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LETTER

Letter to the Editor

The Interstellar Reddening Law in the Corona Austrina Dark Cloud

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Summary. BV polarimetry of stars associated to the Corona Austrina dark cloud complex shows $\overline{\lambda}_{max}$ = 0.9 μ corresponding to R = A_V/E_{B-V} = 5.0 ±0.8. This value is confirmed by the E_{V-K}/E_{B-V} and E_{V-L}/E_{B-V} excess ratios.

Key words: polarization - dust complexes - interstellar reddening law.

The existence of regions in which the interstellar dust has a mean grain size which is abnormally large was recently confirmed by Cohen (1977). These regions are well known dark cloud complexes such as the ρ Ophiuchi cloud.

According to the extinction theory, the mean grain size should be proportional to λ_{max}, the wavelength of maximum linear polarization, and the shape of the interstellar reddening law should be unique after being normalized by λ_{max} (Serkowski, 1973). The shape of the interstellar reddening law as measured by R = A_V/E_{B-V} and the wavelength of maximum polarization should then be correlated as was first noted by Serkowski (1968), and Carrasco et al. (1973).

This correlation was firmly stablished by Serkowski et al. (1975) and confirmed by Whittet and van Breda (1978) which in turn found some not unexpected exceptions. By grouping the stars in galactic longitude zones this relation was independently confirmed by Whittet (1977).

The Corona Austrina dark cloud appears as a logical candidate to search for another place of larger than average grain size. Three stars were selected because they appear connected to the dust complex being, at the same time, bright enough to give a reasonable signal to noise ratio at the available telescopes. TY CrA and HD 176386 are illuminating the reflection nebulae NGC 6726 and 6727 respectively, and the bright pair HR 7169/70 faintly illuminates the dust in the region near Anon. 1 of Knacke et al. (1973). This is more clearly seen in deep blue plates obtained with the CTIO Curtis-Schmidt camera.

The La Plata Observatory 83 cm telescope at La Plata during September - October 1977 and the "Perrine" 76 cm telescope at El Leoncito during May 1978 were employed in conjunction with the rotating-analyzer polarimeter of La Plata Observatory to Obtain polarization measurements in the B and V bands of the standard UBV system. The analyzer was a KN-36 Polaroid sheet. Three unpolarized standards were measured each night to determine the instrumental polarization, while two highly polarized standards (Serkowski, 1974) were measured to calibrate the zero of the position angle system and to check for depolarization factors. The instrumental polarization although non-negligible was found to change less than 0.05% from night to night, the position angle system remained within 1° during all the observations and no depolarization corrections were necessary.

Internal errors were computed for each observing night and star by comparing the resulting Stokes parameters obtained through each 30 sec integration. The observations of different nights were combined in weighed averages. The weight of each observation was adopted as the square of the inverse of the internal mean square error. An analysis showed that the external errors were never more than the double of the internal ones, more oftenly almost equal. This justifies the weighing procedure. A diaphragm of 25" was used and the reflection nebula around HD 176386 never contributed with more than 5% of the signal.

The polarimetric measurements are summarized in Table 1.

The wavelength of maximum polarization λ_{max}, and P_{max}, the polarization at λ_{max}, can be obtained from the values in Table 1 through formulas (11) and (4) of Serkowski et al. (1975). A weighed mean from the values in the last column of Table 1 gives P_V/P_B = 1.37±0.12 corresponding to λ_{max} = 0.90±0.15 μ. The last value corresponds to R = A_V/E_{B-V} = 5.0±0.8 according to equation

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Table 1 Polarimetric observations.

Star	Visual P(%)	Visual θ(°)	Blue P(%)	Blue θ(°)	n	T[†] (sec)	P_V/P_B
HR 7169/70	0.504±0.032	109.1±1.8	0.365±0.042	109.8±3.3	5	700	1.38±0.18
HD 176386	0.785±0.097	92.3±3.5	0.580±0.031	87.3±1.5	5	900	1.35±0.18
TY CrA*	1.58 ±0.21	89 ±4	1.14 ±0.24	100 ±6	1	300	1.39±0.35

† Total integration interval in each band.

* Quoted errors are internal errors.

Table 2 UBV Observations and derived quantities.

Star	V	B-V	U-B	n	E_{B-V}	(Sp)[†]	E_{V-K}/E_{B-V}	E_{V-L}/E_{B-V}	JHKL Ref.*
HD 176386	7.30	0.12	-0.05	8	0.16	b9	5.6	5.2	2, 3
TY CrA	9.48	0.56	0.13	4	0.67	b7	4.6	5.2	1, 2, 3

† Spectral type from the UBV colors.

* References for JHKL photometry.

1. Knacke et al. (1973).
2. Glass and Penston (1975).
3. Vrba et al. (1976).

(12) in Serkowski et al. (1975), or equation (5) in Whittet and van Breda (1978).

In Table 2 the UBV observations obtained with the 40 cm and 100 cm telescopes at Cerro Tololo during September 1974 and July 1976 are presented. When these observations are combined with the JHKL observations of Knacke et al. (1973) Glass and Penston (1975) and Vrba et al. (1976) the value of R can be predicted from the approximate relations $R \simeq 1.04(E_{V-L}/E_{B-V})$ and $R \simeq 1.14(E_{V-K}/E_{B-V})$ (Schultz and Wiemer, 1975). If we adopt a weight proportional to the color excess E_{B-V} of each star we get $\overline{R} = 5.4$ in good agreement with the value obtained above in spite of the small reddenings involved in forming the color excess ratios.

The Corona Austrina dark cloud complex seems to be another example of grain growth favoured by ultraviolet shielding. IR polarimetry of some of the sources shown in the survey by Vrba et al. (1976) should be attempted since they seem to be stars deeply inmersed in Rossano's (1978) cloud A where extinctions in excess of 10 magnitudes are expected.

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