The partial pressures found for the oxides and dioxides of titanium and zirconium are of particular interest. The abundances of the elements given by H. C. Urey [*The Planets* (Yale University Press, New Haven, 1952), p. 231] were assumed to represent the composition of the main sequence stars in this investigation. In this case, the partial pressures of TiO and ZrO are governed strongly at higher temperatures by the concentration of the neutral atoms of Ti and Zr while at the lower temperatures by the formation of TiO_2 and ZrO_2 . The ZrO passes into the dioxide form in significant amounts at higher temperatures than does the TiO and this appears to be a more important factor in controlling the relative abundance of TiO and ZrO than the total amounts of Ti and Zr involved.

Variations in the Law of Interstellar Reddening.

STEPHEN E. STROM, *Harvard College Observatory and Smithsonian Astrophysical Observatory*.—The effect of the ratio of polarization to total absorption on the law of interstellar reddening has been studied. From the photometric data of Borgmann (Borgmann, J., *Bull. Astron. Inst. Neth.* **15**, 251, 1960) and the polarimetric study of Hiltner (Hiltner, W. A., *Astrophys. J. Suppl.* **2**, 389, 1956), a color-excess ratio, which avoids luminosity effects, was calculated for two groups of stars. The first of these groups consisted of 25 stars for which the ratio $p/(3E_{B-V}) \geq 0.044$; the second group consisted of 23 stars for which $p/(3E_{B-V}) \geq 0.016$. The two groups were found to have significantly different color-excess ratios. The paper discusses the possible effects of galactic longitude, spectral and luminosity class, and depolarization in influencing this result.

The $p/(3E_{B-V})$ ratio has also been studied for a sample of stars lying behind high-velocity interstellar clouds. For this sample, the ratio is anomalously high.

An observational program of polarization vs wavelength measurements is discussed with regard to these results.

Variation of the Quiet Sun at 9.1 cm Wavelength with Sunspot Cycle.

G. SWARUP, *Stanford University*.—The brightness distribution across the quiet sun at 9.1-cm wavelength has been determined using the Stanford spectroheliograph antenna, which provides 3 min-of-arc wide pencil beams. The flux-density of the quiet sun has decreased from $135 \times 10^{-22} \text{ W m}^{-2} \text{ cps}^{-1}$ in 1958 to $68 \times 10^{-22} \text{ W m}^{-2} \text{ cps}^{-1}$ in 1962. The brightness distribution is markedly asymmetrical and shows limb brightening in the equatorial regions but not in the polar. The central brightness temperature has varied from about $35\,000^\circ\text{K}$ in 1959 to $25\,000^\circ\text{K}$ in 1962. The observations are compared with various models of chromosphere and corona.

The effect of chromospheric spicules on the radio emission at centimeter wavelengths is examined. It is found that the spicules produce fine structure in the brightness distribution across the sun in wavelength range of a few millimeters to a few centimeters, which should be detectable with two-element interferometers with modest collecting area and at spacings up to about 200 000 wavelengths.

Spectrum of the Slowly Varying Component of Solar Radio Emission.

G. SWARUP, *Stanford University*, T. KAKINUMA, *Nagoya University, Japan*, A. E. COVINGTON AND G. A. HARVEY, *National Research Council, Canada*, R. F. MULLALY AND J. ROME, *CSIRO, Australia*.—The characteristics of the slowly varying component of solar radio emission associated with sunspot groups having areas >500 millionths of the solar hemisphere have been determined by combining high-resolution observations of ten sources obtained at wavelengths of 3.2, 7.5, 9.1, 10.7, and 21 cm. The observations were made with interferometers which are located at Nagoya, Ottawa, Stanford, and Sydney, and which provide fan and pencil shaped beams having widths of about 1 to 3 min of arc.

It appears that a strong source of the slowly varying component has a higher value of flux density near 10 cm than at 3 cm or 21 cm. The size has a value of about 2 to 3 min of arc at wavelengths of 3 and 10 cm and about 3 to 4 min of arc at 21 cm. The calculated values of heights show a large scatter, but are of the order of 10 000 to 20 000 km at wavelengths of 3 and 10 cm, and about 40 000 to 90 000 km at 21 cm. The radio emission is circularly polarized, with the degree of polarization being $>30\%$ at 3 cm, $\sim 10\%$ at 10 cm and $<2\%$ at 21 cm. At 10.7 cm, the radio brightness temperatures of the ten sources range from 1.6 to $3.8 \times 10^6 \text{ K}$, when it is assumed that the north-south widths of the sources are the same as the measured east-west widths. The temperatures show good correlation with both sunspot areas and magnetic fields.

It is found that the observed spectral characteristics are not consistent with simple magneto-ionic theory in which only the effect of electron-ion collisional absorption is considered; resonance absorption at harmonics of the gyromagnetic frequency should also be considered to explain both the flux density spectrum and the polarization (Kakinuma and Swarup, *Astrophys. J.*, November 1962).

Kinematical Analysis of the Cepheid Variables.

BUNSHIRO TAKASE, *Radio Astronomy Laboratory, University of California*.—The selected 130 Cepheid