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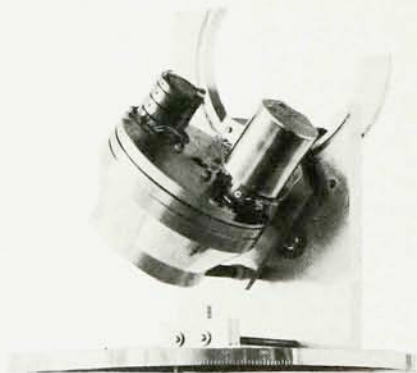
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ratio of red to blue shifts would depend on whether non-Doppler mechanisms also cause red shifts, on the degree of randomness in the motions, and on the rate of rarefaction in the $(\text{Gpc})^3$ volume element.) The animal that collects the data 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
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Edmonton, Canada

11/82

Merle Tuve remembered

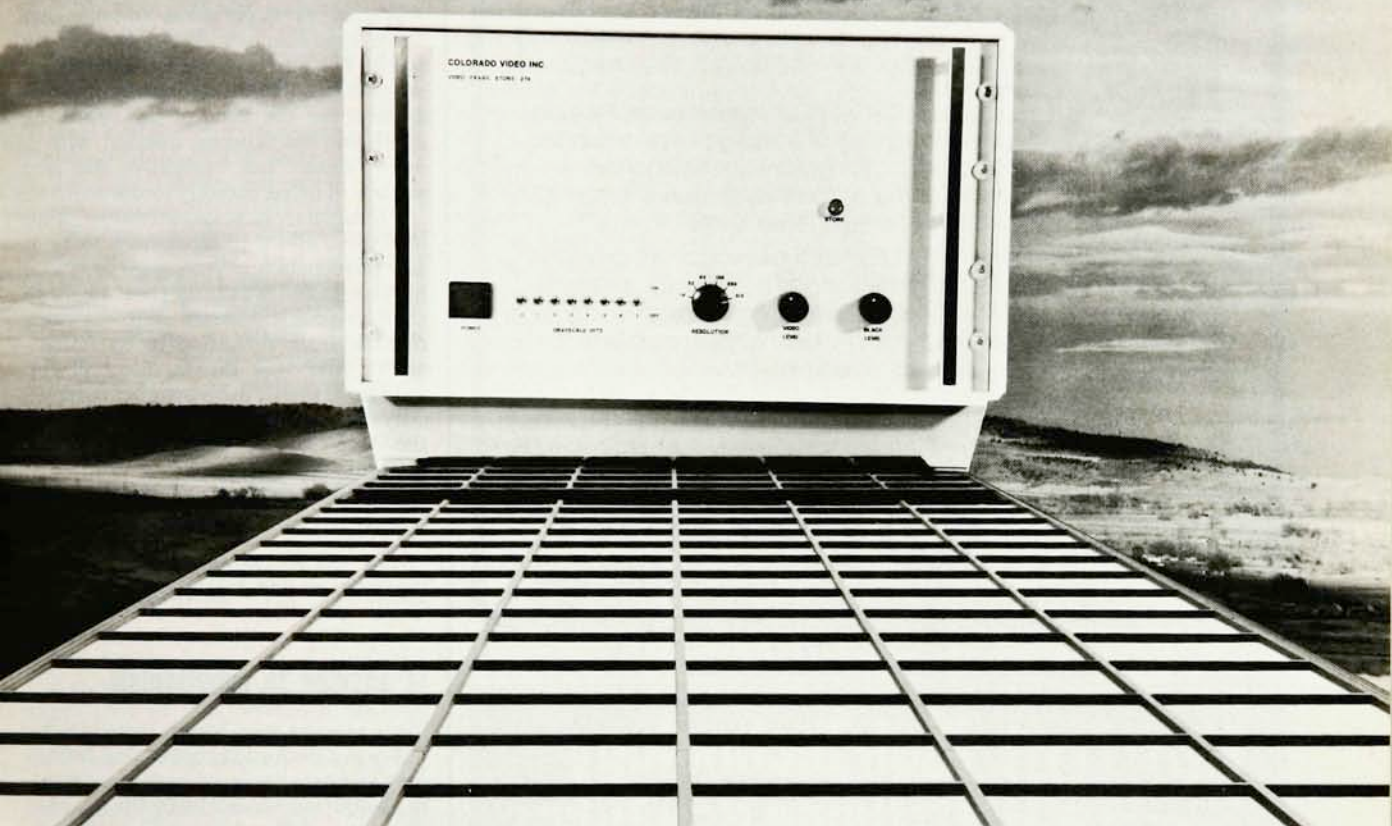
I would like to add a word of appreciation about the late Merle Tuve (September, page 90), whose personal contribution to turning the tide of World War II was indeed great.

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°)



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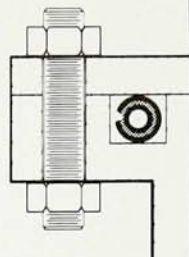
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that would allow the shot axis to remain vertical with base down on landing, thus protecting the fuse in the nose.

He was quickly so successful that we clamored for a similar facility and soon got one near Avebury in Wiltshire. It was quite an experience, and one that Tuve must also have had, to stand near a 4.5" AA gun on a vertical mounting when it was fired and then wait the 125 seconds for the howl of the returning shell and its landing nearby, with a very small but actually non-zero chance of being directly underneath it.

I remember how impressed we were by Tuve's speed in building a team of 150 physicists and engineers to create his true radar proximity fuse. I believe that he took not more than eighteen months from initiation to operation.

The fuse was the memesis of the kamikaze pilots, for whom it was explicitly designed, and turned the course of the war in the Pacific. It was a fantastic achievement.

I never met Tuve again, but I have frequently sung his praises.

JOHN F. ALLEN
University of St. Andrews
St. Andrews, Scotland

11/82

In answer to creationism

Your readers may be interested in the following resolution concerning astronomy and creationism which was recently passed (unanimously) by the Board of Directors of the Astronomical Society of the Pacific.

As scientists and educators, we are concerned that a religious doctrine called "scientific creationism" or "creation science" is being advanced as a scientific alternative to the evolution of the physical and biological world.

Among its many dubious tenets, creationism proposes that the age of the universe is only a few thousand years, an idea that flatly contradicts both the physical evidence that has been accumulating for centuries and its logical interpretation. An examination of that evidence clearly indicates ages for the Earth, the solar system, and the Milky Way galaxy that are vastly older than a few thousand years.

The radioactive dating of materials from the Earth, the Moon, and meteorites shows the age of the solar system to be at least 4.6 billion years. The abundances of heavier elements and the evolution of the great globular clusters of stars show that our galaxy is substantially older. Moreover,