GEOPHYSICS

Atoms Span Galactic Space

A galactic explosion which occurred about 10,000,000 years ago is believed to be the cause of a recently photographed giant electron ring in a neighboring galaxy.

➤ A GIANT RING of atomic particles has been discovered encircling one end of a far-distant galaxy.

It is probably the first evidence of material from one galactic universe being ejected across the vast distance of space to another galaxy. It is also the first evidence of an overall magnetic field of a spiral galaxy.

The ring is so faint it could not have been photographed except with special techniques. Its faint luminescence results when electrons spewed into intergalactic space by the galaxy known as M-82 impinge upon the magnetic field of "neighboring" M-81.

The two galaxies are "only" 10 million light years, or 60 billion billion miles from the earth, which is not far in astronomical terms.

M-82 is apparently in the midst of a gigantic explosion, which was photographed in September 1963 by Dr. Allan R. Sandage of Mt. Wilson and Palomar Observatories, operated jointly by California Institute of Technology and Carnegie Institution of Washington.

Dr. Halton C. Arp, also of Mt. Wilson and Palomar Observatories, lists three reasons for believing the ring is caused by the M-82 explosion:

1. It is situated on the side of M-81 nearest M-82.

2. It appears to be stronger and better defined in the direction in which M-82 seems to be exploding most of its material.

3. The plane of the ring is tilted away from the M-81 axis toward M-82.

The ring probably consists of electrons, shot from M-82, which have velocities close to light's speed of 186,000 miles a second. They are normally invisible, but when the electrons tangle with the magnetic field of M-81, they become visible. They become "threaded" onto the magnetic lines of force of this field and radiate synchrotron energy in the form of light as they spiral around the magnetic lines of force.

Another indication that M-82's explosion has affected neighboring M-81 are three dark parallel lines in the nucleus of M-81. Although these bars have been seen on photographs for 50 years, there was no explanation for them.

"These dark lines may be of dust exploded out of M-82 and reaching the area of M-81's nucleus," Dr. Arp suggested. "Or they may be shock front lines of the ring."

From the distance the electrons have traveled, Dr. Arp has calculated that the M-82 explosion occurred some 400,000 years earlier. The age of the ring is about 300,000 years. To these ages must be added, of course, 10,000,000 years, the time the light from the explosion has taken to reach earth.

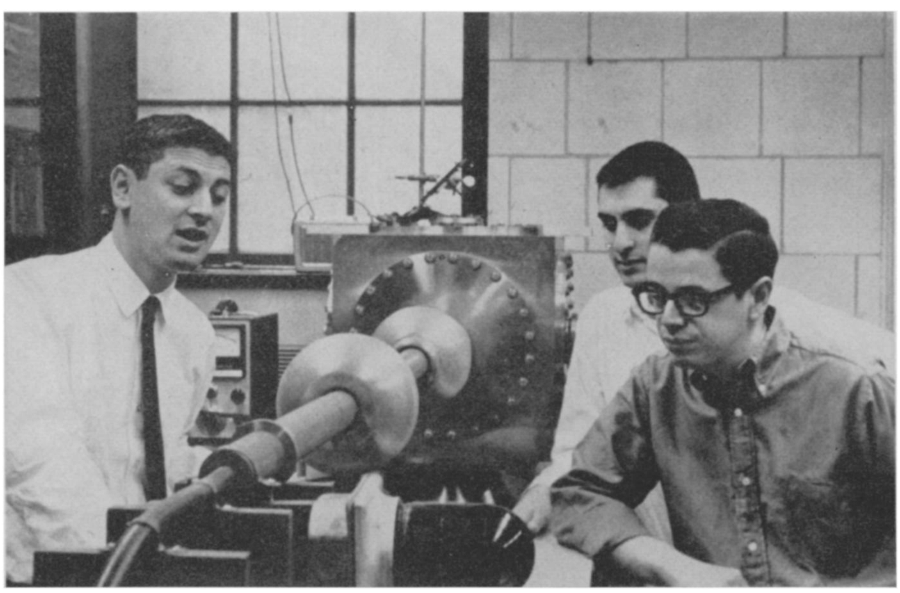
The strength of the magnetic field of M-81 is only a few millionths of a gauss, which is very weak compared to the earth's magnetic field.

A photograph of the ring, published in Science, 148:363, 1965, was taken by Dr. Arp. To obtain the picture, Dr. Arp used a photographic technique that intensifies the image of a faint object and filters out unwanted light. He also took advantage of the fact that the night sky is the "darkest" it has been for 11 years, because the sun is at a low point in its 11-year cycle of sunspot activity.

The faint ring is 100,000 light years from its parent galaxy M-82. It is also 100,000 light years in diameter.

Dr. Arp suggests that further studies should be made of the ring to learn whether its electrons are polarized, releasing their radiation in one plane. Preliminary observations indicate some polarization. Also, observations should be made to learn whether the ring is emitting energy in radio waves.

• Science News Letter, 87:295 May 8, 1965



University of Chicago

MOLECULAR COLLISIONS—A vacuum chamber containing a pair of electrodes similar to those which would be used in a "molecular beam accelerator" being designed at the University of Chicago is being inspected by Lennard Wharton (left), assistant professor of chemistry. With him are Edward Bromberg and George Ury, graduate students. ➔

PHYSICS

New Accelerator Extends Molecular Beam's Energy

➤ A 30-FOOT-LONG TUBE, modeled after the particle accelerators used in high energy physics, will soon be giving chemists at the University of Chicago a 2,000% increase in the range of their studies of gas molecules colliding at high speed.

The instrument will be capable of firing a whole molecule at an atomic target. It may enable chemists to learn the secrets of molecular collisions.

Unlike atomic particles, gas molecules have no electric charge, so the electric fields that provide the kick in particle accelerators have a much reduced effect. Particle accelerators produce energies of several billion electron volts, compared with the 0.01 to 0.2 e.v. obtainable with conventional molecular beam accelerators. A range of from 0.01 to 0.2 e.v produces a beam of molecules with energy corresponding to a gas with a temperature range between minus 260 degrees Fahrenhit and plus 3,000 degrees Fahrenheit

The new accelerator will have a range between 0.5 e.v. and 4.0 e.v., equivalent to a maximum temperature of 80,000 degrees F. The super-tool was designed by Dr. Lennard Wharton of the University of Chicago under a grant from the Air Force Office of Scientific Research.

A carefully spaced sequence of 1,000 pairs of electrodes will speed a stream of gas through the tube, boosting its speed bit by bit as it passes each pair.

Previously used systems have used intersecting streams of gas to provide high speed collisions.

The advantage of a linear accelerator is that by the time the gas molecules reach their target, they are all traveling at approximately the same speed. This provides much more controlled conditions, thereby enabling more accurate measurements.

Dr. Wharton was a Science Talent Search scholarship winner in 1951, after which he went to Massachusetts Institute of Technology, Cambridge University, England, and Harvard University.

• Science News Letter, 87:295 May 8, 1965