LETTERS

Purpose of the master's degree

Your November editorial on the role of the master's degree raises important questions and probably was written in the hope of stimulating discussion. I feel strongly that the policy which allows (and thereby almost encourages) graduate students to skip the master's degree and to proceed directly to the PhD is often a mistake. I am not impressed by the argument that the time needed to obtain a PhD is already too long and that insistence on a master's degree would make a bad situation even worse. If the PhD takes too long, possibly it is because too many students can barely make the grade or achieve it only by "kindness" on the part of an examining committee. Of course, candidacy tests are supposed to screen out those not suited to PhD requirements.

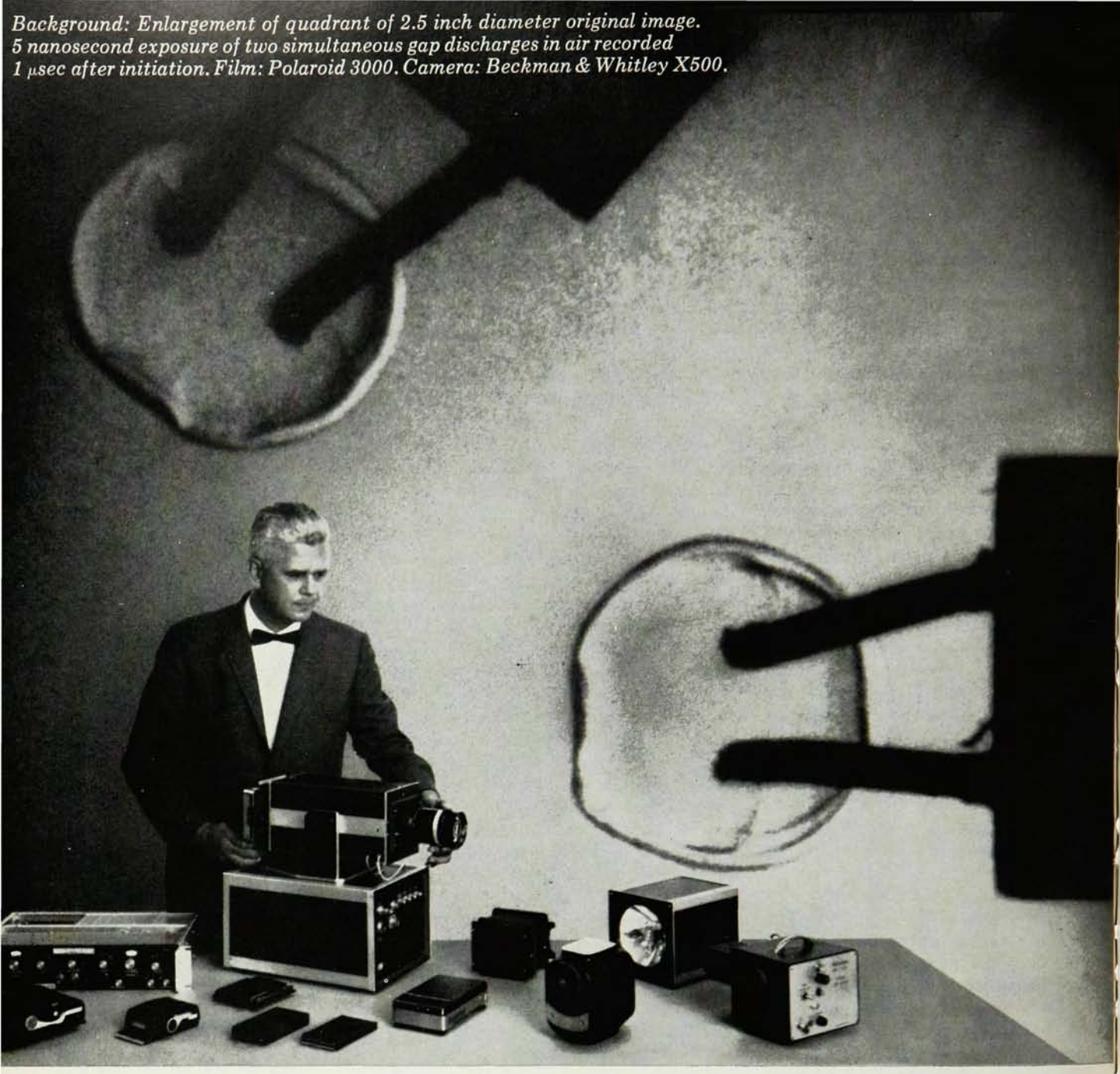
Unfortunately, this test is often taken at a stage when the student has been more occupied with course work than with research so that his suitability for PhD work is based largely on the knowledge he has acquired. I believe that ability to undertake research without detailed direction and supervision is (or should be) characteristic of a PhD and the only way to find out whether a graduate student has the capability to develop to this level is to let him do research of a more restricted type than for a PhD thesis and to write this up for a master's thesis. The spirit in which this work is done and the manner in which the thesis is written and examined should be the same as for the PhD although naturally much less will be demanded in the actual performance. The master's thesis should be completed in about 15–18 months, but if the student shows poor ability it may take two years. In any case, it should be clear whether the student is of suitable caliber to go on to the PhD degree, and if not, he can be dissuaded without loss of face.

There will be howls of protest that this will take far too long, that it is a waste of time, etc., etc., but I contend that it is no waste of time to terminate a student after a thorough test over two years instead of allowing him to continue for five or six years and become a poor PhD at the end. It is relevant to consider how many graduate students might terminate at the master's level instead of becoming indifferent PhD's. The answer probably varies greatly with the subject, with the university, with the quality of incoming students, etc. But I believe it would probably be worthwhile to terminate between 30% and 50% of those now struggling on towards the doctorate.

The question will be asked whether this plan will greatly extend the period required to obtain a PhD degree. I believe that it need not do so if the master's work is planned so that it can become part of a larger whole. The type of experimentation will be more restricted; materials to be prepared or properties studied will be much more limited; the sophistication of mathematical analysis will be considerably less than for a PhD thesis.

If it is argued that this proposal is too idealistic and that employers have little or no faith in the master's degree, then I say that this situation exists because we have depreciated the academic currency. A good master's degree should be a very useful training and qualification. There is much work in research and development laboratories suitable for those with good master's degrees.

The editorial has suggested that the master's degree should be basically different from the PhD degree, and should suit someone with "peculiar talents," whose training is characterized by "*breadth*." This solves no problems. How shall we select graduate students with the "peculiar talents" who will benefit by this broader training? How do we solve the problem of finding the students who are *really* suitable for doctoral training? And let us not forget that with broadness goes shallowness. We already strive for so much breadth at the bachelor level that there is precious little depth left, and here we have the same old cry again for the master's degree.



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Says the editorial: "How different is the European situation. . . . ." Probably that is because there is depth already at the bachelor's level so that at the master's level worthwhile achievements become possible. Finally, I must emphasize that the views expressed here are entirely my own personal views.

G. W. Brindley
Pennsylvania State University

High-school learning

In a letter by Alfred A. Kraus Jr (PHYSICS TODAY, November, page 15) the charge is made that in the PSSC-type of high-school physics course, the content is so broad that students skim the top and "merely understand," but do not engage in enough prediction and control. Also the suggestion is made that the high-school physics course be designed to contain certain topics that will be studied in "depth" and omitted from the university physics course. It would seem to me that this suggestion has questionable merit for several reasons:

1. It appears to be based on the premise that physics consists of discrete areas of knowledge that bear little or no relation to each other. In my opinion, one of the biggest improvements in high-school physics (and high-school science in general) in recent years has been the partial obliteration of the classical division lines and, in their place, an emphasis on unity and an attempt at achieving maximum "mileage" from a minimal number of concepts.

2. A more practical problem, perhaps, is that of the students' mathematical background. To teach a topic in sufficient depth to warrant its omission from the university physics course would, I think, presuppose a level of knowledge and skill in the area of mathematics that simply is not attained by the average high-school physics student at the present time.

3. There is also the problem of the terminal high-school student. It has been my experience that the terminal student does not usually take physics, but when he does, he usually does so because he expects to find the course interesting, useful or both as a background for a vocation. As a physics teacher, I would like to see such a student learn as much physics as he can and savor some of its excitement. However, I am not so sure that an in-depth knowledge of, let us say, calorimetry is what he is looking for or what he needs.

The really revolutionary suggestion in the letter I have cited is that university-level physics teachers should recognize the possibility that their students may have learned some physics in high school!

I agree that needless duplication of material is a waste of both the students' and teachers' time. However, methods of avoiding this problem already exist. Many colleges and universities make use of proficiency examinations whereby qualified students can sidestep certain courses. This same approach is used on a larger scale by the College Entrance Examination Board in the Advanced Placement Program in Physics. Such programs merit support not only as a means of increasing efficiency at the college level, but also as a vindication of high-school physics (many high schools are doing an excellent job in the area of teaching physics) and as a step toward a sorely needed rapprochement between high-school and college physics.

Vance L. Huntsinger
Deerfield, Illinois, High School

A REPLY FROM KRAUS: The letter by Huntsinger deserves the following comments:

1. That a course of study should have a defined content does not mean there are no relations between courses. If Huntsinger really believed this, he would resign from any high school that had separate chemistry and physics courses. Yet this attitude is all too prevalent in some PSSC groups. Their postulate would say that a university that offers separate courses in electromagnetism and optics is obviously sinning because the optics instructor would not be permitted to mention the electric and magnetic fields. I think one excellent way to teach optics is to have electromagnet-