Cygni. The time of secondary minimum does not fall at phase 0.5 and is found to be a function of wavelength. The color index curves indicate the two stars to be essentially alike. The light curves undergo continuous variation, signifying highly ellipsoidal components. The minima are asymmetric; secondary minimum is of greater duration than primary minimum. The light in the maximum shows a reflection effect ($\cos\theta$ term) which has a sign opposite that expected by theory. A tentative orbital solution is discussed.

Steady-State Populations in an A0 Atmosphere.

MYRON LECAR, *Goddard Institute for Space Studies and Yale University Observatory*.—Previously (Lecar, M., NASA TN-D-2110, 1964), steady state populations had been computed for the first 10 states of hydrogen, using radiation fields from an LTE atmosphere ($T_e = 10^4$ °K, $g = 10^4$ cm/sec²). Departures from LTE were found to be negligible at the depths where the Balmer and Paschen continua were formed, and thus the emergent continuous spectrum was accurately predicted by the LTE atmosphere.

The calculation of the steady state populations was modified to take into account the effect of the departures from LTE on the radiation field. The departures from LTE increased significantly at the depth where the Lyman continuum is formed, but the effects of these departures did not propagate into the deeper layers. To an accuracy of 1%, the emergent continuous flux in the Balmer and higher continua remained representative of an LTE atmosphere.

Spectrum of Deneb: 1887-1963.

WILLIAM LILLER AND MARTHA H. LILLER, *Harvard University*.—From a study of 86 moderately high dispersion spectrograms of Deneb taken at the Harvard College Observatory and the University of Michigan Observatory, we have found from a comparison of the central intensities of the H line of Ca II and H ϵ that this A2 Ia star was approximately 200°K hotter during the period 1887-1901 than it is now. Little temperature change has occurred since 1910. Ratios of line strengths such as $\lambda 4481$ (Mg II)/ $\lambda 4508$ (Fe II) have remained unchanged making it clear that the spectral changes result from activity in the shell which is known to surround Deneb. The helium lines at $\lambda 4471$, 4026, and 3888 are too weak in our material to be of any use in this analysis.

Interpretation of the Distortion of Profiles of Coronal Emission Lines. C. G. LILLIEQUIST AND D. E. BILLINGS, *High Altitude Observatory*.—A

pattern of profile distortion from Gaussian correlating well with half-width has been found in sets of tracings of graded height, red line spectra. One very successful interpretation of this pattern is a combination of orderly distorting influences due to a broad temperature distribution and coherent macroscopic mass flow (Billings, D. E., *Astrophys. J.* **139**, 710, 1964). Least-squares fitting of the observed profiles to patterns of theoretical distorted profiles yields an approximate temperature distribution with a most abundant temperature near 660 000°K and 10% of the radiating ions at 480 000° and 900 000°K, at the $1/e$ levels in the distribution, and a line of sight component of mass flow between 7 km/sec and 14 km/sec. If the profiles in such a set of tracing were assumed to be Gaussian, their linewidth temperatures would vary between 1 000 000° and 1 800 000°K.

Light Scattering by Small Particles in the Zodiacal Light.

S. LITTLE, B. J. O'MARA, AND L. H. ALLER, *University of California, Los Angeles*.—Models of the zodiacal cloud in the plane of the ecliptic have been computed using scattering functions taken from experimental results of N. Richter *et al.* (*Veröff. Sonneberg* **5**, 201, 1962) and the Mie theory for spherical particles. We have attempted to determine the size distribution, the density variation, the number density at the earth's distance, the albedo, and the composition (dielectric vs metallic particles). We have compared Richter's results with those predicted for the same particle size distribution to assess whether it is justifiable to apply the Mie theory for crushed nonspherical aggregates. The existing zodiacal light observations permit a wide range of solution in particle size distribution, density distribution, etc., for plausible choices of dielectric materials. It is probable that the metallic component is small.

Infrared Brightness Temperature of Saturn.

F. J. LOW, *National Radio Astronomy Observatory*.—Infrared intensities of Saturn, Jupiter, and Mars have been measured relative to a number of stars. These data show that at wavelengths shorter than $14\ \mu$ the brightness temperature of Saturn is well below the value of 125°K deduced by Menzel, Coblentz, and Lampland (*Astrophys. J.* **16**, 177, 1926). The visual Bond albedos of Saturn and Jupiter imply that solar radiation alone can sustain surface temperatures of 89°K and 124°K, respectively. The measured brightness temperatures of the two planets are only slightly above these temperatures and are accurately inversely proportional to the square root of their distances from the sun. The increase in brightness temperature at