the visible-light range of the electromagnetic spectrum. The image presented on page 56 was therefore of visible light rather than of x rays as mistakenly stated.

I hope that this will clarify matters for those readers who might have wondered why a telescope designed for ultraviolet observations might be guided by a fine-error sensor operating in the x-ray region. The IUE obtains observations in the spectral range about 1150–3200Å but not in x rays.

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States of matter

Frederic Kahn's excellent article (May, page 66) makes it easy to understand his enthusiam for liquid crystals. But to identify liquid crystals as the fourth state of matter unfairly elevates them over others studied by readers of PHYSICS TODAY. I presume the first three states of matter are solids, liquids and gases. Surely plasmas, which account for more than 99% of the solar system's mass and are used in fluorescent lighting, spark ignition of gasoline engines, and so on, have a stronger claim on fourth than liquid crystals. The stuff of neutron stars, black holes, and superfluid helium II is clearly not solids, liquids, gases or plasmas in the usual meaning of those terms and thus must also be counted as other states of matter.

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THE AUTHOR COMMENTS: Jay Huebner points out that there are other states of matter which do not fit neatly into the three categories of solids, liquids, and gases. While it might be interesting to select rationally the "fourth state," we would first have to agree on a set of objective criteria. Perhaps another reader would wish to propose some. I'll merely summarize here a few qualifications of liquid crystals.

Liquid crystals flow and take on the shape of their container—a property of liquids—but have a long range (orientational) order—a characteristic of solids. They may also have positional order in one or two dimensions—also characteristic of solids. Hence the widely used designation mesophase.

As for abundance, thousands of known organic compounds have liquid crystalline phases, including soaps and nonionic detergents used every day by readers of this journal. Some authors estimate that as many as 5% of all organic compounds exhibit liquid-crystalline behavior.

Not incidentally, liquid crystals have biological significance. Quarternary phase diagrams involving liquid-crystal phases play an important role in understanding the origins of atherosclerosis and gallstones.[1] Cells and tissues are often liquid crystals or close analogs.[2]

> Liquid crystals stand between the isotropic liquid phase and the strongly organized solid state. Life stands between complete disorder, which is death, and complete rigidity, which is death again.[1]

References

1. D. G. Dervichian, Mol. Cryst. Liq. Cryst. **40**, 733 (1977).
2. Y. Bouligand, "Liquid Crystals in Biological Systems" in Solid State Physics, Supplement **14**, 259 (1978).

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Physicists and nuclear war

I was very pleased to see your June editorial (page 112) urging *physicists* to get involved in teaching the technology of nuclear war to students and the general public and calling on them to exchange relevant teaching materials via the Nuclear War Education Project of the Federation of American Scientists. However, I believe that many universities and colleges will find it difficult to offer a full, regular course devoted just to the science and technology of modern destruction. Such a course, to be viable, must be truly interdisciplinary, offering economics, history, political science, sociology, and so on, and is best taught by interdisciplinary faculty teams. Such teams exist potentially on many campuses, but it is difficult to draw them together and supply appropriate teaching materials. A "bridge" between science and nonscience faculty concerned with the problem of nuclear war appears to be required, as is a link between such teams on different campuses throughout the nation (and the world?).

In the hope of creating such bridges and links, a group of faculty from different universities across the nation, all of whom participated in the nationwide Convocation on the Threat of Nuclear War last November, have organized a new organization: "United Campuses to Prevent Nuclear War" (UCAM for short, based in Suite 1101, 1346 Connecticut Avenue, Washington, DC 20036). Consisting of scientists and nonscientists, we are collaborating with scientist groups, such as F.A.S., U.C.S., and P.S.R., to initiate and produce materials for courses and campus convocations. (We have already participated in the convocations of 22 April on the economics of the nuclear arms race, held on over 300 campuses