

Laser goggles fail

The Food and Drug Administration's Bureau of Radiological Health has been conducting preliminary tests of laser protective eyewear. I believe the test findings and actions being taken as a result may interest readers who buy or use eye-protective equipment.

Protective goggles are used in certain laser applications to protect operators or bystanders from direct exposure to high radiation levels that could cause serious eye damage. Without protective eyewear and either fixed or portable shields of the same material, many injuries from laser exposure possibly can occur.

The exposure of laser-goggle materials to sufficiently high power or energy will cause damage in the form of melting, bleaching, bubbling or shattering. However, some eye-safety products will fail in this way after several seconds of exposure to laser beams of about one watt, or a power density of about six to twelve watts per square centimeter. The FDA's Bureau of Radiological Health is concerned that not all eye-protection users or buyers are aware of this fact.

Manufacturers have been notified that some types of protective eyewear have failed during preliminary non-human testing in Bureau Laboratories. The Bureau, however, has received no reports to date of human injury that might have occurred as a direct result of eye-protection equipment failures.

Representatives of manufacturers and of professional groups met last 5 October at Bureau Headquarters in Rockville, Maryland, to discuss methods by which all products providing eye protection from lasers could be uniformly evaluated and appropriately labeled, and the essential information disseminated to users and purchasers.

The Bureau is working with manufacturers and other affected groups to develop criteria for the selection and use of protective eyewear to provide guidance for laser users and purchasers at the earliest possible date.

Bureau laboratory personnel noted that protective goggles intended for use with helium-neon gas lasers, which normally have an output of a few milliwatts, have not shown signs of failure in the limited tests conducted thus far. Users who have occasion to employ these goggles when operating such low



power helium-neon lasers should continue to do so.

Individuals using protective goggles around high-power lasers—for example, a multiwatt argon-ion laser—are advised to determine the failure points of their eyewear by contacting the manufacturer. In the event that the necessary information is unavailable, the eyewear should be tested by exposure to the most intense radiation against which it is expected to provide protection. Such a test should represent the worst-case condition of exposure to the eyewear. The eyewear tested should be carefully inspected before it is returned to service. If the eyewear fails, operation of the system should be suspended until alternative means of personnel protection are provided. Laser protective eyewear should always be inspected prior to each use for signs of melting, bleaching, bubbling or cracking. If any of these signs is noted, the eyewear should be removed from service.

Multiwatt lasers may commonly be found in universities, industry, and research laboratories and in medical applications. In some instances, servicing and alignment procedures for these lasers may result in possible direct ex-

posure to a high-power laser beam over a period of seconds or possibly minutes. Under these circumstances, the worker may risk serious eye injury if he is unaware of the failure point of the protective eyewear.

The chance of eyewear failure increases as laser power and energy rise. Therefore, persons buying a laser product are urged to make certain that the presently owned eye-protective equipment will accommodate the power of the new product.

It is the intention of the Bureau to develop, both from laboratory experience and from suggestions submitted, a set of criteria for the selection and use of protective eyewear in laser applications. Suggestions, comments, or information from your readers that would assist the Bureau in establishing criteria and collecting eyewear failure data would be welcome.

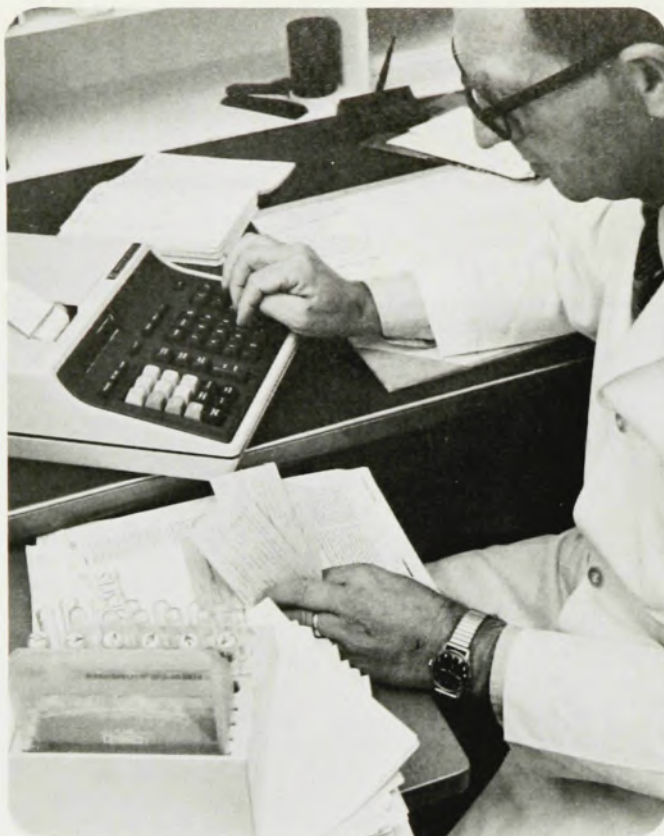
Communications should be directed to the Director, Bureau of Radiological Health, Food and Drug Administration, 5600 Fishers Lane, Rockville, Maryland 20852.

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Limits to theory

Edoardo Amaldi has presented us with a stimulating discussion about the ultimate nature of physical theory ("The Unity of Physics," September, page 23). While he recognizes the "openness" of mathematics arising from Gödel's theorem, he leaves aside a second and more compelling reason for the limitations of any theoretical descriptive process. Information is inevitably handled by the use of real physical degrees of freedom. These information-bearing degrees of freedom are resident in the same universe we are trying to describe. The information-bearing degrees of freedom are thus subject to the same physical laws of that universe. It is very likely, therefore that there are insurmountable restrictions on the amount of information that can be represented. Similarly, there are probably restrictions on the reliability with which information can be manipulated and preserved.

A few of us have, over a number of years, attempted to understand the na-



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letters

ture of the fundamental limitations imposed on the handling of information by the laws of physics. This field is still very clearly in its hesitant infancy. In this note I only want to call attention to the fact that these problems exist by citing two of the most recent references^{1,2} and an earlier more philosophical one.³ These studies treat the *interaction* of information streams and are therefore not simply based on Shannon's theory of the linear-communications channel.

References

1. C. H. Bennett, IBM J. Research Develop. 17, 525 (1973).
2. R. Landauer, Journal of Statistical Physics 9, (December 1973).
2. R. Landauer, IEEE Spectrum 4, 105 (1967).

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Fathers with PhD's

Jane Jackson in her letter "Mothers with PhD's" (June 1972, page 13) proposes that men physicists ought to be shown "how it can be to their advantage to work at less than full-time positions." I can see only two alternatives if her proposal is to be implemented: either employers pay the same salaries for part-time employees as for full-time employees, which can hardly be expected, or men will have to be convinced that it is to their advantage to take salary cuts proportional to the cut in their employment time.

The female physicists in whose favor male physicists are supposed to volunteer a reduction in their incomes can be divided into two subjects: (a) those who are married to a gainfully employed male and (b) those who are not married to a gainfully employed male. Subset (b) includes women who are the sole breadwinners of their families. There is no reason why a male physicist who is the sole breadwinner of his family should reduce his income in favor of a female physicist in subset (a). It would mean that not only he but also his wife and children should sacrifice to enable another family, which is usually well off, to increase their income even more. A case can be made, however, for a voluntary income reduction by male physicists in favor of female physicists in subset (b). Exactly the same case can be made, of course, for a voluntary income reduction by employed physicists of either sex in favor of unemployed male physicists who are the sole breadwinners of their families. I understand there are quite a few physicists in the latter category these days.

Hence, it follows that the problem is symmetric with respect to sex. The real need is to find positions for unemployed physicists who are not supported by a gainfully employed spouse. This could possibly be accomplished by temporary sacrifices by those who are employed until the present slump is over.

The demand by the Committee on Women in Physics for special treatment of women is a red herring, because it is not related to economic need and because it is undemocratic.

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THE AUTHOR COMMENTS: The *real* need is to find positions for unemployed physicists. It is immaterial whether or not they are supported by a gainfully employed spouse. They are physicists, and they must be allowed to *be* physicists. A second need that permanent part-time positions can supply is to make our profession more flexible—to provide an alternative, for whoever wants it and for whatever reason, to the present arbitrary dictum that one works full time or not at all.

The advantages of part-time employment are numerous and apply to *both* sexes (contrary to the assumption implicit in E. Fontheim's letter). I outlined several of them, for academically employed physicists, in my letter of June 1972. In my previous letters and in these comments I address myself to males, only because I believe that men as a group are less aware than women of the possibilities and advantages of part-time work.

The APS Council apparently agrees that part-time employment offers advantages to both sexes, for its letter to employers of physicists, which was sent to more than 500 academic departments, government laboratories, industrial firms, and technical institutes as a result of the February 1972 report of the Committee on Women in Physics, contains the recommendation: "We urge that your Organization make senior appointments and tenure available to persons other than those giving full-time service and that both men and women be eligible for such appointments." (Please note that no special treatment of women is demanded here.)

Suppose that a man decides that he would prefer to work part time. What then would be the economic considerations? They are broader than Fontheim implies. As I discussed in my previous letter, a man who chooses to work less than full time could (a) lower the standard of living of his family, (b) expect or allow his wife to help support the family, or (c) maintain the present standard of living of his family but put

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