physical sciences

Anomalous redshifts in some normal galaxies

In estimating the distances to various parts of the universe astronomers have traditionally proceeded by measuring the redshift in the light of the object. The assumption has been that the redshift is due to velocity in the line of sight and that the velocity is proportional to distance.

Lately observers have cited several objects where the redshift does not seem to be due solely to velocity, but up to now the anomalies have been in very peculiar objects. In the Dec. 31 NATURE Toivo Jaakkola of the University of Helsinki reports that a study of some normal galaxies shows possible redshift anomalies in them.

Jaakkola studied groups, pairs and clusters of galaxies, comparing the redshifts of individuals with those of the systems the individuals were in. He found that galaxies of classes E, SO and Sa have less redshift than their systems, while Sb and Sc ones have more. He says that this could indicate some kind of redshift effect that depends on galaxy type.

Centaurus XR-3: A young neutron star?

Many theorists now agreee that the radio pulsars are rotating neutron stars. In the Dec. 24 NATURE R. N. Henriksen, P. A. Feldman and W. Y. Chau of Queen's University in Kingston, Ontario, propose that the pulsating X-ray source Centaurus XR-3 is also a neutron star, but a younger one than those of the radio pulsars.

The radio-pulsar model attributes the periodicity of the signal to a lighthouse effect: The star's rotation periodically carries an emitting spot across the line of sight. In contrast the X-ray model supposes that the fluctuation period of the X-ray emanations of Cen XR-3 is caused by nutation, a regular wobbling of the star's rotation axis. In this picture, the line of sight nearly coincides with the star's rotation axis instead of being more or less perpendicular to it as in the radio model. As the axis wobbles, the observer gets different views of hot spots on the surface, and this causes the pulsation in the X-ray signals received.

The existence of the hot spots is attributed to strains in the crust of the neutron star caused by precession of its rotation. The strains convert part of the rotational energy to heat.

The theory leads to an estimate of 370 years for the age of the neutron star. Radio-pulsar neutron stars are supposed to be thousands of years old.

Photochemistry of interstellar space

One of the questions raised by the existence of clouds of interstellar molecules is where the molecules are formed. They appear mostly in the interstellar dust clouds, and the question is: Are they formed there or do they form in the envelopes of certain stars?

A part of the answer can be supplied by determining whether the compounds in question can survive the impact of the general galactic light long enough to migrate from other places into the dust clouds. (Once they are in the dust clouds, the shade cast by the dust tends to protect them.)

Survival depends on three factors: the rate at which a molecule absorbs light, the probability of its being dissociated by the energy absorbed, and the energy density of the background.

A group from the Goddard Space Flight Center led by L. J. Stief subjected samples of formaldehyde, ammonia, water, methane and carbon monoxide to a light flux equal to what they consider the best measurement of the interstellar background. They report in the Jan. 1 ASTROPHYSICAL JOURNAL that the first four molecules all show lifetimes less than 100 years. That of carbon monoxide is between 100 and 1,000 years. From this the investigators conclude that it is unlikely that the molecules were formed elsewhere than in the clouds where they are found. (Their lifetimes in the shade of the clouds are on the order of a million years.)

Methane and the albedo of Uranus

The albedo of a planet measures the amount of incident sunlight that it reflects. The albedo may vary from wavelength to wavelength, the brightness at each wavelength being determined by selective reflection or absorption by substances in the planet's atmosphere or on its surface. Albedo studies are thus one way of trying to find out what substances are present on a planet.

Working at the Kitt Peak National Observatory, A. B. Binder and D. W. McCarthy Jr. of the IIT Research Institute in Tucson, Ariz., measured the albedo of Uranus at 10 infrared wavelengths. They report in the Jan. 1 ASTROPHYSICAL JOURNAL LETTERS that the distribution of reflected energy by wavelength is similar to laboratory studies of methane and to observations of Titan, Saturn and Jupiter, where methane dominates the albedo in this part of the spectrum. They suggest that light in this range (0.90 to 1.62 microns wavelength) is reflected from a thin layer of solid methane crystals high in the Uranian atmosphere.

Moving magnetic bubbles

Magnetic bubbles are cylindrical domains that form in certain ferromagnetic materials when a magnetic field is applied from outside. The magnetic fields of most of the atoms in the material line up with the external field, but those in the bubbles line up in the opposite direction. The bubbles retain their shape and can be made to move through the material by applying another signal field that can be generated by electrical circuit elements outside the ferromagnetic material (SN: 5/8/71, p. 318).

This ability to move on command makes the bubbles prime candidates for use in data storage and processing, and researchers in various parts of the world are working toward that end. A team at the Philips Research Laboratories in Eindhoven, the Netherlands, has now found out how to make the bubbles move more easily than was possible before. It is done by imposing still another magnetic field, an alternating one. In the presence of both the original forming field and the alternating field the bubbles do not move, but when the signal field is applied, they move more easily than they would without the alternating field. The improvement may contribute to more efficient data processing some day, but the present work is still basic and far from application in devices.