NEUTRON STARS

The strangest signals reaching earth

A white dwarf is the densest star the existence of which has been confirmed by observation. One cubic centimeter of its matter would weigh some one million grams.

A neutron star would have a much higher density, some million times that of a white dwarf, as well as very high internal and surface temperatures. Its presence has been theorized but none has been detected.

Since about the first of March, however, the search for neutron stars has intensified because of a relatively small area, low in the northern midnight sky, from which the strangest radio signals yet received on earth are being detected. If the signals come from a star, the source broadcasting the radio waves is very likely the first neutron star ever detected. At the very least, its radiation has characteristics that place it half way between a neutron star and a white dwarf.

The concept of a neutron star was proposed by Dr. Fritz Zwicky of California Institute of Technology and the late Dr. Walter Baade of Mt. Wilson Observatory in 1934. Neutron stars have been the subject of theoretical studies by astronomers ever since. A common view of their structure is that most of the protons and electrons combine to form neutrons, with only a thin shell of blanketing electrons. Such a star might have a mass about that of the sun, but a diameter of less than a hundred kilometers.

This would make it difficult to detect in most wavelengths, and even its radio signature is a matter of speculation.

Such a star's extreme density and small diameter, however, would permit its output to fluctuate rapidly, as does that of the present find. This one's strangest feature, in fact, appears to be its very sharp radio pulse, repeating with unfailing regularity every 1.3372795 seconds, with an error of only two-millionths of a second.

The regularity of its emission, in fact, is reminiscent of the signals sought—but never found—eight years ago in Project Ozma, when astronomers turned a radio telescope at Green Bank, W. Va., to the sky in search of extraterrestrial life.

The new source itself is not only nameless but numberless and is known only by its position in the sky: right ascension 19 hours, 19 minutes, 38 seconds (plus or minus 3 seconds), and declination 22 degrees, zero seconds (plus or minus 30 seconds). It appears to be within the Milky Way, between 93,000 million and 200 million million miles from earth.

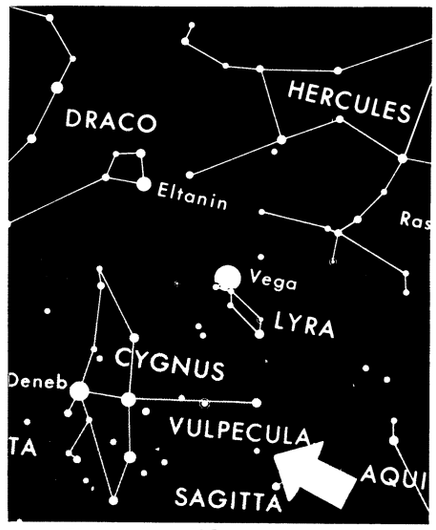
If the radio waves were audible, the sound would be rather like that of a kitten mewing on a descending pitch every 1.33 seconds, fading down to a remarkably steady frequency before the next pip, perhaps the effect of interaction with interstellar electrons.

The rapidly pulsating radio source was first detected by Dr. Anthony Hewish and four co-workers at the Cavendish Laboratory's Mullard Radio Astronomy Observatory, University of Cambridge, using the interferometric radio telescope brought into operation in July 1967.

The radio astronomers soon noticed signals that first appeared to be weak interference were coming from a fixed location. The tracking requirements however, ruled out terrestrial origin. Systematic investigation starting in November showed that the signals consisted of a series of pulses, each lasting three-tenths of a second and repeating every 1.33 seconds with an accuracy of one part in 10 million; almost nothing short of an atomic clock is that regular.

To make sure their measurements were correct, and to determine as many characteristics of the radiation as possible, the scientists did not make their observations known until publication in the Feb. 24 British scientific journal NATURE. The first word to reach California came via a letter from an English scientist, not part of the discovery group, to a visiting English post-graduate student, who presented its gist at a California Institute of Technology seminar.

What a few scientists thought might have been a leg-pulling paragraph in the letter was undoubtedly a soundly based scientific report, although the cause of the unusual signals remains mysterious. The regularity of the signals was—and still is—a puzzle.



Site of invisible neutron star.

That such sources may be relatively common is suggested by the fact that the Mullard group has since found three others "having remarkably similar properties," although they have not yet reported their positions nor determined the exact characteristics of their rapid pulsations.

Dr. Hewish and his co-workers state that the "most significant feature to be accounted for is the extreme regularity of the pulses," which suggests that an entire star is pulsating.

Drs. S. J. Bell, J. D. H. Pilkington, P. F. Scott and R. A. Collins are co-workers of Dr. Hewish in the continuing research.

PRESSING THE LEVER

Health message: cheaper drugs

The Federal Government, with a $15.6 billion medical services budget, has in hand the most powerful lever available to drive down drug prices. Last week President Johnson decided to use it.

In his annual health message to the Congress, he threw the weight of his Administration behind efforts, already launched in the Congress, to use Federal expenditure for drugs as a weapon in this fight.

He proposes a two-step process:

- A national compendium of pharmaceuticals, of the type proposed earlier by Senators Russell Long (D-La.) and Joseph M. Montoya (D-N.Mex.) (SN: 5/27/67, p. 494) is to be completed (optimistically) by 1970. This will give physicians and hospitals generally whatever information is available about the clinical equivalency of costly brand-named drugs and their cheaper generic equivalents.
- The massive outlays for drugs under the Medicare and Medicaid programs will be geared to the compendium, assuring price drops for the beneficiaries. Though physicians can not be forced to prescribe according to it, there will be pressure from patients for them to. And general prescription practices are expected to follow those under Federally supported programs.

Clinical equivalency is a knotty problem (SN: 3/4/67, p. 206). Efforts to find equivalents of chloramphenicol, for instance, have been largely unsuccessful (SN: 12/23/67, p. 608). Nine other presumably identical products have been proved to be less effective. Nevertheless, Food and Drug Administration

Commissioner James L. Goddard, who will head the task force for the President, believes equivalency can be established for some 50 drugs in an 18-month span.

The message, by and large, is a message for the future; budgetary exigencies prevent the immediate start of any bold, new and expensive programs. The sum total would increase the Federal health budget from 1968's $14 billion to $15.6 billion for fiscal 1969. This, however, is largely the increased costs of existing programs.

Five major new goals, including the reduction of infant mortality; meeting the need for more doctors, nurses and other health workers; dealing with the soaring cost of medical care; lowering the toll of accidental deaths; and launching a nationwide volunteer effort to improve the health of all Americans, will take "years to achieve."

A notable omission from the message —reportedly deleted less than a week before its delivery—was the long-expected reorganization of the health part of the sprawling Department of Health, Education and Welfare (SN: 3/9, p. 231).

Acting Secretary of Health, Education and Welfare Wilbur J. Cohen, who was, with Former Secretary John W. Gardner, the architect of a plan to reorganize the Public Health Service so the National Institutes of Health would be independent, says the reorganization is being held up from 30 to 60 days until a study is completed embracing the health activities of the entire Federal Government.

CARDIOLOGY I

A plea for a transplant moratorium

To transplant or not to transplant? The question dominated the 17th Annual Scientific Session of the American College of Cardiology which ended in San Francisco last week; it is a riddle with several answers, none of them final.

Dr. Christiaan Barnard, 44, the South African surgeon whose pioneering efforts made the issue more than an academic question, said yes.

But three of America's top cardiac specialists begged for a moratorium on transplants until the results of the first six are exhaustively evaluated and the results published in the medical press.

They are Dr. George E. Burch of Tulane University, New Orleans, president-elect of the college; Dr. Eliot Corday of the University of California at Los Angeles, a past president, and Dr. Simon Dack of Mt. Sinai Medical School in New York, another.

Even though Dr. Barnard's second transplant patient, dentist Philip Blaiberg of Cape Town, was still alive, two full months after his surgery, the three Americans said they are not satisfied that the enormously complicated problems of tissue rejection have been solved.

Dr. Burch was especially emphatic in his views. "I would not select any patient for a cardiac transplant, because once you take his own heart out, you know he's going to die," he said. "His new heart will be rejected by his body because we are still unable to suppress the immune reaction."

Dr. Corday echoed the sentiments. "Until we overcome the fantastic problem of immunity, we'll have a tremendous mortality rate from transplants," he said. "So, until we improve the state of the art, I say the risk is too great."

Dr. Barnard defended his historic operations with equal vigor. "A doctor has one duty and one duty only, and that is to treat his patient until he has no means left," he declared. "If we feel a heart transplant is a method for helping a patient, we must do it."

Nor does he hold with the theory that heart transplants should be viewed as only a last-ditch resort in a life or death situation.

"It is not how long the patient is going to live, but how he is going to live," he said.

Dr. Barnard described the condition of both his transplant patients as miserable in the extreme before they underwent the operations. He said they were unable to eat or sleep, and suffered constantly from complications to their liver, brains and kidneys as the result of poor blood flow from faltering hearts.

Under these circumstances, he said, he felt more than justified in attempting operations that might restore them to some semblance of good health.

But even though Dr. Barnard said his conscience is clear and he will undertake a third transplant soon, the American physicians are approaching the whole problem with extreme caution. They foresee a multitude of agonizing problems arising because of the peculiar nature of the heart transplant.

For this reason, the American College of Cardiology will sponsor a national conference in April in Bethesda, Md., in an attempt to clear the air of the moral and ethical questions which are clouding the American transplant picture now.

The organization will ask for delegates from the nation's major religious denominations, the American Bar Association, medical societies, and a number of other groups.

Dr. William Likoff, president of the ACC, says the major hurdle to be overcome is to establish firm guidelines as to what constitutes the moment of death.

At present, American physicians generally consider the time of a patient's death as the moment his heart stops beating. But physicians know that a heart can continue to beat for eight hours or more after the brain is irretrievably dead, especially under artificial stimulus.

"But it is no longer true that a person is dead only when there is an arrest of the cardiovascular system," Dr. Likoff says. "Physicians can sometimes start the heart beating again after it has stopped."

For transplant purposes, it might be more practical to consider the moment of death as some specified time after all electrical activity has stopped in the brain, he adds.

The Bethesda meeting will also consider the proper involvement of donors, recipients and their families from a legal as well as medical standpoint.

The size of the problem can be understood in the light of figures produced by Dr. Likoff: "If this surgery were applied to all who need it, it is estimated that there would be 1,000 heart transplants a week," he says.

CARDIOLOGY II

Advance in mitral valves

While the controversy continued to rage over the transplants, another surgeon brought news to the cardiologists that another operation, considered to be a life or death gamble a few years ago, has now become comparatively safe and commonplace.

Dr. Albert Starr, chief of cardiovascular surgery at the University of Oregon in Portland, led the team which installed the first mechanical mitral valve in a human heart less than eight years ago.

Dr. Starr's team lost four out of its first five patients, a mortality roughly equivalent to that of the heart transplants.

The Oregon surgeon reported that there are now approximately 50,000 people walking around with artificial mitral and aortic valves, most of whom would be dead without them.

Refinements in technique and materials used for the valves has chopped the mortality rate down to about five percent and it continues to get better.

The valve improvements have been so great that Dr. Starr believes that some 15 percent of the people equipped with the older type valves should come in and have them replaced with the new ones.