DISCOVERY

Other worlds, other planets

A new planet-like object circling a nearby star, making two in the system, has been discovered by Dr. Peter van de Kamp, director of Swarthmore College's Sproul Observatory. He says the star, known as Barnard's star, shows a "striking analogy to the one planetary system that we know so well, namely, our own."

There may be even more than two planet-like objects in the Barnard system, perhaps as many as 10, but Dr. van de Kamp does not believe he could squeeze even a third one out of the observational data. Time, not a larger telescope, is the problem. In order to detect and analyze the very small wobbles, or perturbations, caused in the path of a star with one or more unseen companions, precise observations over long periods of time are needed.

Three other stars have been found to have planet-sized objects, making a total of five discovered, besides the sun's family of nine. They confirm theories that the universe abounds with billions of other planets circling other star-suns. Even by conservative estimates, many scientists have suggested that a hundred million of them have some form of life. Some may even have life as advanced or more advanced than earth's mankind, although not everyone agrees that human life on earth today can really be called advanced.

The two companions of Barnard's star are poor targets for any sentient life, however, since temperatures on either of them are likely to be at least a couple of hundred degrees below zero F.

Barnard's star has been under scrutiny at Sproul Observatory since 1938, and that scrutiny has been intense since 1963, when Dr. van de Kamp reported discovery of one planet-like object accompanying it in its travel through space. He called this first companion Barnard's star B.

It had an extremely elliptical orbit, and observations since then have shown the orbit to be even more egg-shaped than originally thought, as well as the indications of a secondary wobble. Using not a computer but only "hands and a slide rule," Dr. van de Kamp calculated that the same elongated orbit could be replaced by two nearly circular ones, with periods of 26 and 12 years, respectively. He will report his calculations in a forthcoming issue of ASTRONOMICAL JOURNAL.

He has designated the two objects Barnard's star B-1 and B-2. The star itself is the second closest to the sun, six light years away. It was discovered in 1916 by E. E. Barnard, and has the largest known proper motion, the measured change in a star's position against the background of more distant stars.

Some 3,100 photographic plates have been taken of this star, mostly since 1938, with Sproul's 24-inch refractor. If the mass of Barnard's star is assumed to be 15 percent of the sun's mass, then Kepler's third law of planetary motion requires the orbit of the unseen companions relative to the visible star to have radii of 4.7 and 2.8 times the astronomical unit, the 93-million-mile distance from sun to earth.

The radii of the observed perturbations are 0.034 and 0.014 times the astronomical unit, leading to masses of 1.1 and 0.8 times the mass of Jupiter for the companions B-1 and B-2, respectively. These objects, therefore, may be considered to be planets.

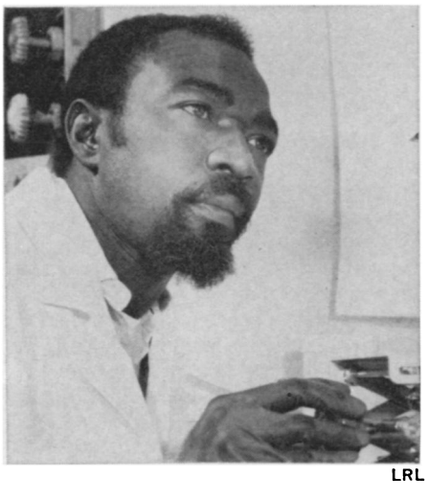
Dr. van de Kamp says, "The sizes of their orbits around Barnard's star are closely comparable to those of Jupiter and of an average asteroid in our solar system."

Two of the discoveries of other planet-like objects outside of the earth's solar system were also made at Sproul. In 1943, Dr. Kaj Aa. Strand, now director of the U.S. Naval Observatory, found an unseen companion in the 61-Cygni system, and in 1960 Dr. Sarah Lee Lippincott reported detection of an invisible object of small mass around the star known as Lalande-21185.

The fifth known star with an unseen object "of definitely planet-like mass" accompanying it is L-726-8, reported this month by Dr. L. W. Fredrick and graduate student P. J. Shelus of the University of Virginia's Leander McCormick Observatory. The star's mass is less than one-thousandth's the sun.

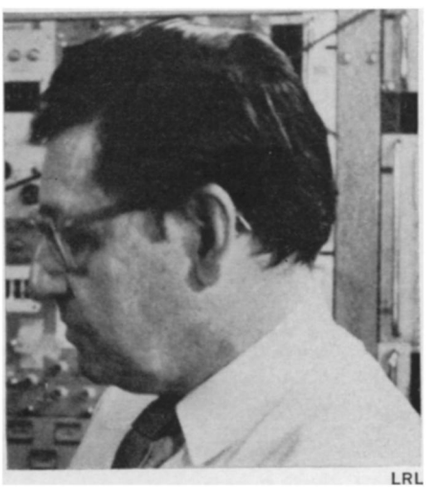
TRANSURANIC COMPETITOR

Another route to 104



LRL

Harris: Two-millionths of an ounce.



LRL

Team leader Ghiorso: No question.

In 1964, a few radioactive atoms existed for three-tenths of a second in a Soviet laboratory, and G. M. Flerov and his colleagues, who detected it, announced the discovery of element 104. But the announcement was met with skepticism in the United States; scientists there were unable to duplicate the Soviet work, and it is still awaiting approval by the International Union of Pure and Applied Chemistry.

Now, U.S. scientists declare they have gone their own route to corral the elusive element.

At the American Chemical Society's national meeting in Minneapolis, Minn., last week, Dr. Albert Ghiorso, leader of a group of scientists at the University of California at Berkeley, announced that his team had positively produced element 104 in the laboratory.

"There is no question about our discovery," says Dr. Ghiorso. His confidence is echoed by Nobelist and former co-worker Glenn T. Seaborg.

When the elements are arranged in the periodic table, based on atomic number (the number of protons in the nucleus), they show a tendency to repeat their properties at regular intervals. Following this pattern, then, the atoms of element 104 should behave like the members of a related group, and combine with chloride ions to form chloride compounds (SN: 4/13/68, p. 352). In 1966, the Soviets reported tests that claimed that the atoms they produced did form chloride, and that the chloride had a half-life of three-tenths of a second, the half-life the Soviets originally found for element 104 in 1964. But because the number of atoms was

so small, and the atoms so short-lived, and because the possibility existed that other atoms might have produced the same results, confirmatory experiments were needed.

Rather than try to reproduce the Soviet work exactly, however, the nuclear scientists at Berkeley used a starting material (einsteinium) more likely to give element 104 than the plutonium the Russians used. They were unable to get any activity indicating the presence of element 104.

In 1968 and 1969, Dr. Ghiorso and his colleagues set out on their own. They took a two-millionth-ounce sample of the element californium and bombarded it with carbon ions. (The Russians had bombarded plutonium with neon ions.)

Since istopes are separate atomic species of an element, they occupy characteristic energy-niches by which they can be identified. Two isotopes produced by the bombardment of californium in a high-intensity linear accelerator (HILAC) fell into the energy range that would be expected for element 104. So Dr. Ghiorso's group concluded that it had made the discovery it was searching for.

A little atomic bookkeeping provided proof. The two isotopes decayed by emitting alpha particles. Using simple addition and adding an alpha particle back to the decayed product, the investigators obtained the values for the atomic weight and number of element 104.

The two isotopes have atomic weights of 257 and 259. A third isotope, atomic weight 258, was believed to have been observed. But the Berkeley team is not positive. The Soviet report was of isotope 260.

The Berkeley team consisted of Dr. Matti J. Nurmia, Dr. Kari A. Y. Eskola, and his wife, Pirkko, all from the University of Helsinki in Finland, and James A. Harris, a nuclear chemist.

Placing the new element in the periodic table, Dr. Seaborg said, "It's beyond the actinide series. It's what I term the transactinide series, which will extend from 104 to 112." Follow-up experiments of bombarding another isotope of californium should show if the Russians were right or wrong in their 1964 claim, says Dr. Ghiorso. But, he points out, the experiments will take a few months. ◇

NIXON'S BUDGET

Down and down some more

The ink was hardly dry on President Nixon's version of the budget for fiscal 1970, submitted to Congress last week, when critics began claiming that it would have to be substantially cut. Programs in science and technology were not heavily affected overall, but key areas, some involving university research support, were cut.

The $192.9 billion Nixon budget is $4 billion below that offered by President Johnson in January (SN: 1/25, p. 87), but House Ways and Means Committee Chairman Wilbur D. Mills (D. Ark.) maintained that Congress ought to trim another $5 billion, particularly if the proposed 10 percent surtax is to survive. "There's no doubt there will be a ceiling somewhere between $187 billion and $190 billion atttached to the surtax," Mills says.

The National Aeronautics and Space Administration's appropriation is down about $45 million from President Johnson's budget, although a boost of $125 million is included for lunar exploration with an increased number of Apollo landings, together with Saturn 5 boosters to handle the flights.

To offset this, the Apollo Applications Program has been trimmed by $57 million, which NASA officials say will slow the program by about five months but will not cause cancellation of any now-scheduled missions. A variety of satellites and interplanetary probes have also been eliminated or postponed, for a total offsetting reduction of $131 million. One item that significantly remains unchanged is the $36.5 million request for nuclear rocket research and development (SN: 4/12, p. 351). The nuclear rocket represents NASA's hope for large interplanetary missions in the mid and late 1970's.

The shrinking Sustaining University Program, which supports space-related university education and basic research, remained at President Johnson's requested level of $9 million, although a House subcommittee has already hacked the sum by two-thirds once, and could do it again. Some NASA officials fear that the program, once funded at a $40 million annual level, may disappear altogether, though Administrator Thomas Paine says it "definitely will not."

The National Institutes of Health took a cut of approximately $35.5 million from its original request of $1.5 billion. The reduction is mainly in research manpower development, competing research grants and collaborative research. But this will allow an increase of $5 million over 1969, principally for research on human reproduction and family planning. Increases also will be provided for the recently established National Eye Institute and the National Institute of Environmental Health Sciences.

A token increase of $5 million is proposed in medical and dental special educational improvement grants, to be added to the January budget of $96.4 million. Although this will not be a great deal of help in the shortage of physicians, estimated at some 50,000, it calls attention to the need. Last year fewer than 8,000 physicians were graduated from the country's 91 medical schools.

The Atomic Energy Commission appropriation request is down more than $78 million from President Johnson's, which in turn was already almost $133 million below the fiscal 1969 level. At least a third of the latest cut is due to President Nixon's decision to deploy a limited Safeguard system of antiballistic missiles around missile installations, rather than a full-scale Sentinel system. One potentially significant increase is a $10 million boost, to $22.7 million, for what an AEC military affairs official says is "to support a readiness to resume atmospheric testing if necessary." An across-the-board slowdown in operations accounts for a $30 million reduction, with $10 million trimmed from the light-water breeder reactor program sought by Admiral Hyman G. Rickover for future nuclear naval ships. The only program entirely dropped, however, is research in food irradiation (SN: 3/22, p. 287).

The 200 GeV particle accelerator at Batavia, Ill., remains unchanged at $12.9 million, while $2.6 million is added in the new budget to modify the heavy-ion linear accelerator at Lawrence Radiation Laboratory in Berkeley, Calif. This replaces never-funded plans to build an entire new facility, an omnitron (see p. 406), which would have cost at least 10 times as much.

One of the few agencies to survive intact from Johnson to Nixon is the National Science Foundation, whose $497 million request stands untouched.

In the Interior Department's budget, $5.9 million has been trimmed from research and study programs, including complete deferral of a $2 million study of underground power transmission and a similar cut in mapping, oil shale and water resource studies of the U.S. Geological Survey. One of the few additions is $400,000 for tighter policing of off-shore oil drilling sites and enforcement of safety regulations, prompted by the leak in the Santa Barbara channel.

One of the most significant items in the Transportation Department's budget—and indeed in the whole budget—might have been the supersonic transport. Except that it isn't there. This does not mean that the project has been shelved, but merely that the decision is still being avoided. A potentially controversial item is a $97 million Johnson-