STATISTICAL HR DIAGRAMS FOR ONE HUNDRED AND FIFTEEN THOUSAND PROPER-MOTION STARS

Willem J. Luyten

University of Minnesota

Since regular HR diagrams require apparent magnitudes, colors or spectra, and parallaxes, and such complete data are available for relatively few stars, there may be some advantage in making up diagrams which utilize proper motions instead of parallaxes, and are thus statistically similar to an HR diagram. The reduced proper motion, first used by Hertzsprung, is defined as $H = m + 5 + 5\log \mu$, but may also be written as $H = M + 5\log T$, where T is the tangential velocity, and is expressed in astronomical units per year. A diagram plotting H against color will thus contain the considerable dispersion in tangential velocity which is a serious disadvantage. However, this is outweighed by two practical advantages. First the one and the same person who does the proper motion survey can, and does also determine the other two quantities needed. Second, when using data obtained from such a proper motion survey one deals, statistically, with all the stars within a given distance and the results, therefore, are much more representative of the real situation in space than many HR diagrams which often contain an unrealistic preponderance of giants.

Utilizing the data obtained in the Bruce and Palomar Proper Motion Surveys I have made up such a diagram for 115,000 proper-motion stars brighter than the twenty-first photographic magnitude. It is immediately evident that white dwarfs and degenerate stars are much more numerous in space than yellow giants. Owing to the dispersion in tangential velocity and the existence of large numbers of high-velocity subdwarfs, the degenerate sequence is clearly indicated only for the bluest stars. A separate diagram has therefore been given for the degenerate stars, and this shows why relatively few yellow degenerates have been spectro-

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scopically confirmed thus far: the spectroscopists have limited their observations to stars which are too bright to contain more than a sprinkling of such yellow degenerates.

A further diagram is given which shows that a number of objects identified spectroscopically or photometrically as white dwarf are not degenerate at all. Using the proper-motion data to obtain corrections to my luminosity function a still further HR diagram is presented for all stars now expected to be within ten parsecs, and estimated to number about seven hundred. All these diagrams, as well as discussions of them are published in full detail in No. LI of the Proper Motion Survey with the Forty-Eight Inch Schmidt Telescope.

DISCUSSION

BUSCOMBE: H. Augensen has obtained slit spectrograms at Cerro Tololo for about 100 stars ($7<m_V<10$) from the LTT catalogue. Several have radial velocities more than 75 km/s relative to the Sun, and have particularly weak metallic lines.

LUYTEN: We would have expected that stars in this luminosity range would be high-velocity subdwarfs rather than fully degenerate stars.

SION: Have you constructed reduced proper motion diagrams for degenerate stars having spectroscopic identification?

LUYTEN: No, not separately, we just haven't had time to look up whether any of our 6,2000 degenerate stars had spectra determined for them.

STRAND: In your diagram of stars within 10 pc what is the evidence for the large population below 16th absolute magnitude belonging to the main sequence?

LUYTEN: These numbers were derived from my luminosity function which is still essentially the same as the one published in 1968.

STRAND: How many stars do you have at 20th magnitude with proper motions of a second of arc?

LUYTEN: I don't remember offhand but my guess is not more than eight or nine.

BIDELMAN: I would like to mention that S.G. Lee, a graduate student working with me, has determined Luyten's H vs. M relation separately for various spectral subgroups, using the stars having trigonometric parallaxes > ".025 that are included in the recent Giclas northern-hemisphere proper-motion catalogue. She finds that a mean relation very similar to that determined many years ago by Luyten, using quite different input data, fits all subgroups surprisingly well. The mean tangential velocity for the various subgroups ranges between 58 and 68 km/sec.

LUYTEN: I am glad to learn that there has been no important change in one of the basic relations which is needed in the derivation of the luminosity function.