New York Journal American

(1)

published 1895–1966

11/9/1965

Is the key to the answers about the universe to be found in the quasi-stellars and the Blue Stellar Objects? Perhaps. Here is a thoughtful article by Dr. Edward Argyle, research scientist at the Dominion Radio Astrophysical Observatory located at Penticton, British Columbia, Canada.

By DR. EDWARD ARGYLE

A Journal-American Exclusive

PENTICTON, B.C., Nov. 9.—How did the universe come into being? How long ago? How long will it last? Or has the universe always existed and will it continue to exist forever and ever?

These are questions which many scientists have believed never could be answered.

But now it appears the possibility of some answers may exist.

The key may be found in two groups of highly energetic objects which exist some billions of light years distant from the Earth. These objects are known as Blue Stellar Objects (BSOs) and quasi-stellars or quasars. The two groups are different in nature, but probably related.

A proposal is under consideration by the science advisory committee of the National Aeronautics and Space Administration for a radio antenna with a 10-mile diameter which would allow astronomers to detect and study objects which might be as distant as 20 billion light years.

A light year is the distance that light travels in a year, roughly 5,880,000,000,000 miles.

If we could reach 20 billion light years into space, we would be looking at a point, in time, close to the origin of the universe. For when we study light or radio signals from an object which is 20

DR. EDWARD ARGYLE
Interstellar Detective

In an effort to find out what the "star" might be, a spectrogram was taken. The "star" remained a mystery.

A COUPLE of years later

was receding at a speed of 70,000 miles per second. For comparison, the speed of light is roughly 186,000 miles per second.

OBVIOUSLY these objects could not be stars. Not actually knowing what they were, astronomers called them "quasi - stellar radio sources," which was shortened to "quasars."

Meanwhile, astronomers at Yale, examining thousands of plates, found images of 3C273 on hundreds of negatives, some taken as long ago as 1887. Measuring the brightness of the quasar, they found that 3C273 varied considerably in brightness, going through a 10-year cycle. Sometimes the object would flare up to double its normal brightness, then subside to normal about a week later.

Here was another mystery. If 3C273 really fluctuated in brightness with a period as short as 10 years, it would have to be a very small object. Otherwise the variations in the brightness would average away to nothing.

On the other hand, astronomers felt that any object that appeared bright at a distance of 1,500 million light years would have to be at least 10,000 light-years across.

Measurement of the radio strength of this quasar, performed by Dr. W. A. Dent of the University of Michigan, showed that there likewise is a fluctuation in the radio output. In view of this, the findings at Yale had to be accepted.

Therefore this strange object must be no more than light-days (not light-years) in diameter and yet must be radiating energy at such an

we are looking at light and signals which first came into being 20 billion years ago.

They started on their journey then; it has taken them that length of time to reach us. A study of them would tell us the story of conditions as they existed 20 billion years ago.

But the 10-mile antenna which would enable us to do this is some years in the future—if it is to be built at all.

FOR SOME years now astronomers working with radio telescopes have been identifying radio sources in the sky. A few years ago Dr. T. A. Matthews, at the radio observatory of the California Institute of Technology, determined an accurate position for several such sources.

One of these sources, 3C48, was very small, measuring less than four seconds of an arc in diameter, but its radiations were powerful. The small apparent diameter argued that it carried a great concentration of energy.

Working with Matthews, Dr. A. R. Sandage trained the 200-inch telescope at Palomar on the position of the object. A photographic plate was exposed for 90 minutes in the telescope. The plate revealed an image of a "faint star" at exactly the position pinpointed by Matthews.

This was surprising, for heretofore radio telescopes trained on even the brightest nearby stars had not detected any radio waves. But here was an object so faint that it required 90 minutes of exposure to produce an image on a plate pouring out a strong radio signal.

measured another radio source, 3C273, and found that its diameter measured less than a second of an arc. Matthews pinpointed this object and the big optical telescope at Palomar was trained on it.

The image captured was brighter than had been the case with 3C48 and a good quality spectrogram was obtained. Six spectrum lines were identified and their red-shift corresponds to 16 per cent of the speed of light.

Red-shift is a phenomenon which occurs when a source of light is receding from the viewer at a respectable fraction of the speed of light—the entire spectrum shifting toward the red end of the spectrum. From the amount of the shift the speed of the object can be determined.

Red shift, however, also can be caused by gravitational forces within the object which produces the light. But if this were the case with 3C273, it must be a star with a diameter of only six miles. Such a possibility was ruled out by a Russian astronomer who showed that the radio waves it emitted could not be produced in a star.

The only reasonable assumption seemed to be that the object was receding from us at a speed of 30,000 miles per second.

If this were the case, it was 1,500 million light years distant and thousands of light years in diameter.

Spurred by the success with 3C273, Matthews and Dr. J. L. Greenstein had another look at the spectrum of 3C48 and succeeded in identifying its spectrum lines. They found it was 3,500 mil-

enormous rate that it is easily detected at a distance of 1,500 million light-years.

SLOWLY the number of known quasars has grown until now there are about 20 certain and another 20 probable identifications. It seems likely that eventually a few hundred bright enough to be studied will be found, then it will be possible to study the universe as it was eons ago, for the signals which we receive from these objects are messages from deep in time as well as in space.

Now, rather suddenly and dramatically, the Blue Stellar Objects (BSOs) enter upon the scene as another possible leg-up for the study of the ancient universe.

The quasars appear, as their name implies, upon a plate as a star-like object. However, they can be distinguished from true stars by measurement of their color. Quasars are much bluer than ordinary stars.

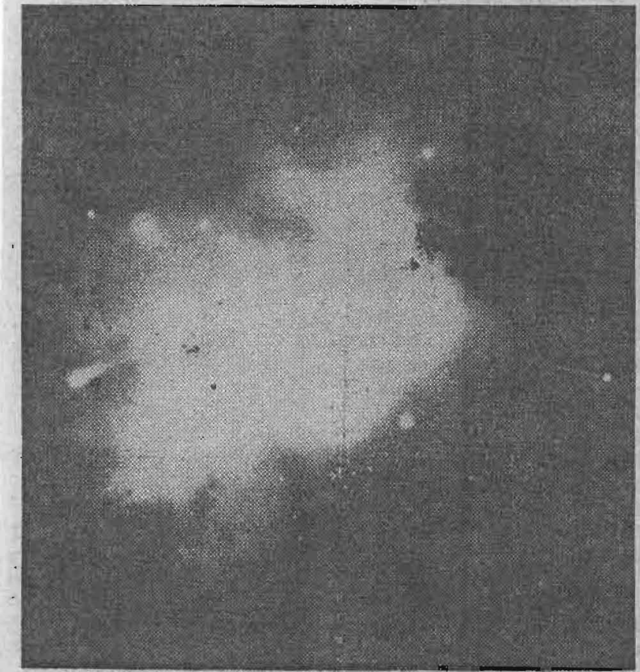
Sandage, noting this, was struck by the resemblance in color to the BSOs, about which little was known except that they were faint, had puzzling spectra and were abnormally blue. The blue stars couldn't be quasars since they did not emit radio waves.

But could they, Sandage wondered, be old quasars that had stopped sending out radio waves? Sandage took new spectrograms of some of them and found that they were, indeed, very remote objects receding from us at a high rate of speed.

These Blue Stellar Objects (they can no longer be called stars) will serve even better than quasars in cos-

Found: Key to a Mystery

10 Billion Years Old?



ARTIST Ray Wilson sketched this conception of 'big bang'—explosive birth of the universe.

STUDYING telescopic picture of galaxy are Drs. Allan Sandage and Phillip Veron of Palomar.

mological studies because they are numerous.

Sandage estimates there are about 100,000 of them within reach of the 200-inch telescope at Palomar. With so many available for study, statistical methods of analysis will be possible.

FOR YEARS there have been two conflitcing theories. One, the big-bang theory, says that at one time, perhaps as short a time ago as 10 billion years, perhaps much longer ago than that, all the matter in existence was collected together in one highly concentrated, highly energetic mass and that this mass exploded.

The explosion, the big bang, signaled the genesis of the universe. The universe today is formed of the matter which was in that great mass, still fleeing outward from the center of the ancient explosion.

Some day the momentum imparted by the explosion will come to an end. All energy will be expended. The universe, scattered thin, will die and that is it: there was a beginning, there will be an end.

The other theory, the steady-state theory, says that there was no beginning and that there will not be an end. The universe always has existed; it always will exist.

The steady-state universe is an expanding universe just as the big-bang universe is. But it will never thin out, for as the galaxies drift apart, new matter (probably hydrogen) is formed between the galaxies. In time, enough of this matter comes into being to create a brand-new galaxy, and thus the universe expands, does not thin out.

One day we may know, through the study of the BSOs and the quasars, which of these mechanisms (if either) is true. And when and if we build that 10-mile diameter antenna, we will be able to read much of the history of the universe.