

letters

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and that of the so called "free-electron laser." The laser relies on a population inversion created by a pump but the "free-electron laser" produces synchronously emitted synchrotron radiation by tuning the light frequency to achieve synchronism with electrons of an "inverted" part of the electron-beam energy distribution.

References

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Neutrino paradox

There is an apparent consequence of neutrino physics that introduces the spectre of a paradox (at least to me). The articles I've studied tell about prodigious production rates in stellar interiors and various atomic reactions; about how the interaction cross section allows neutrinos to zip through a light year of lead like a hot awl through a pat of oleo, and about the sleuthful, imaginative experiments that have been performed to perceive them.

A most interesting entity, this elusive particle of Wolfgang's.

I am beset, however, by a question that begs understanding.

If neutrino generators are as prolific as is theorized, and if neutrino interaction with matter is the ultimate paranoia as is evidenced by experiment, then, if one assumes time-independent (on a universal scale) creation rates, why is it that present background population from all sources, since time immemorial, is not overwhelming? After all, the universe is not lead or chlorine-37. What, I ask, is the mechanism that negates the existence of an Olbers's Paradox for neutrinos?

Do they age? Is there an unknown absorption mechanism in interstellar space? Or perhaps, do Stephen Hawking's mini-black holes gobble 'em up?

With assumed license, my tongue in cheek, and a wee touch of assertiveness, especially since there be no negation precedence (of which I am aware), I propose Mohler's Paradox to the more nimble minds about me.

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We asked John Bahcall of the Institute for

Advanced Studies to comment on Sailor Mohler's letter. He agrees that there is indeed an Olbers's Paradox for neutrinos, just as there is for photons. Both apparent paradoxes, have the same resolution—namely the red shift resulting from the expansion of the Universe. The more distant a source of photons or neutrinos, the more these are Doppler shifted to lower energies.

EDITOR

Physicists and energy problem

I think that it is time for The American Physical Society and the American Institute of Physics to re-publicize and re-inforce their 1975 study of *The Efficient Use of Energy*. It could profitably be updated, especially with respect to the costs of energy, as well, although the basic conclusions stand now as they did then.

In the year the study was published, I, a physicist, began to teach the energy-related subjects in the School of Architecture at California Polytechnic State University, San Luis Obispo, which is the largest school of architecture in this country. First, I want to emphasize the study's strong recommendation of the disciplines of classical physics, and to point out that there is, in the British Commonwealth, a specific discipline of the applied sciences with respect to architecture: architectural science. I educated myself first with a bachelor's degree in physics, second with a long tour in a defense laboratory, third by attending a good school of architecture for two years, and fourth by taking the Master of Architectural Science at the University of Sydney. Departments of physics in this country—especially those in universities having schools of architecture—could very profitably institute master's programs in architectural science. The program at Sydney, which is a world-class university in many fields, was developed under the far-sighted leadership of Henry J. Cowan. Frankly, "modern physics" always has seemed hopelessly muddled to me, aside from the junctures effected with the classical disciplines by Einstein, de Broglie, and Gabor; no student ought to be permitted to study quantum mechanics until he has mastered acoustics, which scarcely is taught nowadays!

My point is that we seem to be drawing farther and farther away from the efficient, let alone intelligent, use of energy. Recently, I testified before my city's council on the subject of its vaunted "energy policy." Our late mayor, who at the time had been tapped as Secretary of Transportation, took umbrage when I introduced the findings of the APS study, partly, as he said, because he didn't understand technical matters, and partly, undoubtedly, because he had conceived the policy as a mandatory insulation program for home-owners; the chief

beneficiaries of the policy would be the electric utilities, who could substantially shave their peak loads, which in this region are due to electric space heating of homes. Any attempt to do this more directly, by restricting space heating with electricity, was rejected as "politically unacceptable" by the policy's coordinator. The policy had been studied and developed for more than a year by a very large committee, yet my introduction of the APS study came as a complete novelty to all those concerned with it.

Are physicists really having any effect on energy consumption? If not, why? There is evidence that "quality of life" only marginally increases when the installed electric capacity of a society exceeds 2 kW per capita; in this region the figure is nearly 5 kW per capita, and those who govern are clamoring for more. Here we have extinguished the most concentrated food resource in the world, the Columbia River's salmon runs, in our quest for electric power; we could restore a substantial fraction of the runs by removing the first four dams on the river (or reducing their operating heads) at the cost of 10% to 15% of the installed capacity. Yet the Corps of Engineers is aggressively expanding its hydropower program. The aluminum industry uses 21% of our electric power, yet provides only 0.5% of our employment; the cost of a large commercial airplane would increase only by a few percent if electric power were charged at its present replacement value, yet we subsidize the manufacture of energy-wasting aluminum window-frames by suppressing real costs. And so, *ad infinitum*.

Aden Meinel, past president of the Optical Society, who together with his wife, Marjorie, kept the idea of solar energy alive when it was extremely unfashionable, used to start his lectures with a gigantic projection of the Sun, saying "Nature long ago discovered the correct scale and distance for thermonuclear fusion." We physicists have the knowledge to contribute a great deal to this, the critical problem of our times. It is evident that we need much more than mere knowledge to influence policy effectively.

One can do no more than quote the finest "politician" this country has yet produced: "We must disenfranchise ourselves, and then we shall save our country."

JAMES B. LEE
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Science policy

I read in the August (page 72) that Lewis Branscomb, APS President, was greeted with "gales of laughter" at a science-policy meeting at New York University when he set forth his ten "outrageous proposals"