methods, I can say that the glass state is not just limited to glass—that amorphous state of polymeric silicon oxide with doping of other oxides, including boron oxide. In fact, all polymers, including those extensively used in daily life starting with organic monomers, show the "mysterious" glass transition.

A study of the glass transition in any polymeric material is necessarily dictated by complex variations in the motions of the polymeric chain segments, which form as sheets, coils, helices, and the like. The glass transition in the case of doped silicon oxides may be ascribed to the conformational changes in the vicinity of the tetrahedral silicon, while in polymers it involves oxygen atoms in the polymeric helices or sheets.

One can draw inferences from the crystal structures of pure silicon oxides such as quartz in that even those crystals enter the glass state upon heating.[1] Then it is very difficult to recover the original crystal with the same characteristics.

When melted, even crystals of sucrose, a simple everyday compound, lead to a glassy state that is far more mysterious than the glass itself.

To understand the underlying principles of the behavior of the glass state, we must use radial distribution functions from diffraction data to study these mysterious glass transitions, particularly in regard to their structural details at the molecular level.

Reference

1. B. D. Sharma, *J. Chem. Educ.* **64**, 404 (1987).

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Many thanks to the authors for their comments about my Reference Frame column. I have just a few remarks in reply.

Ian Hodge and I agree that we still need a deep, first-principles understanding of the remarkably successful Adam–Gibbs formula, in both its original and extended nonlinear versions. It will be interesting to see whether the physical mechanisms underlying the two related phenomenologies are actually the same in their respective regions of validity.

Jeppe Dyre remarks that some basic features of the glass transition are captured by the simple asymmetric double-well model. He clearly understands that there is a great deal more to the mystery than that, and I think he is making his point in an interesting way. Viscous relaxation rates near the glass transition are about 15 orders of magnitude slower than molecular vibration frequencies. As Dyre points out, processes on both time scales are taking place in glass-forming systems. How do we relate one to the other?

I admit I'm puzzled by the other two letters. True, all molecular interactions are ultimately quantum mechanical in nature; but, like most specialists in this field, I see no reason to think that the generic glass transition is intrinsically a quantum, as opposed to classical, phenomenon. Hans-Jürgen Hoffmann seems to imply otherwise. In reply to Brahama Sharma, perhaps it will be helpful to say that when I talk about the "glass transition," I am thinking of metallic glasses, polymeric glasses, and a wide variety of other noncrystalline materials, not just silicate glass.

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Sound commentary

I'm tickled to see that the feature article "Medical Diagnostic Ultrasound" (Physics Today, March 2007, page 44) is by my neighbor, Carr Everbach, and I enjoyed it. He starts by mentioning "sounding" water depths from the sound given by a lead weight hitting the bottom; he also mentions "the propagation time" and that the phrase "to sound something out" is connected.

I'm puzzled, though, since the sound of the sounding lead hitting the soft, muddy Mediterranean Sea bottom would hardly be heard in the air, given the acoustic mismatch. Is there evidence that stethoscopes were held against the ship's hull? Or did someone perhaps press an ear against the hull?

The online edition of the Oxford English Dictionary says that "sound" in this meaning is simply related to water, alas, and not to aural sound. Moreover, the speed of sound in water is so high that the tiny propagation-time interval for sound to travel from the sea bottom is hard to discern. Maybe that interval was the fall time in water, a viscous medium?

Perhaps Carr has other evidence, so I may sleep soundly about this.

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Everbach replies: Leonard Finegold's points are sound on several counts. The "sounding machine" used by the ancient Greeks and for thousands of years thereafter consisted of a lead weight that was thrown overboard, into the sound, tied to a knotted rope. The "propagation time" was the time for the weight to fall at its terminal velocity to the sea bottom; that time was proportional to the length of rope paid out—that is, distance from the source. Thanks for sounding me out on this question, Len!

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Professional kindnesses

In harkening back to life in physics 60 or more years ago, it is useful to look at the American Astronomical Society, whose membership today is about what American Physical Society membership was then.

Chatting recently with an astronomer friend, I was interested to learn that he regularly receives complimentary preprints or reprints from colleagues doing similar research. I cannot recall from my personal experience enjoying that particular form of collegial exchange, but it reminds me of a time when professional relationships were more personal, more cordial, and less competitive.

Preprint exchange strikes me as a social amenity that should be encouraged today to foster friendly personal and professional relationships. It should be a general practice to send preprints or reprints to anyone who has made a significant contribution to one's work and is mentioned, or should have been mentioned, in the acknowledgments.

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Correction

November 2007, page 76—The Physical Science Study Committee was mistakenly referred to as the Physics Science Study Committee. ■