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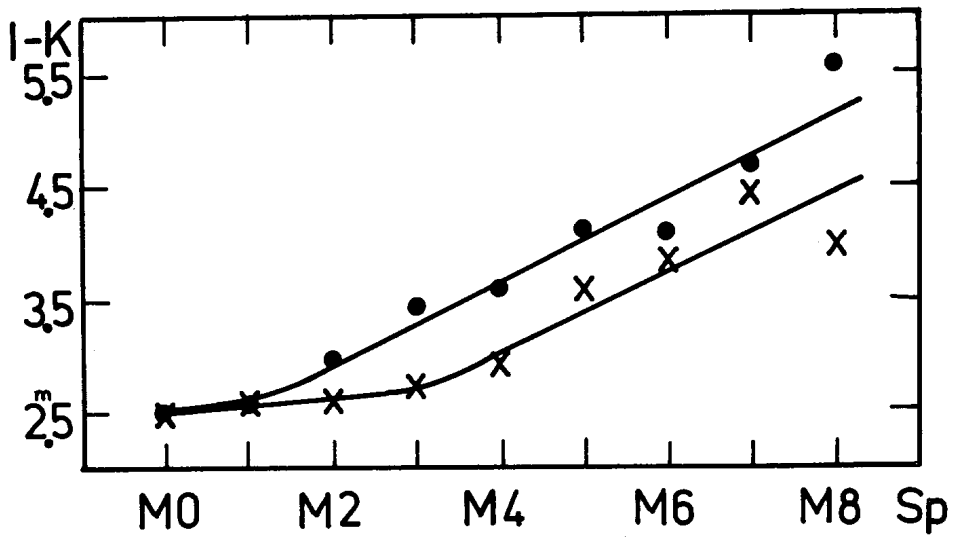
ON THE RELATIONSHIP BETWEEN THE I-K COLOUR INDEX AND THE INTRINSIC POLARIZATION OF THE LATE-TYPE STARS

As is well known (1,2), the intrinsic polarization of the M-type stars changes along with the brightness variation of the stars and also depends on their spectral type. The observations also show that within the same spectral class the intrinsic polarization of the stars can be different.

We made a detailed investigation of the observational data and found an interesting relation between the I-K colour index and the intrinsic polarization of the M-type stars. Serkowski's polarimetric data (3) and the I-K colour indices of the CIT-catalogue (4) formed the basis of the present investigation. The effective wavelength of the I magnitude is at 0.9 μm and that of the K magnitude is at 2 μm. In each spectral class (from M0 to M8) we selected the stars whose intrinsic polarizations at maximum light exceeded the average value of the polarization of the corresponding spectral class ($p > \bar{p}$).

Figure 1



In Fig. 1 we plotted the $\overline{I-K}$ average colour indices of the highly polarized stars (dots) and that of other stars (crosses) against the spectral classes.

As can be concluded from Figure 1, in one and the same spectral class later than M1 the average colour indices $\overline{I-K}$ of the stars having intrinsic polarizations are systematically larger than that of the stars with non-polarized light. We note that the I-K colour index of a star is generally between the two lines of Fig.1 if its intrinsic polarization is smaller than the average polarization $\bar{p}$ of the spectral class which the star belongs to.

These facts indicate that the stars with intrinsic polarizations show I-K excess compared with the other stars of the same spectral class.

Using the data of (3,4) we obtained the following relation between $\overline{I-K}$ and log $\bar{p}$:

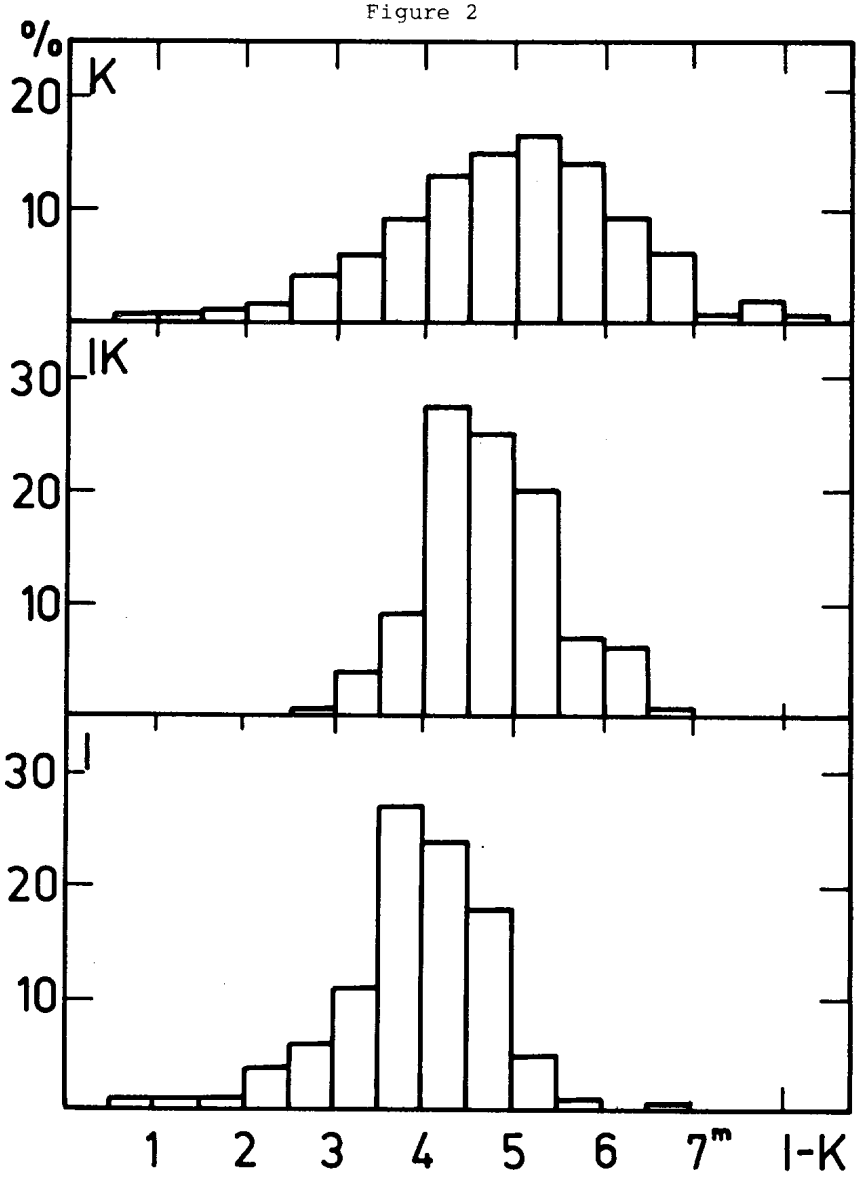
$$\overline{I-K} = 4.65 + 2.58 \log \bar{p}$$

In connection with this a further qualitative analysis can be made. In the CIT-catalogue the stars showing brightness variations in I- and/or K-spectral range are marked. Further on we call these stars I-, K- and IK-type variables, respectively.

The frequency of the I-, K- and IK-type variables, as a function of I-K was investigated. The frequency distributions are shown in Figure 2. As can be seen from the Figure, the maxima of the frquency distributions of the K- and IK-type variables are shifted towards the higher I-K values. Compared with the formula obtained this means that the occurrence of intrinsic polarization is more probable among the K-type variables. The calculations reveal that the frequency of the stars having intrinsic polarization is, indeed, 1.5 times greater among the K- and IK-type than among the I-type variables. This relation is also in accordance with the fact that near the galactic equator ($|b| < 25^{o}$) the intrinsic polarization of the stars and the ratio n_K/n_I of the numbers of the K- and I-type variables are 1.5-2.0 times greater than the corresponding quantities for the stars at high galactic latitudes ($|b| > 25^{o}$).

Since the intrinsic polarization of a late-type variable increases with the decrease of the brightness of the star, it would be worth investigating the relation between the polarization and the I-K colour index during the light variation separately for each late-type variable.

Figure 2



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References:

1 T. Gehrels, A. Kruszewski, K. Serkowski, A.J.,73,677, 1969.

2 R.A. Vardanian, Astrofizika,6, v.1,77, 1970.

3 K. Serkowski, preprint, Lun.Plan.Lab. Arizona, 1971.

4 G. Neugebauer, R.B. Leighton, Two-Micron Sky Survey, Cal.Tech. Pasadena, 1969.