Letters

Nuclear weapons vs. nuclear energy

For the June 2015 issue of PHYSICS TODAY (page 26), Toni Feder interviewed Alexander Glaser, Zia Mian, and Frank von Hippel about their disarmament agenda. I have some comments on that interview and on the book they and Harold Feiveson wrote, *Unmaking the Bomb: A Fissile Material Approach to Nuclear Disarmament and Nonproliferation* (MIT Press, 2014; see the review by Matthew Bunn, PHYSICS TODAY, May 2015, page 50).

In the book, the authors make strong arguments about the virtue of taking every possible measure to ban or make illegal the use of uranium enriched above 20% uranium-235 and other isotopes that are usable to make nuclear bombs.

It is hard to argue against the virtue of trying to undo history as the book and the interview suggest: Restrict or eliminate the use of uranium enriched above 20% and other fissile isotopes that are weaponizable. The ultimate goal is the elimination of all nuclear weapons. Who could say that is not a good goal?

Glaringly missing from both the interview and the book is acknowledgment of the enormous benefits of nuclear energy that were so prominent in the era of Atoms for Peace. Almost 20% of the electrical power people and industries use worldwide comes from nuclear fission, which generates hardly any carbon dioxide and other dangerous emissions and is responsible for far, far fewer deaths per year than all other forms of power, especially fossil fuels. The interviewees essentially ignore that. Also ignored is the issue of alleviating energy poverty; nuclear power technology can address that issue now. With the rising population and its attendant vastly higher energy requirements, people will need to bring themselves out of poverty, especially energy-related poverty. We can anticipate noncarbon energy use expanding greatly in the next century, and nuclear is the one energy source that is expandable for as long as the technology continues to improve.

Richard Rhodes, in his book *The Making of the Atomic Bomb* (Simon & Schuster, 1986), has made the point that since the introduction of nuclear weapons, the worldwide death rate from wars has plummeted, owing presumably to nuclear-armed nations avoiding the direct conflict that had previously been so devastatingly frequent. Authors Glaser, Mian, von Hippel, and Feiveson ignore Rhodes's point.

I find the goal of Glaser and coauthors admirable, but I entreat them to weigh the peaceful uses of nuclear energy when they wage their war against fissile material, and I urge them to consider safeguards and openness. The fissile material and the science and technology used in nuclear bombs also go into civilian nuclear power. I call for supporting efforts to diminish nuclear weapons; at the same time, I support the use of nuclear power with strong emphasis on safeguards and openness. Even as the arsenals of nuclear weapons diminish, the world's population needs to expand per-capita energy use by a large factor to reduce energy poverty. It is hard to argue that such can be achieved without massive use of nuclear power.

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■ **Feiveson, Glaser, Mian, and von Hippel reply:** Our book, *Unmaking the Bomb*, is about the security risks of nuclear-weapon-usable (fissile) material—specifically, highly enriched uranium and separated plutonium. We argue that the production, use, and stockpiling of those materials can and should be eliminated if we are to achieve a safer world. We engage with the issue of nuclear power only in that context.

Although, in principle, nuclear power could make a significant contribution to climate change mitigation, its future currently appears limited. The nuclear share of global electric power generation fell from a peak of about 18% in 1996 to 11% today. Looking forward to 2050, the International Atomic Energy Agency projects this share will keep falling or at most remain constant.[1]

Deploying nuclear power more intensively and widely would require that it be made safe against catastrophic accidents and resistant to possible diversion to nuclear weapons use. That would require public support, nuclear regulators who are protected from political pressure from the industry they regulate, and a much stronger and more equitable nonproliferation regime.

As the controversy over Iran's nuclear energy program dramatizes, safeguards are not sufficient to deal with the risks of nuclear proliferation inherent in today's nuclear energy technology. Even a very small nuclear power program can produce quickly significant quantities of nuclear weapons materials. Ending all plutonium separation and national control of uranium enrichment would be important steps to reduce these concerns.

In summary, phasing out carbon fuels is a priority, but so is preventing the further spread of nuclear weapons and achieving nuclear disarmament.

Reference

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More on femtosecond bond formation

The Search and Discovery news story by Mark Wilson (PHYSICS TODAY, August 2015, page 19) highlighted the exciting results on coherent control of bond formation by Zohar Amitay and coworkers.[1] I have followed that work with great interest. The report emphasizes femtosecond bond formation but does not mention that this process was reported 20 years earlier.[2]

The initial demonstration of femtosecond bond making and the follow-up quantum mechanical calculations[2,3] explained that the ultrashort laser pulse is capable of capturing collision pairs, which, for a short time, can absorb light with frequencies that are not resonant with the colliding atoms or with the bound precursors.

In the context of coherent control of bimolecular reactions, the photoassociation process is useful in establishing the time, orientation, and alignment of the collision that leads to the nascent molecule. Bimolecular laser control without photoassociation had been observed before, most notably in the work of F. Fleming Crim and coworkers, who controlled the bimolecular reaction between semi-deuterated water and chlorine.[4] Those experiments took advantage of the fact that overtone excitation of either the OH or OD bond remained localized long enough to permit selective chemistry to occur following a collision with a chlorine atom. The femtosecond photoassociation and its chirp enhancement—the work highlighted in Wilson's report—bypass the need for long-lived intermediates and promise a fertile new field of chemical investigation.

References

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3. P. Gross, M. Dantus, *J. Chem. Phys.* **106**, 8013 (1997); P. Backhaus, B. Schmidt, M. Dantus, *Chem. Phys. Lett.* **306**, 18 (1999).
4. A. Sinha, J. D. Thoemke, F. F. Crim, *J. Chem. Phys.* **96**, 372 (1992).

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A minor scrape at Wounded Knee

The massacre at Wounded Knee, South Dakota, was a major and inglorious episode in US history that effectively put an end to Indian armed resistance. Given that it took place in 1890, I was puzzled to read in Val Fitch's obituary in the September PHYSICS TODAY (page 63) that "Val 'was born . . . on March 10, 1923 . . . just 20 years after the battle of Wounded Knee.' " That the misinformation is in quotes indicates it comes from something Fitch himself wrote.

The improperly truncated quote, it turns out, can be found in Fitch's autobiographical sketch on the Nobel Prize website. It reads, in part, "my father, Fred Fitch, had acquired a ranch of more than 4 square miles and had persuaded a local school teacher, Frances Logsdon, to marry and join him in living there. They moved to the ranch just 20 years after the battle of Wounded Knee, which occurred about 40 miles northwest." So his parents moved there in 1910, and he was born in 1923.

Purely anecdotally, there seems to be something about the hardy souls who grew up in that time and region that bred outstanding physicists. In addition to Fitch, Ernest Lawrence and Merle Tuve came from Canton, South Dakota, and Robert R. Wilson was born in Frontier, Wyoming. There are probably others, maybe of not quite the same level of renown.

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■ **Smith replies:** We thank Alan Chodos for spotting the error that slipped by us in editing, and we are delighted that he used the opportunity to point out some other great scientists with backgrounds like Val's.

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Tallying Harden McConnell's legacy

In Harden McConnell's obituary (PHYSICS TODAY, September 2015, page 65), the correct number of postdoctoral fellows that McConnell advised was 93. Thus the total number of postdoctoral fellows plus graduate students who received a PhD with McConnell was 172.

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