We have calculated the occupation numbers for the terms in a model ion (3 bound terms and continuum) using the statistical equilibrium equations and taking into consideration all radiative and collisional transitions. The optical depth required to explain the observations implies marked departures from local thermodynamical equilibrium in the region (~ 500 km) where the lines are formed (the b values for the ground term $\sim 10^4$).

We have studied the profiles of the resonance lines on spectra of quiescent prominences taken with the Climax coronagraph. In most cases the lines are Gaussian to within the accuracy of the measurements, the broadening velocity corresponding to ~ 10 – 12 km/sec.

Astronomical Instrumentation for Project Polariscope. T. M. TESKA, S. F. PELLICORI, AND E. H. ROLAND, *The University of Arizona*.—A 28-inch balloon-borne telescope with a Wollaston prism polarimeter is to be flown during the winter of 1963–64 in order to make observations in the ultraviolet between 3000 and 2000 Å (Gehrels and Teska, *Appl. Opt.* **2**, 67, 1963).

The Wollaston-type prism is constructed of ammonium dihydrogen phosphate (ADP). The prism uses a 25° angle of cut with the halves of the prism contacted with a silicone fluid. Since the birefringent material used for construction is fragile, the prism is sealed in an insulated cell having high thermal mass. This cell is provided with fused silica windows. The transmission of each of the optical beams slowly drops from 70% at 3000 Å to 30% at 1950 Å for the 40-mm length of prism used.

Tentative filters having widths of about 200 Å have been constructed and tested. The filters are dyed silicone fluids mounted between silica windows and cast in an epoxy cell. The filter materials used are *p*-dimethylaminobenzaldehyde and 2-methylpyrazine. The filters are transparent above 3500 Å and must be used with "solar-blind" photocathodes such as cesium telluride.

The photomultiplier outputs are integrated using transistorized versions of the Weibrecht Mark-Six system. A single-ended electrometer-tube input stage is followed by a silicon field-effect transistor which drives the output stages of the amplifier. The amplifier is temperature compensated for low zero drift consistent with a readout resolution of one part in 4000. Dry-reed relays are used for capacitor switching.

For testing of components in the laboratory, a number of optical modules can be bolted together in various serial arrangements. The individual modules are a monochromator, a collimator, a reference detector, a goniometer table, an ADP Glan–

Thompson polarizing prism, a telescope, and a detector. This test instrument is rigidly constructed to allow it to be mounted on the Polariscope telescope for polarimeter calibration.

Hydrogen Line Observations of M33. K. C. TURNER, M. A. TUVE, AND B. F. BURKE, *Carnegie Institution of Washington*.—A series of observations spaced at intervals of a half beamwidth (every 5 min of arc) was made along the major and minor axes of M33 with the NRAO 300-ft radio telescope and the Carnegie 90-channel hydrogen-line receiver. No evidence of expansion was found along the minor axis, although some asymmetry in velocity was seen at the center. The recession velocity of the nebula was found to be 179 ± 1 km/sec. At least two hydrogen spiral arms could be distinguished on either side of the center along the major axis. Marked departure from solid-body rotation occurs at about 10 min of arc from the center. After this point the rotation laws for the two halves of the nebula differ from one another. No hydrogen was observed with rotational velocity greater than 150 km/sec with respect to the center. A rotation curve for the object would have a maximum velocity below 100 km/sec.

Astrometric Study of Barnard's Star. PETER VAN DE KAMP, *Sproul Observatory*.—A total of 2413 plates, taken with the Sproul 24-inch refractor, ranging in epoch from 1916 to 1962 are available for analysis. About three-fourths of the material was measured twice.

An intercomparison of the 12 measurers and their times of measurements revealed a reasonable constancy of the Gaertner measuring machine over two decades and a generally satisfactory small degree of personal equation.

All measurements were corrected for the latest values of parallax, proper motion, acceleration, and known color and magnitude effects. The yearly mean residuals, of average weight 64 (96 plates) clearly exhibit a long-period systematic run, mainly in right ascension, but also in declination, which admits of no simpler explanation than that of a perturbation, caused by an unseen companion of Barnard's star.

Thanks to the early observations (1916–1919) both proper motion and secular acceleration of Barnard's star are known with high accuracy (*Astron. J.* **67**, 284, 1962). Although it is still possible to admit small changes both in the proper motion and the period of the perturbation, it appears unlikely that the period could be shorter than