physical sciences notes

X-RAY ASTRONOMY

Power output found for X-ray star

The power output of the stellar X-ray source known as Cygnus XR-2 has been calculated by two California astronomers to be, in X-rays alone, some 1,000 times the total power radiated by the sun in the entire spectrum.

Their calculations are based on optical spectrograms taken with Lick Observatory's 120-inch telescope, the world's second largest. The observations confirm an earlier suggestion by Dr. Roger Lynds of Kitt Peak National Observatory and Dr. E. M. Burbidge of the University of California, San Diego, that Cygnus XR-2 is a double star.

Because of the very short orbital period of about five or six hours, the two stars revolving around a common center of gravity appear to be nearly in contact. One of the objects is a star with a temperature and radius similar to that of the sun.

Since the absolute rate of emission of light and heat from a star like the sun is known, the distance to the Cygnus source could be calculated by comparing the apparent brightness of the star and the sun. Cygnus XR-2 is between 1,500 and 2,000 light years away, Dr. Robert P. Kraft of Lick and Dr. Marie-Helene Demoulin of the University of California, San Diego found.

Of the 40 X-ray sources (SN: 7/22/67, p. 77) thus far detected from rocket and balloon flight, only a few have been identified with objects photographed in light telescopes, and this is the first for which distance has been measured.

HIGH ENERGY PHYSICS

Particle decay not symmetric

Experiments with the Stanford Linear Accelerator confirm that the decay of the K-zero particle is inexplicably slightly asymmetric, though less so than an earlier, faulty experiment indicated.

The results suggest that in weak interactions, such as the decay of subatomic particles, nature can tell the difference between left and right and positive and negative charge. Physicists had thought that the combination of the two qualities, called charge and parity or CP, would be symmetrical.

The first experiment showing asymmetric K-zero decay was carried out by a Princeton University team, but the very small asymmetry measured puzzled the researchers. Charge asymmetry in the stronger electromagnetic forces of the particles was suggested as the cause of the asymmetry, but experiments on other particles to show charge asymmetry in electromagnetic reactions were contradictory.

Reporting to the University of Miami's High Energy Conference last month, Dr. Melvin Schwartz of Stanford said early results showed what appeared to be an asymmetry of five percent. But it was discovered that a heavy block of iron used in the experiment to slow down some particles had once been picked up by an electromagnet and magnetized; the extra magnetic field was distorting his results. When lead replaced the iron, a very slight asymmetry was measured. The question still remains whether the discrepancy comes from CP invariance or electromagnetic forces.

Dr. Schwartz almost published the five-percent result, but is glad he didn't because the next journal would have seen fifty theoretical papers explaining why it happened. "I wrote one myself," he said.

ION MICROSCOPY

Single atom photographed, identified

A powerful new tool for finding ways to make better alloys, a field ion microscope combined with a spectrometer, has been developed by Prof. Erwin Müller and his associates at Pennsylvania State University.

The FIM atom probe can focus on a single atom, separate it from thousands of surrounding atoms and then identify it, making the instrument highly desirable for the atom-by-atom study and analysis of metals, alloys and their impurities.

The new instrument represents a major modification of the field emission microscope invented by Prof. Müller in 1956. With it he first photographed an atom, but the atom could not be identified chemically.

This has now been achieved by combining the FIM with a time-of-flight spectrometer. The atom being examined is evaporated from the whisker tip on which it is viewed; the time it takes the ion to drift through the yard-long spectrometer identifies it as iron, tungsten, or molybdenum.

ASTROPHYSICS

Apparent bridge from the Milky Way

The first indication of any long-period connection between the Milky Way galaxy and the neighboring Small Magellanic Cloud may have been detected by Dr. Fritz Strauss of Carnegie Institution's Department of Terrestrial Magnetism.

Dr. Strauss searched for a bridge of neutral hydrogen between our galaxy and the Magellanic Clouds, with the 100-foot radio telescope of the Institute Nacional de Radioastronomía at La Plata, Argentina.

He was able to trace an arm of hydrogen extending from the outer spiral of the Milky Way through at least 60 degrees of galactic longitude—about half way to the Cloud. Measurements of the arm's velocity and position strongly suggest a connection.

Also described in Carnegie's Report of the President for 1966-67 is an experiment aimed at testing whether or not a method could be developed for measuring the lifetimes of excited ions, necessary for determining the abundances of elements in stars.

In the experiment, a beam of sodium ions from a Van de Graaff accelerator passes through a thin carbon foil. The emerging atoms may be in any charge state from neutral to completely ionized. If excited, the atom will radiate as if it were a free atom.

The glowing beam that has passed through the foil is imaged on a lens and the image then passed into an image tube spectrograph. Only preliminary data are yet available, but they give evidence that a new field of atomic studies relating to cosmological problems has been opened.