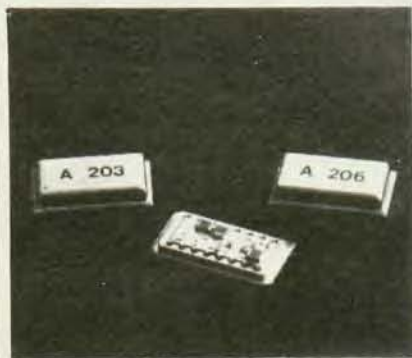


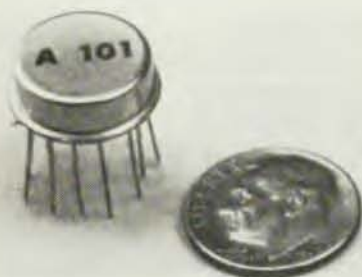
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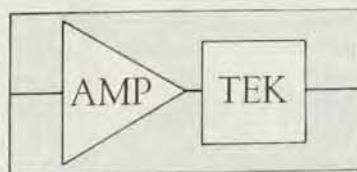
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letters

acoustics for concert halls—a scientific revolution à la Thomas Kuhn—is long overdue. Sabine, as a practical designer, did not trust his theory too much, with brilliant results. We should do as he did, not as he said, and, above all, try to discover why what he did works.

Incidentally, Schroeder's enthusiasm for the electronic auditorium and "assisted resonance" is misleading. No first class hall has any electronic enhancement of "reverberation." In fact, there are only two or three really good halls, and all were built before the invention of the thermionic amplifying valve! There is no better testimony to the wrongness of the theory used since the time of Sabine. We must get the physics of the architecture right before we concern ourselves with fancy electronics; so much should be clear.

Kuhn emphasizes the critical role of perception and conceptualization in scientific revolutions. Where Priestly saw dephlogisticated air, Lavoisier saw oxygen. Where Sabine and his followers, the "normal" scientists of today, perceive a "reverberant field," a few revolutionaries, following Joseph Henry, hear a short sequence of discrete reflections.

Soon we shall know if the revolution succeeds.

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2. J. R. Welty, *Engineering Heat Transfer*, John Wiley & Sons, New York (1974).
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4. J. Henry, *Proc. Amer. Assoc.* **10**, 119 (1856).
5. R. F. Allison, *J. Aud. Eng. Soc.* **22**, 314 (1974).
6. J. B. Lee, *J. Acoust. Soc. Am.* **68**, S26 (1980).

JAMES B. LEE

Portland, Oregon

12/23/80
THE AUTHOR COMMENTS: James Lee's analogy between reverberant sound fields and volume holograms is amusing and not completely misleading: The statistical relationships of randomly interfering waves are rather alike for acoustical and optical fields. In fact, in my course on coherent optics at Göttingen, I demonstrate some aspects of speckle statistics with standing sound waves in the lecture hall—the students being asked to move their heads to "scan" the acoustical interference patterns. However, I fail to see how "The necessity of diffuse reflections in large rooms follows directly from Denis Gabor's theory of information in holography;..." Rather, I believe that necessity follows from the work described in my October article and the references cited there.

Lee's emphasis of the importance of early discrete reflections is quite prop-

erly placed. In modern times, Princeton physicist Joseph Henry was apparently the first to appreciate this and act upon it: His design of a new lecture hall for the Smithsonian Institution was considered highly satisfactory.¹

I also agree with Lee that the potentialities of electronic sound enhancement are no carte-blanc for poor architectural design, although Royal Festival Hall in London has been so saved. Rather, the great advantage of electroacoustics is that it makes *multi-purpose* halls possible: the conversion of a given enclosed space from satisfactory concert hall to intelligible drama theater or lecture hall. A large population center, like New York City, can (perhaps) afford separate buildings for different functions, but the smaller towns of our (or any) country will have, I maintain, much to gain from electroacoustic sound modification.

Reference

1. J. Henry, "Acoustics Applied to Public Buildings", *Smithsonian Reports* (1854 and 1856).

MANFRED R. SCHROEDER

University of Göttingen

Göttingen, F. R. Germany

1/12/81

Quark history

Edward Witten has written a nice article on quarks and the $1/N$ expansion (July, page 38). However, the paragraph where he relates the symmetry group $SU(3)$ to the three colors of quarks is, in a certain way, unfair. This group was largely used when we knew only three quarks, namely u , d and s . Even nowadays we often refer to the "early quantum period" or to the "old quantum period." In the same way proper credit should be given to the "early quantum-chromodynamics period" which led to the introduction of quark color.

GUY FAUCHER

École Polytechnique

Montréal, Québec

8/1/80

THE AUTHOR COMMENTS: There are two $SU(3)$ groups in quantum chromodynamics. There is the approximate (not exact) symmetry among the three light flavors of quarks (up, down and strange). This is the group Guy Faucher is referring to. It is *not* a gauge symmetry. There is also the *exact* color gauge symmetry of QCD, which is also $SU(3)$. This latter group is the one that is important in the mechanism that binds quarks and gluons into hadrons, and it is the *only* group I referred to in my paper. It is only an "accident," not currently understood, that the two groups are both $SU(3)$. The accident is really that the number of colors (three) is the same as the number of light flavors. If the charmed quark

were lighter, so that there would be four light flavors, the flavor group referred to by Faucher would be SU(4); the color group would still be SU(3).

EDWARD WITTEN
Princeton University
Princeton, New Jersey

11/19/80

Quark nomenclature

Although quark nomenclature is certainly picturesque and somewhat entertaining, I think it is unduly inconsistent. Some uses of the term "charm" are in question. "Charm," itself, is consistent with other quark terminology, such as "bare bottom" or "naked beauty," but to describe a quark as "charmed" is not. "Charmed" means "lucky," not "having charm" in the sense of beauty. The term "charming" is the one required for consistency, and I propose that henceforth a quark be described as "charming," not "charmed."

MANNY HILLMAN
Brookhaven National Laboratory
Upton, New York

12/22/81

Sizes of recruiting posters

I would like to suggest that institutions sending out announcements about their graduate programs voluntarily limit the size of their posters informing prospective students about their programs. Over the years the size of the posters has been increasing. Today, I received one 55 cm (22") wide and 48 cm (19") long. This is too wide to fit into our display arrangement. As a result this very nice poster was not added to the information available to our students, since our display area only handles material 28 cm (11") wide.

As graduate students get scarcer, the publicity and recruiting campaigns have intensified, but I believe that it would be to our mutual advantage to limit the size of publicity materials voluntarily to 22 cm (8.5") wide and 35.5 cm (14") long.

JOSEPH E. PRICE
Idaho State University
Pocatello, Idaho

10/27/80

In praise of Eddington

Now that the Catholic Church is reconsidering its "conviction" of Galileo for blasphemy, perhaps it would be appropriate for the scientific community to do likewise—reconsider its conviction of Eddington for insanity. The remarkable humor of the alphas and

pulsar

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