ing May was about 4 μ. The average size of the particles apparently decreased to about 2 to 3 μ in June and July, but it remained fairly constant until the end of July.

Volatile fission products and those with gaseous or volatile precursors were depleted in single particles (*1, 2*). Hence, such products of fission as Sr^{89} with a precursor of Kr^{89} (3.2 min) were expected to behave quite differently from the refractory fission products, such as Zr^{95}. Because of the similar half-lives of Sr^{89} and Zr^{95} (50.4 and 65 days, respectively), their ratio of production was expected to be approximately unity. The ratio of Sr^{89} to Zr^{95} in the ground-level rain at Fayetteville was 1.2 on 20 May, but it increased to 5.2 on 29 May, during the period when the number of single particles reached a minimum. The ratio of Sr^{89} to Zr^{95} in rain returned to 0.7 on 6 June. These results demonstrate the phenomenon of atmospheric fractionation of the products of fission and show that the highly radioactive single fallout particles are important in the process of transport of the nuclear debris.

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7. Supported by AEC contract AT-(40-1)-2529. K.Y. was on leave from the Radiation Research Center of the Osaka Prefecture, Osaka, Japan, from September 1965 through August 1966. We thank R. S. Clark for his advice and counsel.

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Ultraviolet Stellar Spectroscopy on Gemini 11

Abstract. *Objective-prism and objective-grating spectrograms were obtained in six star fields during the Gemini 11 mission. The grating spectra show absorption lines in the 2000 to 3000 angstrom wavelength region of Canopus and Sirius and provide ultraviolet-energy distribution data for approximately 50 stars. Many prism spectra show the Balmer discontinuity due to hydrogen and two absorption features probably due to ultraviolet iron multiplets.*

During the 2-hour standup EVA (extravehicular activity) of Gemini 11 on 14 September 1966, astronauts C. Conrad and R. Gordon photographed ultraviolet stellar spectra in six regions of the sky. Objective-grating spectra with a dispersion of 180 Å/mm were obtained in regions centered on λ Scorpii, Canopus, and ϵ Orionis, and objective-prism spectra with a dispersion of 1500 Å/mm at 2500 Å were obtained in regions centered on Antares, λ Scorpii, and ι Orionis. The limiting magnitude for the 2200 to 2600 Å region of early B-type stars on well-guided 2-minute exposures is about $V = 5.0$ with the grating and about $V = 6.5$ with the prism.

The grating spectra show resolved absorption lines in the middle-ultraviolet spectra of Canopus and Sirius, the first time that lines have been observed in this wavelength region in stars other than the sun (*1*). The spectrum of Canopus (Fig. 1) shows the very strong Mg II resonance doublet at 2799 Å, the weaker Mg I resonance line at 2852 Å, the 2882 Å line of Si I, and several broad features which are mostly identifiable as blended features of Fe I and Fe II. The ultimate lines of Fe II near 2400 Å are especially strong. The broad absorption feature near 2530 Å is probably a blend of the ultimate lines of Si I with Fe I. The absorption feature near 2620 Å probably contains the ultimate lines of Mn II as well as a strong multiplet of Fe II. Variations in focus, together with field distortions and only moderate resolution of wavelength (about 15 Å), make precise measurements of wavelength difficult. However, the above identifications are generally confirmed by the close similarity of the Canopus ultraviolet spectrum to that of the sun (*2*).

The spectrum of Sirius shows the Mg II doublet as well as the lines of the hydrogen Balmer series. As expected, no lines are resolved in the middle-ultraviolet spectra of the B stars observed in Scorpius and Orion.

Grating spectra of 99 stars are identifiable in three regions photographed. The film has a photometric calibration,

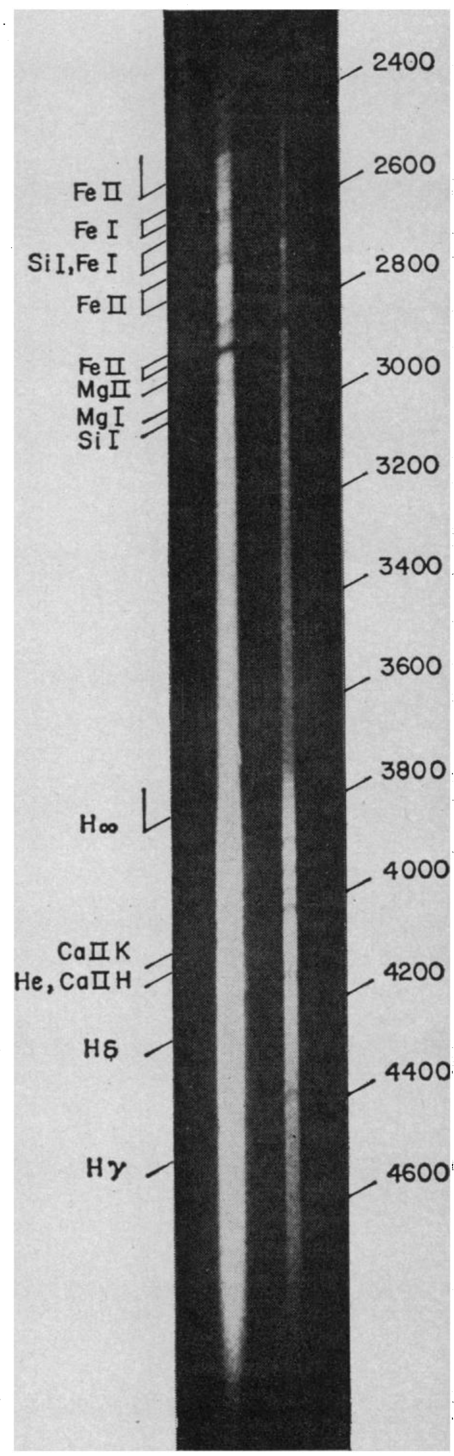

Fig. 1. The spectrum of Canopus. A wavelength scale is given to the right; ions with strong lines are listed to the left. The double spectrum was caused by sudden spacecraft motion during exposure.

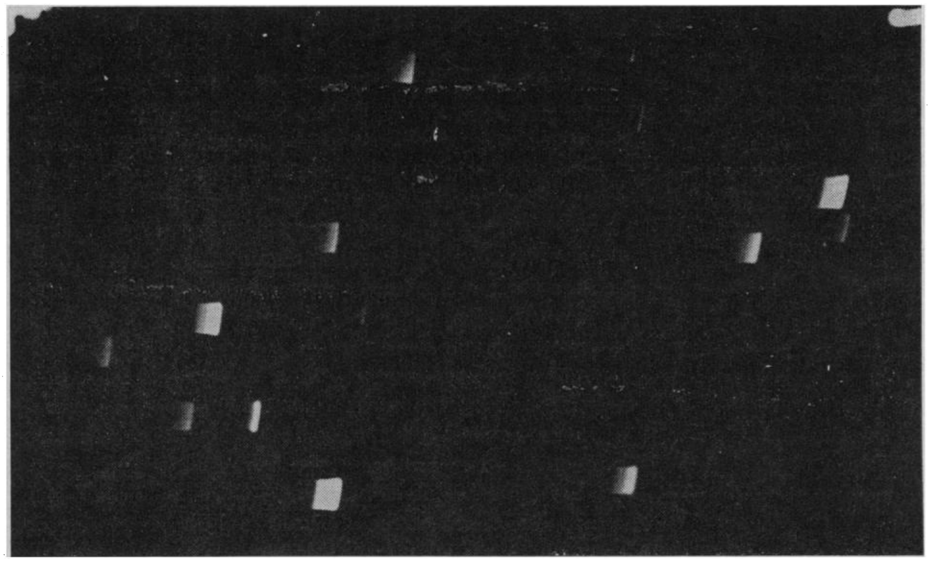

Fig. 2. Prismatic spectra of stars near Antares. In this figure, north is to the left and east is down. The break near the right edge of the spectra is due to the hydrogen Balmer discontinuity. The break near the center of several spectra is due to an instrumental effect. The overexposed image of τ Scorpii appears to the left of center at the bottom, with Antares immediately above and to the left.

and it is expected that energy curves can be derived for about 50 stars. These data will be supplemented by energy curves currently being measured for 20 stars observed during the Gemini 10 flight (*3*). This work partially overlaps and partially extends previous ultraviolet-energy distribution measures (*4*).

The prism spectra (Fig. 2) show two spectral features despite their very low dispersion. The Balmer discontinuity of hydrogen is very prominent in A stars, and in F stars the metal multiplets seen in the grating spectrum of Canopus blend into two broad absorption features visible in the 2400 to 2800 Å region. The spread in the correlation between these features and conventional spectral types has not yet been established. An emission line is visible in the prism spectrum of the Wolf-Rayet star HD 156385 (spectral class WC7p). This is tentatively identified as the 2297 Å line of C III due to the $2p^2\ {}^1D\text{-}2p\ {}^1P^0$ transition.

The spectra were obtained with the quartz–lithium fluoride Barnes lens (73-mm, focal length *f*/3.3) of the general-purpose Maurer camera, designed especially for use by the Gemini astronauts. The image diameter produced by the camera is 50 μ or less, over a field diameter of 30° and a wavelength range from 2100 to 3000 Å. The transparency cutoff of the lens is at about 2100 Å.

The observations were carried out with the right-hand hatch open and with the spacecraft docked to the Agena. The camera was attached to the spacecraft frame by a bracket which positioned the field center 5° above the roll axis of the spacecraft. To operate the camera, Gordon stood up in the open hatch while Conrad remained in his seat to control the pointing of the spacecraft and to time the length of exposures. Each field was visually located by the astronauts, and the Gemini attitude control system was used to point the spacecraft at the region. The Agena's automatic stabilizing system was then activated, and Gordon proceeded to take six exposures on each field with lengths ranging from 20 seconds to 2 minutes.

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5. We thank many persons in NASA for assistance in the conduct of this program. Chief among these are the Gemini 11 flight crew, Commanders C. Conrad and R. Gordon; C. Kotila, technical monitor for this experiment; and R. Stokes, who supervised the development of the Maurer camera.

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Signs Test Applied to Caribbean Deep-Sea Core A 172-6

Abstract. *Caribbean core A 172-6 of the Lamont Geological Observatory series has been subjected to a nonparametric test for trend in order to examine the distribution of selected elements and of published paleotemperature data throughout a core length of 9.35 meters. First appearance of trend below top of core has been calculated, and the results of these tests are discussed.*

Core A 172-6 of the Lamont Geological Observatory series was spectrochemically analyzed for selected major and minor elements and the data thus obtained were compared in a study by Yalkovsky (*1*) with published paleotemperature data [Emiliani (*2*)] at correlative sampling intervals of 10-cm spacing throughout a core length of 9.35 m. The elements considered (among others analyzed for) in both the earlier investigation and the study reported here are aluminum, silicon, iron, titanium, calcium, magnesium, and manganese.

This core is a sample taken from the eastern extension of the Beata Ridge (14°59′N, 68°51′W) from a depth of 4160 m by means of a Kullenberg-type piston corer. It has been described by Ericson (*3*) as being composed of uniform foraminiferal lutite that gives evidence of continuous normal deposition (that is, particle-by-particle) and as being apparently free from sand and graded silt layering, cyclical banding, and color differences. It has been further described by Suess (*4*) as having been selected because of apparent homogeneity of appearance and as being as free as possible from the effects of turbidity currents, erosion, or slumping. Radiocarbon dates established for several horizons of this core by Suess (*4*) would give an average rate of sedimentation of 3.70 cm per 1000 years for the interval included. Paleotemperatures established by Emiliani (*2*) fall within the range 19.7° to 30.4°C.

In order to test the stability of the core, as well as to examine the relations among the various components and particularly their distribution with respect to time, some of the major elements and the paleotemperature have been subjected to a signs test for runs with time considered to be related directly to depth below top of core.

Two general kinds of information