letters

Soviet cosmology

It was a pleasure to see your news story on the possible observation of a 100 cubic-megaparsec void in Böotes (January, page 17). In particular I was glad to see the reference on work done by our group in Moscow as a possible explanation of superclustering of galaxies and the formation of a large void, empty of luminous matter. But I don't quite agree with your formulation of our idea, that the pattern appears to be caused not primarily by gravitation. . ." but rather "by complex hydrodynamic interaction."

As a matter of fact, we are developing a comprehensive theory of the motion of matter under the sole action of gravitational force! The term "complex" is somewhat artificial, and your formulation gives no information about our explanation, which appears as the result of the nonlinear stage of gravitational instability. We neglect the pressure of matter, because the wavelength of the initial perturbations is large. The short waves are damped earlier, as pointed out by Joseph Silk.

In this case it is quite natural that the particle trajectories are intersecting, forming caustic-like singularities. For details, I refer you to my first paper (Zeldovich, Astronomy and Astrophysics, 1970), to a general investigation of singularities carried out with a mathematician (V. J. Arnold, Ya. B. Zeldovich, S. F. Shandarin, Geophys. and Astrophys. Fluid Dynamics, 1982, in press), and to my forthcoming review article in the third volume of *Astrophysics and Space Physics*, Series E of Soviet Scientific Reviews, edited by R. A. Sunyaev in 1982 and published by Harwood.

Once more I must express my high esteem of PHYSICS TODAY. The contributions of physicists to astronomy are important for the flourishing of astronomy.

YA. B. ZELDOVICH
Academician
USSR Academy of Sciences
7/82

Physics in Saudi Arabia

The June editorial (page 112) by Harold Davis stresses the "upsurge of public concern about nuclear war" and the "tangible actions to reduce the peril." It urges physicists to make their primary contribution to "the goal of avoiding nuclear war . . . to educate the public about this gravest of perils."

The May issue (page 11), however, carries a disquieting, though almost lyrical, letter about physics in Saudi Arabia by Mujadid, Lubna, and Mansoor Ijaz. "Arabia, truly a land of peace, prayers and prosperity" is developing now a 30-million-dollar nuclear research center at the University of Petroleum and Minerals, and another center for nuclear-fusion studies at the King Adulaziz University of Jeddah. One reads further in the letter: "Incidentally, an attractive feature of Saudi universities is their capacity to finance projects in grand fashion." The authors' statement about the Saudi long-range planning of nuclear reactors, discovery of uranium, use of radioisotopes for diagnostic purposes in medicine and industry sound too naive to be believed.

It is to be gravely deplored, for it seems that the authors did not educate, at least as yet, the Saudi public, nor its authorities, about "this gravest of perils."

ELI A. MISHKIN
Polytechnic Institute of New York
Brooklyn, New York
7/82

THE AUTHOR COMMENTS: I am extremely disappointed in Eli Mishkin's interpretation of my letter concerning Saudi Arabia. Saudi Arabian educational programs in nuclear science and technology are only aimed at peaceful uses of nuclear techniques, and I do not understand why the words "nuclear reactor" appear so dangerous to some readers. The use of nuclear reactors for desalination of water and power generation beyond the year 2000 (when oil may run out) is of special interest to the Saudis, and at this time this may be the only option available to them unless solar or alternate energy sources become available. It is my firm belief and understanding that the Saudis do not intend in any way to promote or enter the nuclear-arms race, which would destroy the peace that has existed in their country for centuries. In an earlier communication I have been informed that King Abdulaziz University has rejected the fusion-energy proposals made to them by foreign scientists. The public in Saudi Arabia is quite aware of the dangers associated with a nuclear war and that is why their leaders are playing such an important role in keeping peace in that part of the world.

MUJADDID A. IJAZ
Virginia Polytechnic Institute and State University
Blacksburg, Virginia
8/82

Video-game physics?

An exciting possibility in the application of computers to physics instruction has been missed by both the advocates (Alfred Bork and others, September 1981, page 24) and their critics (Miller,

continued on page 84

letters

continued from page 15

and Allis and others, July, page 11). The computer can provide experiences not available in the ordinary world, but it can also permit the student to interact with these extraordinary events and objects.

An example of this is seen in the current video-game mania. It seems that half our young people are busily engaged in manipulating space ships and other extraordinary objects. The objects currently obey Newtonian physics as a rule. It would be highly interesting to reprogram some of these games so that they obey relativistic or even quantum mechanics.

The Mr. Tompkins series by Gamov did much to kindle my interest in physics, and to expand my intuition for the extraordinary phenomena of modern physics. Imagine the possibility of playing quantum "Pong," or relativistic "Asteroids," or even quantum electrodynamic "Pac-man." I have written to some of the manufacturers of video games to encourage the production of games that incorporate modern physical ideas. Such games might do much to interest students in physics as well as helping to develop physical intuition.

THOMAS L. CLARKE
Ocean Acoustics Laboratory
8/82 *Miami, Florida*

THE AUTHOR COMMENTS:

▶ Because students learn little or *no real physics* in the beginning computer lessons in physics, how can they get *anything* out of computer study of advanced ideas like relativity or quantum mechanics?

▶ Says Clarke: "The computer can provide experiences not available in the ordinary world. . ." *This* is just the sickness. What the students need in the beginning studies in physics *is* touch with the *real ordinary world*—like a bob on a string—a ball on a plane—a spring with a load—*all real things*.

▶ As for getting a *feel* for physics in video games—never! Basketball embraces physics abundant. Does a player ever learn any physics playing the game?

▶ And finally, I have examined students who had their first physics with computers. Mama mia! They do not even know *what physics is*! Is there no one who sees the darkness?

I liken this invasion by computers into the *teaching* of physics to the invasion of the new math, and we all know the absolute disaster this created.

JULIUS SUMNER MILLER
9/82 *Torrance, California*

THE AUTHOR COMMENTS: I certainly agree with the comments in Thomas Clarke's first paragraph, and I believe that my own paper in PHYSICS TODAY and many of my other publications argue the value of interaction in all components of learning.

But I am not at all convinced that the video games present us any model whatsoever. First, there is a serious question as to what, if anything, is being learned. Certainly my own paper supports the notion of developing intuition. Yet I cannot believe, given the video games that I see, that there is much intuition being developed in most of those games. Indeed, I know of no evidence to show that this is the case. Second, the games encourage a whole variety of other aspects which I find quite undesirable. Almost all the video games in current use represent a high degree of violence. Something is always being killed, or eaten or destroyed in other ways. A delightful column by Art Buchwald, about a year ago, was entitled "The Senseless Destruction of Asteroids." I think it expresses fully the notion that what happens in the video games is mostly a high level of violence.

There are other problems associated with video games. One thing that is quickly noticable on observation, for example, is that the video-game environment is almost entirely an all-male environment. The girls that are there are primarily there simply because they have come with the boys. This seems undesirable in an educational environment that encourages equal opportunity.

This is not to say that one could not design games that have an instructional purpose, avoid violence, and appeal equally to a wider range of individuals and miss some of the other shortcomings of the other video games. But one must wait for actual examples of that.

Whether it would be helpful to have relativistic universes, too, is a matter for speculation. Again certainly I would agree that intuition-building material is needed, but the question of whether this can be done in anything like the current game-like situation is a serious one.

I, too, like the Mr. Tompkins series and many of the other popularizations of science that were available at that time. Certainly activities that stimulate interest are important and useful. We seem to have far too few of them at the present time.

We have extremely serious problems today in science and math education, and these problems are getting worse by the day. We have decreasing numbers of competent science and math teachers, dramatically so. We do not pay these teachers enough to persuade them to continue teaching. We are training far fewer science and math teachers than we were ten years ago by

a factor of five to ten. Over one-third of the high schools in the United States offer more than one year of science and only one-third offer more than one year of mathematics. Many important courses are simply not given in the smaller, often rural, high schools.

I do not see how any of these extremely important problems will be addressed by encouraging relativistic video games. I think that the computer, used in other ways, can play a very important part in providing a solution, perhaps the only solution available. What amazes me is that magazines like PHYSICS TODAY and communities such as the physics community seem so little interested in the almost complete destruction of science education in the United States in the past few years. I do not believe that I am exaggerating in the slightest in making these comments.

ALFRED BORK
University of California
Irvine, California
9/82

Mass vs. weight and SI units

It is encouraging to read (May, page 80) of progress in resolving the controversy between the American Association of Physics Teachers and the National Bureau of Standards as to the distinction between units of mass and of weight. This has been achieved through long negotiation between the AAPT Metric Committee and David Goldman of the NBS, who has worked patiently and constructively in a difficult situation. The NBS publications no longer directly endorse the view that the word *weight* can be used as a synonym for *mass*. This modification has led to the AAPT removing its vote of censure against the NBS.

However, it is also clear that the problem has not been fully resolved. This is evident both from the NBS publication[1] on SI units and from the resolution[2] adopted by the AAPT when the censure was removed. In this resolution, the AAPT adopted SI as its official system of units and recognized the 1901 declaration of the General Conference of Weights and Measures (CGPM) as an integral part of the system.

The English text of this declaration[3] reads as follows:

> Taking into account the decision of the CIPM of the 15 October 1887, according to which the kilogram has been defined as a unit of mass; taking into account the decision contained in the sanction of the prototypes of the Metric System, unanimously accepted by the CGPM on the 26 September 1889; considering the necessity to put an end to the ambiguity which in