Relative Photometry of HD 227858 and HD 338931 from Landholt Standard SA 113475

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Introduction

Methods

Results

Star	Filter	t(s)	$X = \sec z$	$S_{*,sky} = \mathsf{SUM}$	$S_* = \mathsf{FLUX} = \mathsf{SUM} - \mathsf{MSKY} * \mathsf{AREA}$
HD 227858	B	30	1.294	117809	39381
HD 227858	V	30	1.301	388133	131079
HD 227858	R	30	1.307	567655	254168
HD 227858	I	30	1.323	417430	260971
HD 338931	B	30	1.394	255793	152570
HD 338931	V	30	1.405	767017	494401
HD 338931	R	30	1.413	1390626	977589
HD 338931	I	30	1.424	1285304	1075136
SA 113475	B	30	1.206	169993	38822
SA 113475	B	30	1.482	179149	33471
SA 113475	V	30	1.207	477466	154874
SA 113475	V	30	1.498	665531	147737
SA 113475	R	30	1.209	802783	344417
SA 113475	R	30	1.498	1064716	332641
SA 113475	I	30	1.213	477466	154874
SA 113475	I	30	1.521	665531	147737

From Equation 1 and reference data for SA 113475, we arrive at the extinc-

tion coefficients:

$$k_B = 0.583$$
$$k_V = 0.176$$
$$k_R = 0.131$$
$$k_I = 0.166$$

$$m_a - m'_a = k(X_a - X'_a) = -2.5 \log_{10} \frac{S_a t'_a}{S'_a t_a} \tag{1}$$

With known magnitudes of a calibration star, we can use Equation 2 to determine the magnitude of the target star, m_*.

$$m_{rel,*} = m_* - m_r = k(X_r - X_*) - 2.5 \log_{10} \frac{S_* t_r}{S_r t_*} \tag{2}$$

So relative to SA 113475, the target stars have relative magnitudes:

Star	Filter	$m_{rel,*}$
HD 227858	B	-0.067
HD 227858	V	+0.165
HD 227858	R	+0.317
HD 227858	I	-0.585
HD 338931	B	-1.596
HD 338931	V	-1.295
HD 338931	R	-1.160
HD 338931	I	-2.190

Analysis

$S_{*,sky} = \Delta\nu\overline{\Phi f} t A/g$

FIXME We can determine the precise relationship between flux and signal for each filter as well, using Equation 3

$$S_{*,sky} = \frac{\Delta\nu \overline{\Phi} t \overline{f} A}{g} \tag{3}$$

where $\overline{f}$ is the averaged flux in the filter band, t is the exposure time, A is the aperture of the telescope (area at entry), g is the gain in electrons per count, $\overline{\Phi} = \overline{ql\phi}$ is the averaged response of the system over the filter, and $\Delta\nu$ is the bandwidth of the filter.

Conclusion

References