number of subscribers to the atlas, and subscribers may be asked to pay as much as 25 shillings. Sufficient support for the project has been received and the work has been commenced. Copies may be ordered from me.

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ON THE SPECTRAL TYPES AND LUMINOSITIES OF THE M DWARFS

1. The visual region of the spectrum is especially well suited to the determination of accurate spectral types of the K and M dwarfs. The low-level lines of sodium, calcium, and chromium increase rapidly in intensity from Ko to Mo and may be used for classification on spectrograms of very low dispersion. In the case of the M dwarfs the strong *TiO* absorption in the red region is a very sensitive criterion of spectral type; it is visible in giants of type Mo and increases uniformly in intensity in the later subdivisions. In addition, it is situated in the spectral region which can be most efficiently photographed with the new superspeed panchromatic emulsions. Spectrograms of tenth-magnitude M dwarfs can be obtained in a few minutes with the short-focus Moffitt camera, which, although designed for the photographic region, gives excellent definition over a flat field from $H\beta$ to Hα. The distance between $H\alpha$ and $H\beta$ on these spectrograms is 5.5 mm; a number of spectral features are observable, and K and M dwarfs can be separated readily from giants.

Spectrograms of a number of the brighter late K and M dwarfs have been obtained for the purpose of setting up a fundamental sequence of classification standards in the visual region. The accuracy of the classification has been found to be good; and, while the number of stars observed is small, some conclusions of interest may be drawn from their reclassification.

Twenty-five K and M dwarfs of large parallax are included in Table 1. The columns give the name of the star, the number in Schlesinger's parallax catalogue, the apparent visual magnitude, the trigonometric parallax, the visual absolute magnitude, and the

spectral type as determined from criteria in the visual region. For the K stars the intensity of *Cr* 5206, the D lines, and the *Ca* lines in the neighborhood of λ 6100 were used for classification; the *TiO* bands between λ 5800 and 6500 were used in the case of the M dwarfs. The three bright giants, δ Ophiuchi, γ Eridani, and α Ceti, which have been classified as Mo at Mount Wilson, were considered

TABLE 1

Star	Schlesinger	Apparent Vis. Mag.	π Trig.	Abs. Vis. Mag.	Spec. (Yerkes)
HR 753	769	5.9	0.144±5	+ 6.7	K3
70 Oph B	5405-B	6.0	.196±4	7.4	K4
61 Cyg A	6558-A	5.6	.299±3	8.0	K5
61 Cyg B	6558-B	6.3	.299±3	8.7	K6
Cin 2238	5009	8.3	.113±6	8.6	K6
Cin 2322	5191	7.8	.124±5	8.3	K6
Gmb 1618	3151	6.8	.220±8	8.5	K6
Castor C	2393-C	9.6	.073±3	8.9	K6
Lal 18115-A	2917-A	7.9	.162±3	9.0	Mo
Lal 18115-B	2917-B	8.0	.162±3	9.1	Mo
Lal 21258	3400	8.6	.174±8	9.8	Mo+
Cin 1383	3460	9.3	.120±5	9.7	M1
Gmb 34-A	71-A	8.1	.284±5	10.3	M1
Lal 25372	4119	8.5	.191±8	9.9	M2
Lal 21185	3389	7.6	.388±6	10.5	M2
Cin 1244	3188	9.4	.193±8	10.8	M3+
Cin 2354	5278	9.1	.213±5	10.8	M4
Σ 1398-A	5652-A	8.9	.282±4	11.2	M4
CC 995	4925	10.0	.255±5	12.0	M4+
Krüger 60-A	7020	9.8	.258±4	11.9	M4+
Σ 1398-B	5652-B	9.7	.282±4	12.0	M5
Barnard's Star	5352	9.7	.545±3	13.4	M6
Gmb 34-B	71-B	10.9	.284±5	13.2	M6
Wolf 359	.....	13.5	.403±10	16.5	M8
Wolf 489	4084	14.2	0.130±9	+14.8	<Mo

to be standards of that type for the dwarfs. The red *TiO* band is well seen in these stars with the dispersion used. The visual magnitudes were obtained from a number of sources; some of them are uncertain by several tenths of a magnitude. I am indebted to Dr. Kuiper for several of the values listed; I am also indebted to Dr. Kuiper for the inspection of his spectrograms of the last two stars, Wolf 359 and Wolf 489; these objects are too faint to be guided on with the Bruce spectrograph.

2. The absolute magnitudes and spectral types of the stars in Table 1 are plotted in Figure 1. There is a remarkably close agree-

ment between the luminosities of dwarfs of the same spectral type; if the various errors in the observations are taken into account, the true dispersion becomes vanishingly small, except in the case of Wolf 489, for which a spectral type of Mo has been published. The spectrogram of this star obtained by Dr. Kuiper, while underexposed, gives rather strong evidence that the type is earlier than Mo and that the star is of special interest. If it is of type G or K, then

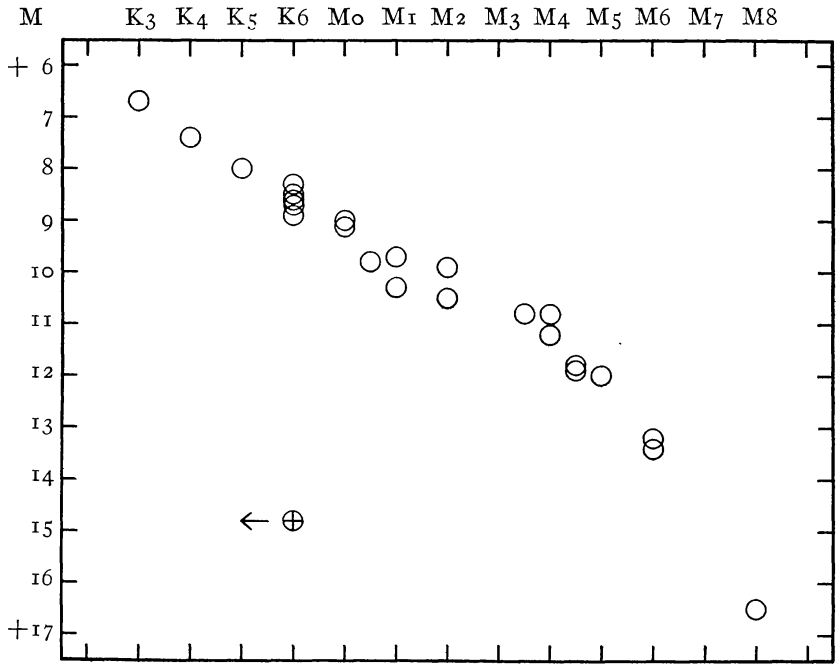

FIG. 1.—Spectral types and absolute magnitudes

it bears a position relative to normal G and K dwarfs similar to that which the white dwarfs hold with respect to the A-type main-sequence stars.

3. Although caution must be observed in making generalizations from the limited number of stars in Table 1, we may draw the following tentative conclusions concerning the late K and M dwarfs:

a) For any given spectral type (that is, for any given surface brightness or effective temperature), only one value of the luminosity is observed.

b) From (*a*) it follows that there is only one value of the radius for any given spectral type or luminosity.