PHYSICS

'Wild' Atomic Reactions

Wild gravity reactions provide fuel for the most gigantic explosive outbursts in space that produce some of the brightest objects known in the skies.

➤ "WILD" GRAVITY reactions, a hundred times more powerful than even the thermal fusion in a hydogen bomb or in a star like the sun, are the fuel for strange heavenly objects discovered during the past year.

These wild gravitational reactions lead to very violent stellar events—the most gigantic explosive outbursts in the universe, Dr. Fred Hoyle of Cambridge University, England, told the American Physical Society meeting in New York.

The mammoth heavenly blasts occur when a very large mass, such as 100 million times that of the sun, is concentrated in a very small region of space, such as a light year, Dr. Hoyle reported.

A light year is the distance covered in one year by light traveling at 186,000 miles a second, or six million million miles. By the standards of the vast spaces of the cosmos, a light year is a short distance.

Some of the objects in which violent events occur are optically visible and are among the brightest and most distant objects known.

Besides these, there are also violent events in which huge energies are spewed forth in the form of particles moving at speeds close to that of light. Such emission, Dr. Hoyle said, takes the form of a directed jet or jets, often two jets in opposing directions. These jets most likely came from an explosion of a single object.

Although the sun and similar stars are supported by pressure, other forces play a role for these massive objects concentrated into small volumes.

Rotation appears to be the most important of these other forces, and it could cause a break-up of the extremely large mass into smaller although still very massive objects in which the wild reactions take place.

When the extremely large masses collapse to the stage where their inward velocity becomes comparable to that of light, Dr. Hoyle said, several things may happen.

One is that the mass might split into pieces, thus accounting for the jets. Another is that the object might disappear from the viewpoint of the external observer, leaving its gravitational field behind. A third possibility is that the the object would settle down into a series of pulsations.

The strongest energy source known is gravitational collapse, which can yield more than a hundred times the energy for the same amount of mass as do nuclear fusion reactions.

Sources of radio waves in the heavens and the cosmic rays bombarding earth from space, Dr. Hoyle noted, "seem to be clear indications" that gravitational energy is actually being converted to particles moving with near the speed of light.

There is some new evidence from the Russian astronomer, Dr. I. S. Shklovsky, Dr. Hoyle said, that the Milky Way galaxy in which the sun, earth and other planets are located has undergone such a massive superstar explosion.

Dr. Shklovsky's observations concern the spurlike structures above and below the plane of the galaxy that are strong sources of radio waves. The halo surrounding our galaxy, Dr. Hoyle suggested, is a remnant of that event and was not there when the galaxy was formed.

Two of the objects in which gravitational collapse may be taking place are known as 3C48 and 3C273. Another, M-82, Dr. Hoyle termed a very small-scale explosion, a minor example compared to the other two.

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Exploring Atom Structure

➤ A NEW WAY of exploring atomic structure has been devised by National Bureau of Standards scientists by combining "black" light with speedy electrons.

The information gained by using this double-edged tool for finding how the atom is put together is of great importance to:

1. Space research, because the light used is the same as that met by satellites and space probes in their journeys.
2. Studying control of nuclear fission.
3. Improvement in long-distance radio communications, giving clues to understanding the nature of the earth's far-out atmospheric layers that act as radio-reflecting mirrors.

The "tool" is actually two new research methods used in combination. The partnership opens a field of physics that until now has remained almost entirely unexplored, the American Physical Society meeting in New York was told.

One of the new methods makes use of ultraviolet light of very short wavelength produced in the Bureau's 180-million-electron-volt atom smasher for electrons. This light, similar to the ultraviolet light given off by the sun, is so short that, unlike the kind causing sunburn, it is absorbed by the earth's atmosphere and never reaches the surface.

The other technique is a means of accelerating and controlling electrons so that they travel at nearly identical speeds, then using these tiny particles of negative electricity to probe the behavior of electrons making clouds around the atom's nucleus.

The electron structure of the atom is responsible for its physical and chemical properties—color, hardness, taste and ability to combine with other atoms to form compounds.

Combining the two techniques allows scientists for the first time to study how atoms and molecules behave in the so-called intermediate energy range. This range extends roughly from energies of 10 to 1,000 electron volts.

It thus lies between the range involved in common chemical reactions, on the low side, to energies involved in nuclear and X-ray phenomena, on the high side.

The first results of the National Bureau of Standards work consist in the discovery and partial analysis of new atomic energy levels. Many of these levels belong to previously unknown negative ions.

The ultraviolet technique was developed by Drs. Robert P. Madden and Keith Codling. The electron method was devised by Drs. John A. Simpson, C. E. Kuyatt and S. R. Mielczarek.

Theoretical interpretation of the experimental results is being conducted by Drs. U. Fano, John W. Cooper and F. Prats.

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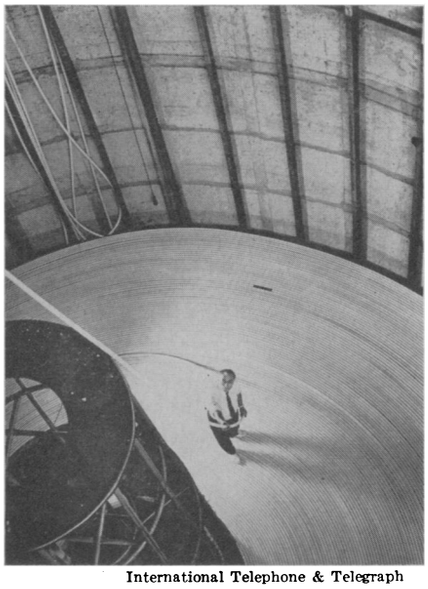

International Telephone & Telegraph

MILES OF CABLE—Miles of undersea telephone cable are coiled in a giant tank at the British affiliate company of International Telephone and Telegraph Corporation, Southampton, England, to be tested underwater at controlled temperature.

Blasts Used in Research

➤ EXPLOSIONS of atomic bombs, such as those now being detonated in Nevada, can be used for basic scientific research as well as weapons development.

Developing a nuclear device with a blast that would form new elements heavier than any so far made by man is one aim of the tests. Scientists are optimistic about prospects for accomplishing this, Dr. George A. Cowan of the Los Alamos Scientific Laboratory, Los Alamos, N. Mex., reported to the American Physical Society meeting in New York.

Dr. Cowan said that ways of making the high concentration of neutrons needed