

College Physics in Transition

By Frank Verbrugge

The following summary account is concerned with a new plan for developing a coordinated nationwide program for improving physics education at the college level. The author is professor of physics at the University of Minnesota and secretary of the American Association of Physics Teachers.

COORDINATED group efforts, which in the past twenty years have become a major development in scientific research—particularly in physics—have also in recent years made major contributions to developments in science education. Large programs, affecting both course content and teaching techniques, have been undertaken. These have in general been directed at secondary-school courses in mathematics and the several physical and biological sciences.

At the college level, no comparable program has as yet been developed for any area of science, although extensive studies are under way for college mathematics. In physics, the vast array of subject matter which can be presented in an introductory course and the interrelations of this course content with the wide variety of learning aids (such as laboratory experiments, lecture and corridor demonstrations, and the like) would imply that, before any large-scale program be planned, there should be extensive discussion as to its desirability and prospective character. Accordingly, a College Physics Conference attended by approximately sixty physicists has held a series of meetings during the past year. The meetings were sponsored by the American Association of Physics Teachers, supported by a grant from the National Science Foundation. A progress report, prepared at the end of the first meeting, appeared in the February 1960 issue of *Physics Today*. A final report of the Conference will be found in this month's issue of the *American Journal of Physics*.

Need for a National Program

MANY physicists share the point of view that the teaching of physics can best continue to develop as it has developed in the past—namely, through individual efforts and an exchange of information, both in

publications and at professional meetings. The success of this approach in the past, they say, should induce physicists to think carefully before introducing radical modifications in the structure of physics teaching. A free, individualized approach avoids the rigidity that a unified program might engender.

Lively exchanges of opinion occurred at the meetings of the Conference regarding the desirability of a program for physics which would be national in scope. Eventually, the Conference reached a consensus on a program for action; a program which can be far-reaching in its effects. There was unanimous agreement that no unified, monolithic program should be planned; rather, a course of action was proposed which would retain a high degree of flexibility within a framework of broad and extensive coordination.

Among the arguments presented in support of a coordinated national effort were the following:

- (a) The rapid growth of physics as an area of human knowledge and activity demands the type of group effort which is already an accepted pattern in physics research. Few, if any, physicists possess the competence to effectively prepare and present, even at an introductory level, subject matter in the many frontier areas of physics.
- (b) It is essential for the development of physics, and of student interest in it, that a much larger number of research physicists become actively engaged in creative work related to physics teaching—as distinct from agreeing merely to teach undergraduate courses. Such active participation can be stimulated more effectively by the existence of a national effort.
- (c) It is important that the younger physicists be encouraged to participate in developmental activities related to physics teaching. Physics departments will more readily encourage such participation, will formally provide time for the work involved, and will give suitable professional recognition for it to their younger

staff members, when there is the prospect of local benefits resulting from a national program.

(d) The development of national programs for changes in the content of courses in science and mathematics at the secondary-school levels will require not only greater recognition of student background in the college courses, but will also demand an accelerated and coordinated program of course modification at the college level.

(e) There are many recent developments in the technical aids available for the teaching and learning of physics. These can markedly increase the effectiveness of the demonstration-lecture, the discussion period, and the laboratory program. The full development of these technical aids is feasible only if it is done on a coordinated, national basis.

Meetings of the Conference

THE three meetings of the College Physics Conference were held in December, February, and May—at Cambridge, St. Louis, and Minneapolis, respectively. As previously reported, the first three-day meeting dealt primarily with a discussion of the needs and general characteristics of a program for the improvement of college physics. Possible types of activity in the various areas of physics were outlined in some detail; geographical subgroups were then encouraged to arrange for regional meetings, prior to the second Conference meeting, to provide a broader base for discussion of national needs.

The St. Louis meeting opened with a consideration of the regional reports. The conference then agreed to subdivide itself again—this time according to “problem areas” common to all of physics teaching. These problems included the following: (a) the aims and general context of physics; (b) equipment and teaching facilities (problems both of development and distribution); (c) teaching-related problems; (d) the preparation of teachers of college physics; (e) the preparation of special resource materials—a reference shelf for college physics; (f) fellowships and awards; (g) testing; (h) new approaches; (i) organization of a program of action.

Each of the subcommittees presented an oral preliminary report to the Conference at the St. Louis meeting. Written reports were subsequently prepared and were mailed to the members of the Steering Committee of the Conference. On the basis of these reports, the Steering Committee prepared a preliminary draft of the *College Physics Conference Report*. The final meeting of the Conference was largely devoted to the preparation and consideration of a final report and to the problems of planning an organization which would coordinate a program of action for college physics.

The Report of the Conference

THE Conference report (and its appendixes) describes in considerable detail some aims of physics teaching, specific areas of activity to achieve the basic aims, and suggested means by which the entire physics profession can, in an organized manner, participate in

these activities. Many suggestions are made regarding such specific activities as: laboratory and demonstration apparatus; examinations; publications (monographs, review articles, apparatus notes, and the like); modifications of course content; experimentation with the development of new courses; films and other teaching aids.

The report is being published in the September 1960 issue of the *American Journal of Physics*. Preprints of the report will be distributed to physics departments throughout the United States. A special supply of reprints of the *Journal* version of the report will also be prepared.

Organization

TO develop and coordinate the program proposed in its report, the Conference in its final session voted to recommend that the American Association of Physics Teachers establish a Commission on College Physics. The Executive Committee of AAPT, following the close of the Conference, established a 17-member commission, with membership as suggested by the Conference.

The Commission is responsible to AAPT and will report periodically to it. However, it is authorized to plan its own programs, to seek independently financial support for these programs, and to employ such staff and consultants as it finds necessary. The Commission will call upon the entire physics profession to participate in the program. Universities and colleges will be invited to participate in the collaborative effort and to make available and provide support for the teaching time of one or more of their staff members for specific phases of the program.

The Commission held an organizational meeting at the American Institute of Physics on June 17. It elected Walter C. Michels and Francis L. Friedman as its chairman and vice-chairman, respectively. Other major actions were the decision to proceed at once to secure a full-time executive secretary for the Commission and the selection of an Executive Committee.

The Commission has three ex-officio members: the president and the president-elect of AAPT and the director of AIP. Of the remaining twelve additional members nominated by the Conference (other than those indicated above), the following had accepted their appointment to the Commission as of June 17: S. C. Brown, G. J. Holton, R. I. Hulsizer, V. Parker, M. Phillips, R. Resnick, M. Sands, F. W. Sears, and J. R. Zacharias.

It is, of course, too early to assess what the College Physics Conference has accomplished or to estimate the level of activity which the Commission will stimulate. However, the plans which in recent months have been developing at college and university centers, and the level of interest which developed during the meetings of the Conference, provide a basis for the expectation that college physics courses will enjoy a high level of activity, experimentation, innovation, and support in the years ahead.