

LETTERS

The Ovshinsky effect

A recent publication¹ of an "earth-shaking" discovery of a switching phenomenon in disordered structures is well below the standards of *Physical Review Letters* and is a sad example of the misuse of a scientific journal for commercial publicity. The switching device and two of the oscillograms reported in this paper have been described and advertised in several trade magazines² since 1964 under names such as "Ovonic Switch." The reported switching process is preceded by a current-controlled negative-resistance phenomenon,² which, completely ignored in this publication, is partly responsible for the electronic instability of the device. A very similar switching and negative-resistance phenomenon³ is observed in amorphous oxide films of various valve metals and semiconducting films of cadmium sulfide, silicon and gallium arsenide and has been discussed in literature by several workers. A complete list of the references is given in my book *Thin Film Phenomena*.⁴ The discussion of the switching phenomenon and the role of field ionization of traps in Stanford R. Ovshinsky's paper is not new and is in fact borrowed piece by piece from various references.

References

1. S. R. Ovshinsky, Phys. Rev. Letters **21**, 1450 (1968).
2. Control Engineering, April 1964; EEE

Circuit Design Engineering, May 1966.
(These are examples.)

3. K. L. Chopra, Proc. IEEE **51**, 941 (1963); J. Appl. Phys. **36**, 184 (1965).
(These are examples.)
4. K. L. Chopra, *Thin Film Phenomena*, McGraw-Hill, New York (1969) chap. 7.

KASTURI L. CHOPRA
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THE AUTHOR REPLIES: The *Physical Review Letter* in question reports new experimental observations of reversible electrical breakdown phenomena in broad range of amorphous semiconducting materials. These are the phenomena that underlie the operation of the threshold switch device reported in the trade magazine mentioned by Chopra. Is not this study and reporting of physical phenomena a legitimate scientific activity, completely independent of their potential applications? The letter was submitted for publication as soon as our observations established a sufficiently complete picture to warrant calling the attention of the scientific community to these phenomena. *Physical Review Letters* was chosen because of the rapidly growing interest among physicists in the electronic structure and transport properties of disordered materials.

In contrast to the examples of switching phenomena cited by Chopra as well as others readily found in the literature, the negative resistance phenomenon does not precede the onset of switching in the studies reported in my letter.

STANFORD R. OVSHINSKY
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THE EDITORS COMMENT: A recent paper by S. R. Ovshinsky on a "Reversible Electrical Switching Phenomena in Disordered Structures," recently published in *Physical Review Letters*, has aroused a great deal of comment and controversy. Consequently, we would like to make as clear as possible the circumstances surrounding our acceptance of the paper.

The manuscript was processed in the normal way used for all manuscripts received by *Physical Review Letters*. The first referee excused himself since he was involved as a consultant to Ovshinsky. The second referee recommended submission to a

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* Demonstrated at February APS meeting in New York.

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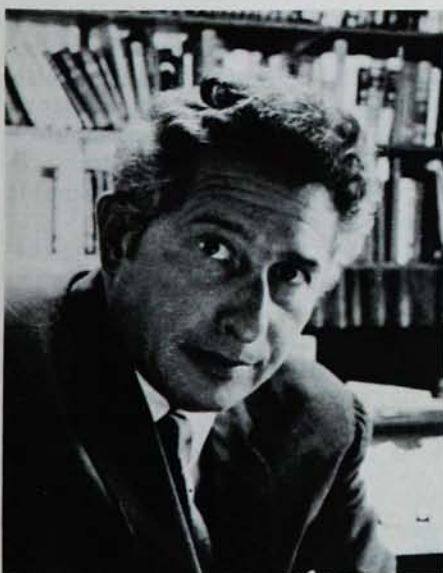
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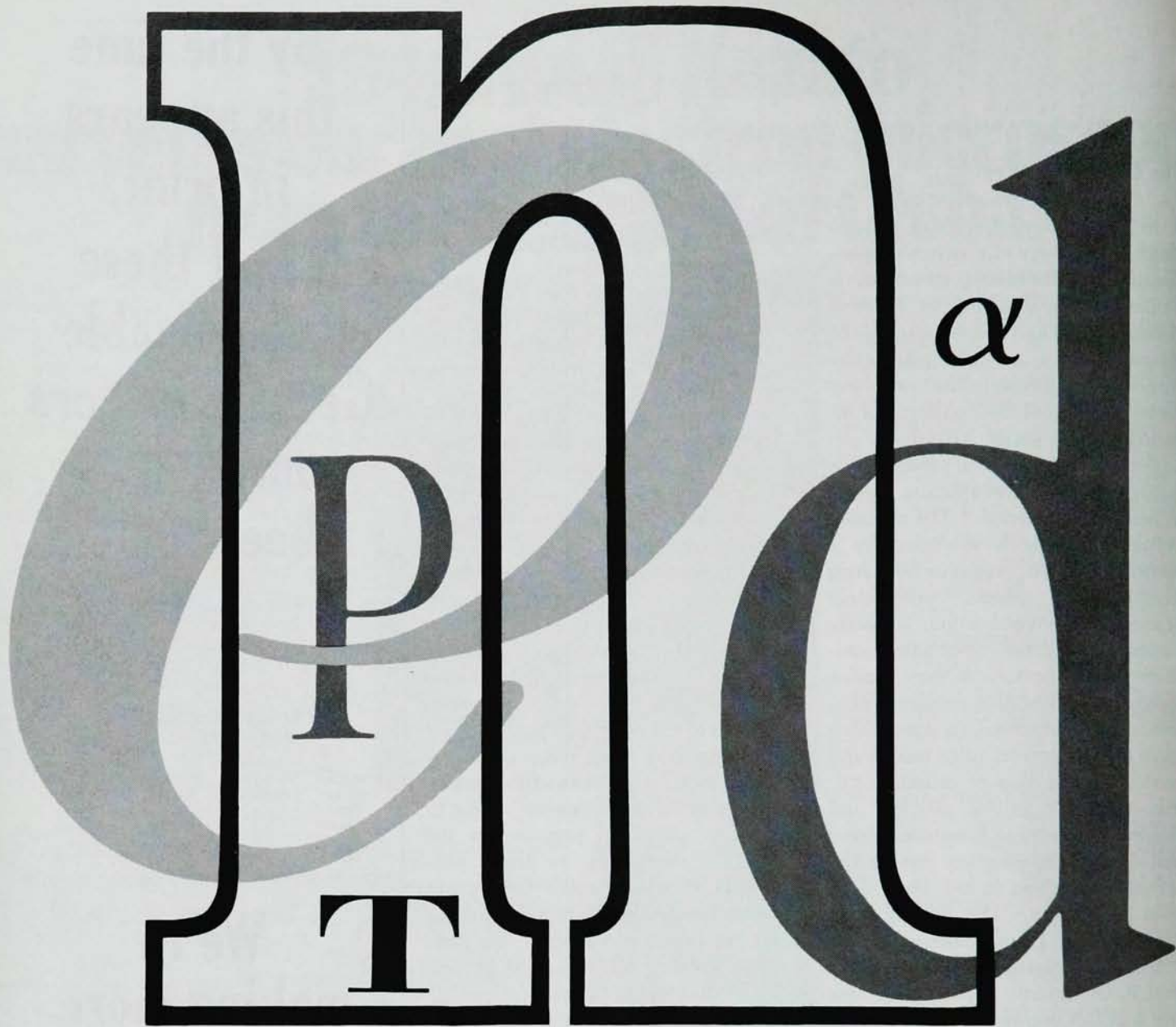
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journal dealing with applied physics and considered the subject unsuitable for *Physical Review Letters*, a judgment in which we concurred. As is usual in such cases the author objected to our decision and requested reconsideration. At about the same time we received unsolicited letters from two prominent fellows of our society urging us to publish the letter quoting among other arguments the international interest aroused by reports of Ovshinsky's discovery. On the basis of these strong recommendations we reversed our decision and accepted the letter.

The publicity surrounding the letter did not originate with us, nor with the American Institute of Physics. That was entirely the work of the author and the press.

S. A. GOUDSMIT
GEORGE L. TRIGG
Physical Review Letters

Morality and weapons work

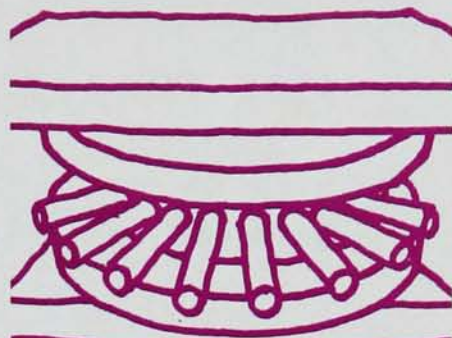
In your November *PHYSICS TODAY* editorial you presented some arguments for preserving the current forms of studying and discussing the social and political problems of science. I dearly wish that we lived in a world in which those forms could adequately deal with the problems at hand and allow us to devote all our time to teaching and to physics. But the world is not that way now, and I would like to bring to your attention and to that of the readers of *PHYSICS TODAY* just such a problem.

In the San Francisco Bay area in which Stanford University is situated, there are a large number of companies and organizations involved in the research and development of highly technical, war-and defense-related products and services. A grave and painful problem has developed among a not insignificant number of scientists and engineers in these organizations. These men, who are highly skilled in their field and have prospering careers, are finding it morally difficult to continue in their positions and careers. Some of these men entered the defense-related field many years ago when the ideologies associated with national defense and the nature of the threats to our nation's security were different or at least more real to them. Others entered these fields more recently. But the moral problems of the Vietnam war have changed their attitudes. For many of these men their entire profes-

sional status, their financial position, their knowledge and their self-esteem are involved in fields for which civilian industries have little or no need. Some have sacrificed careers to leave the field; others try to draw distinctions between working on defensive as against offensive weaponry. For the young men, the leaving of a particular position may easily involve a change to 1A status in the draft in addition to all the other personal problems a change involves.

Now as educators, and particularly educators of graduate students, we know that some of those we educate now in physics, so purely and so enthusiastically, may find themselves in this position five, or 15 or 25 years from now. As teachers we are not neutral in this and we are not guiltless. The American Institute of Physics and its member societies are strongly and positively urging students into physics careers. In particular, *PHYSICS TODAY*, with its very interesting format, its timely articles and informal style, is certainly an important influence. Yet, nowhere in *PHYSICS TODAY* or in the meetings of the societies is this problem discussed—or even brought to the attention of the students and young physicists. It is no use saying that they are clever enough to think about such things or that if they read enough, they will learn about such problems. Graduate students tend to think about their careers with a more or less sizable portion of daydreaming—a quiet teaching position among adoring students, a set of Maxwell equations for the nuclear force field or a substitute for the transistor. We older physicists and educators who have learned something of the twists and turns of life and careers have a duty to put some reality into these dreams.

I have two suggestions as to how to insert this reality. First, *PHYSICS TODAY* should open its pages to a discussion of this problem. I know we can find some accurate documentation from groups and industries in this area. Certainly opposing opinions will also be needed. Second, in the placement service provided at the meetings of the societies, particularly at the American Physical Society large meetings, an effort must be made to have employers clearly designate weapon- and defense-related positions. I have heard the disquieting story told several times that some employers conceal the weapon or defense aspects of a position in the first



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