# NOTE ON ABSOLUTE MAGNITUDES IN THE RED AND INFRARED OF LATE M-TYPE DWARFS

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**Abstract.** The importance of red and infrared magnitudes for late dwarf M-type stars is stressed. The absolute magnitudes for the nearest stars with $(R-I) \geqslant 1.20$ is re-assessed.

The Sproul Observatory astrometric program initiated in 1937 by Peter van de Kamp is primarily devoted to nearby stars which are to a great extent faint red dwarf stars. One of the main objectives is to ascertain whether these stars have unseen companions revealed by the discovery of variable proper motion. A by-product of this program is the accurate determination of parallaxes which leads to absolute magnitudes. Magnitudes in the red and infrared may also be important in pointing to unresolved binaries from red or infrared excess.

For late M dwarfs there is little difference in the $(B-V)$ with increasing $M_v$ whereas the $(R-I)$ changes significantly with $M_R$ for the very late type stars. Therefore, red and infrared colors and magnitudes can be important as standards. Kron and his associates' (Kron *et al.*, 1957) monumental photometric red and infrared work on 282 stars with known parallaxes includes many red dwarfs.

In this note I am particularly concerned with the study of the dispersion of color and magnitude for the very late M-dwarfs where $(R-I)$, Kron's system, is $+1.2$ mag. or greater. This constitutes stars with spectral types M4 and later with $M_v$ greater than $+12$. Kron (Kron *et al.*, 1957) has pointed out the intrinsic scatter, from $(B-V)$ vs $(R-I)$ plots, up to several tenths magnitudes far exceeding the probable errors assigned to the colors.

Turning to a plot of $M_R$ against $(R-I)$ for $(R-I) \geqslant 1.20$, (figure 1), the author has reassessed the parallax determinations of each star to achieve the best possible $M_R$. The probable error of each $M_R$ as determined from the probable error of the parallax is indicated. Since these are nearby stars with $\pi \geq +0''.10$ the *p.e.* in $M_R$ is generally smaller than $\pm 0^m.15$. The positions in the diagram show a scatter of 1 mag. in $M_R$ and 0.2 to 0.3 in $(R-I)$. Kron and associates (Kron *et al.*, 1957) found systematic differences that depend on space velocity. This appears true in the diagram for stars with $(R-I) < 1.3$, in the sense that high velocity stars are too faint for the $(R-I)$. The relatively few stars available, which are redder, do not show this systematic behavior. Components of double stars have been singled out to see if both components deviate from the average in the same way. In general this seems not to be the case. BD+19°5116 A, which is not red enough to appear in the accompanying diagram, is close to the average of other stars with similar color but the B component is outstanding. One obvious explanation is that BD+19°5116 B is a close double of near equal magnitudes. The

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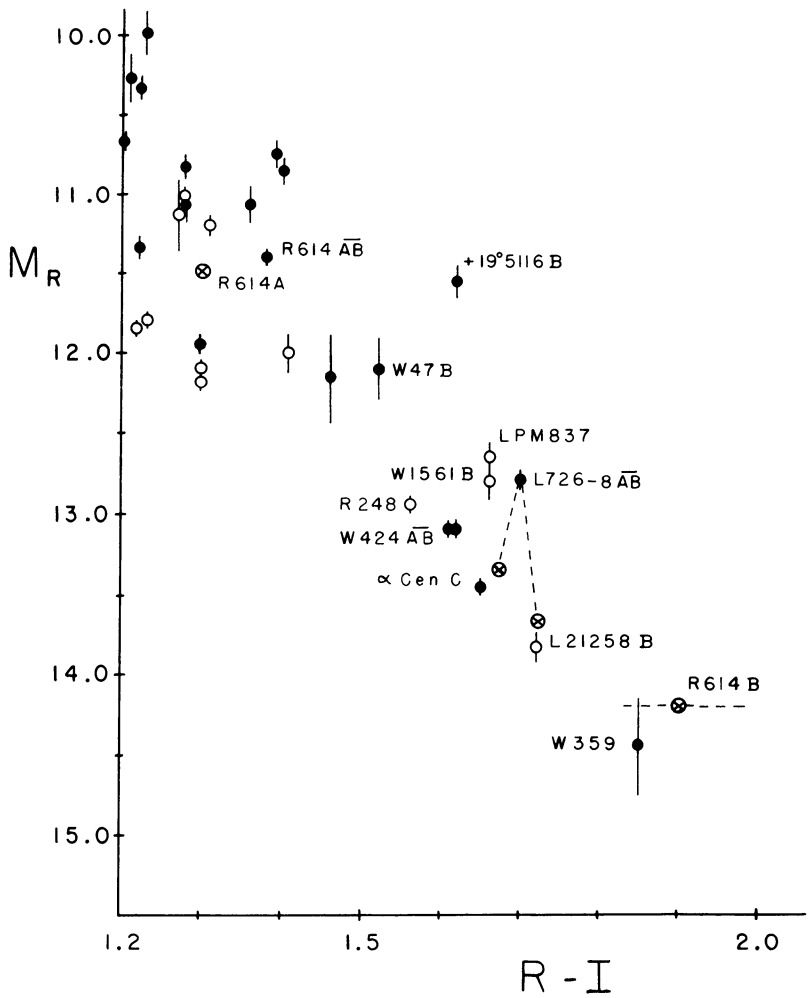


Fig. 1. $M_R-(R-I)$ relation for nearby late M type dwarfs. The vertical lines represent the probable errors of the $M_R$. The open circles indicate high velocity stars. The open circles with crosses inside represent estimates.

separate components of L 726–8 differing by 0.5 visual magnitude are estimated to lie close to α Cen C and Lal 21258 B, respectively.

The infrared magnitudes of Ross 614 A and B have been inferred by the shift in the blended image of the system toward their center of mass on Sproul astrometric infrared sensitive plates compared to the position of the blended image in the visual region. This shift yields a value for the $\Delta$ m in the infrared compared to that in the visual region (Lippincott and Hershey, 1972).

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## References

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Lippincott, S. L. and Hershey, J. L.: 1972, *Astron. J.* 77, 259.

## DISCUSSION

*Murray:* I feel that there really is a problem of the red dwarfs. Any kinematic investigation of these stars must be based on a selection by photometric criteria only. Unfortunately suitable plates for proper motion work, reaching $m_v \sim 17$ are not easily available, but anyone who has a suitable material should be encouraged to determine proper motions of all red stars in each field.

*McCarthy:* Concerning the need for more data for red dwarf stars discussed by Miss Lippincott and also by Murray I wish to point out the importance of red dwarfs in the Pleiades cluster. Ambartsumian has predicted that some 1000 stars fainter than $m_v = 13$ will prove to be cluster members at the faint end of the main sequence. Thus far some 200 flare stars have been discovered at the Byurakan, Asiago and Tonantzintla observatories. Most recently (August 1972) another 200 flare stars have been reported in a Buyrakan reprint. Many of those flare stars are identical with the faint red stars selected in objective prism studies by Treanor and myself and in preliminary blink estimates by Luyten.

The determination of $R - I$ colours will be important for these stars. In December 1971 I obtained 24 plates centered on the Pleiades in infrared, red, yellow and blue wave lengths with the Palomar 48″ (120 cm) Schmidt telescope. At Castel Gandolfo we have begun the determination of pseudo-magnitudes and colours for these stars. I welcome any suggestions and aids in determining a faint red and infrared photoelectric sequence as a basis for photoelectric interpolation.