgetown University. Of these, less than five percent are in the three areas of comparable academic rigor, mathematics, physics, and chemistry, of the College of Arts and Sciences. Hence, it would seem - or at least the faculty of the Physics Department like to think - that the physics majors above sophomore level are "undergraduates of high ability."

Major questions to be asked about the applicants to the Undergraduate Research Participation program are whether they show a keen interest in one of the three areas of research and whether they can participate in the program without detriment to an already heavy academic schedule.

INSTITUTION Georgetown University

SCIENTIFIC PERSONNEL AND EDUCATION

DIRECTOR Rev. Matthew P. Thekaekara, S.J.

SPECIAL PROJECTS IN SCIENCE EDUCATION

UNDERGRADUATE SCIENCE EDUCATION

BUDGET:

	<u>AY 63-64</u>	S 64 <u>AY 64-65</u>	S 65 <u>AY 65-66</u>	et seq.
I Summer				
A. Participant Support				
<u>6</u> Participants @ <u>\$60.00</u>				
per week for <u>10</u> weeks		\$3,600.00	\$3,600.00	
B. Cost of Program Allowance				
<u>6</u> Allowances @ <u>\$80.00</u>				
per week for <u>10</u> weeks		\$4,800.00	\$4,800.00	
TOTAL I (A + B).....	_____	<u>\$8,400.00</u>	<u>\$8,400.00</u>	_____
 II Academic Year				
A. Participant Support				
<u>6</u> Participants @ <u>\$200.00</u>		\$1,200.00	\$1,200.00	
B. Cost of Program Allowance				
<u>6</u> Allowances @ <u>\$500.00</u>		\$3,000.00	\$3,000.00	
TOTAL II (A + B).....	_____	<u>\$4,200.00</u>	<u>\$4,200.00</u>	
 GRAND TOTAL.....		 <u>\$25,200.00</u>		



Group photograph of participants and staff

Photographed in the presence of the

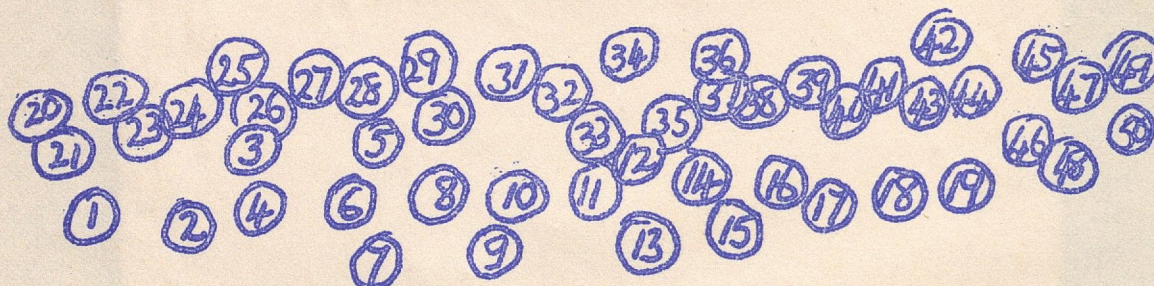
1954

1954

Georgetown University
In-Service Institute in Physics

1963-64

Group Photograph of Participants and Staff



- | | | | |
|----|--------------------------------|----|----------------------|
| 1 | Mary Ball Massey | 26 | Perry Williams |
| 2 | Barbara H. Holmes | 27 | Ralph Trautwein |
| 3 | Janet Boyle | 28 | Everett Stanley |
| 4 | Deborah E. Watson | 29 | Maurice R. Blose |
| 5 | Mother Kevin (Tveddle) | 30 | Frederick Martin |
| 6 | Sr. Christopher, OSB | 31 | Richard Louie |
| 7 | Sr. Marita Werner, OSB | 32 | Paul Beale |
| 8 | Sr. Marita Funke, OSB | 33 | John L. Morris, Jr. |
| 9 | Sr. Jean Marie Fagan, OSB | 34 | Leslie H. Olson |
| 10 | Sr. Marian J. Cain | 35 | Floyd Bassett |
| 11 | Sr. Joseph Mary Maguire, RSM | 36 | George Stimmel |
| 12 | Sr. Joseph Denis Sevigny, SHJM | 37 | David Buchanan |
| 13 | Sr. M. Genevieve Fuerzer, S.C. | 38 | R. L. Jenkins |
| 14 | Sr. Antoinette Rodes, OSP | 39 | P. L. Collins |
| 15 | Sr. Margaret Pierro, MFP | 40 | Gordon R. Bourne |
| 16 | Feriha Kunt | 41 | Thomas M. Diggs |
| 17 | Mary Margaret Moore | 42 | Edmund Slabinski |
| 18 | Elith Garland | 43 | Melvin Woodburn |
| 19 | Bettie Bryant | 44 | G. Laners |
| 20 | Earl W. Gill | 45 | John Burke |
| 21 | Bill Hoffacker | 46 | James H. Thomas |
| 22 | Ronald Smetanick | 47 | L. Massa |
| 23 | Elmer Kreisel | 48 | M. P. Thekkara, S.J. |
| 24 | Ray Boggs | 49 | William Mullineaux |
| 25 | John F. Mc Guire | 50 | Mario Romagnoli |