

parties.

The solution to a major problem of national scope obviously cannot be sought exclusively in the activities of a handful of retired physicists. Nevertheless, a relatively small commitment on the part of a few hundred key people could have a very substantial effect. What are needed at this early stage are suggestions for modes of interaction, the identification of potential problems to be solved and barriers to be overcome, and a general sharing of experiences. The process is likely to be a long one. The membership at large of the American Physical Society is a logical place to begin. We invite your responses and participation.

PAUL HORWITZ

Bolt Beranek and Newman, Inc.

Cambridge, Massachusetts

7/83

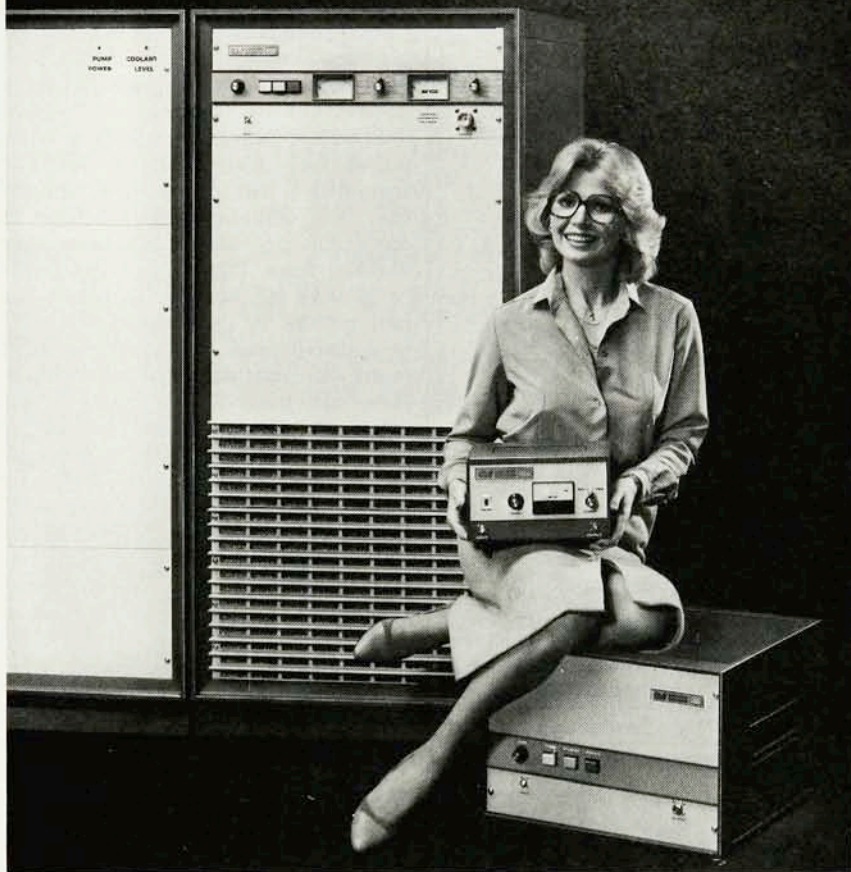
Heisenberg and QCD

I would like to comment on Gerald E. Brown's and Mannque Rho's recent paper "The structure of the nucleon" (February, page 24). At the APS 1982 Spring Meeting in Washington, D.C., Brown gave an invited paper entitled "Structure of the Nucleons."¹ After he delivered his paper, I challenged Brown to defend his QCD arguments. I stated that Werner Heisenberg had argued² that he was afraid that the quark hypothesis was not really taken seriously by its proponents. He pointed out that they do not deal with the mass dynamics of the transformation of mass from energy to the particle spectrum, and that it was irrational to speculate on the division of quarks into subparticles because it would take many times the rest energy of the particles to produce them. I asked him how he would challenge Heisenberg's arguments. He stated that he could not, and that it would be best to ask this of others since he was a nuclear physicist.

In answer to Brown's comment, I have asked other QCD theorists and their supporters how they would challenge Heisenberg's arguments. One prominent particle theorist who presented an invited paper at the same Spring Meeting shouted "No way!" before I could even finish pronouncing Heisenberg's name. In general, this question has had the same sort of devastating effect on all the physicists I've asked it of. Considering Heisenberg's status, it's no wonder that few physicists are willing to challenge his arguments.

Heisenberg did more than argue against QCD-type theories, he also presented ideas on how particle theory should develop. He stated that particles "can be created and annihilated" and "they are not 'elementary' in the

RF power for plasma research.



We're proud to have supplied a number of broadband amplifiers for the Tokamak fusion research project at Princeton University. A 5-kW AR amplifier is being used as an rf pulsing driver in a three-stage cascade which culminates in 2.5 MW of plasma-heating power to the Princeton Large Torus (PLT). Other AR amplifiers, 10 W to 1 kW, perform various rf testing and calibration duties in the Plasma Physics Laboratory.

AR amplifiers are unconditionally stable, immune even to worst-case load mismatch such as infinite VSWR or shorted or open output terminals without damage to themselves or shut-

down of the system. And their full bandwidth is instantly available—no tuning or system adjustments needed for continuous or automatic sweeping.

The chances are very good that we'll have the combination you seek in a broadband power amplifier—clean bandwidth (sub-octave to five decades with top frequencies up to 1 GHz), reliable output power, linearity as needed, pulse capability, adjustable gain—often in a package about half the size of its nearest "competitor."

SEND FOR FREE BOOKLET



7410 © ar



**AMPLIFIER
RESEARCH**

160 School House Road, Souderton, PA 18964
215-723-8181 • TWX 510-661-6094

The Broadband
High-Power
People



PLASMA/FUSION SHOW-BOOTH 34
Circle number 74 on Reader Service Card

PHYSICS TODAY / SEPTEMBER 1983

111

The Source:



Constant Current Source

- Ultra-Stable DC Current Source
- Ideal for Cryo Cal Sensors
- Versatile for General Lab Use
- Current Output: 0.1 μ A to 10 mA
- Two Year Warranty



For information on current sources and cryogenic temperature sensors, come to the Source. Write or call collect

2457 University Avenue
St. Paul, Minnesota 55114 USA
(612) 645-0072
Telex: 955329, TLX SRVC; Attn: CRYCO

Circle number 75 on Reader Service Card

PRECISION CURRENT INTEGRATOR

•

BIPOLAR RESPONSE

•

WIDE RANGE →

•

HIGH SENSITIVITY →

•

ISOLATED DIGITAL OUTPUTS →

RED NUN

INSTRUMENT CORP.

P.O. BOX 100, WESTFIELD, N.J. 07091
(201) 233-5427

Circle number 76 on Reader Service Card

letters

original meaning of the word." He argued for descriptions of particles in terms of "continuous matter" and the different particles as the "spectrum of matter." He states in his closing argument: "In the theory one should try to make precise assumptions concerning the dynamics of matter, without any philosophical prejudices. The dynamics must be taken seriously, and we should not be content with vaguely defined hypotheses that leave essential points open. Everything outside of the dynamics is just a verbal description of the table of data, and even then the data table probably yields more information than the verbal description can." I've followed Heisenberg's lead, and results to date show reasonable qualitative and quantitative agreement with the "particle spectrum" and the four basic forces using simple numerical methods based on mass density, differential density, surface tension, and relative velocity.³ An update paper that includes quantitative results will be published later this year.

References

1. G. Brown, *Bull. Am. Phys. Soc.* **27**, 451 (1982).
2. W. Heisenberg, *PHYSICS TODAY* **29** March, 1976, page 32.
3. B. G. Wallace, R. A. Rhodes, W. F. Block, *J. Clas. Phys.* **1** (2), 17 (1982).

BRYAN G. WALLACE
St. Petersburg, Florida

3/83

Is capitalism to blame?

It's truly irksome and disappointing to witness so distinguished a scholar as Sheldon Glashow (Guest Comment, April, page 9) lapse into the all-too-familiar academic's posture of blaming a problem of our nation on American capitalism (in his letter, Glashow used the code word "marketplace" instead of capitalism). "How is it that the forces of the marketplace have failed us?" he asks, in discussing the decline of US technology. These "forces of the marketplace" are driving our "few good science teachers" into the "arms of US industry," he complains.

Are our faltering industries suffering simply from capitalism? Do science teachers who decide to move to industry respond solely to capitalism? Are the scientific and mathematical illiteracy noted by Glashow in many Harvard undergraduates simply the products of capitalism? I doubt it.

Our economy is a mixed one, composed of substantial capitalistic and government-controlled elements. Thus, industry's capacity to invest in advanced technology and novel products is strongly influenced by interest

rates, which depend on the interactions among key public- and private-sector elements such as the sizes of Federal deficits, Federal Reserve Bank money supply policy, international monetary exchange rates and market competition for investment dollars. The science teacher's decision to transfer to industry may weigh both the attractiveness of the marketplace and the repulsiveness of teaching situations affected by short-sighted legislators, politicized school administrations and misguided social theories. The scientific and mathematical illiteracy of many high-school graduates may owe much more to a lack of student interest and raw capability than to an insufficiency of teachers. (By the way, why does Harvard admit such illiterates to the nation's ruling class?)

Let's try to be very careful to describe our problems accurately and try to avoid simplistic ascriptions of blame for them.

MARVIN KING

Riverside Research Institute
New York, New York

4/83

Limits on knowledge

It seems to me that the last point in Joseph Ford's article ("How random is a coin toss?" April, page 40) is the most profound, and, at the same time, the least appreciated. Our prejudices die hard.

Most people would agree that our knowledge is "stored" somewhere in our brains, and this implies that our knowledge of the external world (assuming that there is such a thing) cannot be complete since our brains are so much smaller. It is not just that there are things we choose not to learn, but that our knowledge of things that we believe we know is incomplete in ways of which we are often not aware. For example, it has been known for a long time that the seemingly infinite variety of colors in all their glory is composed from three primitive responses, and although there seems to be such a variety of colors, no one can tell the difference between the D lines of sodium without an instrument. More recent research on the way in which visual information is processed in the brain reveals that the things we find important are so because of the way our brains are constructed. In many cases things seem obviously different, not because they are different but because we are "wired" to make this distinction. The map in our brains is not in one-to-one correspondence with the external world that it represents, and it cannot possibly be—Plato's illustrations of people living in a cave and trying to discover what the external world is like from shadows on