ated with the production of π-mesons, K-mesons and anti-baryons.[2] He also constructed a field-theory model to illustrate these ideas.[3] However, experiments in which Krisch himself participated showed that the model was wrong.[4] Besides, the question of how the presence of three Gaussian terms in the elastic-scattering cross section precisely relates with what a proton looks like was never clearly resolved.[5]

What has come to be recognized in the literature is that Krisch's "onion" model is basically a phenomenological fit to the elastic pp scattering data, not a dynamical model of the nucleon structure. In fact experiments may well indicate the presence of further Gaussian terms,[6] while theoretically one can construct models with an infinite number of such terms.[7] Furthermore models, where the differential cross section is given by a sequence of Gaussian terms, tend to indicate that these terms correspond to single, double and multiple scattering of one basic mechanism, and do not represent, say, three different dynamical processes.

I would like to add that the idea of a smoothed Yukawa potential representing finite size cores of nucleons which I proposed[8] was stimulated by the work of many authors and by the phenomenological fit to the pp data by Jay Orear, and not borrowed from Krisch's ideas. Subsequent analyses of experimental data which Joe Rosen and I carried out using smoothed Yukawa optical potentials led us to the nucleon substructure model shown in figure 5c of my article.

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Velikovsky again

Although the Velikovsky issue may now have become overexposed, we can still learn from the conflict. The latest objection to Velikovsky by David Morrison (February, page 72) was based on the lack of a "causative basis for his ideas" and that "his work remains purely *ad hoc* in nature."

However, there are many cases in physics where correct laws were formulated on an *ad hoc* basis, or even on incorrect grounds. Examples of the former are the Lorentz equations, Planck's radiation theory, and perhaps Schrödinger's equation. A causative basis is certainly an advantage for a theory, but its absence does not necessarily refute a theory. The validity of a theory is based on how well it correlates events, and how well it predicts future findings.

Some of Velikovsky's claims are hard to accept. Nevertheless, many of his predictions have come true, although they originally contradicted scientific belief. Eventually, some of his major predictions may be found to be untrue, and then, and not until then, Velikovsky's theories should be rejected or amended.

But the real point of this conflict stretches far beyond any argument about the validity of Velikovsky's theories. There is no question that his theories are unorthodox, that his use of historical references as a basis was unusual, and that he presented his theories in an unscientific manner. Nevertheless, why should so much anger have been vented on Velikovsky? Why are we so eager to put down divergent and unorthodox theories? Why do we wish to punish transgressors?

We can calmly and rationally reject a theory after it has been proven to be incorrect. The outburst of passion from the scientific community should serve as a lasting example of how physicists should *not* behave.

LEONARD R. WEISBERG
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Public involvement

The epitome of Davis's editorial (January, page 120) is contained in his statement, "Our complaint is that none (AEC Chairman, NSF Director, President's Science Advisor) is qualified to function in government circles as a spokesman for the scientific community." Davis's criticism is, at best, presumptuous of whose interests the aforementioned principals should represent. Davis is careful to cite an example in which the interests of the scientific community ostensibly coincide with the interests of the public. Any implication that such is the general case, however, can be disregarded. This is not to say that scientists are not sensitive to the needs of the public. To the contrary, scientists as individu-

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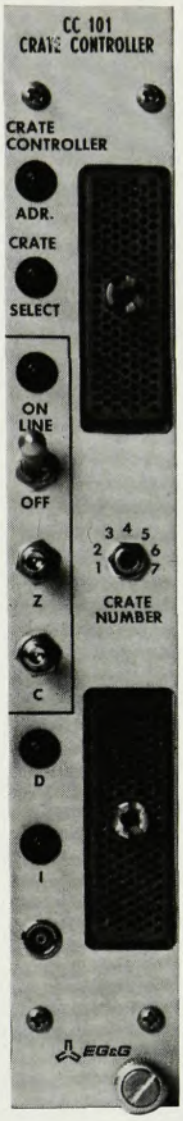

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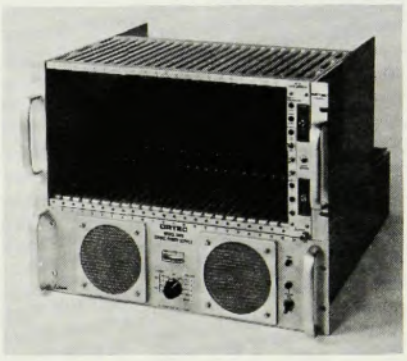

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als are among the most sensitive persons in our society. Any group of individuals, however, no matter how delineated, cannot be presumed to represent the interests of a larger population.

If Davis wants a voice in government circles for the scientific community, let scientists hire professional lobbyists or, even better, solicit public support and involvement. Davis's editorial theme can be construed as an example of the type attitude, discussed by R. N. Chan [Bull. APS **17**, 74 (1972)] that encourages short-circuiting public involvement in the making of technological decisions.

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Physics for children

I was delighted to see the June issue devoted to physics for children. For the last four years or so, I have been fooling around with the idea of scientific creativity in very young children. I even spent some time in kindergarten and pre-school settings, including one labeled "emotionally disturbed," experiencing the joy and challenge of little kids.

I'd like to share with your readers a statement attributed to J. Robert Oppenheimer by Marshall McCluhan *et al* in the book *The Medium is the Massage*:

"There are children playing in the street who could solve some of my top problems in physics, because they have modes of sensory perception that I lost long ago."

KENNETH FOX
The University of Tennessee
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As a physicist who is presently teaching 8th grade physical science, I am somewhat disturbed by your notion of the role of the physicist in elementary and secondary education. In your June editorial (page 84) you suggest that the role of the physicist could be that of a science advisor, who trains and motivates teachers in developing programs and materials. While I do not dispute the fact that there is a crying need for the continued education of existing teachers, I seriously question the physicists' ability to step in as some "Deus ex Machina" to train and advise educators. However it seems to me that this is what you are suggesting, even though you readily admit that many physicists would not belong in the classroom with young children.

It is my strong contention that before the physicist can make meaningful contributions in the area of pre-college education, he must first have extensive experience as a secondary or elementary school teacher. To support this contention I can offer my own experiences in the classroom with 8th grade students. I have learned in my two years of teaching many things that I was totally unaware of concerning the everyday life of a teacher. What, for instance, does an individual, inexperienced in secondary teaching, know about classroom management, range of abilities, motivation, learning disabilities, and the psychology of the exceptional child? Is such an individual even aware of the effectiveness of present science teaching methods? Does he possess the intangible, intuitive ability to communicate and relate to young children?

Educators would certainly welcome any physicist who desires to enter their profession. Nevertheless let the physicist be aware that it is he who must be retrained by virtue of direct contact with young children. Then, and only then, can he make lasting, relevant contributions to the area of pre-college education.

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Deformable particles

In a recent letter (May, page 11) Howard Robbins raises the question of whether or not a charged tachyon could have a trajectory that is consistent with relativity. He points out that motion must be accelerated because of Cerenkov radiation and that rectilinear, accelerated motion is not an invariant concept and thus the trajectory of a charged tachyon could not be predicted with knowledge of its position and velocity at any one time. This question has also been raised in some detail by H. K. Wimmel[1] who concludes that no satisfactory answer exists at present.

It should be pointed out, however, that this problem is not unique to tachyons but arises in any problem that includes radiation reaction as a significant ingredient. In such cases the differential equation of motion includes the time derivative of the acceleration, and hence the initial value of the acceleration must also be given (this is the "new dynamical quantity" suggested by Robbins).

It can be shown[2] that a properly Lorentz invariant classical theory of Cerenkov emitting, charged tachyons may be given in terms of an extended, Lorentz deformable particle. Such a

continued on page 49