ASTRONOMY

# Edge of Visible Universe

**The 200-inch telescope can look three times farther into space than was thought possible when it was built, another revision of the distance scale shows.**

➤ THE OUTERMOST edge of the visible universe seen through the giant 200-inch telescope atop Mount Palomar is probably three times farther away than was thought only a few years ago.

The astronomical age of the universe, that time in the past when all matter was at one place in space, may be closer to 6,000,000,000 years than the 2,000,000,000 years so recently believed.

The universe is apparently expanding at an even slower rate than has previously been thought. Its expansion, however, is the same in all directions.

Only two years ago, astronomers cut the astronomical yardstick for measuring the universe in half. (See SNL, Jan. 10, 1953, p. 19.) That change still holds for relatively close objects, such as star clusters within our Milky Way galaxy, or the distance to the Andromeda Nebula, a giant starry pinwheel believed to resemble the Milky Way.

For very distant objects, however, a further correction is required, Dr. Allan R. Sandage of Mt. Wilson and Palomar Observatories has suggested.

He told a joint meeting of the Astronomical Society of the Pacific and the astronomy section of the American Association for the Advancement of Science that recent photometric work at Mt. Wilson and Palomar Observatories and Lick Observatory suggested a change of three, not two, for far-away galaxies.

The same studies also suggested the change in the apparent universe expansion rate. It is now thought to be, Dr. Sandage said, about 108 miles per second per million parsecs, compared to 318 miles per second per million parsecs, the value adopted by the late Dr. Edwin Hubble in 1936.

A parsec is the distance that a beam of light, moving at light's speed of 186,000 miles per second, will cover in 3.26 years.

As far as is now known, Dr. Sandage pointed out, "all external galaxies in all directions of space are apparently receding from each other with speeds directly proportional to their distances."

An indicator of the distance to far-away galaxies and clusters of galaxies is the observed brightness of the objects. The more remote these "island universes," each composed of millions of stars and nebulae, the fainter they appear.

Recent measurements have shown that what were thought to be stars in some of these more distant galaxies are actually clouds of glowing hydrogen gas. They have also shown that the apparent magnitude scale is out of line when applied to very faint objects.

When measurements of the brightness of galaxies are combined with measurements of the puzzling "red-shifts" of these objects, astronomers have observations on which to test the expanding universe theory.

The "red-shift" is a displacement toward the red, or longer wave-length, end of the spectrum found in lines from the rainbow-like spectrum of light from distant heavenly objects.

Dr. Sandage reported that Dr. M. L. Humason, also of Mt. Wilson and Palomar Observatories, and Dr. N. U. Mayall of Lick Observatory, Mt. Hamilton, Calif., recently completed 20 years of research charting the "red-shifts" of nearly 800 galaxies beyond our own Milky Way.

The range of measurements now available, Dr. Sandage told the astronomers, covers nearby systems with nearly zero recessional speed to the extremely distant Hydra cluster with an apparent recessional speed of 36,000 miles a second, about one-fifth the speed of light.

The apparent brightness studies were made by Dr. Edison Pettit, another astronomer of Mt. Wilson and Palomar Observatories. This catalogue, combined with the red-shift measurements, for the first time, Dr. Sandage said, provides a basis for testing the expanding universe theory, first proposed by Dr. Hubble in 1929.

The question of the reality of this red-shift, Dr. Sandage said, is still to be solved. It could mean an actual receding velocity. On the other hand, it could mean that, because of some law of nature that is not now known, light loses energy, and thus becomes redder as it travels through space in the course of time.

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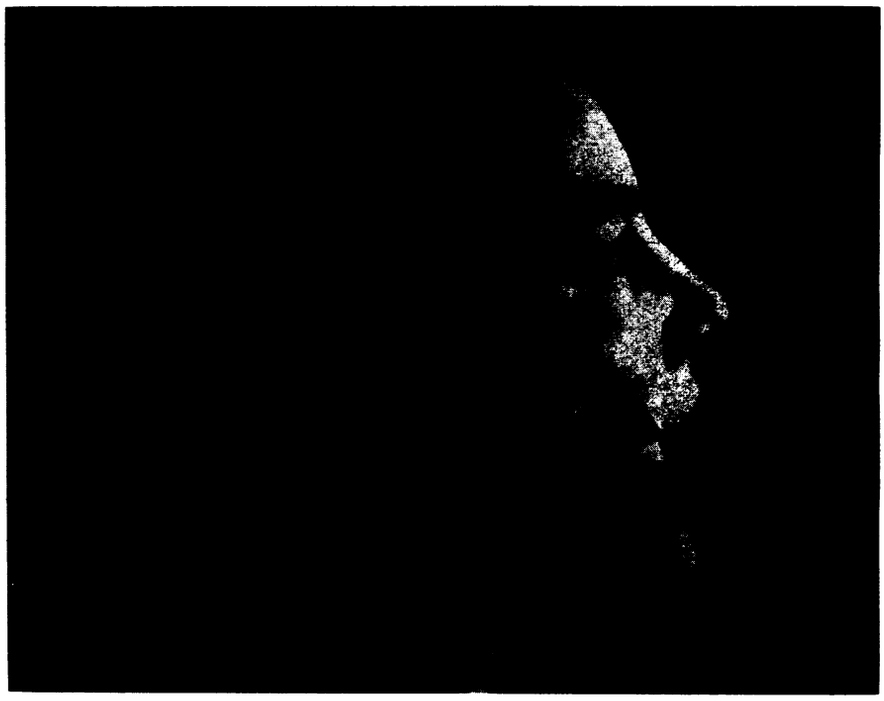
CHEMISTRY

## Gasoline "Sweetening" Speeded by New Process

➤ FASTER "SWEETENING" of gasoline and cleaner auto engines may result from a new process reported by Drs. L. D. Rampino and M. J. Gorham at the meeting of the American Association for the Advancement of Science in Berkeley, Calif.

When gasoline is separated from petroleum, there are often offensive odors in the solution caused by sulfur compounds called



*PHOTOGRAPHY OF SPEECH—This picture, combining X-ray and conventional photography on a single negative, is the result of a new motion-picture technique developed at the University of Rochester. It is used in clinical studies of the mechanism of speech.*