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.

• Science News Letter, 85:83 Feb. 8, 1964

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.

• Science News Letter, 85:83 Feb. 8, 1964

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

to synthesize heavy elements are being tested in the current series of nuclear blasts. One reason these attempts have not succeeded so far is that the explosions have been relatively small in order to confine them underground.

New knowledge about earthquakes is another area in which nuclear explosions add to basic understanding. Dr. Cowan reported. Underground blasts concentrate a known amount of energy at a certain spot and time in a known earth layer. Seismologists can then compare the record made on their instruments by such a blast with the records made by actual earthquakes.

These studies could also help in detecting clandestine underground nuclear tests should they be banned.

• Science News Letter, 85:83 Feb. 8, 1964

Glass Changes Color

➤ GLASS WALLS with automatic sunshades built into them are foreseen with a new kind of glass now being tested for commerical production.

The chemical shade is produced when light floods this glass. It could be used for:

1. Windows in stores and homes.
2. Glass-walled office buildings.
3. Space vehicles.

The new kind of glass darkens when light shines on it and clears when the light source is removed.

The color-changing ability is due to submicroscopic crystals of silver halide spread throughout the glass. The crystals are so tiny they do not affect transparency of the glass, although they do react to light.

Silver halide crystals are also the darkening agents in photographic emulsions, but the crystals there are very much larger. Photographic crystals are irreversibly decomposed by light to form a silver image, so cannot change back again.

Dr. S. Donald Stookey, director of fundamental chemical research at Corning Glass Works, reported the invention of the self-tinting glass to the American Physical Society meeting in New York. He developed the light-sensitive materials with Dr. William H. Armistead, a Corning vice president.

The new class of glass is still in the laboratory stage and not yet available commerically. The glasses keep indefinitely their ability to darken quickly and then clear.

Light in the invisible near-ultraviolet produces the darkening, which can occur in sunlight in only a few seconds. A typical glass darkens in daylight but is clear under normal indoor lighting. Some glasses recover transparency in minutes, while others require hours, Dr. Stookey said.

When darkened, the glass becomes neutral gray, brown or purple in color. Some samples, Dr. Stookey said, have become so dark that only one percent of the light comes through.

The new glasses are called "photochromic" because of their ability to change color in light.

Photochromic action can be controlled in a piece of glass so that only part of it darkens, even when the entire piece is exposed to light. This is done by treating a selected portion during manufacture.

The photochromic materials are true glasses. They can be made transparent or opaque, are chemically inert, non-porous and rigid. They can be ground and polished and shaped in various forms.

• Science News Letter, 85:84 Feb. 8, 1964

New Nuclear Particle

➤ A STRANGE INHABITANT of the atomic nucleus, so new it has not been permanently named, has been discovered among the debris resulting when matter and anti-matter collide. It is somewhere between 30 and 50 in the list of so-called "fundamental particles."

The new nuclear particle is temporarily named "b-star," indicating that it belongs to the class of matter called bosons and exists only in an excited, or high-energy, state. It was found while analyzing particles that were produced when a beam of energetic anti-protons smashed into protons, in the synchrotron at Brookhaven National Laboratory, Upton, N.Y.

Discovery of the "b-star" was reported to the American Physical Society meeting in New York by Dr. T. Ferbel of Yale University. The fleeting lifetime of the new particle is not known but it is believed to be less than a ten-billionth of a second.

Only known property of the b-star is its mass, which is equivalent to 560 million electron volts, the units physicists use to measure mass.

A particle that may be the same as the b-star has been found by an international team of scientists using the powerful CERN atom smasher at Geneva. However, they measure its mass as 570 to 580 million electron volts, instead of 560.

This CERN particle was discovered by hurling a beam of negative pi mesons having a high energy of 12 to 18 billion electron volts into protons, Dr. David Caldwell, now at Princeton University, reported.

The CERN studies were done by Drs. Ernst Bleuler of Purdue University, L. W. Jones of the University of Michigan, and Drs. D. Harting, W. C. Middlekoop, B. Zacharoz and B. Elsner of CERN.

Working with Dr. Ferbel on the anti-proton studies were Drs. J. Sandweiss and H. Taft, also of Yale; Drs. M. Gailloud, T. W. Morris and W. J. Willis of Brookhaven National Laboratory and Drs. A. Bachman, P. Baumel and R. Lea of City College of New York.

• Science News Letter, 85:84 Feb. 8, 1964

TECHNOLOGY

Roadside Transmitters Aid Motorists

➤ ROADSIDE radio transmitters on freeways for communication with persons driving on the freeway may help to reduce hazardous highway conditions, two Georgia Institute of Technology researchers reported in Washington, D. C.

The transmitters were used successfully to broadcast accident information, hazardous driving conditions, and general maintenance and route information on part of the Kentucky Toll Road to more than 1,000 motorists with special receivers in their cars.

• Science News Letter, 85:84 Feb. 8, 1964

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