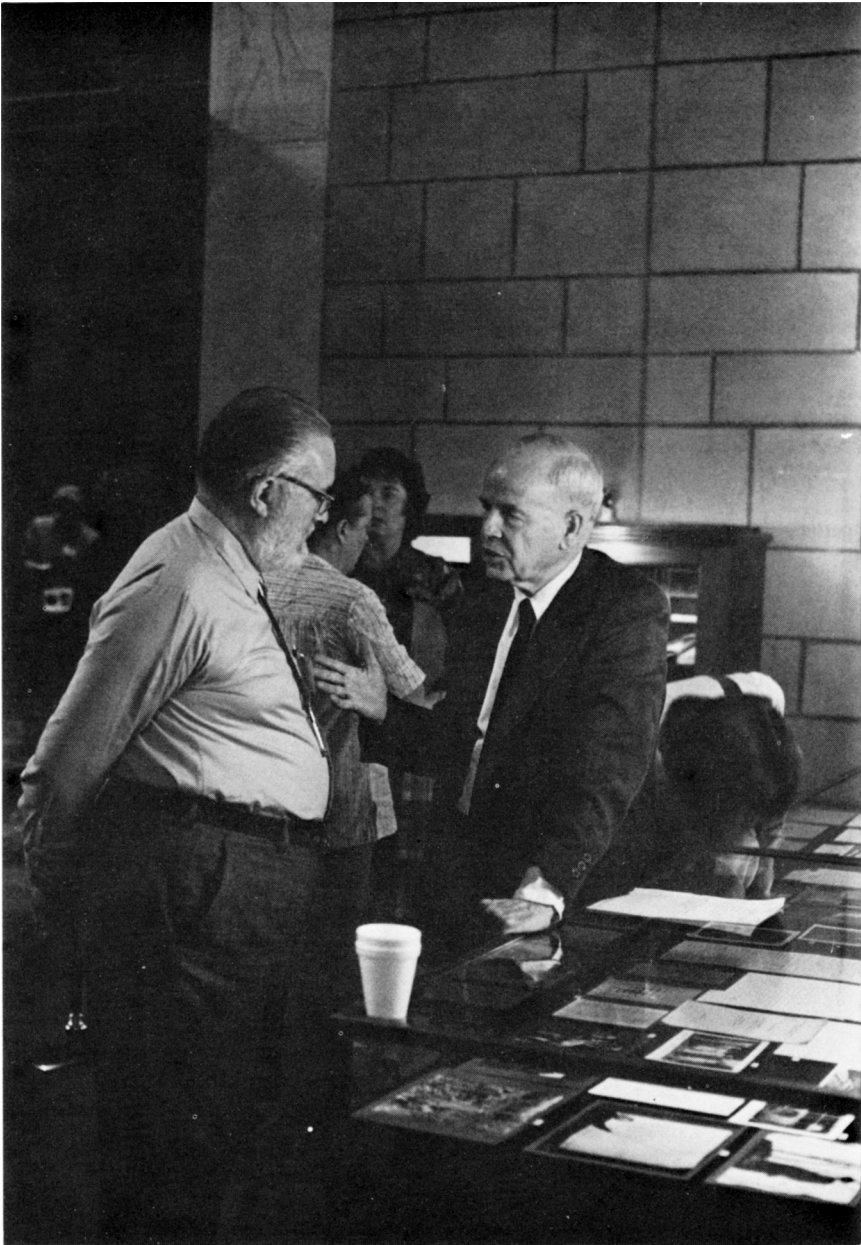


PART I

FUNDAMENTALS OF THE HR DIAGRAM



Frank K. Edmondson and W.W. Morgan.

SOME USES OF SPECTRAL CLASSIFICATION IN HR DIAGRAMS

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The MK spectrum-luminosity class diagram (S-LC diagram) between types O9 and G0 is a two-dimensional array containing approximately 100 - 150 information elements; each information element is a single cell denoted by a spectral type and a luminosity class. These individual, non-dimensional cells (i.e. AO III) can be considered as carriers of observational information toward the HR diagram. Some categories of peculiar spectra (for example, spectra resembling that of the "silicon star" θ Aur) can be attached to certain cells, and can be considered as local perturbations upon the underlying continuity of the spectrum-luminosity class sequences. By such a procedure, the S-LC diagram cells can be considered open-ended, in that progressive additions to the cells can be made indefinitely into the future. Such a procedure can incorporate successfully an unlimited variety of "normal" and "peculiar" categories of spectra - both those already known and those still to be discovered. A morphological system that is unitary thus comes into existence - a system of considerable astrophysical interest. The translation of the detailed language of this system into that of the classical HR diagram is a task for the future.

Several new examples of what could be called local perturbations in the continuity of the luminosity-class sequences have been discovered recently by Dr. H.A. Abt and the writer, while working on a revision of the Yerkes MK Spectral Atlas for stars earlier than the Sun; these include: (1) A category of B7 III - B9 III giants which have the property of relatively narrow, stellar K lines, together with broad lines of He I. Among members of this group, some (or all) of the peculiar Mn II - Hg II stars

are found. (2) A strong He I star has been found recently in the Orion Association; this makes a total of three such stars known there. All three of these stars lie very close to the Zero-Age Main Sequence as defined by Morton and Adams.

The investigation described here was based on features in the spectral range 3500 - 4700 Å. It is of prime importance to carry out similar investigations in other spectral regions. For this purpose, each region should be surveyed independently of the MK results for the photographic region described here. Thus, a system independent of the MK system would be devised in each case (far UV; green - red; infrared). When each such system has been completed, its morphology can then be compared as a whole with the MK system. A similar procedure should be followed for the weak-lined stars in the photographic region used here.

The new Spectral Atlas is being prepared for publication jointly by the Yerkes Observatory of the University of Chicago and the Kitt Peak National Observatory; the authors are H.A. Abt, J.W. Tapscott and Morgan. All spectrograms used in this work were obtained by Abt with the Meinel spectrographs of the Kitt Peak National Observatory and the Cerro Tololo Inter-American Observatory. The work was made possible by grants to Morgan from the National Science Foundation.

DISCUSSION

STENCEL: I'm glad you mentioned 31 Com since it and a few other early G giants (24UMa, HR 1327) exhibit obviously larger line widths at high-dispersion compared to early spectral types (e.g. F5III, G0IV, late G giants), presumably due to its position in the Hertzsprung gap. This discontinuity is in a sense similar to your discontinuity.

McNAMARA: It has been shown by Strom in NGC 2264 and myself for the Orion Nebula cluster that age spreads in young clusters can be at least 2×10^6 years, even during the stage of major star production. Could this age spread, extrapolated to higher luminosities explain the age differences that you have suggested for the Northern and Southern sword sections of the Orion Nebula region?

MORGAN: There seems to be strong evidence for differences in ages for different sub-clusterings in the Orion Association. At one extreme is the Orion Nebula cluster; at the other is the expanding group in the Northern region of the Association investigated by Janet Lesh.