

LETTERS (continued from page 15)

proximately harmonically in a one-dimensional potential well between plate and cathode. . . . Similarly, in the magnetron type of maser, stimulated emission of radiation takes place as the electrons undergo transitions to states of lower angular momentum quantum number."² Thus the founding fathers recognized masers as oscillators and were also drawn to consider other oscillators (including magnetrons!) using maser/laser language.

While extending laser concepts to include atom lasers, it may also be appropriate to mention other nonelectromagnetic lasers. They include at least the widely studied phonon masers first discussed by Townes and Nicholaas Bloembergen and the recently reported exciton lasers, as well as the neutrino lasers that are postulated to have been important in the early moments of the universe.³

References

1. See, for example, M. Bertolotti, *Masers and Lasers: An Historical Approach*, Adam Hilger, Bristol, England (1983), p. 80, on the maser, and J. Hecht, *The Laser Guidebook*, McGraw-Hill, New York (1992), p. 14, on the laser.
2. G. Gould, in *Quantum Electronics: A Symposium*, C. H. Townes, ed., Columbia U. P., New York (1960), p. 291.
3. C. H. Townes, N. Bloembergen, in *Quantum Electronics: A Symposium*, C. H. Townes, ed., Columbia U. P., New York (1960), p. 405. A. Mysyrowicz, E. Benson, E. Fortin, *Phys. Rev. Lett.* **77**, 896 (1996). N. Kaiser, R. A. Malaney, G. D. Starkman, *Phys. Rev. Lett.* **71**, 1128 (1993).

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Planned ITER Study Is Deferred, not Nixed

The well-done story by Irwin Goodwin entitled "National Research Council Studies Operate Under New Openness Rules" in your August issue (page 48) states that the Department of Energy "canceled an NRC study of the controversial International Thermonuclear Experimental Reactor," adding that the NRC had already chosen the committee to do the work. Strictly speaking, DOE has deferred rather than canceled the study, pending resolution of the legal issues. And the NRC has not selected a committee.

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Socioeconomic Factors, Not EMFs, Put Children at Risk for Leukemia

After studying the potential links between electromagnetic fields and cancer and other health problems, the National Academy of Sciences' National Research Council panel concluded that the only possible reason for concern was the "weak but statistically significant association" between people's proximity to high-voltage power lines and childhood leukemias, as reported in PHYSICS TODAY (January, page 49).

However, I am sure that the British epidemiologist Leo J. Kinlen and his collaborators would advance other prime suspects as risk factors for childhood leukemias—specifically, certain socioeconomic factors. In a series of reports prepared between 1990 and 1996,¹ Kinlen *et al.* revealed that seven specific population mixes each lead to significant increases in childhood leukemias, and sometimes also in childhood non-Hodgkin lymphomas, in the UK. "Significant" here means that the probability that the given relative risk values are caused by purely statistical fluctuations is less than 5% or even less than 1%.

Kinlen *et al.* found relative risk values of 1.58 in new towns (planned postwar communities); 1.41 in rapidly growing towns and villages; 1.65 in rural areas with many drafted soldiers; 1.53 in rural areas with many oil workers; 1.61 in rural areas with many construction workers and rich parents; 1.50 in towns in which the number of commuters had increased strongly; 1.76 in villages that had many urban evacuees during 1947–49 as a result of World War II air raids. They also determined that parents having a high socioeconomic status is often a further risk factor for both childhood leukemias and non-Hodgkin lymphomas.

Kinlen *et al.*'s findings for the UK have been confirmed in part by Pierluigi Cocco and his colleagues² in Italy. Looking at a small cluster of childhood leukemia cases in Carbonia, Sardinia, they came up with some relative risk values that were remarkable: 0.3 for high socioeconomic status of parents (in contrast to Kinlen's results); 4.1 for parental birth outside Carbonia (in agreement with Kinlen); 4.0 for having a well in the backyard; 4.0 if pregnant mothers had taken anti-nausea medicine; 2.7 for a family history of cancer.

According to Cocco *et al.*, other risk factors associated with lower relative risk values, in the range 1.5 to 1.9, are maternal smoking, paternal drinking of at least 60 grams of alcohol per day, electrical substation within 300 meters and solvents at the paternal workplace. Other situations, like the presence of pets or radon daughters, are even less important. For policymakers, journalists and epidemiologists, it would certainly be fruitful to take into account the Kinlen and the Cocco studies.

References

1. L. J. Kinlen *et al.*, *Br. Med. J.* **310**, 763 (1996), and references therein.
2. P. Cocco *et al.*, *Arch. Environmental Health* **51** (3), 242 (1996).

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Up with IPCC Climate Report; Down with per Capita Energy Use

Fred Singer continues to disseminate incorrect information about the climate change issue (PHYSICS TODAY, "Letters," August, page 84).

He claims that the "discernible human influence" statement given in the "Second Assessment Report" (SAR) of the Intergovernmental Panel on Climate Change (IPCC) was based

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mainly on two papers by Benjamin Santer *et al.* He is wrong: The multifaceted basis for the statement is clearly stated in the SAR (page 5)—immediately preceding the “influence” statement—and it should be evident to anyone who reads chapter 8 of the report. The conclusions of that chapter, which deals with the issue of identifying human effects on climate, represent a synthesis of scientific information from many sources (107 peer-reviewed articles are cited).

In addition, Singer also claims that global controls on carbon dioxide emissions would have “serious economic consequences.” The vast majority of economic analyses of the problem come to a contrary conclusion. Furthermore, the United Nations Framework Convention on Climate Change itself seeks to ensure that there will be no such consequences. Article 2, which signatory parties must abide by, states that the ultimate objective of the convention is to stabilize greenhouse gas concentrations in the atmosphere in a way that will “enable economic development to proceed in a sustainable manner.”

Singer also claims that the projections of future global mean warming (1 °C to 3.5 °C by 2100) are based on flawed models that have not been validated. In fact, the model used for

these projections simulates past global mean temperature changes with remarkable fidelity (as shown in chapter 8), and the projections are based on a range of climate sensitivity values that is supported by many lines of evidence. Furthermore, an entire chapter of the SAR (chapter 5) addresses the question of model evaluation, and assesses how well current models simulate important features of present-day and past climatic states.

Related to the issue of future change, Singer refers to a declaration made by “atmospheric scientists” (few of whom, by the way, are mainstream atmospheric scientists) who do not support what Singer refers to as “the so-called ‘scientific consensus’ that envisages climate catastrophes” and that calls for “hasty [remedial] action.” This is a mischievous straw man; it is categorically not the consensus scientific view. We refer your readers to the SAR for the truth; the report neither invokes impending climate catastrophes nor makes any recommendation for precipitous remedial action.

Finally, Singer has the effrontery to cite his own letter to *Science* (volume 271, page 581, 1996) to support his erroneous assertions—without telling your readers that the points he raised there were all refuted in a subsequent letter (T. M. L. Wigley *et al.*, *Science*, volume

271, page 1481, 1996).

Red herrings like Singer's are better served up in a cookery journal, not PHYSICS TODAY.

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It is legitimate and proper to raise scientific questions about any consensus opinion of scientists, including the one given in the “Second Assessment Report” of the Intergovernmental Panel on Climate Change that we may be seeing “a discernible human influence on global climate.” However, it is troubling to read S. Fred Singer's letter in which he goes on to question the wisdom of having legally binding targets for emission limits for carbon dioxide that would constrain the generation of energy, as called for at the July 1996 conference held in Geneva by parties to the United Nations Climate Treaty. The reason he gives for his questioning is, “Such global controls on energy use would have serious economic consequences, impacting mainly on the world's poor.” He then quotes the attendees at a Leipzig meeting in November 1995 as

having declared that any restriction on energy use that inhibits economic growth "should be viewed with caution."

Three things seem clear to me. First, growth of energy consumption cannot continue indefinitely.¹ Second, by further increasing the annual emission of greenhouse gases, we are continuing a global experiment whose outcome is unknown.

Third, if our activities do bring about changes in the global climate, (a) we don't know if the changes will be reversible, and if they prove to be, we don't know on what time scale; (b) the costs of those changes most likely will not fall on us, but on our children and grandchildren.

Two paths are possible: Either we continue to increase the annual production of greenhouse gases or we reduce their production. With so much at stake, wisdom suggests that we be conservative and choose the path that leaves us in the less precarious position in case we choose the wrong path.

The suggestion that a conservative path would "impact mainly on the world's poor" seems disingenuous for two reasons. One is that a number of recent reports have indicated that the present world path of economic growth is increasing the economic gap between the well-to-do and the poor, both in the US and worldwide. If that is true, the benefits of our present path are increasingly being denied to the world's poor. The other reason is that if continued population growth and economic growth do produce significant changes in the global climate, one can be quite certain that the impact of such changes will fall "mainly on the world's poor."

The most effective way to stabilize emissions of carbon dioxide is to stop population growth. The US has the highest population growth rate of any industrialized nation, and we have the world's highest per capita consumption of resources, especially fossil fuels. Thus, one can make the case that the world's worst population problem is right here in the US. We have the responsibility—and fortunately also the jurisdiction and resources—that allow us to deal with our population problem.²

Accordingly, I propose that we pursue two immediate goals. First, we should stabilize US emissions of carbon dioxide by using improved energy efficiency to achieve at least a 1% annual reduction of the US per capita consumption of fossil fuels, to match the annual 1% increase in US population. Second, we should initiate a national dialogue on the population problem in the US, with the aim of establishing a consensus population policy

for the US that would be an example for the rest of the world.

The first goal should not be so difficult to accomplish. As reported earlier this year, a group called Redefining Progress "scored a major coup in February when it released a statement signed by more than 2,000 economists, including six Nobel laureates, acknowledging climate change as a 'significant environmental, economic, social, and geopolitical' challenge and urging action in the form of market-based policies. Such an approach, according to the statement, would 'slow climate change without harming American living standards, and . . . may in fact improve U.S. productivity in the long run.'"³

References

1. A. A. Bartlett, *Am. J. Phys.* **46**, 876 (1978).
2. A. A. Bartlett, *Wild Earth* (fall 1997).
3. Rocky Mountain Institute Newsletter, **13** (2), 6 (1997).

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Borosilicate Glass Is an Option for Plutonium Disposal

Richard Garwin has brought to my attention a potentially misleading phrase in my PHYSICS TODAY article entitled "Nuclear Waste Disposal: The Technical Challenges" (June, page 32), in which I wrote, "Plutonium does not bind strongly to the matrix of borosilicate glasses, and thus can be loaded only in trace amounts to prevent the possibility of criticality or recovery for illicit uses."

Garwin correctly points out that borosilicate glass can accommodate several percent of plutonium by weight, which is more than a trace amount, and that one of two options for plutonium disposal recommended in a 1995 National Research Council report (*Management and Disposition of Excess Weapons Plutonium: Reactor-Related Options*) is vitrification in borosilicate glass in combination with high-level radioactive waste. My statement was based on ongoing research—sponsored by the Department of Energy—on alternative glass and ceramic waste forms that would permit much higher loadings (up to about 10% Pu by weight) than is currently thought possible for conventional borosilicate glasses.

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