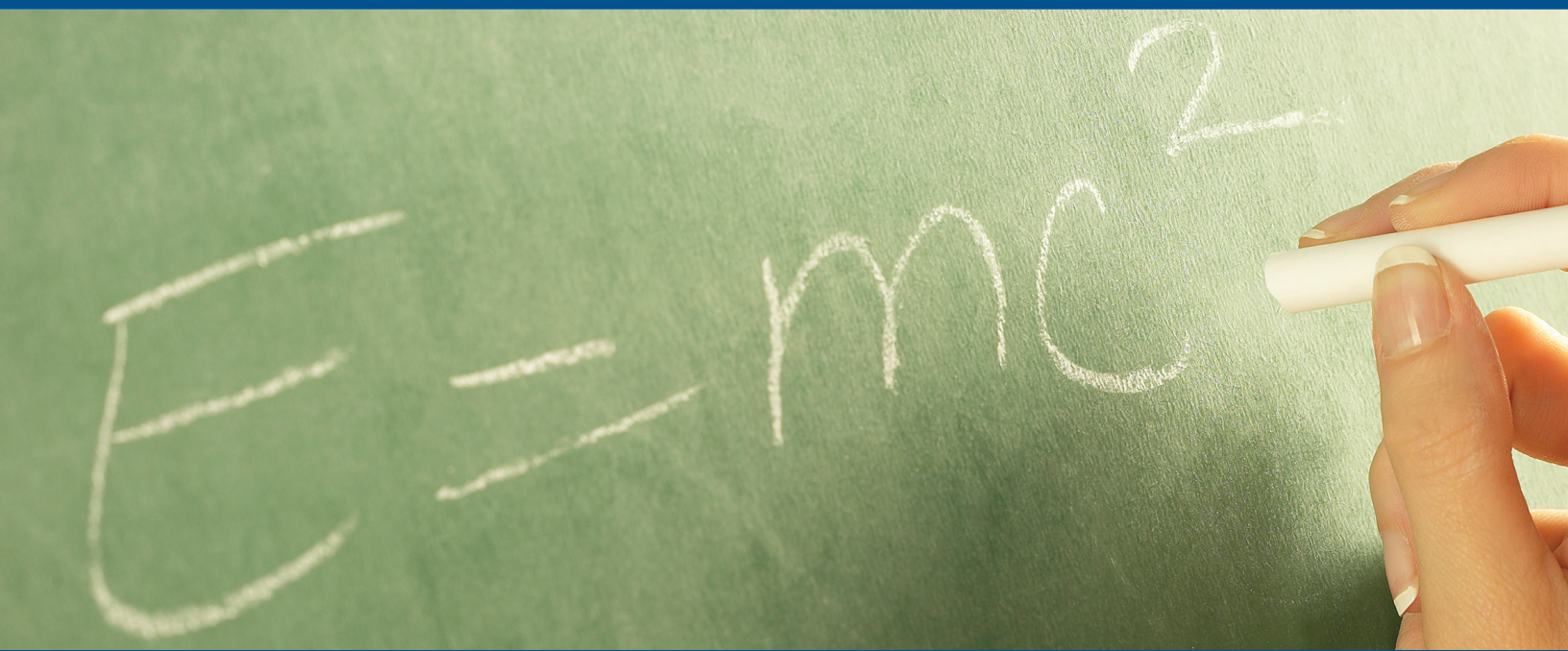


Report of the Joint AAPT-APS Task Force



American Association of
Physics Teachers

APS
physics



GRADUATE EDUCATION IN PHYSICS

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NOTE ON THIS EDITION

This edition replaces the October 2005 publication and contains some minor corrections to data within the narrative as well as corrections to a number of editorial errors. The figures have been revised for clarity of presentation; there were no changes to the data.

INTERACTIVE FEATURES IN THE PDF

Online Documents and websites mentioned in this report can be accessed directly from this PDF by clicking on any red underlined text. For example, see the Footnotes.

Executive Summary

The Task Force on Graduate Education in Physics (TFGE), an ad hoc committee convened jointly by the American Association of Physics Teachers (AAPT) and the American Physical Society (APS), has studied the current status of graduate education in physics Ph.D. programs, and has made recommendations based on what was found. The findings indicate that the majority of Ph.D. programs in physics have a common core curriculum and that students must demonstrate mastery of those subjects by passing either courses or exams. The subjects covered in this core curriculum appear to have remained constant, on average, for some time, and most departments do not plan on wholesale changes to their curricula in the near future. Most departments also require some “breadth” courses in different areas of physics. There also appears to be demand from students and potential employers of Ph.D.’s for training in additional skills, such as public speaking, writing, teaching, teamwork, and leadership. The time to Ph.D. has been lengthening slowly over the past 30 years, but many departments are making efforts to curtail the increase (which seems to have succeeded to the extent that there has not been a significant change in time to Ph.D. across the past 10 years). Overall, graduate education in physics appears to be healthy, but departments should be aware that as the fields of physics evolve, flexibility may be an increasingly important characteristic of physics Ph.D. programs.

The Task Force’s 16 Recommendations

This report of the TFGE is best summarized by listing our recommendations, in order of their appearance herein:

1. The TFGE recommends that the content of core courses be consistent year-to-year and be supervised closely by the department. Within that context, the TFGE believes that turnover in instructors is a positive occurrence.
2. The TFGE finds it noteworthy that the two texts that appear to be most widely used, Jackson for Electricity & Magnetism and Goldstein for Classical Mechanics, are also among the oldest books, having been first published in 1962 and 1950, respectively, although the latest editions were published in 1998 and 2002, respectively. We note with some amusement that Amazon.com offers a special price for buying the two together, presumably reflecting the fact that marketers have noticed that many departments indeed use both texts.
3. The TFGE recommends that the Ph.D. physics core curriculum should consist of the material generally covered in a
 - one-year course in Classical Electrodynamics,
 - one-year course in Quantum Mechanics,
 - one-semester course in Classical Mechanics, and
 - one-semester course in Statistical Mechanics and Thermodynamics.
4. The TFGE feels that graduate programs benefit by having some breadth requirement in physics, typically taken within the first two years, and recommends that departments require such breadth. The opportunity to take related courses outside physics is also recommended for many students. Departments should provide opportunities for students to develop other skills, such as machine shop, public speaking, and grant writing.
5. TFGE recommends that departments include attendance at the departmental colloquium as a requirement in their graduate programs. The TFGE also recommends that departments consider adding some required computational training to their graduate programs.
6. The TFGE recommends that departments require communication training and information literacy/fluency in their graduate programs.
7. The TFGE concurs with the APS Task Force on Ethics recommendation that the physics community should sponsor and promote development of ethics education programs, and further recommends that this should occur in graduate programs.
8. The TFGE recommends that department chairs review the “best practices” of their peers in the areas of climate and diversity.
9. The TFGE recommends that departments formulate guidelines for graduate student rights and practices and provide these to graduate students.

- 10.** The TFGE recommends that departments take an active role in monitoring students' progress toward Ph.D., in order to ensure, independent of the advisor, that the student is making appropriate progress.
- 11.** The TFGE recommends that departments offer advice and mentoring to their graduate students on the full range of career options available to physics Ph.D.'s and in particular increase their students' awareness of, and preparation for, positions in industry.
- 12.** The TFGE recommends that department chairs share best practices on a regular basis, both at the biennial meetings organized by AAPT and APS, and on a web-site.
- 13.** The TFGE recommends that there be continued close collaboration between AAPT and APS on the subject of graduate physics education. The TFGE further recommends that the AAPT/APS periodically reinvestigate the topics studied here, as well as expanding the scope of the studies to obtain a more extensive view of graduate education in physics.
- 14.** The TFGE makes no recommendation at this time concerning the use of comprehensive exams, except to note that there needs to be some method of evaluating students' knowledge of the core subjects.
- 15.** The TFGE recommends that the physics department chairs engage in discussions of comprehensive examinations and their alternatives.
- 16.** The TFGE makes no explicit recommendations concerning specific courses and their content, but we encourage innovative methods for delivering the graduate curriculum.

