Cepheus IV Association. G. A. H. WALKER, (introduced by R. M. Petrie), *Dominion Astrophysical Observatory*.—A group of 16 heavily reddened OB stars were found at $0^{\text{h}}, +67^{\circ}$ by Blanco and Williams (*Astrophys. J.* **130**, 482, 1959) close to the bright $H\text{ II}$ region S-278, on objective prism plates. Radial velocities, $H\gamma$ absolute magnitudes, spectral types, and central depths of the $\lambda 4430$ interstellar band have been derived from slit spectra for 13 of these stars at the Dominion Astrophysical Observatory. Two stars within $2'$ of the close central triplet of the association were also found to be OB stars. The spectral types agree well with those of Blanco and Williams. All the stars show poor lines and, according to $H\gamma$, are subdwarfs. This is supported by the prominence of the $\lambda 4686\text{ He II}$ line in absorption for the stars of B0 and earlier. The $H\gamma$ spectral type relation shows stronger $H\gamma$ than the Orion association, suggesting that Cepheus IV is very young. None of the stars is early enough in type to account for the extensive surrounding $H\text{ II}$ region, and it is suggested that there may be many association members too heavily obscured for detection.

The $H\gamma$ profiles seem to be variable for eight of the stars and the radial velocities show large variations. This suggests that they are similar to $\beta\text{ CMa}$ type variables although the latter are thought to be subgiants rather than subdwarfs.

The relative MKK class V luminosities give a very good correlation with V_0 but the relative $H\gamma$ luminosities do not. The 4430 intensities suggest that the E_{B-V} values are too large for four of the brightest stars. Adjustment of the V_0 values as indicated by the 4430 measures gives a satisfactory agreement with the $H\gamma$ luminosities. The $H\gamma$ luminosities and adjusted V_0 values give a distance of 860 pc. The MKK luminosities and unadjusted V_0 values give 808 pc.

General Circulation of the Solar Atmosphere. FRED WARD (introduced by Nannielou H. Dieter), *Air Force Cambridge Research Laboratories*.—Consideration of the solar rotation rate and its latitudinal variation leads to the hypothesis that the lower part of the solar atmosphere has large and dynamically important nonaxisymmetric horizontal circulations. This follows from an examination of the results of recent hydrodynamical model experiments and measurements of the energy balance in the terrestrial atmosphere. These results show how radically a thermodynamically driven circulation can be altered by rotation.

In this proposed model for the general circulation of the solar atmosphere, there are large-scale horizontal motions with east-west and north-south

components. These motions are variable in time, latitude, and longitude. Moreover, these motions are organized, that is, the latitudinal and longitudinal components are correlated. This correlation is such that fluid with an excess east-west velocity (excess angular velocity) will also tend to have an equatorward proper motion. Fluid with below average angular velocity will tend to have a poleward proper motion. In this way horizontal exchange processes operate to maintain a differential velocity profile, i.e., the equatorial acceleration.

A test for the existence of such a circulation from sunspot proper motion data yields positive and statistically significant results. These organized horizontal motions transport angular momentum (counter to the mean gradient) toward the equatorial regions. The rate of transport is such that if this mechanism were to cease, and all other processes continued unabated, the solar atmosphere would reach solid rotation in just a few rotations.

Photometric Investigation of the Galactic Clusters M37 and NGC 2420. FREDERICK R. WEST, JR., *Ames Research Center*.—The galactic cluster M37 is found to be a large, rich cluster with about 930 member stars brighter than apparent visual magnitude $V=17^{\text{m}}.7$ within a radius of $10'$ from the cluster center. Star counts show its linear diameter to be about 13.5 pc. The interstellar reddening is found to be constant across the cluster with the color excesses $E_{(B-V)}=0^{\text{m}}.27$ and $E_{(U-B)}=0^{\text{m}}.24$ adopted for the cluster stars. No ultraviolet excess is found for the stars of M37. The evolutionary deviation method of Johnson gives an (unreddened) distance modulus of $10^{\text{m}}.8 \pm 0^{\text{m}}.1$ and an age of 220×10^6 yr for the cluster. The color-magnitude diagram shows a well-defined main sequence and a red giant branch with 27 members. The luminosity function of the cluster main sequence closely agrees with the smoothed initial luminosity function of Sandage to $M_V=6^{\text{m}}$ mag.

The galactic cluster NGC 2420 is not as large and rich as M37, with a diameter of at least 10.5 pc and at least 500 members brighter than $V=19^{\text{m}}.0$. The cluster stars show a definite ultraviolet excess $\delta(U-V)=0^{\text{m}}.09$, but very little interstellar reddening, with color excesses $E_{(B-V)}=0^{\text{m}}.01$, $E_{(U-B)}=0^{\text{m}}.01$. The evolutionary deviation method of Johnson gives an (unreddened) distance modulus of $11^{\text{m}}.9 \pm 0^{\text{m}}.2$ and an age of 2×10^9 yr for the cluster. NGC 2420 turns out to be considerably older than M37. The color-magnitude diagram shows a main sequence $0^{\text{m}}.3$ wide in $(B-V)$ and a steep, well-defined red giant branch. A few cluster members appear to lie in the Hertzsprung gap region of the color-magnitude diagram. The luminosity function