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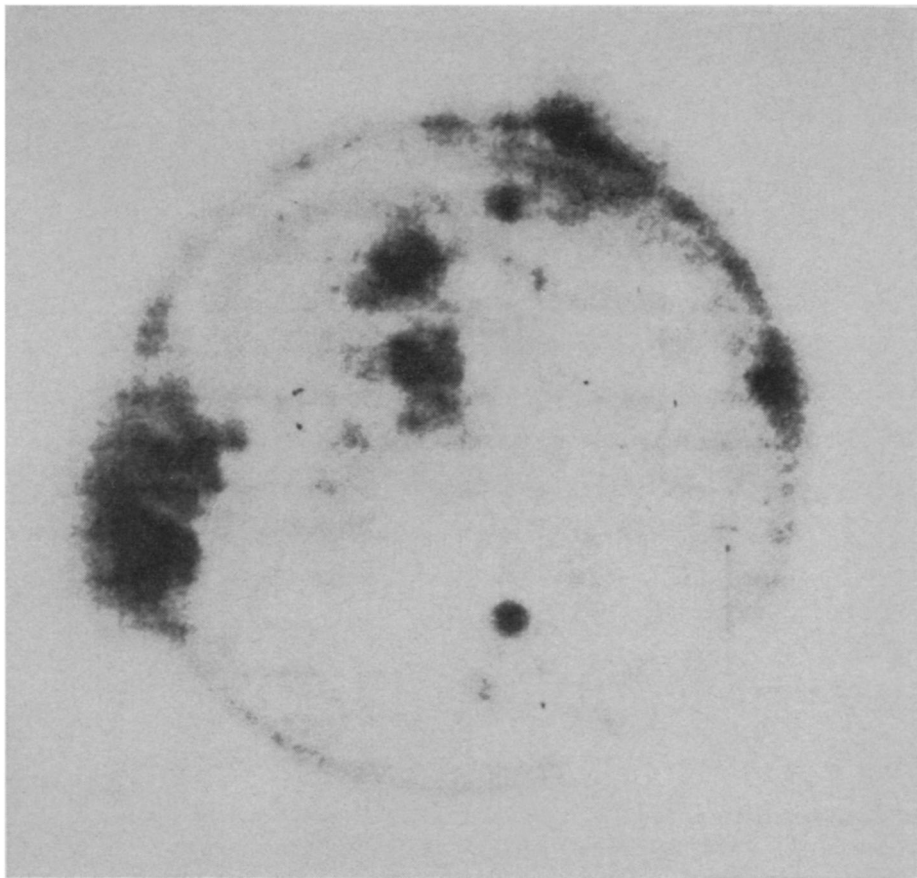
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ULTRAVIOLET ASTRONOMY



Naval Research Laboratory

The sun in ultraviolet, showing the hot spots caused by highly ionized iron.

New Window to Heavens

New stars found, old ones analyzed by instruments carried above earth's semiopaque atmosphere.

by Ann Ewing

For 250 years after Galileo revolutionized the science by turning his telescope toward the heavens, astronomers could view the universe only through a very narrow chink in the curtain of atmospheric gases that blankets earth.

Only visible light filtered through this gap until photographic plates that could record infrared and ultraviolet light were developed some 100 years ago. Even the most modern photographic plates, however, tap only the very small portions of the infrared or ultraviolet spectrum lying close to the visible.

With rocket astronomy, and now with unmanned and manned space vehicles, the atmospheric window has been opened to the full range of infrared and ultraviolet, and X-rays and gamma rays as well.

To observe the cosmos in ultraviolet and X-rays is a "challenging problem," according to Dr. Herbert Friedman, whose group at the Naval Research

Laboratory pioneered rocket astronomy in exploring these regions of the spectrum.

The NRL scientists found in 1960, for instance, that the heavens contain ultraviolet stars that cannot be seen by the human eye but can be spotted by instruments carried 60 or more miles high, above most of earth's atmosphere.

Within the last year, ultraviolet photographs of the heavens have been taken on three of the U.S. Gemini manned space flights. The pictures taken from Gemini 10 on July 10, 1966, showed a very rich field of stars in the southern Milky Way.

Spectrograms made last September during the two-hour extravehicular activity of an astronaut revealed the presence of magnesium in the heaven's brightest star, Sirius, as well as magnesium, iron and silicon in the second brightest star, Canopus (SN: 4/1).

Those from Gemini 12 in November are still being analyzed but preliminary



results indicate that at least 50 stars were recorded in ultraviolet, including 20 in the Orion region.

The Gemini photographs were planned only as a first step. Astronauts on the coming Apollo flights are also scheduled to take pictures of the heavens in ultraviolet. Even more ambitious are the plans for the second unmanned Orbiting Astronomical Observatory, expected to be launched by July 1968.

The first OAO was a complete flop. It was put into orbit on April 8 last year but its batteries failed in two days; no useful scientific information was transmitted.

The second OAO will carry one of the same ultraviolet experiments lofted into space on the unsuccessful flight, and a new one developed too late to be flown on the first OAO (see p. 499).

The telescope package developed at the University of Wisconsin is designed to conduct a detailed study of emissions in the ultraviolet from about 200 stars and nebulae. The range of radiation covered is in wavelengths from about 1,000 to 4,200 angstroms, one angstrom being one ten-billionth of a meter.

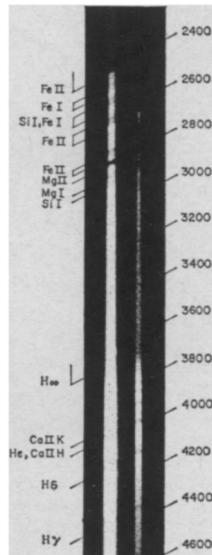
The resulting information is expected to help astronomers better define the chemical composition, pressure and density of stellar objects, possibly resulting in revisions of theories of the evolution of stars.

The new ultraviolet experiment was

tected in the 1960 NRL rocket flight.

The absorption of ultraviolet light by interstellar gas forms a natural division between ultraviolet and X-ray astronomy, the former then being defined by the wavelength range between 912 and 3,000 angstroms.

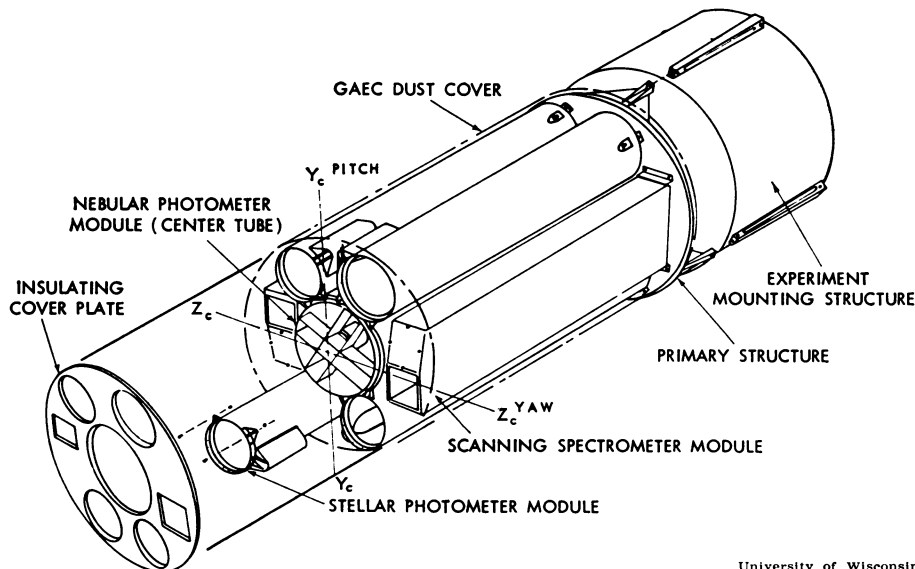
This large extension of the accessible



Science

Canopus ultraviolet spectrum.

ultraviolet spectrum is in itself sufficient justification for making observations from space vehicles, but added to this is the important fact that most of the



University of Wisconsin

One of the two ultraviolet experiments to be carried on OAO next year.

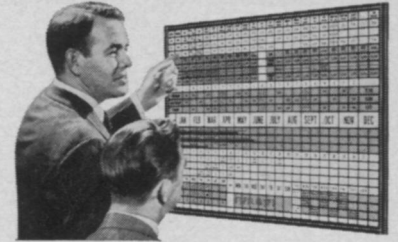
developed by the Smithsonian Astrophysical Observatory. Instead of scanning individual stars, a series of instruments will picture the entire sky at several different, although overlapping, wavelengths.

The instruments are called UVICON's contraction of UltraViolet Image CONverters, and they are expected to show many more stars visible only in the ultraviolet than were de-

tection lines of the abundant elements lie on the short side of visible wavelengths.

The possible investigations of ultraviolet astronomical interest fall into five broad categories: stellar photospheres, which show absorption lines; extended stellar atmospheres, which show emission lines; variable stars; the interstellar medium, and extended sources.

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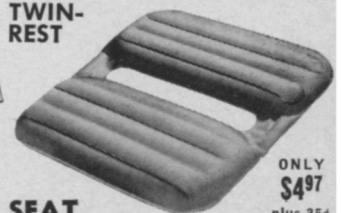
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