Space Administration, Goddard Space Flight Center, Theoretical Division, Silver Spring, Maryland.—Computations of advanced evolutionary phases were made for a Population I star of 15.6 solar masses, whose hydrogen-burning phase was treated by S. Sakashita, Y. Ono, and C. Hayashi [1959, *Prog. Theoret. Phys. (Kyoto)* **22**, 531]. The effect of radiation pressure was taken into account. The helium-burning phase accounts for the early-type supergiant branch of the H-R diagram of the double cluster h and χ Persei.

A gravitational contraction phase begins during hydrogen burning when $X_{\text{core}}=0.005$. The effective temperature increases slightly for 1.4×10^5 years until $X_{\text{core}}=0.00003$. The envelope then expands, while the inner regions continue to contract until gravitation is providing most of the star's energy. At $T_e < 9000^\circ\text{K}$, the direction of evolution in the H-R diagram again reverses and the star begins to burn helium as an A-type star near the low-temperature end of the early-type supergiant branch of h and χ Persei. For this phase we essentially repeated the work of C. Hayashi, J. Jugaku, and M. Nishida [1959, *Prog. Theoret. Phys. (Kyoto)* **21**, 315], but included the effect of the conversion of helium to carbon on the mean molecular weight. We find higher central temperatures for the later stages of helium burning and also a reversal of direction of the evolutionary track when the star has become a late B-type with $Y_{\text{core}}=0.35$, after 8.2×10^5 years of helium burning. The star reaches the M-type supergiant region in an additional 3.4×10^5 years with $Y_{\text{core}}=0.015$ and a central temperature of 3.2×10^8 °K. The mass of the convective core during helium burning increases monotonically. Thus the dependence of the later evolutionary phases on the star's helium-burning history is small.

Preliminary results have been obtained for the subsequent carbon (or neon) burning phase, indicating a very large stellar radius, which will be reduced considerably when the outer convective zone is taken into account. This phase will probably account for the M-type supergiant branch of h and χ Persei. The central temperature at the onset of carbon burning is 7×10^8 °K and the central density is $40\,000$ g/cm³.

S Stars South of Declination -25° . KARL G. HENIZE, *Dearborn Observatory, Northwestern University, Evanston, Illinois.*—A catalogue of 145 S stars found on the objective-prism spectrum plates of the Michigan-Mount Wilson Southern $H\alpha$ Survey has been compiled. This survey covers the sky south of declination -25° uniformly to red magnitude 10.5. The spectra cover the red-yellow region with a dispersion of 450 Å/mm at $H\alpha$ and permit classification of most of the stars by the Keenan system

through comparison of ZrO bands at $\lambda 6345$ and $\lambda 6474$ with TiO bands at $\lambda 5861$ and $\lambda 6159$. (Keenan, P. C., 1954, *Astrophys. J.* **120**, 484.)

Fifty-one of these stars are known to be variable. Of these, 20 appear in the *General Catalogue of Variable Stars* while the variability of the remaining 31 has been discovered in this survey. The percentage of variables increases both with later temperature class and with increasing ZrO abundance. The distribution in galactic latitude is approximately the same for the variable stars as for the nonvariables. Distribution in galactic latitude shows little or no dependence on the abundance of ZrO. The latitude distribution of all 145 stars is compared with the data of J. J. Nassau and V. M. Blanco (1954, *Astrophys. J.* **120**, 464) and is found to correspond closely to the distribution of their late-M stars.

In addition to the 145 clearly identifiable S stars, 18 stars with weak and somewhat uncertain ZrO and 4 stars with uncertain ZrO together with extremely strong sodium D absorption were found. The latter stars, which appear similar to WZ Cas, are VY Aps, UY Cen, CD $-60^\circ 30'17$ and Anon $08^h 45^m 9$, $-70^\circ 35'$ (1875).

Observations of Interstellar Lines. GEORGE H. HERBIG, *Lick Observatory, University of California, Mt. Hamilton, California.*—The coude spectrograph of the 120-inch telescope has been used since March 1960 for observations of interstellar lines in early-type stars, mainly with a dispersion of 2.0 Å/mm. The present report deals with the results obtained up to August, but covers only the ultraviolet spectral region. A weak interstellar line observed in ζ Persei by Spitzer and Field, and identified by Feast and by McKellar and Richardson as probably due to the molecule CH, has now been measured on a number of spectrograms of ζ Ophiuchi. The mean wavelength is 3143.17, which agrees well with the laboratory value of about 3143.15. In addition, two fainter predicted lines of CH have been found at 3137.53 and 3146.00, so that there can be no doubt as to the identification. A very faint predicted line of CH⁺, the R(0) line of the 4,0 band, has also been measured in ζ Ophiuchi at 3447.08. A specific search for interstellar lines of OH, OH⁺, NH, and CN⁺ has thus far been unsuccessful.

Parabolic Orbit Calculations on the IBM 650. PAUL HERGET, *Cincinnati Observatory.*—An IBM 650 electronic computer program has been planned to compute parabolic orbits for comets by means of Olbers' method. It is specifically designed to include a number of HALT's so that the operator may observe and control the course of the calculations until satisfactory residuals are obtained.

Control is effected by means of the "plus-minus" dial on the console, and arbitrary, trial values of M