DISCUSSION

Weidemann: The local mass density of white dwarfs as estimated by me in 1967, 0.02 or 0.04 $M_\odot/pc^3$ depended on observation of high latitude blue stars by Sandage and Luyten made that same year; they found one blue white dwarf per square degree down to the eighteenth magnitude. Are there any observational programs in progress or planned which might extend these studies to fainter magnitudes?

King: In a Berkeley program, George Chiu is determining proper motions of all stars in three fields of 1/10 square degree each. The accuracy is high down to the 19th magnitude and not quite as good from there to the 21st magnitude. A preliminary examination shows that some of the stars with large motions are yellow and white in color; there are about a dozen of these per field. Some of them may be halo main sequence stars, farther away but moving faster; but it is likely that something of the order of a dozen stars per field will turn out to be white dwarfs.

Gliese: We know two values for the total mass density near the sun: 0.09 $M_\odot/pc^3$ from Einasto and 0.15 $M_\odot/pc^3$ from Oort's paper in 1965. Can anyone comment on this discrepancy?

McCarthy: Both Oort and Einasto are here at Grenoble; perhaps we can ask them directly.

King: It appears to me that we no longer have large numbers of M dwarfs with low velocities; the space density and the velocity dispersions seem to be back to what we had expected. Yet one outstanding discrepancy remains: the statistical parallax of the Murray-Sanduleak stars, which gives a distance that now appears to be twice too small. Can anyone explain how this happened?

D. Jones: We realized three years ago that the ratio of the reverse solar motion to the dispersion in transverse velocity was erroneous for the Murray-Sanduleak stars. The statistical parallax was found by equating the mean proper motion to the basic solar motion. With the new photometric parallaxes the dispersion in transverse motion is nearly the same as for stars near the sun; the mean proper motion which should equal the reverse solar motion is now anomalous. We do not understand why.

Murray: Concerning the paper of Gliese I should like to speak in defense of so called "small" proper motions. We should remember that at 100 parsecs a velocity of 20 km/sec corresponds to a proper motion of 0".04/yr and any discussion which is limited to proper motions of 0".1 or 0".2 is bound to be very incomplete.

Gliese: The 21 Murray-Sanduleak stars proved to be very important for the problem of the space density of the M dwarfs. Therefore I am

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asking if photoelectric photometry exists for these stars. Furthermore: will it be possible to determine CaII emission intensities as age indicators?

D. Jones: Photoelectric colours *BVRI* have now been measured for all these stars by Weistrop and in *VRI* most of them have been observed by Bingham, Wallis and myself. The two series are in good agreement. Regarding the second question, the CaII emission should be measurable, but I do not believe such observations have been made.

King: I would like to emphasize the importance of correct photometry on a system that has no color-equation errors. It appears that the apparent density of M dwarfs is closely correlated with the reliability of the photometry. When the magnitudes and colors are correct, the excessive density of M dwarfs goes away. I should like to ask Dr. Weistrop if it is correct that the large reduction in her density determination for M dwarfs is due completely to a change in her photometry of these stars?

Weistrop: Yes, the photographic sample was the group for which photoelectric data were obtained. Some of the stars in the photographic sample were eliminated since they turned out to be bluer than $B-V = 1.40$ but you are essentially correct.

Strand: In reference to a remark by King that the photometry of the red dwarfs was poor for the purpose of determining photometric parallax he might have referred to the $B-V$ photometry which is not suitable for these stars, whereas $V-R$ or $V-I$ photometry is suitable.

Bok: We should use the PDS equipment for establishing sequences to $V = 21$ and to similar faint limits in *R* and *I*. I nominate SA 57 for northern work and SA 141 for southern work. I hope that in each of these areas for a field of 16 square degrees, more or less, good standard sequences can be established by combined photoelectric to $V = 16$ and photographic PDS techniques to $V = 21$ techniques. I hope too that machine color-magnitude counts can be made in these fields. We simply lack good faint counts for the polar caps. This must be remedied promptly.

King: In response to Bok's recommendation, I wish to point out that the presentation this afternoon by Kron will refer to some detailed work of the type that you advocate.

McCarthy: The fine illustrations of the effective use by Jones of luminosity criteria for M dwarfs by measuring the strengths of sodium and calcium hydride features reminds us that the first to use sodium as a luminosity criterium was Luyten and the one who first used calcium hydride was Ohman. Both of them are with us today and must be happy to see their findings so splendidly employed. I have two questions for D. Jones: how late in spectral type does your M dwarfs survey extend? and second, what has been the limiting *V* magnitude reached in your work?

D. Jones: To answer your first question: about dM5. Regarding the second question, I note that our list was supplied by Thè who believes that these stars are all fainter than $V = 15$. Staller is currently observing these stars photoelectrically in *R* and *I*. I should add that only 20% can be found in the best proper motion survey of Luyten and Giclas.

McCarthy: I wish Dr. Wing could tell us of the additional spectral criteria which he and Ford discovered near 9900Å in the spectra of dwarf M stars. Have subsequent observations confirmed this and is anything more known of its identification?

Wing: There is a feature at 9900Å in the spectra of cool M dwarfs found by Ford and myself in 1969. It has the property that it is quite strong in the latest M dwarfs, much weaker in the earlier M dwarfs and not at all visible in the M giants. Although it has never been applied to the problem of separating individual dwarfs from giants it has been used by Whitford to place upper limits on the contribution of M dwarfs to the integrated light of galaxies. Recently an identification of this band with FeH has been proposed by Nordh, Lindgren and myself; our paper summarizing the evidence is now being prepared. Thus the 9900Å band appears to be another band of a metallic hydride of low dissociation energy which gives a clear separation of giants from dwarfs. It is not a very easy feature to observe but it should have useful applications in classifying the reddest stars.

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