NAVY

Herbert Friedman: building a science.

X-rays from Beyond the Milky Way

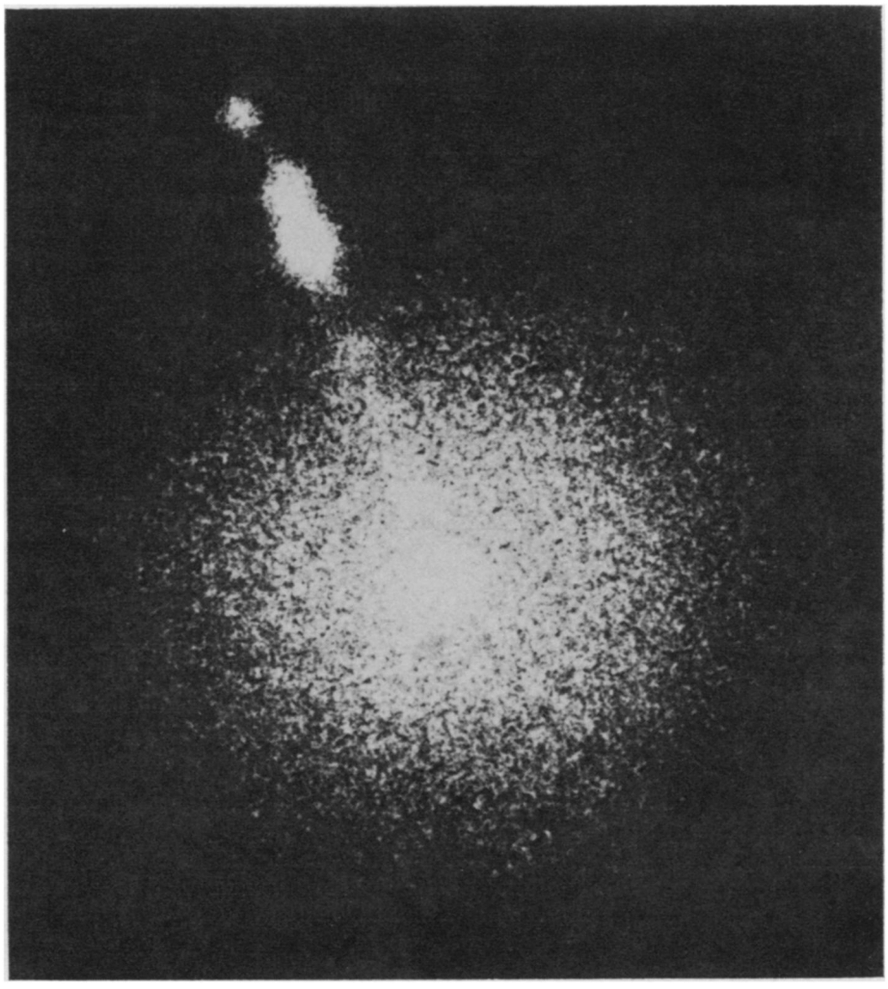
Quasar and extragalactic sources of X-radiation stimulate interest; huge new instruments needed.

Dr. Herbert Friedman of the Naval Research Laboratory would like to map the entire sky in X-rays from a satellite, using a "telescope" 100 feet square. In one corner of his office is a four-foot square honeycomb of closely spaced metal strips designed to detect incoming X-rays. Twenty-four such panels could be joined to make the large X-ray detector.

One of the first, if not the first, man who dreamed and talked about, then planned and executed a program to learn about earth's three-dimensional environment by hurling rockets into space, he is still looking far into the future.

Dr. Friedman's rocket work began in 1949 when a V-2 rocket fired from White Sands, N.M., brought back the first scientific proof that X-rays stream from the sun.

His most recent X-ray experiments, conducted with co-worker E. T. Byram, look far beyond the solar system in an X-ray search for objects in the constellation Virgo. They were made from an Aerobee rocket launched last May from White Sands.



U.S. Naval Observatory, Flagstaff

M-87, first extragalactic object pinpointed as a source of X-rays.

The NRL scientists found:

- The first quasar known to also emit X-rays. Quasar 3C-273-B is one-sixth of the way out to the edge of the universe if interpretation of other observations is correct and it is actually showing a cosmological red shift (SN: 7/1).
- Evidence confirming that the cluster of 1,000 million stars in Virgo called M-87 also emits X-rays, the first such object known without doubt to be beyond the Milky Way (SN: 1/7).
- Three X-ray sources comparable in intensity to 3C-273-B, but not coincident with any known quasar or radio galaxy. However, since the three are all far from the plane of the galaxy, they

are believed to be outside the Milky Way.

• Indirect evidence that the background radiation pervading the cosmos from the original explosion in which the universe was formed extends to the X-ray region, supporting studies previously made with radio waves.

X-ray astronomy has progressed rapidly during the last five years and has now "come of age," Dr. Friedman believes. By 1963, two discrete sources were detected, Scorpius XR-1 and the Crab Nebula. By 1964, the list had increased to 10 sources; in 1965, to 37.

In all, some 40 sources are now known to emit X-rays. If all of them were the same distance from the solar system, the X-ray emitting quasar would be by far the most powerful emitter so far observed. It is a billion times more luminous in X-rays than the Crab Nebula, a supernova remnant in the Milky Way, and about 500 times as bright in X-rays as the intense radio galaxy, M-87.

X-rays come between ultraviolet (SN: 5/27) and gamma rays in the electromagnetic spectrum of radiation that extends from the longest radio waves through visible light to the extremely short, and very powerful, cosmic rays. Radio waves have an energy of about one-thousandth of an electron volt, while X-rays have energies of some 1,000 billion electron volts.

Even X-rays, however, differ so much in energy that those used in clinical examinations are about 1,000 times more powerful than those detected above the bulk of earth's atmosphere.

Exactly how X-rays are produced is not known, but the energy output of objects radiating in this region is so vast that existing theories are being strained to account for it. This is one reason Dr. Friedman finds X-ray astronomy "so fascinating and exciting." If new discoveries of such powerful sources as quasars and X-ray objects continue at the present rate, fundamentally new theories of the generation of energy would be necessary to account for them.

Because the instrumentation on the May flight worked so well, Dr. Friedman is confident much larger arrays carried on a satellite, or even placed on the moon, would be successful in mapping the heavens in X-rays. He notes that an instrument whose collecting area was nearly 100 square feet would have a sensitivity 1,000 times better than now available, that is, it could detect sources 1,000 times weaker than now possible.

Dr. Friedman has made a proposal for such an experiment to the National Aeronautics and Space Administration, but "it is one among many" under consideration for flights following a planned manned orbiting observatory.

The observatory, called Apollo Telescope Mount, is scheduled to circle earth during the next period of maximum solar activity, expected to begin late in 1968. ATM experiments are aimed primarily at investigating solar-terrestrial relationships, especially in ultraviolet and X-ray radiation.

The proposed sky-survey equipment could be built for a few million dollars, Dr. Friedman says. This would be "a small part of using Apollo-scale hardware" for a launch and earth orbit lasting as long as four weeks, he notes.

Dr. Friedman received the President's Award for Distinguished Federal Civilian Service, the highest accorded a Government career employe, in 1964. He holds more than 50 patents, including an X-ray exposure meter credited with saving more than 50 million man hours during World War II.

NIH BUDGET

'After all, we're at war': NIH Feels the Pinch

During the last 15 years a combination of scientific expertise and generous Congressional appropriations made the National Institutes of Health one of the world's most prestigious houses of biomedical research.

Each spring, NIH director Dr. James A. Shannon has told Congress what the nine Institutes planned for the following year, and by fall Congress has given them the money to do it—plus a little extra to speed research along. In fiscal 1966, that little extra amounted to $100 million. Last year, NIH's bonus was $65 million.

Although NIH's total request this year is for $1.2 billion, it is not a lump sum; Congress deals with the appropriations Institute by Institute—each one according to its needs or the mood of the time. Last year, for example, the National Cancer Institute got $176 million, the Heart Institute $165 million and the Institute of General Medical Sciences received $145 million.

This year, Cancer is likely to go up $7.7 million, once-favored Heart will climb $3.2 million, while the newer General Medical Sciences will top the field with an increase of $15.2 million, pressing hard behind the traditional big spenders.

The Heart Institute's drug-study—a three year project to find anti-heart attack pills—continues at a steady but not expanding pace. Dr. Shannon, skeptical of the wisdom of pursuing the development of a totally artificial heart before there is enough basic physiology to warrant it, has cut back on that bioengineering work. If figures tell the tale, support of heart research generally has reached a plateau, but other fields are peaking.

Within General Medical Sciences, for example, interest in biomedical engineering is skyrocketing. NIH decision-makers think it makes good sense at this time to push for greater application of sophisticated engineering knowledge to biological problems like miniature implants, medical computers and the like. This is for the good of man as well as the good of NIH, which is responding to the President's call for payoffs from basic research.

The budget Congress approves, and usually increases, is really the fifth in a series of what NIH calls "who-struck-John budgets." After taking a look at its research programs, NIH officials last year wrote a fiscal 1968 budget calling for $1.6 billion and sent it on to Dr. William H. Stewart, Surgeon General of the parent U.S. Public Health Service. (In a move to free itself from PHS supervision—and cuts—NIH is trying to become a separate department under the Secretary of Health, Education and Welfare (SN: 5/20). Before the first of this year, the Surgeon General lopped off $100 million—the largest slice his office has ever made in an NIH budget—and passed John along to HEW, where it was cut further, to $1.4 billion. From there, it traveled to the President's Bureau of the Budget where it was trimmed a third time before the formal request was sent to Congress in January at $1.2 billion.

Although the trimming and cutting is more-or-less expected, in the past Dr. Shannon could count on Congress to put back what the others had taken away—in special areas, at least. And he could often predict the amounts; Congress always came through.

This year, for the first time, NIH's bonus is likely to be zero.

NIH lost its foremost champion in the House when Representative John E. Fogarty (D-R.I.) died in January. And four of the majority members of Fogarty's Appropriations Subcommittee on Labor, Health, Education and Welfare last year were not returned to the 90th Congress. When the subcommittee met in May to look over NIH's 1968 requests, chairman Daniel J. Flood (D-Pa.) was the only Democrat remaining from the Fogarty days.

Although Flood, who professes much interest in health spending, is considered a liberal Congressman, the four new appointees are "extremely conservative," one official says. Their voting records show them less likely to support new or expanding Federal pro-