

He who delays ...can save.

**Modular flexibility is
a money-saving
advantage of
Maxwell's 500 Volt
delay generator.**

You can buy as few delay
modules as you want ...
and expand or change
your system as required
... with Maxwell
Laboratories' Model 40150
Delay Generator. Buying
only what you need as
you need it is a significant
cost advantage ...
here are others:

- NO EXTERNAL SHIELDING
- PRECISION; FAST RISE TIME
AND REPEATABILITY
- HIGH VOLTAGE OUTPUT
- PROTECTED CIRCUITS

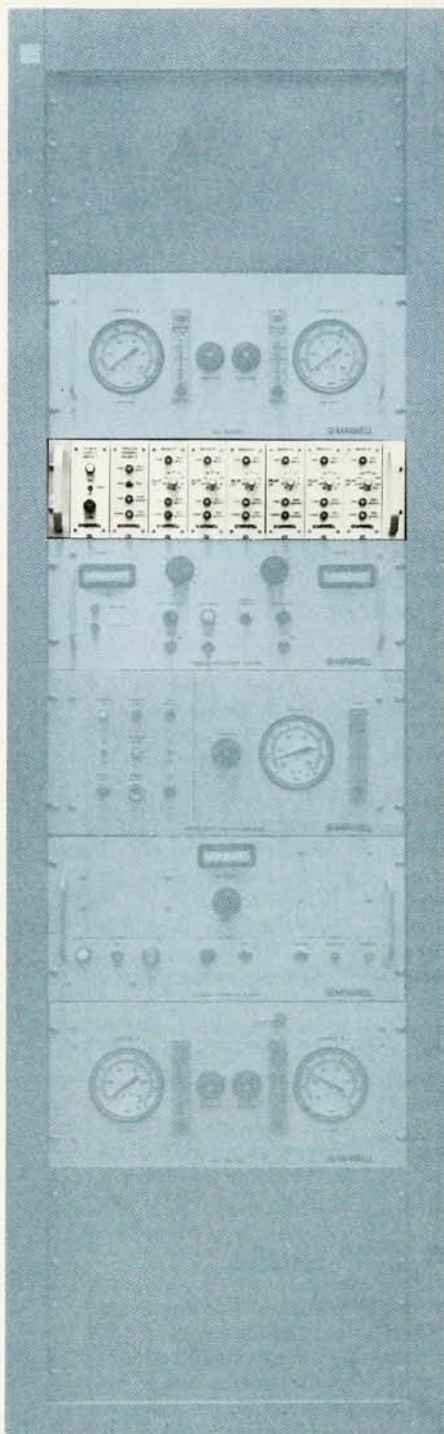
Call
**Jim DeVoss at
(619) 279-5100.**



MAXWELL®
MAXWELL LABORATORIES, INC.

8835 Balboa Ave., San Diego, CA 92123
Phone (619) 279-5100
TWX 910-335-2063

Representatives: United Kingdom, Alrad Instruments, (44) (635) 30345 Newbury, West Germany, Carl Baasel Lasertechnik
KG, (49) 089/527-051, Italy, dB-Electronic Instruments s.r.l., 6469341/2/3, Japan, Densho Kaisha, Ltd., (81) (3) 436-0041,
France, Optilas, (33) (6) 077 40 63, Holland, Optilas B.V., 01720-3 12 34.



letters

invariance." The footnotes 1, 2 are references to articles in *Physical Review Letters*, three issues apart, by the Princeton group and the Illinois group, respectively.

I believe that it should be widely recognized by the scientific community that I communicated by letter with Rene Turlay of the Princeton group our own results, *three weeks prior to the submission* by the Princeton group of their manuscripts to *Physical Review Letters*. I did this because of questioning by Turlay during the spring of 1964 on whether we were observing $K_2^0 \rightarrow \pi^+ \pi^-$ when I would see him during meetings and conferences. In my letter to Turlay, I suggested simultaneous publication of the two results; unfortunately Turlay did not respond for three weeks, at which he informed me that they had just submitted their manuscript.

It has always been a surprise to me that members of the Princeton collaboration have not, to my knowledge, been willing to admit to that communication, irrespective of whether it had an impact upon their own thinking and actions. It has been a further disappointment to me that over the years, members of the group have attempted to downplay the Illinois effort and to essentially re-write history by eliminating reference to the work.

Two years ago, I wrote a paper entitled "CP Violation, the Other View." I will be pleased to send a copy to any individual interested in understanding more completely the history of the discovery of CP violation.

ALEXANDER ABASHIAN

Virginia Polytechnic Institute and State
University

10/82

Blacksburg, Virginia

Nonhomogeneous kinetics

The dynamics of processes in nonrandom systems is an emerging subject in several areas of science, including physics, chemistry and biology. The subject may be called "nonhomogeneous kinetics." It has been applied to processes in radiation chemistry and in model cells (micelles and vesicles) and to structured systems as large as the cosmos. During the introduction of chemistry students to nonhomogeneous reaction kinetics I sometimes use the Shane-Wirtanen map of a million galaxies¹ as an illustration of a nonrandom distribution (a structured system). Although involvement with nonhomogeneous kinetics perhaps gives one an exaggerated awareness of system structure, it has led to the following comments on items that have appeared recently in *PHYSICS TODAY*.

The article by James Phillips on the

physics of glass (February, page 27) contains an electron micrograph of an evaporated film of As_2S_3 that is 600 Å thick. The film is a network of roughly hexagonal and pentagonal domains that are about 1000 Å in diameter, separated by troughs that are about 30 Å wide (~3% of the domain diameter) and nearly as deep as the film. An interpretation of the troughs was proposed by analogy to misfit dislocations at crystalline interfaces. However, every prairie dweller has seen similar domains and troughs on the surface of gumbo that has dried after a rain (see figure). The troughs are due to shrinkage as the water evaporates from the clay structure. The average diameter of the domains is a function of the cohesive strength and brittleness of the material, and of the rate of shrinkage. The average trough width (about 2 mm) in the figure is about 3% of the average domain diameter (about 7 cm), a ratio similar to that in the As_2S_3 film. Pentagonal and hexagonal domains are favored in both materials. The topological model of glass formation seems good, but the nature of a glassy film evaporated onto a rigid support may be different from that of an unrestrained, bulk glass. The troughs in the former are caused by shrinkage on cooling, with the base of the film stuck to the rigid support. In an unrestrained bulk glass, troughs equivalent to grain boundaries should be much less significant and they should be virtually removed by application of a pressure of a few hundred atmospheres.

Domains on the surface of drawn fibers of insulating oxide glasses are caused by the more rapid cooling and hardening of the surface than of the interior of the fiber during drawing. The hardened surface cracks and the domains (scabs) are drawn apart. The domain size and uniformity would be a function of the drawing procedure and the material properties. The disappearance of domain interfaces on silica or silicate glass fibers upon exposure to moisture can be attributed to hydration and swelling of the surface.

Turn now to models of the structure of the universe. Models are constructed to account for the nature, energy and spacial distribution of radiation impinging on the Earth from space. Let us consider the background 3 K radiation and the apparent increase of red shift of light with distance of the source from the Earth (Martin Harwit, November, page 172). For secular reasons, the Big Bang theory appears to be unaesthetic (lacks symmetry, is too limiting in time and space), and may therefore be wrong. Say that the universe is larger and older than assumed in the Big Bang theory by factors of 10^{20} or any other large numbers, and that the average density is similar in each 1



Dried gumbo in the desert near Kairouan, Tunisia, just like that in Saskatchewan.

(Gpc)³ element of volume, then nuclear furnaces at the centers of spiral (and some other?) galaxies would be an acceptable source of the uniform 3 K radiation (this speculation was kindly confirmed by Martin Harwit).

Now consider possible wavelengths and frequencies of density fluctuations in the cosmic fluid. As a very crude approximation, assume that there is a linear correlation between a system's size and its oscillation time. The correlation is roughly true over a 10^{30} -fold span from a carbon-carbon bond vibration in a molecule (10^{-10} m, 10^{-13} sec), through a sound wavelength in air (1 m, 10^{-3} sec), to the Earth-Sun rotation (10^{11} m, 10^8 sec) and galactic rotations (10^{20} m, 10^{17} sec). The model in which the red shift increases with distance out to our detection limit might be limited by the fact that we cannot detect anything far enough away. On a scale that our galaxy is the size of this page in the magazine, the Earth is the size of the nucleus in one of the atoms in the paper. The largest detector covers about 10^{-8} of the Earth's surface. On the galaxy/page scale, the detector that covers 10^{-8} of the nuclear surface has been able to detect bright objects at a distance of 3 km. That's not bad for a puny detector, but there is no reason not to assume that the universe continues by another factor of 10^{10} or some other number.

One of several possible interpretations of the red shifts is that we are in the rarefaction phase of a density fluctuation in the cosmic fluid. Half a fluctuation wavelength away they should be seeing blue shifts. The wavelength of the oscillation would be greater than 2 Gpc and the oscillation period greater than 10^{15} yr. If this model is valid, we have a while to wait before the red shifts change to blue shifts in our neighborhood. (A degree of randomness in the motions should produce a number of Doppler blue shifts even now. Some blue shifts are observed for nearby galaxies [P. S. Wesson, private communication]. The

1983 Award in Science Writing

Physics • Astronomy

Sponsored by
**American Institute of Physics
United States Steel Foundation**

For distinguished writing
about physics or astronomy
in a
newspaper or magazine
or book

Award for a scientist—
physicist, astronomer, or
member of AIP member society

Closes June 10, 1983
(for period of June 1, 1982
to May 31, 1983)

THE AWARD CONSISTS OF:

- \$1,500 Cash Prize
- Moebius Strip
- Certificate

For entry blank—fill in and mail this coupon to:

**Public Information
American Institute of Physics
335 East 45 Street
New York, New York 10017**

Name _____
Title _____
Organization _____
Street Address _____
City, State, ZIP Code _____

NOW AN AMERICAN MADE

IMAGE CONVERTER CAMERA

with proven frame and streak capabilities

- Frame rates from 2000 to 20,000,000 f.p.s.
- Streak rates from 5 mm/millisecond to 2500 mm/microsecond
- Fiber optic output
- Fiber optic coupled intensifier
- Wide range of plug-ins available

THAT'S SURPRISINGLY INEXPENSIVE

For information call or write:

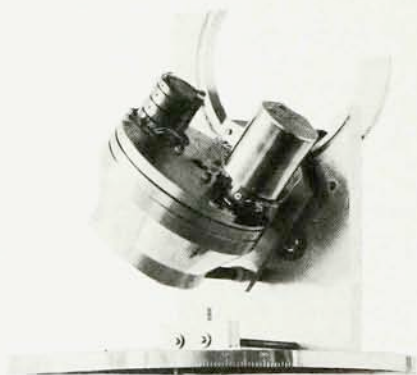
CORDIN

2230 South 3270 West Salt Lake City, UT 84119 (801) 972-5272

Circle number 62 on Reader Service Card

Electron Energy Analysis

XPS
AES
LEED
UVPS
EELS
ISS



Vacuum Science Workshop's Hemispherical Analysers offer you all the latest advances in lens design, fringe field correction and multichannel detection, in compact units designed for ease of fitment to your existing UHV system. With a VSW analyser you can expect exceptional resolution and sensitivity for electrons from a few eV. to several Kev., and advanced features like beam steering, beam dump/alignment aperture and input and output lenses to help you optimise performance. Options to suit your own specific needs include a choice of scan units for low, medium, or high energies, and either single or multichannel detection.

The Technology Shop, Inc.

Box 443, Weston, MA 02193 Tel: (617) 443-9198, Telex 940536.

APS SHOW-BOOTH #83

Circle number 63 on Reader Service Card

letters

ratio of red to blue shifts would depend on whether non-Doppler mechanisms also cause red shifts, on the degree of randomness in the motions, and on the rate of rarefaction in the $(\text{Gpc})^3$ volume element.) The animal that collects the data when the time comes won't be much like us. To look for confirming blue shifts with hope of success during the timespan of our species, which is about 10^6 yr, one should try to look a thousand or a million times farther into space. A target of 1 Ppc seems to fit easily within the allotted time.

Reference

1. E. J. Groth, P. J. E. Peebles, M. Seldner and R. M. Soneira, *Sci. Am.*, **237**, no. 5, 76 (1977), see the 5th and 11th figures.

GORDON R. FREEMAN
University of Alberta
Edmonton, Canada

11/82

Merle Tuve remembered

I would like to add a word of appreciation about the late Merle Tuve (September, page 90), whose personal contribution to turning the tide of World War II was indeed great.

In mid-1940, David Shoenberg and I began work in the Mond Laboratory in Cambridge on an electronic "variable time" anti-aircraft fuse to replace the not very effective clockwork fuses. Our project was not a proximity device but one that picked up an impulse from a muzzle-mounted coil that would enable timing to be adjusted up to the instant of firing.

By mid-1941 we had solved the problem of mounting hot-filament glass-envelope vacuum tubes to withstand the 10^4g initial shell acceleration and the accompanying violent shell vibration, and we had made the device function, after a fashion. However, we suffered in fault diagnosis by having to use the over-water recovery range in the Thames estuary, where the shell touched down at about 12° . This was the critical angle of contact for horizontal ricochet and usually damaged the fuse either by shock or by sea water.

I had by then moved to London to study shell accelerations and vibrations in more detail.

When Tuve had returned to America after paying us a visit to learn our experience, he decided that the answer to damage on touchdown might lie in a vertical recovery range on land. I never knew of his home-made cannon, but heard that he had somehow liberated a half-inch Browning machine gun which he set up on a farm in Connecticut. He used the Browning to study vertical firing to determine the limit of departure from verticality (about 2°)