

## letters

may be that this uncritical acceptance is part of a deeper societal malaise in which more and more people are choosing not to play an active, responsible role in society and opting instead for essentially hedonistic lifestyles. 1984 may already be a reality. The big-is-good-and-bigger-is-better attitude seems to contradict the accepted scientific philosophy that Occam's razor should be used to arbitrate between alternate explanations or solutions to problems. It has always been my approach as both a physicist and engineer that the most reliable and safest engineering solutions are usually the simplest; complex solutions should always be anathema to a good pure or applied scientist.

We are in grave danger of losing our integrity and damaging our public image if pure scientists follow their applied brethren into the *cul de sac* of advocacy for high technology. Big science is not necessarily good science. We must provide leadership in the quest for simple, elegant solutions to those problems we tackle that have societal implications. It is only in this way that we can justify the funds necessary for large esoteric projects like meson factories and large optical and radio telescopes. Realistic solutions demand a breadth of understanding and wisdom. The development of breeder reactors, enrichment processes, fusion reactors, solar power satellites, and so on, may involve the solution of fascinating problems of great interest to many physicists, but they should not forget that, fundamentally, these are only complex solutions to the energy problem that undoubtedly has simpler, holistic and environmentally and societally benign solutions. Our public image will be enhanced only if we eschew being technocrats and seek this latter category of solution in the true humanizing spirit of "Renaissance men."

H. A. BUCKMASTER  
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8/81

## A new era of science?

The time has come for young and future physicists to explicitly recognize, by being taught during their education and as a consequence of their research, that all true scientists develop a supreme regard for the intrinsic worth of *Homo sapiens sapiens* in the process of discovering new knowledge, and that this moral precept should guide their research aims and actions. Laura Nader's article (February, page 9) graphically censures a segment of the pro-android, anti-*H. s. sapiens* world

that has been created by engineering technology using scientific knowledge in a climate of opinion which says that science is amoral, and in a climate of ignorance regarding human origins and the factors which led to the development of our present social institutions. If it should seem strange to some that a cultural anthropologist should directly oppose Edward Teller (February, page 136) in the same issue of a physics journal, then physicists should awaken to the significance of this event. Nader's article is part of the leading edge of a new era of science, while Teller's article is part of the trailing edge of a dying era of classical science. Her view is that growing scientific attention should be diverted to studies of human origins and social institutions. Physicists should reflect on their roles in this matter. It could be intellectually stimulating and rewarding.

CLAIR C. PATTERSON  
California Institute of Technology  
Pasadena, California

4/81

THE AUTHOR COMMENTS: For an incomplete but not irrelevant addition to the comparison of the two articles drawn by Clair Patterson I might emphasize the parallel between Laura Nader's statement "We must build technologies that recognize human frailty," and my own belief: As a physicist deeply and publicly concerned with nuclear reactors it has long since become my favorite statement that, whenever you believe you have a foolproof system, you will find the fool to be bigger than the proof.

I partially agree with Nader's further remark "Because of the way American leaders are handling the problem, I may theorize that the society is having a nervous breakdown instead of an energy crisis." Such a statement pertinent to the previous Administration, however, should be accompanied by a recognition that inflation and energy are closely linked. A governmental nervous breakdown may not be completely denied; the presence of the energy crisis, however, can clearly be asserted.

In regard to the fast breeder reactor which is frequently mentioned, I might remark that I have publicly and repeatedly opposed this reactor in the past years for the simple reason that better solutions are, according to my perception, available.

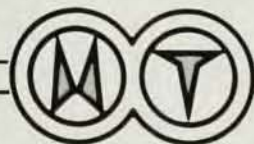
Clair Patterson rapidly arrives at a judgment that "Laura Nader's article is part of the leading edge of a new era of science while Edward Teller's article is part of the trailing edge of a dying era of classical science." This statement is not obviously false if quantum mechanics is included in the era of classical science. It seems to me, however, that

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the words "leading edge" and "trailing edge" are parts of difficult judgments upon which we could depend with confidence only if we could know the future scope of the great human enterprise called science.

EDWARD TELLER

Lawrence Livermore Laboratory  
Livermore, California

5/81

## Sending mail to Sakharov

This is written at the suggestion of František Janouch, Research Institute of Physics, Stockholm, Sweden, as a reminder to readers of PHYSICS TODAY of the continuing need to do everything we scientists can do to help our colleague, Andrei Sakharov. In a letter to PHYSICS TODAY last February, Janouch urged sending scientific preprints to Sakharov by registered mail, with the precaution of requesting a return *avis de reception* card. After some procrastination, without really believing that such a simple scheme would succeed, I followed the suggestion. Having been so pessimistic I was the more delighted, 6 or 8 weeks later, to find a pink card in my mailbox, postmarked (in Russian), "Gorky," and signed, "A. Sakharov." In reply to my letter thanking him for the idea, Janouch wrote, "According to my information, he (Sakharov) is obtaining now quite a lot of different preprints. It is essential only to follow the scheme, otherwise it is easy (for the Soviet officials) to confiscate them." I remind you, for Dr. Janouch, that the correct address is:

Professor Andrei Sakharov  
Prospekt Gagarina 214, kv.3  
Scherbinka 2, Gorky, U.S.S.R.

JOHN LINSLEY

University of New Mexico  
Albuquerque, New Mexico

10/81

## Invention of x-ray telescope

Without detracting from the accomplishments of Riccardo Giacconi, for which he justly deserves the 1980 Eliott Cresson medal of the Franklin Institute, it is unfair to many others to describe him (December, page 74) as "the inventor of the x-ray telescope" (emphasis added). The original theory of the hyperboloidal-paraboloidal, double-reflecting, grazing incidence x-ray telescope was done by H. Wolter,<sup>1</sup> and Giacconi himself has always acknowledged this.<sup>2</sup> Much of the original experimental investigation of reflecting optics for use as an x-ray telescope was done by P. Kirkpatrick and A. V. Baez,<sup>3</sup>

and other early users of Wolter-type x-ray telescopes for viewing an astronomical object (the Sun) besides Giacconi<sup>4</sup> were J. Underwood and W. Muney.<sup>5</sup> Giacconi should more properly be lauded for the astronomy he did with x-ray telescopes than for the sole invention of them.

## References

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2. R. Giacconi, B. Rossi, J. Geophys. Res. 65, 773 (1960); R. Giacconi, W. Reidey, G. Vaiana, L. Van Speybroeck, T. Zehnpfenning, Space Science Rev. 9, 3 (1969).
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JOSEPH F. DOLAN

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3/81

The facts stated by Joseph Dolan are correct, but also incomplete; in my opinion, his letter is more misleading than the single sentence given to this topic in the original news article. There certainly have been other contributors to x-ray telescope development, both before and after Giacconi's original work, including many not mentioned by Dolan. Few, if any, modern scientists work in isolation, but we continue to use terms such as "the inventor" when one person has made a contribution that we recognize to be qualitatively different from the related work of others. Giacconi certainly deserves this common usage. He was the senior author of the paper containing the earliest suggestion for the use of focusing optics for x-ray astronomy, the leader of the group that designed, built, and tested the first aplantic x-ray telescope, and the leader of the group which first obtained scientific results in astronomy using these devices. He also was by far the most effective advocate for these instruments during the almost two decades between his original suggestion and the success of the Einstein Observatory, a period when the advantages of the technique were not always appreciated.

It is not possible to give exact measures of recognition in a short article or letter, but one can hope to leave an accurate general impression, trusting that the reader will consider the limits inherent in the form of the communication as an indication of the degree of completeness to be expected. Dolan's letter leaves the impression that Giacconi was one of half a dozen more or less equivalent contributors, whereas, he has been the undisputed leader in

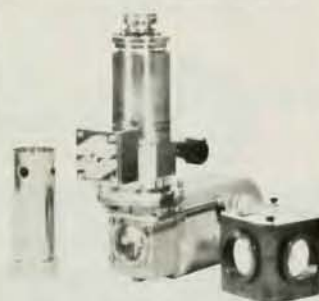
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