Since, for each value of F , the corresponding error in A is only about 0.2, the internal errors of both R_0 and ω'_0 are very small, provided $AR_0 = 150 \pm 10$ km/sec. Thus the major source of uncertainty in these parameters lies with the distance scale.

R. P. Kraft (private communication, 1963) points out that the Cepheid colors may be systematically different than quoted in the original paper by 0.04 mag. So the zero point is probably 0.1 mag. brighter than in Kraft and Schmidt (1963). If so, their distance scale should be increased by about 10%, hence $F \sim 1.1$.

For comparison, the sum of squares of the residual radial velocities based on an identical analysis of the same 144 Cepheids is $19\,945 \text{ (km/sec)}^2$ for Kraft and Schmidt's model ($K = -3.0$, $R_0 = 10.0$, $\omega'_0 = -3.0$, $\omega''_0 = +0.32$, $\omega'''_0 = 0$) and is $24\,560 \text{ (km/sec)}^2$ for the Australian conference model (Standard solar motion, $K = 0$, $R_0 = 10.0$, $\omega'_0 = -3.0$, $\omega''_0 = \omega'''_0 = 0$).

Prominence Magnetic Fields and their Time Variations. CHARLES L. HYDER, *Institute of Geophysics and Planetary Physics*.—The polarization of prominence-emission lines has been observed by Lyot (*Compt. Rend.* **198**, 250, 1934; *Bul. Soc. Astron. France* **51**, 203, 1937), Newkirk (*Publ. Astron. Soc. Pacific* **70**, 185, 1958), Brückner (*Z. Astrophys.* **58**, 461, 1963), and Hyder (submitted to *Astrophys. J.*, 1964). Theoretical studies of these observations lead to inferences about the behavior of prominence magnetic fields over several sunspot cycles.

The theoretical analysis of Lyot's observations (J. W. Warwick and C. L. Hyder, submitted to *Astrophys. J.*, 1964) allowed us to infer that initial prominence magnetic fields are either tangent to or perpendicular to the solar limb below the prominence. This initial field is distorted by solar differential rotation. The differential rotation drags the initial fields into a configuration that has significant components along the sun-earth line for prominences at the limb. The strength of the sun-earth component increases with the age and the solar latitude of the prominence.

As speculated by Warwick and Hyder, the observations by Hyder appear to have been conducted as the directions of the prominence-magnetic fields were in the process of reversing. At the time of the observations, 16–20 March 1964, the new cycle was known to have begun in the northern hemisphere while there had been no sign of the new cycle in the southern hemisphere. Thus all of the prominences in the southern hemisphere were associated with the old cycle while some of the prominences

in the northern hemisphere were associated with the new cycle.

If the polarities of the prominence-fields reverse at sunspot minimum, then one would expect the reversal to have occurred in the northern hemisphere but not in the southern hemisphere. The observations carried out by the author bear this out. These observations will be continued at the Climax Observatory throughout the coming solar cycle.

The association of prominence-magnetic fields with other solar fields are discussed.

Evolution through Alpha-Burning ($M = 3 \rightarrow 15 M_\odot$).

ICKO IBEN, JR., *California Institute of Technology*.—Models of 3, 5, 9, and 15 solar masses and Population I initial composition are followed from gravitationally contracting phases through hydrogen and helium burning stages up to the development of an ^{16}O core. The elements ^{12}C , ^{14}N , ^{16}O , ^1H , ^3He , and ^4He are followed in detail. Alpha-particle burning involves the reactions $^8\text{Be}(\alpha, \gamma)^{12}\text{C}$, $^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$, and $^{14}\text{N}(\alpha, \gamma)^{18}\text{F}$. It is found that, due to the extension of a convective envelope down to regions in which ^{12}C has been converted almost completely to ^{14}N , the surface ratio of ^{14}N to ^{12}C immediately preceding and following giant phases is considerably larger than this ratio in the contraction and early hydrogen-burning phases.

From an initial value of 0.333, the $^{14}\text{N}/^{12}\text{C}$ mass ratio increases to 1.27, 0.88, and 1.09 for $M/M_\odot = 9, 5$, and 3, respectively. This ratio is not changed further during core-helium burning stages. Since, as the calculations show, a star in the mass range $3 \leq M/M_\odot \leq 9$ spends approximately 25% of its life in the core helium burning stage relative to its life near the main sequence in the core-hydrogen burning stage, a statistically large fraction of stars which lie in the Hertzsprung–Russell diagram where core-helium burning is expected to occur should show the predicted enhancement.

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Recombination Spectra of Hydrogen and Helium in Gaseous Nebulae.

JAMES B. KALER, *University of California, Los Angeles*.—The higher members of the Balmer series in the planetary nebula NGC 7027 are much brighter than they should be according to theories of radiative recombination in gaseous nebulae. This result, obtained by Aller, Bowen, and Minkowski (*Astrophys. J.* **122**, 62, 1955) is confirmed by an analysis of more detailed observations secured by Aller, Bowen, and Wilson (*Astrophys. J.*