

I love teaching, and I'm pretty good at it. Many of my days are filled with positive experiences and feedback. But on those days when I am subjected to student hostility, I wonder why I'm doing what I'm doing and how much more I can endure. Certainly, bad teachers exist, but I'm not one of them. I believe those of us who feel most deeply the effects of harassment are the ones who care the most about teaching. I'm tired of trying so hard, in so many ways, and still losing the battle. The workload makes me miss my family. I want to spend time with them in the evenings, on weekends, and on holidays instead of grading papers or preparing lectures or worrying about student demands and complaints.

At work, I am on guard. I'm afraid to talk privately with a student in my office with the door closed. I'm afraid that every word I say or write will be recorded and used against me. I feel demoralized, disheartened, and discouraged. I've experienced anxiety, depression, exhaustion, chronic stress, and stress-related illness. I know of faculty members who have resorted to alcohol and drugs because of student harassment. Some suffer from eating disorders. And I know of at least one who has attempted suicide.

Students who harass college professors should suffer serious consequences. But there are none. Administrators, department heads, and colleagues provide very little support. That lack across academia results in a toxic culture that would be unacceptable in any other industry, as pointed out in the National Academies of Sciences, Engineering, and Medicine study on sexual harassment.² While academia prides itself on being at the forefront of intellectual advancement, it remains one of the most hostile and toxic work environments.

The failure of academic institutions to address student harassment of professors has implications far beyond the learning environment. Our current policies shrug at unacceptable behavior. Because many of my students are in the pre-medicine track, the lack of consequences means that harassers will be treating patients. That can only lead to negative, even disastrous, outcomes.

References

1. A. P. Brabec et al., *Emporia State Res. Stud.* **52**, 1 (2019); A. May, K. E. Tenzek, *Teach. Higher Educ.* **23**, 275 (2018).

2. National Academies of Sciences, Engineering, and Medicine, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine*, National Academies Press (2018).

Name withheld

LETTERS

US-IAEA uranium enrichment safeguards

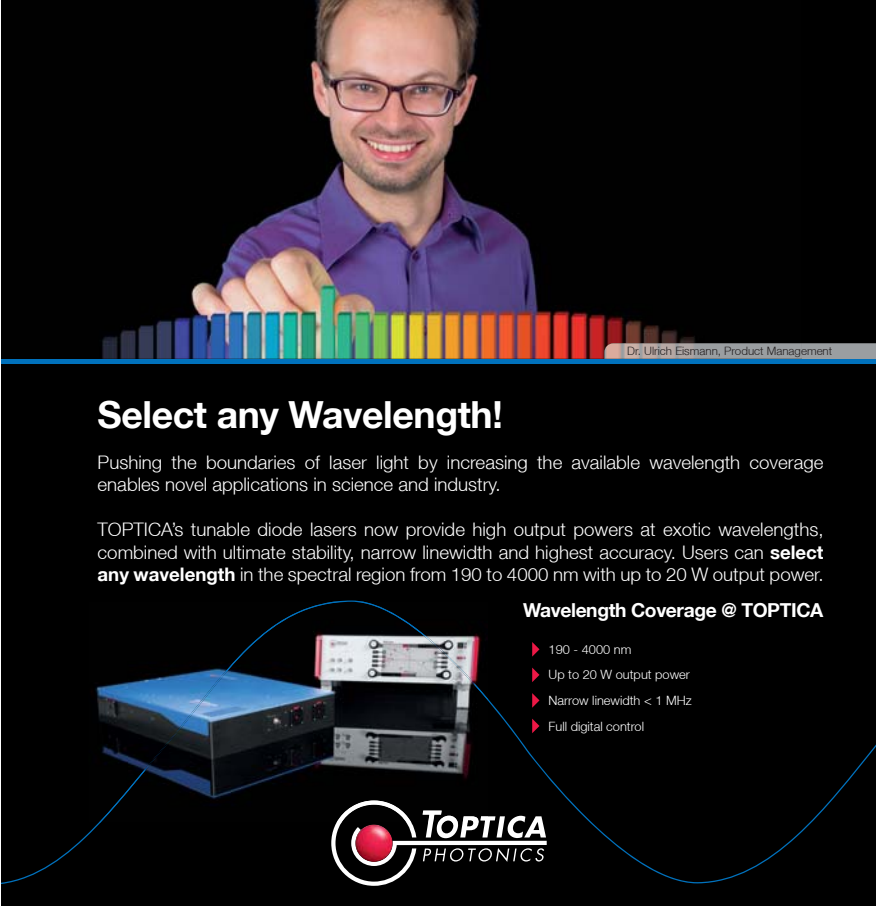
An important safeguards issue related to uranium enrichment plants was omitted from David Kramer's Issues and Events story, "Controversy continues to swirl around uranium enrichment contract" (PHYSICS TODAY, January 2020, page 22).

Kramer notes an assertion by Centrus president and CEO Daniel Poneman that nuclear nonproliferation policy includes a red line requiring a "strict divide between civilian and military programs

and materials." Kramer observes correctly that the line has already been crossed with the production of tritium in US civil nuclear reactors.

As an office director in the Nonproliferation Bureau of the US State Department, I was involved in the interagency decision to allow that production. It was predicated on two assurances from the Department of Energy: that reactors serving that purpose would remain on the list of US facilities subject to International Atomic Energy Agency (IAEA) safeguards, and that if the facility were selected for inspection, the agency's safeguards approach would be the same as used for comparable facilities in non-nuclear-weapons states that participate in the Nuclear Non-Proliferation Treaty (NPT). Note that the US sends the IAEA a list of all US nuclear facilities, excluding those associated with activities having direct national security significance. The IAEA is permitted to apply safeguards to any facility on the list, but it need not do so.

An important nuclear nonproliferation issue is whether the Centrus facilities would be eligible for the application of IAEA safeguards under the US-IAEA



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voluntary offer safeguards agreement. The answer should be yes. One reason is that during the negotiation of the standard NPT safeguards agreement, Australia introduced into the record a statement, which was uncontested, that all enrichment plants in non-nuclear-weapons states would be subject to safeguards regardless of the intended end use of the product material.

Brazil's enrichment facility uses that safeguards approach even though it produces fuel for its naval reactors. The US-IAEA safeguards agreement, in turn, specifies that the IAEA "shall" follow the

same procedures in the US that it uses in applying safeguards "on similar material in similar facilities in non-nuclear-weapon States."

A second point also bears on the relationship between civil nuclear and military activities. In his story, Kramer writes, "US policy stipulates that uranium used for any military purpose, including nuclear fuel, must be enriched using US-origin technology." He goes on to say that a corollary would seem to require that all US commercial reactor fuel be enriched using US nuclear technology since US military bases draw power from the grid.

While that might seem so, in the course of negotiating agreements for nuclear cooperation, the US and its partners have consented to permit transfers to be used for specified military purposes. More precisely, supplying power to military bases is excluded from the definition of military purposes. The agreement with Russia states, for example, that "military purposes shall not include provision of power for military bases drawn from any power network, production of radioisotopes to be used for medical purposes in military hospitals, and other similar purposes as

may be agreed by the Parties." Provisions with the same effect are included in other US agreements for nuclear cooperation.

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Holes in lattices in liquids

In their feature article in the February 2019 issue of *PHYSICS TODAY* (page 38), Robert Evans, Daan Frenkel, and Marjolein Dijkstra quote from "About liquids," an essay in which Victor Weisskopf discusses the mysterious nature of liquids.¹

Around 1960, when I was a graduate student at the University of Washington, the thesis project of one of my fellows was to calculate the entropy of a hole in a crystal lattice. The seemingly quixotic nature of the assignment—"A hole is a nothing. How can it have an entropy?"—led to much merry banter in our group. Today, the idea of holes in lattices is well established.

Evaporation (or sublimation) occurs when molecules on the surface of a condensed phase acquire enough energy to break free, enter the gas phase, and thus achieve unconstrained mobility. Similarly, for crystalline solids, there is a characteristic temperature—the melting temperature—at which the holes become mobile and move freely throughout the lattice. Noncrystalline solids such as rubber and plastics have a range of hole and dislocation types that reach mobility at various temperatures; they soften gradually rather than exhibiting a sharp melting point.

I find that the molecule/hole analogy provides a satisfying way to visualize the phenomenon of melting and the nature of liquids.

Reference

1. V. F. Weisskopf, *Trans. N. Y. Acad. Sci.* **38**, 202 (1977).

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Correction

February 2020, page 21—Edmund Bertschinger of MIT and Mary James of Reed College jointly cochaired the TEAM-UP task force. **PT**

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