ASTRONOMY

Study Galaxies by Color

Photoelectric observations in eight colors of the galaxies are providing scientists with a new method for studying the rate at which galaxies are receding.

➤ A NEW METHOD for studying the rate at which a very far distant galaxy is rushing away from the solar system and all other galaxies has been developed.

Carnegie Institution of Washington, in its annual report, said the method is based on photoelectric observations of each galaxy in eight colors. It was developed by Dr. William A. Baum of Mt. Wilson and Palomar Observatories, which is operated jointly by Carnegie and the California Institute of Technology, using the giant 200-inch telescope atop Mt. Palomar.

From the eight-color photographs, Dr. Baum reduces the information to show the energy radiated by the galaxy as a function of wavelengths of light. Galaxies are clusters of uncounted billions of stars. The Milky Way, in which the sun, earth and other planets are located, is only one of the millions of galaxies that can be found in the universe.

Each galaxy seems to be rushing away from every other galaxy at a rate that increases with distance, except that the rate appears to slow down at the extreme edge of the observable universe. The rate of recession is measured by the shift in the galaxy's light toward the red end of the spectrum. Known as the redshift, this is equivalent for light to the lowering in pitch of a train whistle as a train recedes from the hearer.

The phenomenon is also known as the Doppler shift.

For a galaxy having a redshift, Dr. Baum has found that the entire energy-distribution curve he plotted by eight-color photometry is also shifted toward longer wavelengths. The eight-color photoelectric observations also provide a direct measure of the magnitudes of the remote galaxies.

Dr. Baum's method allows determination of the redshifts for galaxies considerably beyond the range that can be reached with the spectrograph. This is because the displacement of the energy-distribution curve for a distant galaxy compared to that of a relatively nearby galaxy is a measure of the distant galaxy's redshift.

Redshifts as large as four-tenths of the speed of light, or nearly 75,000 miles a second, have been found. This is nearly double the largest definite redshift obtainable from spectroscopic observations.

Dr. Baum concludes that the limiting factor for observing the universe with the 200-inch Hale telescope may well be the redshift of the light from the distant galaxy into the far infrared, where photographic plates are no longer sensitive, where absorption of the light by the earth's atmosphere is large and "night-sky" radiation is strong. Previously, astronomers have thought the falling off of light because of increasing distance was the limiting factor to the distance to which the Hale telescope could observe.

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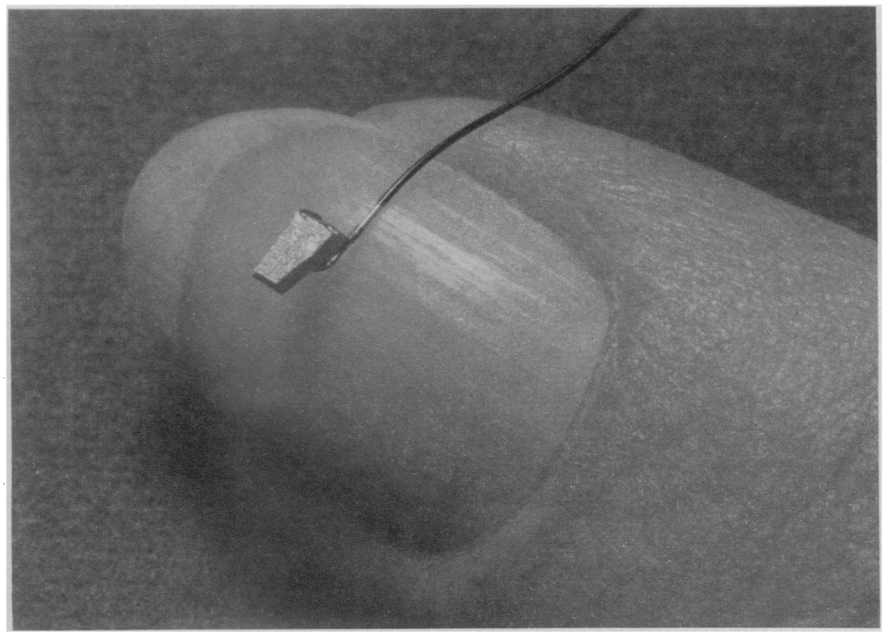

NEUTRON "DETECTIVE"—A neutron detector consisting of a piece of germanium or silicon with approximately a millionth of an ounce of uranium-235 on its surface counts the electrical pulses emitted in the splitting of uranium atoms by neutrons. Function of the detector, developed by Westinghouse scientists, is to map the pattern of neutrons inside the intricate core of a nuclear reactor or "atomic furnace," thus permitting improved reactor design.

ASTRONOMY

Milky Way Found Part of Supercluster of Galaxies

➤ THE MILKY WAY in which the sun, and the earth and other planets are located is part of a supercluster of local galaxies, a United States astronomer reports.

Dr. Gerard de Vaucouleurs of Harvard College Observatory, Cambridge, Mass., says this super-system of galaxies is composed of an irregular assembly of galaxies, clouds and clusters dominated by the Virgo cluster at its center.

Lowest on the rung of this new astronomical hierarchy are the stars, of which the sun is the best known example. Billions of stars are grouped into congregations known as galaxies, one of which is the gigantic pinwheel of stars called the Milky Way.

Galaxies are the second rung.

Grouped about the Milky Way is the local cluster of galaxies, including the two Magellanic clouds. Such a cluster is the third rung.

Next highest are the clusters of clusters of galaxies, the fourth rung in the astronomical hierarchy suggested by Dr. de Vaucouleurs.

They are also known as second-order clusters, and average some hundred million light years across and billions of light years away from the local supercluster, the Milky Way. A light year is the distance covered in one year by light traveling at 186,000 miles per second.

The local supercluster that includes the Milky Way has a total mass a million billion times that of the sun, Dr. de Vaucouleurs has calculated.

His theory concerning the existence of second-order clusters of galaxies is based on a general catalogue of the radial velocities of galaxies from studies at Lick Observatory and Mt. Wilson and Palomar Observatories in California by Drs. M. L. Humason, N. U. Mayall and A. R. Sandage.

Dr. G. O. Abell, astronomy professor at the University of California at Los Angeles, will report in a forthcoming issue of the *Publication of the Astronomical Society of the Pacific* his estimates of the average size of some distant superclusters. These agree well with the estimated diameter of the local supercluster, Dr. de Vaucouleurs reports in *Nature* (Nov. 29).

Some astronomers have questioned the existence of the groups of galaxy clusters. More detailed counts of galaxies and their distribution in space are now underway to settle the question.

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