4-1-1988

Modern Physics And The Introductory Course

Andrew F. Rex
University of Puget Sound, rex@pugetsound.edu

Citation
Rex, Andrew F.. 1988. "Modern Physics and the Introductory Course." American Journal Of Physics 56(4): 297-297.

AMERICAN JOURNAL of PHYSICS

Modern physics and the introductory course

A. F. Rex

Citation: American Journal of Physics **56**, 297 (1988); doi: 10.1119/1.15759
View online: http://dx.doi.org/10.1119/1.15759
View Table of Contents: http://scitation.aip.org/content/aapt/journal/ajp/56/4?ver=pdfcov
Published by the American Association of Physics Teachers

ly mastering the classical theories. Classical mechanics is not at all dull and is certainly not obsolete (as are discarded theories of biology or chemistry, for example). In fact, I suspect NASA sends rockets to the moon using a lot more of Newton's centuries-old theory than Einstein's modern work!

(Rev.) Mark M. Payne, O.S.B.
St. Benedict's Preparatory School
520 Dr. Martin Luther King, Jr., Blvd.
Newark, NJ 07102
9 November 1987

MODERN PHYSICS AND THE INTRODUCTORY COURSE

I am glad that Professor Stork's course on light has gone so well [Am. J. Phys. **55**, 967 (1987)] and am happy that he has collaborated on such a fine text on the subject. But I think that there was no need for him in his letter to downgrade other valid approaches to teaching physics. His point seems to be mainly that modern physics should not be introduced to elementary students, but he does not consider advantages to teaching modern physics aside from the possibility that it would "boost enrollments." One important advantage of teaching modern physics that he does not consider is that of providing scientific literacy for students in a technical age. How can students vote intelligently on matters of scientific concern, or decide whether research should be funded, if they are unaware of the current research concerns? Courses including black holes, relativity, and so on may be more "physics appreciation" than what professional physicists do, but there is nothing wrong with that. Certainly people don't downgrade music appreciation courses because they don't teach people deeper fundamentals.

One side comment is that the notion that "there are stages of conceptual development that a student *must* pass through if he or she is to understand a subject" [emphasis added] is controversial among psychologists. The notions of Piaget are often oversimplified; Bruner and others have provided alternatives. I believe that if we teach interestingly and with care, we can and should include modern topics in our syllabi.

Jay M. Pasachoff
Director, Hopkins Observatory
Williams College
Williamstown, MA 01267–2693
24 November 1987

MODERN PHYSICS AND THE INTRODUCTORY COURSE

Like many college physics teachers I have followed with considerable interest the recent series of editorials and letters dealing with the inclusion of modern physics in the introductory physics course. I noted several strong arguments against such an inclusion in the November 1987 issue of the Journal. David Stork's letter[1] addressed the problem of rushing in to more abstract topics before the student's conceptual development is sufficient to make such abstractions comprehensible or meaningful. This theme was echoed in the November editorial[2] (though I strongly doubt that this was the editor's intention), in which arguments were made in favor of developing a strong base of knowledge before proceeding to more advanced work. Stork also reported that he has had success in maintaining and increasing student interest by relating physics to other disciplines.

That last point is crucial if one considers the principal arguments advanced in favor of including modern physics in the introductory sequence. Some of the sentinel arguments are that the introductory course is no longer an accurate representation of our discipline,[3] that our unchanging courses lead students to infer a lack of vitality,[4] and that there is "delayed gratification"[5] and, therefore, a loss of interest in physics relative to younger, more vigorous sciences.[6] Just beneath the surface of each of these arguments I see the fear that we will not be able to produce enough qualified physicists to satisfy future needs. Indeed, this is something about which all of us in physics education must be concerned.

I would suggest, however, that introducing modern physics into the introductory course is not the only way to encourage interest in physics. One may extend Stork's argument by saying that there are many interesting problems in current research in physics (as well as other disciplines), which can be discussed within the context of the traditional topics of mechanics, heat, electromagnetism, and optics. Surely not all of the work that research physicists do today depends on relativity and quantum theory! The interest of most students is, if anything, greater if they can relate problems to their everyday experiences. This is much easier to do when studying the traditional topics. For this reason it is not unwise pedagogically to include some "Flying Circus" type problems or examples from the physics of sports, as long as one doesn't overdo it. I am pleased to see that several of the new introductory textbooks have added more of these kinds of examples.

Ultimately those of us who teach the introductory courses are responsible for making the material interesting enough to turn potential physics majors into physics majors and to convince other students who take physics that ours is a vital discipline. The textbooks are not perfect, but we cannot blame them for our failure to communicate appreciation for the beauty, utility, and vitality of classical physics.

A. F. Rex
Physics Department
University of Puget Sound
Tacoma, WA 98416
16 November 1987

[1]D. G. Stork, Am. J. Phys. **55**, 967 (1987).
[2]J. S. Rigden, Am. J. Phys. **55**, 973 (1987).
[3]J. S. Rigden, Am. J. Phys. **55**, 491 (1987).
[4]J. S. Rigden, Am. J. Phys. **54**, 1067 (1986).
[5]J. Reichert, Am. J. Phys. **55**, 584 (1987).
[6]I. I. Rabi, quoted by J. S. Rigden, Am. J. Phys. **55**, 779 (1987).