letters

body, whatever may be the opinions and actions of its individual members.

ROBERT H. GOOD
California State University, Hayward
Hayward, California

7/30/79

To modern physics

Space is akimbo and time is in limbo
What more can one really say?
The universe is quaquaverse
And tomorrow is yesterday!
The light was bent and Eddington sent
Results that all could see,
Theologians fussed while philosophers mussed
The continuum as the only reality!
On a Balmer rung hydrogen is strung
It's all so deceptively neat,
Warped and Quarked, teared and c squared
Matter is no longer concrete!
Once indivisible the atom now quite fissionable
Much to Fermi's sustained satisfaction,
A meso-thorium experiment made it self-evident
At a stop light Szilard got his chain reaction!
Galactic drift a spectrum shift
Necessitating a Doppler reading,
Hubble was terse "the square of the inverse"
To show us that it's all receding!
The theory of light like day and night
A structure that's apparently dual,
Some thought it odd that even God
Would have to obey the S-matrix rule!
At the cosmic core prime forces numbering four
And so far they do as they please!
Would nature yield to a unified field?
For Einstein that was the big tease!
But radiation's frequency resembles delinquency
As to which atom will actually leave,
Classical mechanics versus Quantum antics
And Einstein started to grieve!
Bohr just tugged while Heisenberg shrugged
As Schrödinger waved psi psi,
Albert refused, he wasn't amused
When de Broglie began his reply:
"Deux plus deux pardon,
Font Cinq
C'est une marche longue
D'un court Planck!"

DAVID KLEINMAN
New York, New York

Right to emigrate

I am an optical scientist working for Computer Peripherals, Inc., a subsidiary of Control Data Corporation in Rochester, Michigan.

I was born in the USSR and emigrated to the United States of America in 1976 with my wife and son.

I have enjoyed PHYSICS TODAY for many years for both its scientific and political coverage. Today, with pride at having become a member of the American scientific community, I welcome your editorials highlighting the situation of Soviet scientists being refused exit visas in Russia.

My parents and grandmother applied for emigration in 1977 and were refused three times in a row so far without being given a clear reason. After desperate attempts to appeal to the Soviet authorities I can't see any other way than to ask for wide publication of this case to attract the attention of concerned scientists throughout the world. This could be helpful to my relatives and other people in nonfree societies who want to be free. I consider the unwillingness of the Soviet government to issue an exit visa to my folks as a new way of retaliating and threatening Soviet scientists who have left or are going to leave Russia for the US.

BORIS J. MUCHNIK
Rochester, Michigan

6/30/79

Benefit of radioastronomy

The remarks by Bernard Burke entitled "Cost benefit of radioastronomy" (June, page 15) deserve some comment. Burke's principal aim is to justify the great expense involved in present-day radioastronomy by appealing to the practical advantages it provides for humanity by the way. Such a defense in itself is not only irrelevant but it may well backfire when the practical results don't live up to expectations. One should not argue for radioastronomy because it can give us a faster baked potato in a microwave oven, any more than support of classical music should be justified because it allows television jingle writers another musical outlet. Science and art are their own justification, and to appeal to practicality debases both the practitioners of science and those who support it. In his testimony before a Senate committee, Robert Wilson was asked what contribution the National Accelerator Lab made to the national defense. He replied that it made none, except to make the country worth defending. Astronomy needs no further defense than that it adds meaning to human existence.

But the letter by Burke misses the mark on one other point. He is indirectly arguing for more money for radioastronomy, an already expensive enterprise. And he briefly appeals to its great successes in pure science to justify this expense: he refers to pulsars, quasars and the 3 K cosmic background radiation as examples. Two of these discoveries have

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led to Nobel prizes, clearly underscoring their intrinsic scientific merit. But both of these discoveries were made with modest equipment, at modest expense. The discovery of pulsars was carried out largely through the efforts of then graduate student Jocelyn Bell and four other students, spending two years banging wooden poles into the ground, stringing chicken wire between them, and recording the data on paper-chart recorders. No giant computers, no 100-million-dollar radio telescopes and multi-million dollar crash programs there. Just hard work, intelligence, imagination—and a bit of luck. But luck seems to be with those who are prepared for it, and who seize the day. If we look back over the history of radioastronomy, what we find is that many of the great steps were made by the Karl Janskys and Grote Rebers, funding their research on a shoestring; or the Jocelyn Bells who persist in the face of sage advice that what they have found is unimportant.

It is far too glib to suggest that money buys good ideas. This is not to say that "big science" is unnecessary, but that the intellectual edifice of science that Burke refers to is not built on millions of dollars, but on the insights, ideas and creativity of individuals. Let us hope that in the face of increasingly concentrated money in a few giant research institutions, the individuals with scientific ideas can still be heard above the din of the research factories, and be supported simply because of the ingenuity and beauty of their ideas.

KENNETH BRECHER
Boston University
Boston, Massachusetts
7/27/79

THE AUTHOR COMMENTS: Kenneth Brecher prefers, in his comments on my letter, to avoid practicality as an argument for science because it "debases both the practioners and those who support it." This Brahmin view has not been universally agreed to by scientists. Galileo, Franklin, Gauss, Helmholtz, Kelvin, von Neumann, and Fermi are a few of the many practitioners who have expressed the opposite opinion. Science and technology are closely linked, and the aesthetics of science are not tainted when practical applications are found. No rash promises for practical benefits need be made, because history shows that the applications come in unexpected forms from unexpected sources, but the mutually beneficial exchange has been continuous for the last two centuries, and shows little sign of slackening.

In his concern for the heavy demands of big science, and radioastronomy in particular, Brecher is more seriously mistaken. When pioneering work is done with modest means, as in the discovery of pulsars, we can all take pleasure in the elegance of the work. Yet, from the days of Tycho Brahe, it has from time to time been obvious that expensive equipment was needed to get the data so that theorists have facts to preserve them from error. At the opening of our own century, George Ellery Hale paved the way for modern astronomy by building a series of telescopes of extravagant size, and just recently Jan Oort persuaded the Dutch government to spend a very large sum on the Westerbork Synthesis Radio Telescope, with very little local support, and that instrument has already yielded a wealth of new insights into the nature of the cosmos. When the flux of photons is small, the collecting aperture must be large, and size is expensive. Brecher is also mistaken in his notions of size: The discovery of the 3 K cosmic background was not small science. Penzias and Wilson inherited the finest cryogenic maser receiver and the best calibrated antenna in the world, backed by the massive resources of Bell Labs. The discovery of quasars required still greater resources: Initial positions were measured with the Owens Valley interferometer of Cal Tech (the largest ONR program in US radio astronomy), complemented by Hazard's radio occultation work at the great 210-ft dish of CSIRO in Australia (the world's largest). The full story was clinched by optical observations with the 200-inch telescope at Mt. Palomar. No backyard science there!

BERNARD F. BURKE
Massachusetts Institute of Technology
7/25/79

Soviet vs. US referees

You published my letter "PRL versus JETP" and the "PRL Comments," which I find very demonstrative (December, page 82). At the end of the comments, the *PRL* editors inquire:

> ". . . our authors practically never accept the criticism of the referee. Why that difference? [between *PRL* and *JETP Letters*—M.A.]. Are Russian referees more precise and more acquiescent? Are the editors of JETP firmer in their rejections than we are (or can be)?" The answers become obvious, if one questions: What happens, if the referee detains his comments for more than two weeks? Or if the referees essentially contradict each other, so that at least one of them is definitely wrong? Or if the paper is certainly novel, but the referee doubts its influence on further research? Or the author disagrees with the referees' specific criticism? Or the referees' comments are imprecise, or wrong due to his irresponsibility?

The situation in *JETP* and *JETP Letters* is as follows: If the comments refer to the style and are specific, any author does his best readily and quickly, because this leads to immediate publica-