The Determination of Composition and Mixing Length by Comparison between Stellar Models and the Observations. ICKO IBEN, JR., *California Institute of Technology*.—By fitting series of homogeneous composition stellar models to the Sandage (*Astrophys. J.* 125, 435, 1957) Population I age-zero main sequence, it is possible in principle to relate the initial hydrogen content of Population I stars to their assumed heavy element content. An imperfect understanding of convective flow through envelope layers of low mass stars demands that the comparison in the Hertzsprung–Russell diagram between models and observations be confined to the upper main sequence.

With Keller–Meyerott (*Astrophys. J.* 122, 32, 1955) opacities, it is not possible to reach the age-zero main sequence in the *H-R* diagram with $Z \leq 0.03$ and “reasonable” values of X_H . That is, no fit with $Z \leq 0.02$ and any X_H , fits with $Z = 0.03$, $X_H > 0.9$. For each value of $Z \leq 0.03$, the model line closest to the age-zero main sequence in the *H-R* plane lies outside the range permitted by the empirical mass–luminosity relationship for nearby main sequence stars. A good fit in the *H-R* plane may be achieved with $Z = 0.04$, $X_H \sim 0.7$.

However, it appears that the surface temperature of a model upper main-sequence star is significantly lowered by the addition of line effects to the total opacity. With Cox opacities (in Vol. VIII of *Stars and Stellar Systems*) for the composition $Z = 0.02$, $X_H = 0.744$, surface temperatures are lowered by about 0.03 in the logarithm.

By assuming that $\Delta(\log T_e) = -0.03$ for all models computed with Keller–Meyerott opacities, a number of conclusions may be reached. In conjunction with the choices— $[N(O)/N(H)] = 1.4 \times 10^{-3}$ (Osterbrock and Rogerson, *Publs. Astron. Soc. Pacific* 73, 129, 1961); $(X_{16}/Z) = 0.423$ [Aller, *The Abundances of the Elements* (Interscience Publishers, New York, 1961)]; and $L \cong 0.76 L_\odot$ for the initial sun (Iben and Sears, unpublished, 1962)—, one finds that the composition of the initial sun is $Z \cong 0.034$, $X_H \cong 0.64$ and that all high-mass homogeneous stars of this composition lie on the age-zero main sequence in the *H-R* plane. In conjunction with Eggen’s (unpublished, 1962) determination of the masses of visual binaries in the Hyades cluster, one obtains a mean composition of $Z \sim 0.07$, $X_H \sim 0.17$ for Hyades stars. In summary, homogeneous stars of compositions $Z = 0.034$, $X_H = 0.64$ and/or $Z = 0.07$, $X_H = 0.17$ lie on the age-zero main sequence in the *H-R* plane, but of course lie on different curves in the mass–luminosity plane.

Despite the fact that convection rules over a large portion of the envelope of low-mass stars, the inclusion of line absorption also affects considerably the surface temperatures of lower main-sequence models. The determination of mixing length relative to density scale high and a careful appraisal of the validity of

the current theory of turbulent–convective flow must await the appearance of detailed opacities (line effects included) over a large range of composition parameters.

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An Experimental Determination of the Broadening and Shift of Neutral Helium Lines in a Plasma. I. Allowed Transitions. W. B. JOHNSON, *Speedway Laboratories, Linde Company, Indianapolis, Indiana* (present address: *Case Institute of Technology*).—Determinations of the spectral-line profiles of a number of transitions in neutral helium have been made using as a light source the high-current arc operating at atmospheric pressure in helium. These measurements have been made over a range of temperatures encompassed by $T = (16.5 \pm 1.5) \times 10^3$ °K and a range in the values of the electron density extending from 5×10^{15} to 4×10^{16} electrons/cm³. The broadening and shift of all the lines are seen to be a linear function of the electron density over this range. Agreement with theoretical estimates for the linear parameters is reasonably good, particularly for the case of linewidths. Comparisons with other experiments show good correlation of the data in most cases. Contrary to theoretical predictions for the above conditions, the lines do not fit a dispersion profile and are asymmetric.

Density Law in Spherical Stellar Systems. IVAN KING, *University of Illinois Observatory*.—An empirical density law has been found which represents the projected star distribution in globular clusters of all degrees of central concentration. The law has three parameters. One is a number factor, and the second measures the radius of the central density peak, or core. The third parameter is the limiting radius, at which the density drops to zero. Observed limiting radii agree closely with the cutoff to be expected as a result of galactic tidal forces. Since there is no reason to expect the limiting radius to be connected with the core radius, these three parameters are the minimum possible number, and globular clusters are as similar as they could possibly be. The profile of an individual cluster can be characterized by a concentration ratio—the limiting radius divided by the core radius. In globular clusters studied so far, concentration ratios run from 4 to 130.

The same density law fits published star counts in galactic clusters and Sculptor-type galaxies. Concentration ratios appear to run from 3 to 10. Giant