

letters

aversion to nuclear war that they will evolve into a society that abhors nuclear arms and whose principles are radically different from ours.

In the meantime, we should admit the fact that many of us are either passively or actively engaged in work that contributes to a society that builds nuclear weapons to wage nuclear wars.

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7/13/78

THE AUTHOR COMMENTS: Gough Reinhardt's letter fulfills an important need in a fair discussion about nuclear weapons: it represents arguments against arms control and for an arms race with the other superpower. I assume that Reinhardt agrees with our principal aim, avoiding nuclear conflict, and disagrees only with the methods of achieving it. His interpretation of my use of the word "absolute" seems to differ from mine. What I meant was "first priority" and I hope that Reinhardt agrees with this meaning when applied to a nuclear war.

I also share his hope that time will ameliorate the Soviet position because ours is the better system. However, I fear that an unbridled arms race will not give us the time to wait for this development. On the contrary, it will make the outbreak of a nuclear war more probable and would reduce the chances of a turn in the Soviet position.

Because of the superiority of our technical abilities, it is our side that determines the speed of the race for better weapons. Most innovations have been done first in the US, and have forced the Soviets to reinvent them as fast as possible, much faster than they would if we had not preceded them. In other words, every new weapon development will be directed against us a few years later, except if the holocaust breaks out before the Russians have caught up, in which case both of us will be annihilated anyway. Those who advocate military superiority over the other side instead of a balance of forces should keep that in mind.

I do not, and never have advocated unilateral nuclear disarmament. I do think, however, that one should consider most seriously a slow-down of innovations, and a tentative unilateral decrease of the number of nuclear weapons, in order to see whether the other side would follow. After all, we have much more than enough to destroy the other side many times over, and the economic burden of the build-up is relatively much larger for them than for us.

I only see advantages in any step towards a negotiated mutual arms control. I cannot understand Reinhardt's statement that SALT or any test ban tilts the balance in favor of the other side (who

has the better computers to simulate a bomb test?). Every action that slows down the race gives us more time to wait for and increases the probability of a change in the Soviet position.

Reinhardt's remark about the value of life in freedom compared to life under Communism puzzles me. We will never be faced with this alternative without a nuclear conflict, except if we carry out total unilateral nuclear disarmament which, of course, is no solution. After a nuclear war there will be neither a Communist regime nor life in freedom.

I agree only in part with John Dowling's comments and I do not share his view that Harold Davis's editorial lacks logic. We cannot stop our weapon production unilaterally forever; such a step obviously would increase the danger of nuclear war started by the other side. We therefore unfortunately need people who work in the weapon field. However, a certain measured reduction of our nuclear potential may be advisable, since it may perhaps be followed by a Soviet step in the same direction.

It is imperative to slow down the development of new bombs and new ways of delivery and it is largely in our hands to do so. Here, the scientists working on these developments could have a decisive influence; in particular when a given innovation would be destabilizing, meaning that it would increase the chances of a first strike.

Leonard Dy may be right but it is the sacred duty of all of us to do what we can to prove him wrong. After all, the ways of human-kind have changed before in less than 10^4 years; from hunter-gatherers to agriculturists; from a feudal to an industrial society. Today, however, we have much less time to change the habits that Dy describes so eloquently. I cannot share his "hope" that things will become better only after the great catastrophe. Then it is too late; the world will be different, probably uninhabitable, and everything we consider great and beautiful will be lost.

The situation cannot, is not, and must not be completely hopeless. We must do everything in our power, we must create a strong public opinion against nuclear weapons, we must change our priorities and we must succeed. The great experiment of nature that mankind represents must not end in dismal failure.

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It would be very helpful if publishers not unamenable to limited, scholarly reproduction of their material would make the "interior" margins of pages broader, to obviate the problem above. At the least, it would be helpful to place graphs, diagrams, and so on in positions away from the binding, all other things being equal.

RONALD FEIGENBLATT
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7/17/78

Philosophy of particles

In his article "When is a particle?" (June, page 23) Sidney Drell draws a parallel between discussions concerning whether neutrinos, for a long time individually unobserved, really existed; and quarks, apparently essentially unobservable individually according to present theories. In 1948 S. Dancoff gave an essentially positivistic reply, that the debate was unnecessary as long as the neutrino formed part of theories that gave observable results. This point of view is perhaps best expressed by P.A.M. Dirac when he says: "Only questions about the results of experiments have a real significance and it is only such questions that theoretical physics has to consider."

Even in its heyday there were many varieties of logical positivism. At present few physicists would admit to being logical positivists, but many appear to be still "tainted" by its "legacy" (for example, see Eugene Wigner¹). In the problem of existence or non-existence of particles it is well to recall the half-humorous proposal of Von Neurath, a prominent member of the Vienna Circle, to compile an *Index Verborum Prohibitorum*, for such words as Existence, Reality, Truth. These words, which have a perfectly clear meaning in ordinary speech, have been taken over by metaphysicians, and have also penetrated into physics, generating more heat than light. In the above question: "Do neutrinos really exist?" can one reply: "Yes, but not really?"

In the latter part of his article, Drell uses the term "observation" rather than "existence." While this term has been subjected to philosophical analysis (Pierre Duhem² already started this), it has a much clearer meaning for most of us.

In my opinion,³ the clearest "positivistic" view of physical theory is given by contemporary model theory, essentially a form of instrumentalism.

As to whether particles smaller than quarks shall be observed or introduced into more sophisticated theories, only the future can tell, which seems to be the

main conclusion of Drell's article. Perhaps even the concept of "elementary particle" will be discarded, and continuum theories will take its place, unlikely as it seems at present.

References

1. E. P. Wigner, in *Proc. of the International School of Physics "Enrico Fermi,"* Course 49, Academic, N.Y. (1971), page 123, where Wigner says: "For a positivist (as most of us are)..."
2. P. Duhem, *The Aim and Structure of Physical Theory*, 1st ed. Paris (1906). Duhem asserts that any observation is only meaningful in terms of some theory (paradigm?) held by the observer.
3. A. V. Bushkovitch, *Philosophy of Science*, 41, 1, 86 (1974); also *International Logic Review*, 8, 23 (1977).

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7/25/78

Elsasser's memoirs

The review of my memoirs by Paul Hanle (August, page 55) misconstrues the intent of my book. It was written to show the historical background, the social and intellectual ambience, and the more human aspects of science in a great period of physics, with my personal experiences serving as the main connecting thread. The reviewer's standards seem to ask a lot of me: He is unhappy that, apparently, I "cannot advance [my] own achievements," and he thinks of my more detached attitude as implying "self-contempt." Because I have resorted to psychological arguments on occasion it does not follow that I can or even should indulge in character analysis of prominent physicists, as he seems to demand. He says that my early "achievement was much in spite of the social and physics environments." The "social" is largely true since my young manhood coincided with the growth of Nazidom, but addition of the "physics environment" seems an embellishment by the reviewer.

With respect to those physicists I have encountered he says that I have "drawn several dozen sketches . . . , most only a page or two of summary." Here are the names of those physicists to whom I devote an aggregate of about three pages each: Sommerfeld, Heisenberg, Einstein, Born, von Neumann, H. A. Lorentz, Pauli, von Laue, Wigner, Bethe; in addition five pages for Millikan. Oppenheimer occurs frequently, adding up to over six pages. There are seven pages for Schrödinger and seven pages for the Joliot-Curie couple, all of these from the scientific viewpoint together with personal recollections, and that in 260 pages (not 216 as the review says).

Again, I must protest the reviewer's distortion of history when he says: "Nuclear physics was born, at almost the

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