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THE SHAPE OF THE INTERSTELLAR REDDENING LAW

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A simple way to deduce the interstellar reddening law is to compare the spectral distribution of pairs of stars within the same spectral type and luminosity class, one of which is reddened and the other unreddened. Then, the observational problem can be summarized as two questions:

(1) What is the wavelength dependence of the reddening law?

(2) Is this law the same for all the stars?

Making this assumption that the observed difference between two stars is only attributed to the interstellar medium, the answers to these questions help us in the identification of the components responsible for such a reddening (molecules and grains), as well as their physical properties, size distribution of particles, geometrical shape, and their location in space.

Twelve stars of spectral type B0 have been observed by OAO 2 with the set of broadband photometers at 10 effective wavelengths and gave us the opportunity to derive the interstellar reddening and to consider a statistical approach.

Figure 1 represents four color-color diagrams at four representative effective wavelengths. As shown here we have used a least-squares fit of the observed values to a straight line for each effective wavelength to define the mean reddening line, the standard deviation, the slope of the reddening line and its probable error.

The standard deviation, which represents the scatter of the points increases from 0.03 mag at 332.0 nm to 0.28 mag at 155.0 nm and can be attributed to–

(1) Possible errors in V and $B - V$ values
(2) Instrumental fluctuations
(3) Differences in the interstellar reddening law
(4) Differences in the intrinsic flux distribution among the stars themselves

V and $B - V$ have been chosen from recent values given by Lesh (Ref. 1) and Hiltner et al. (Ref. 2) and we can expect to have a homogeneous system.

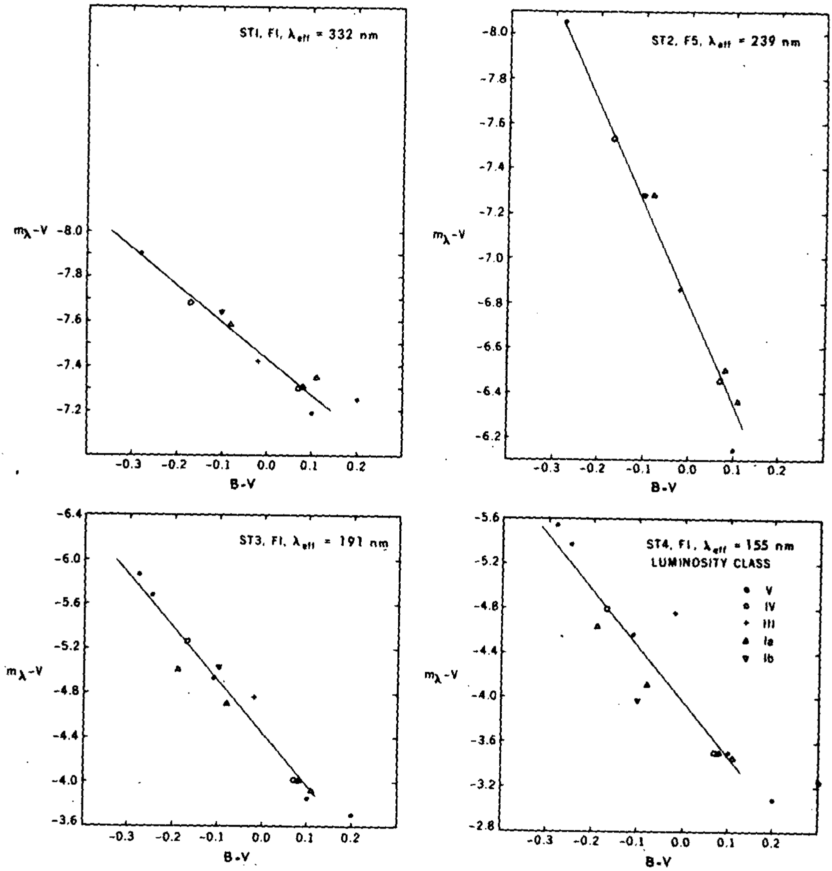

Figure 1—Color-color diagrams at four representative effective wavelengths.

Figure 2 illustrates by the pair of stars (ϵ, υ) Orionis the intrinsic difference that may appear by comparing within the same spectral type the relative flux distribution of a supergiant and a main sequence star. A similar deficiency in the far ultraviolet flux of the supergiant ϵ Orionis was found by Carruthers (Ref. 3) at 111.5-nm.

It is also interesting to point out that this effect appears to be more important than the one due to a misclassification of a star as B0 or B0.5, which is illustrated by the pair (λ Leporis, υ Orionis).

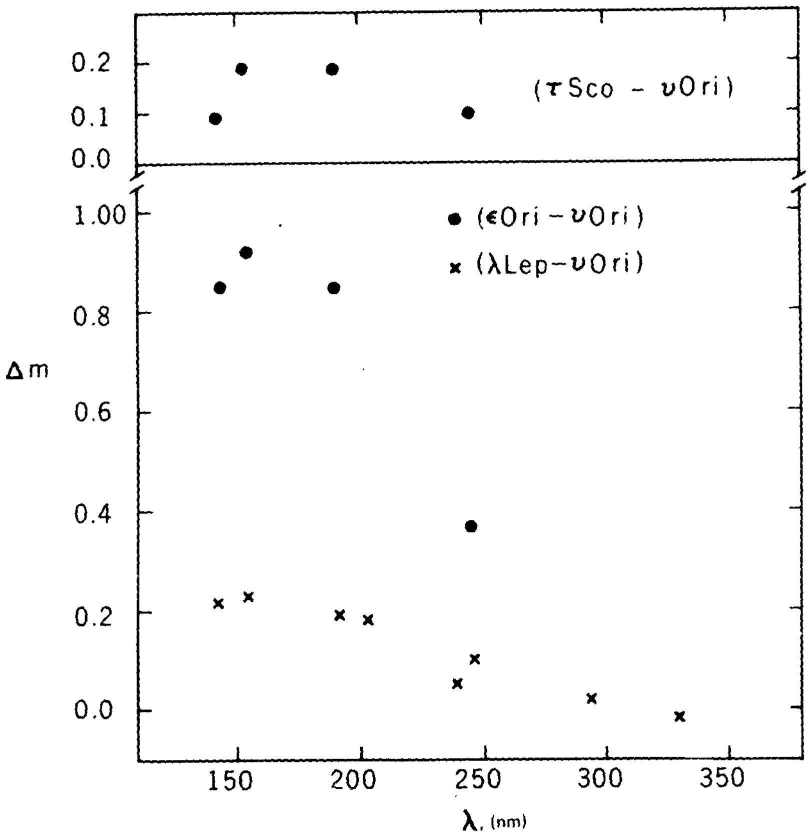

Figure 2–Comparison of the relative flux distribution of a supergiant and a main sequence star.

Although the preceding remarks cannot be representative of a general effect, we can expect to minimize the influence of such intrinsic differences for the reddening determination by comparing stars within the same spectral type and similar luminosity class.

Figure 3 shows the mean reddening law and its probable error and representative individual reddening features obtained by comparing pairs of stars. Separate calculations for main sequence stars and supergiants indicate that the probable error is independent of the luminosity class.

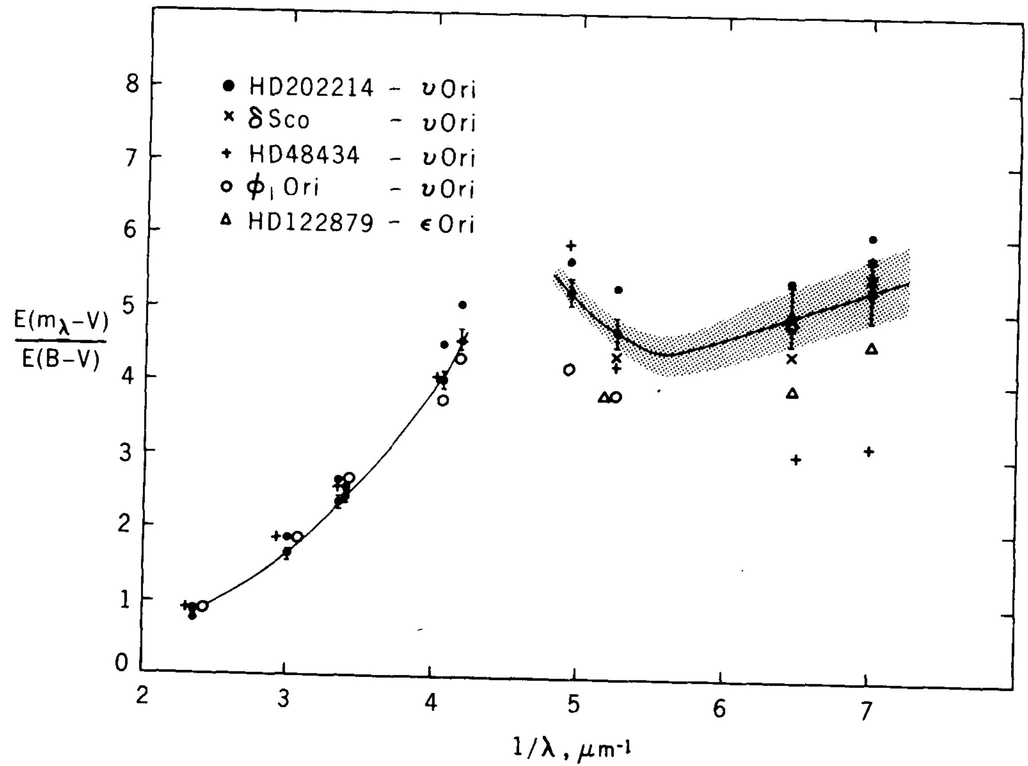

Figure 3–The mean reddening law and its probable error and representative reddening features obtained by comparing pairs of stars.