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.

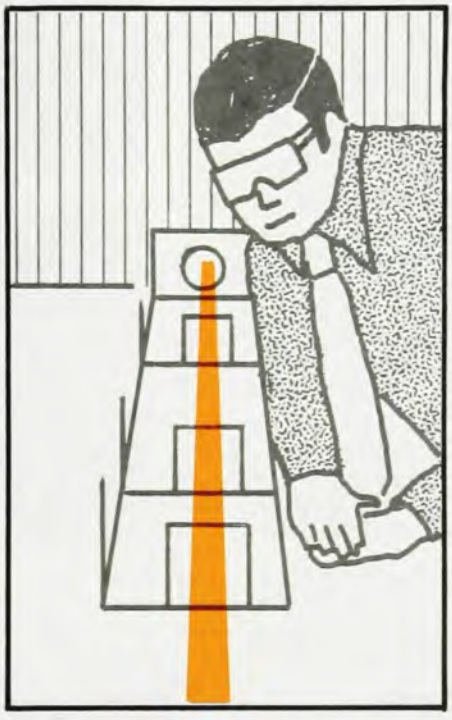
The exposure of laser-goggle materials to sufficiently high power or energy will cause damage in the form of melting, bleaching, bubbling or shattering. However, some eye-safety products will fail in this way after several seconds of exposure to laser beams of about one watt, or a power density of about 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 exposure 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 Godel'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-