

POPA and nuclear war

Louis Rosen ("Guest Comment," May, page 9), in his report on the activities of the Panel on Public Affairs (POPA) of the APS, makes no mention of military and armaments issues. Yet the threat to society posed by military weapons is so great, and the work of physicists in making possible ever more destructive and accurate weapons is so central, that the issues fall well within the charter of POPA as stated in Rosen's opening paragraph.

Why this silence of the official physics community on the effects of nuclear weapons and on the relation of the physics profession to war? Who can seriously deny that the other concerns of POPA—nuclear power, toxic wastes, energy, scientific literacy, and so forth—will shrink to nothing unless society can avoid the use of the weapons developed in large part by physicists?

Why the silence? Many physicists indeed do depend now on the federal military budget for their support. Many others working in civilian nuclear power or in space projects may feel indirectly threatened by serious debate on the arms issues. But we must face the very grave danger we all share. Individually and collectively, we must confront the relation between our work and the possibility of nuclear holocaust.

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THE AUTHOR COMMENTS: There are absolutely no restrictions on the matters which may be brought to POPA for discussion and/or formal study. During the two years that I have served on POPA, there were no formal proposals to study "military and armaments issues."

It is my personal judgment that the most dangerous threat to society comes from the threat of global war. Physicists are very much involved in the avoidance of such a calamity, but the need for such involvement is truly enormous. One obvious way to decrease the probability of a major conflict is to make it extremely unattractive militarily, socially and economically for any nation to start a

war. Physicists are certainly helping to do that. Another way is to reduce the causes of international conflict, many of which reside in scarcities of vital commodities such as energy and food (which is itself an energy-intensive product). Physicists are also helping mightily in this domain.

I have for a long time been convinced that survival of our civilization will depend on arms control, which can serve not only to decrease tensions but also to alleviate shortages of precious resources. Arms control requires verification, wherein physicists can play a vital role. A POPA study in this arena might, indeed, be quite useful.

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Relativity debate continues

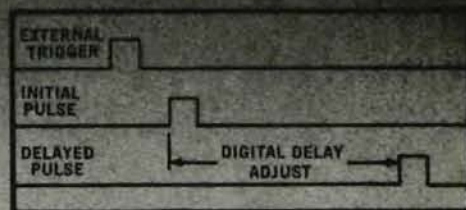
I would like to challenge two statements made by Allen D. Allen (November, page 90) in his reply to Wallace Kantor on the question of experimental relativity: Allen states "But Kantor is incorrect in claiming that there is a reliable experiment that refutes special relativity." With regard to this statement the 1961 interplanetary radar contact with Venus presented the first opportunity to overcome technological limitations and perform direct experiments of Einstein's second postulate of a constant light speed of c in space. When the radar calculations were based on the postulate, the observed-computed residuals ranged to over 3 msec of the expected error of 10 μ sec from the best fit the Lincoln Lab could generate, a variation range of over 30 000%. An analysis of the data showed a component that was relativistic in a $c + v$ Galilean sense.^{1,2} With regards to Allen's statement "Einstein's original contribution here was to assume that there just is no ether, that is, no frame R such that one's speed with respect to R affects the speed of light," Einstein and Infeld state "This word ether has changed its meaning many times in the development of science. At the moment it no longer stands for a medium built up of

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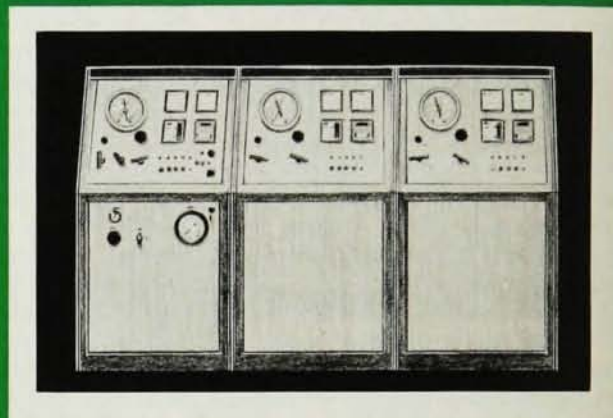
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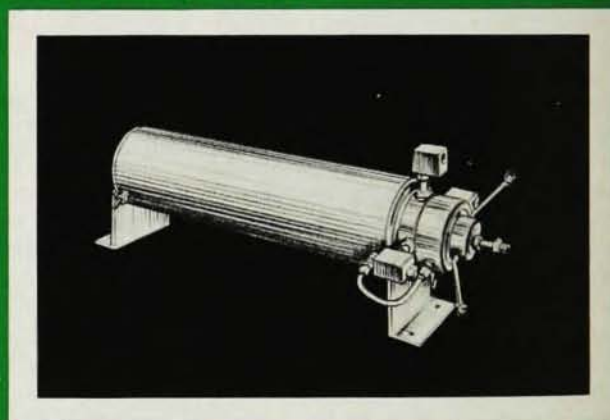
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particles. Its story, by no means finished, is continued by the relativity theory."³

References

1. B. G. Wallace, *Spectros. Lett.* **2**, 361 (1969); **4**, 79 (1971)
2. B. G. Wallace, *Found. Phys.* **3**, 381 (1973)
3. A. Einstein, L. Infeld, *The Evolution of Physics* (Simon and Schuster, Inc., N. Y., 1938) p. 153

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12/80

While on pages 15 and 89 in November, under the title *Experimental Relativity*, Wallace Kantor rightly complains about the *uncritical* acceptance of the experimental basis of relativity theory by many physicists, I agree with Allen D. Allen (pages 89-90) that many of Kantor's remarks cannot go unchallenged either. I agree with the general tone of Allen's remarks. Unfortunately, however, Allen himself makes two remarks that must be challenged. He shares both inaccuracies with the first editions of many elementary textbooks on relativity theory, which may make his slips understandable. Both slips occur on page 90.

The first inaccuracy occurs where Allen claims that "Einstein did not propose that the speed of light is independent of its source." Translated into English, Einstein in his first publication about relativity theory¹ formulated his two relativity principles as follows: "The same laws of electrodynamics and of optics will be valid for all frames of reference for which the equations of mechanics hold good. We will raise this conjecture (the purport of which will hereafter be called the "Principle of Relativity") to the status of a postulate, and we shall also introduce another postulate, which is only seemingly irreconcilable with the former, namely, that light in empty space is always propagated with a definite velocity c which is independent of the state of motion of the emitting body."

From the last words here quoted it is clear that Einstein *did* claim the lack of dependence of the velocity of light on the velocity of the source, and if Allen claims that Einstein did not have to do so because everybody knew that already, then Allen applies himself the reasoning against which he objects at the top of page 90 where he says that "It is well known that x is a horse." A possible dependence on the velocity of the source was taken seriously by the few people still believing in the corpuscular theory of light. Reasoning that, even if photons were corpuscular, they

still would move at velocity c because of the zero rest mass of photons, would be circular reasoning, since it uses relativity theory for drawing this conclusion. Even if one believes that light is an electromagnetic wave, there was the Ritz theory of electromagnetism, according to which those waves would have a velocity c with respect to the source rather than to some ether frame of reference. It is true that nowadays we have enough observational evidence from observation of Doppler effects of nearby double stars for excluding the Ritz theory, but that evidence was not yet available to Einstein when he formulated his theory. Therefore Einstein here had to rely on a postulate.

Allen's second inaccuracy is where he claims (as many have claimed before him) that the light from distant stars could not travel straight when entering an ether atmosphere dragged along by the earth. This claim is contradicted by an 1845 paper by Stokes.² Stokes showed that the observed aberration can be explained, even if the ether wind w relative to the earth is practically zero at the earth's surface (as when the ether is dragged along), provided that in the upper ether atmosphere, where the ether velocity gradually changes from zero to (at infinity) minus the absolute velocity of the earth, somehow the relative ether velocity shall satisfy the equation $\text{curl } w = 0$. It is true that Planck and Lorentz later showed that this kind of behavior of the ether leads to certain unpalatable consequences,³ but their argumentation was based upon the assumption that the ether atmosphere would like the air be kept bound to the earth by its weight and that the barometric law of atmospheres would be valid in it. This is all hypothesis, and, if one absolutely wants it and one has enough imagination, one might think of some unexplained cloud of ether with an irrotational velocity field dragged along by the earth for explaining what most people explain in a much simpler way by accepting Einstein's beautiful relativity ideas.

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THE AUTHOR COMMENTS: Since publishing a letter on an automated relativity program,¹ this author has received several rebuttals, and *PHYSICS TODAY* has received at least two, one of which was published.² These rebuttals are primarily challenges to modern relativity theory which many nonphysicists find implausible.³ The reason Einstein's

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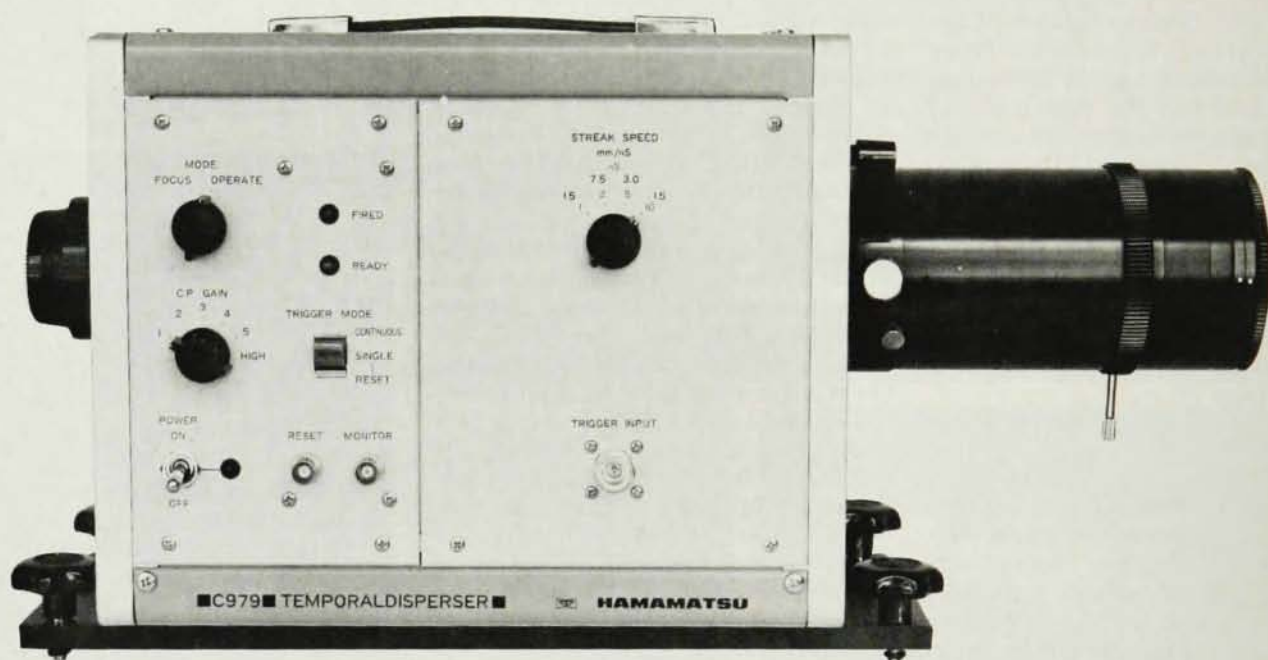
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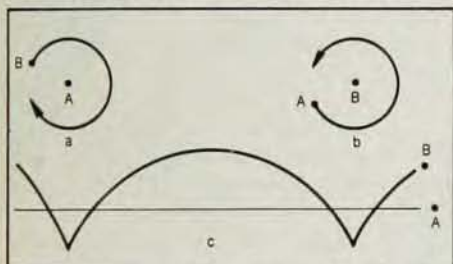
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relativity theories are unacceptable to many people is clear from their own papers which have appeared in *Foundations of Physics*, *Spectroscopy Letters*, and *Speculations in Science and Technology*. Basically, the problem is that frame-independent speed is just not very intuitive. Consider a traffic cop speeding down the road at $0.99c$ in pursuit of a thermal photon wanted for arson. How, one may ask, is it possible for the situation to remain unchanged *vis-à-vis* the chase when the policeman breaks off his pursuit and pulls over to the side of the road? What I should like to do here is show that this question does have an intuitive answer within the context of special relativity. The first step is to show that motion in n dimensions does not necessarily exist in $n - 1$ dimensions.

Negation of motion through dimensional collapse. Consider the two point-particles A and B in the figures.



In the frame of A [figure a], A is a locus being orbited in a perfect circle by B . In the frame of B [figure b], B is a locus being orbited in a perfect circle by A . One can also define a frame in which both A and B are in motion [figure c]. But can one define a frame in which both A and B are at rest? The first impression one has is that such a frame can not be defined. However, this is not the case. Consider an observer $O(x)$ for which there exists exactly one spatial dimension x . Insofar as $O(x)$ is concerned, the plane needed for the motion between A and B does not exist. Thus A and B merely remain a fixed distance apart, and so are at rest with respect to one another. This illustrates intuitively how motion can be negated by eliminating a spatial dimension.

Now consider an observer $O(y, z)$ who somehow manages to climb aboard a lightbeam propagating along the x -axis. In any theory admitting to Lorentz contraction, $O(y, z)$ will find that the x -axis has collapsed and that the cosmos is all contained in the (y, z) plane. For this reason he will be able to transverse any interval on the x -axis in zero time. (It is not the case, as one sometimes hears, that $O(y, z)$ will observe his own clocks to stop. At least this is not the case in Einstein's theory.) Furthermore, for the reason explained above, $O(y, z)$ will find that the

inertial bodies in the cosmos are all at rest with one another in the x direction. Finally, let us extend this to an observer $O(o)$ who manages to propagate in the x, y , and z directions at speed c . For $O(o)$, the cosmos has collapsed to a point—as if at the start of the big bang—and inertial objects are generally all at rest with one another. Since in the frame of $O(o)$ the elements of the set $M = \{\text{inertial bodies}\}$ are all at rest with one another, it should not seem so surprising that $O(o)$ has the same speed with respect to each element of the set M .

Need for more experimentation. Although I have tried to illustrate that modern relativity is not as peculiar as it may appear, I would not want to suggest that one should uncritically accept this or any other theory. We need to keep testing relativity theory experimentally to avoid unscientific overconfidence in our theories. Only in this way does science remain self-correcting, to borrow a phrase from Carl Sagan. In particular, we have no hard evidence at all to support the symmetric aspects of relativity theory. This is because, speaking relativistically, no experiment has ever been conducted in which an observer (or detector) we can communicate with has been outside the rest frame of the Earth. Thus, as I have shown in detail elsewhere,⁴ the invariance $c' = c$ might be just an approximation for a strongly nonlinear transformation. As soon as possible, someone should measure the speed of light in freespace from *inside* a spacecraft moving at a relativistic speed with respect to the earth.

References

1. A. D. Allen, *Physics Today*, May 1980, p. 86.
2. W. Kantor, *Physics Today*, November 1980, p. 15.
3. A. D. Allen, *Physics Today* (reply to 2), p. 89.
4. A. D. Allen, *Spec. Sci. Tech.* 1, 465 (1978).

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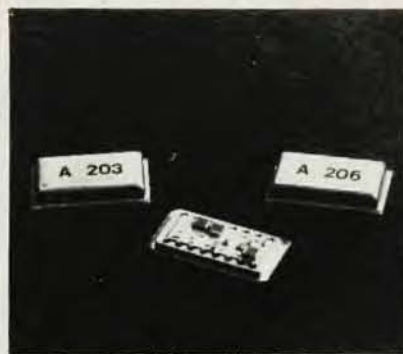
Diehard CP-conservationist

The acceptance of CP violation as a fact has been marked by the Nobel award to Fitch and Cronin, for $K_L^0 \rightarrow \pi^+ \pi^-$, noted in December (page 17), along with the "even simpler" direct preponderance of $K_L^0 \rightarrow e^+ \pi^- \nu$ over $e^- \pi^+ \bar{\nu}$, of the Steinberger and Schwartz experiments. Furthermore, we have all recently heard of speculative links of CP violation in K^0 physics, to the apparent excess of baryons over antibaryons—and of e^- over e^+ —in the universe, and also to the cosmological photon/baryon

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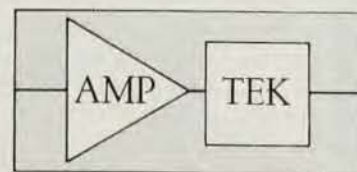
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