OBSERVATION OF INTERGALACTIC DUST BY SCHMIDT-TELESCOPES

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About 25 years ago Zwicky (1957), Holmberg (1958) and Hoffmeister (1962) found intergalactic dust by observations. Zwicky (1957) explained the deficiency of distant clusters of galaxies by intergalactic dust inside the near clusters. Holmberg (1958) made extensive observations of the Virgo cluster. He found systematic differences of the colour indexes between cluster and field galaxies. Intergalactic dust inside of the Virgo cluster should be the reason of these differences. Hoffmeister (1962) found a clear deficiency of galaxies in the region of Microscopicum. Again the reason should be a large cloud of intergalactic dust.

The possibility of the existence of intergalactic dust has been proved for example by Schmidt (1974, 1975) and Margolis and Schramm (1977). These and other authors, e.g. Karatschensev and Lipovetsky (1968), Crane and Hoffmann (1973), Nandy, Morgan and Reddish (1974), used for the intergalactic dust particles the same parameters which are known for the interstellar dust (density of the particles 1 g cm^{-3}, mean diameter of the particles 10^{-5} cm). The interstellar dust affects the observed colours of the stars, which are behind or inside the dust clouds. Therefore the intergalactic dust inside clusters of galaxies must affect the colours of the galaxies too. Van den Bergh (1975) supposes that the observed colour excess of the cluster galaxies were partly produced by a colour difference between galaxies near the centre and outside of the central region of the cluster. But dust inside the cluster can produce a colour excess too, because the length of the line of sight dependes on the direction of insight in the cluster.

The colour excess was computed by the following assumptions

- the density of the dust is uniform in the volume of the cluster of galaxies
- the mean colour of all galaxies of the cluster are the same for each direction of insight in the cluster
- the reddening of the galaxies depends on the properties of the dust particles in the following way

$$E_{B-V} = R \cdot A_V$$

M. Capaccioli (ed.), Astronomy with Schmidt-Type Telescopes, 507–509.

$$A_V = \frac{1.086 \cdot 3 \cdot D \cdot Q}{4 \quad d \cdot a} \cdot \ell$$

R is taken to be 3, D is the density of the dust inside the cluster, d is the density of the dust particles (1 g cm^{-3}), a is the mean diameter of the dust particles (10^{-5} cm), Q the efficiency factor (2.0) and ℓ the lenght of the line of sight.

Now it is possible to compute the reddening (E_{B-V}) for each galaxy and the mean value for all galaxies of any direction of insight in the cluster, depending on the density of dust.

Table 1 shows the reddening of the galaxies from the centre of to the edge of the cluster for different dust densities. The values of Table 1 are valid for a cluster diameter of 2 Mpc. d is the distance from the centre.

Table 1

reddening in mag

d	10^{-31} g cm^{-3}	10^{-30} g cm^{-3}	10^{-29} g cm^{-3}
0.1 Mpc	0.019	0.186	1.860
0.3	0.019	0.194	1.941
0.5	0.018	0.175	1.750
0.7	0.013	0.132	1.320
0.9	0.008	0.077	0.770

In Figure 1 is illustrated the reddening for clusters of different diameters (1 Mpc ≦ D ≦ 10 Mpc) and a dust density of 10^{-30} g cm^{-3}.

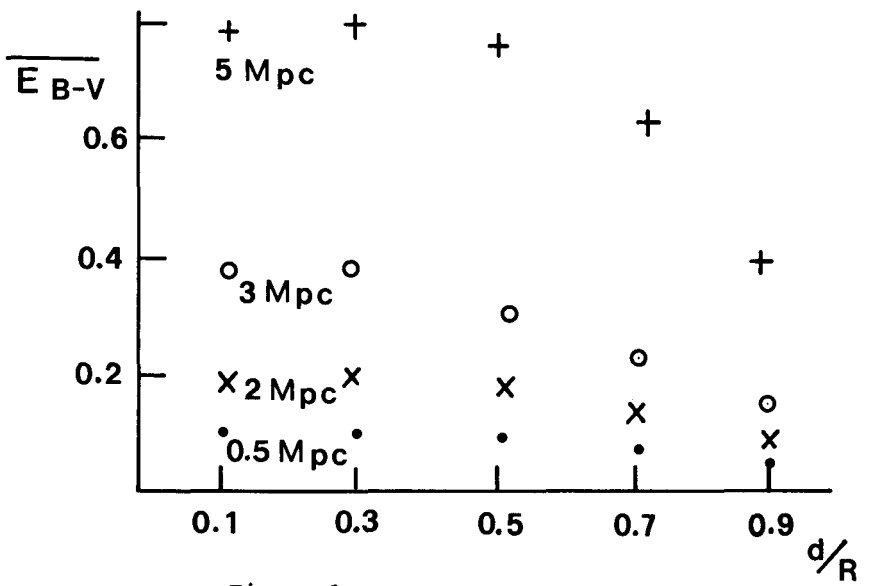

Figure 1

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The colour difference of galaxies near the centre and at the edge of the cluster depends on the density of dust inside the cluster. Figure 2 illustrates the logarithm of the colour excess in dependence on the density of dust inside the cluster.

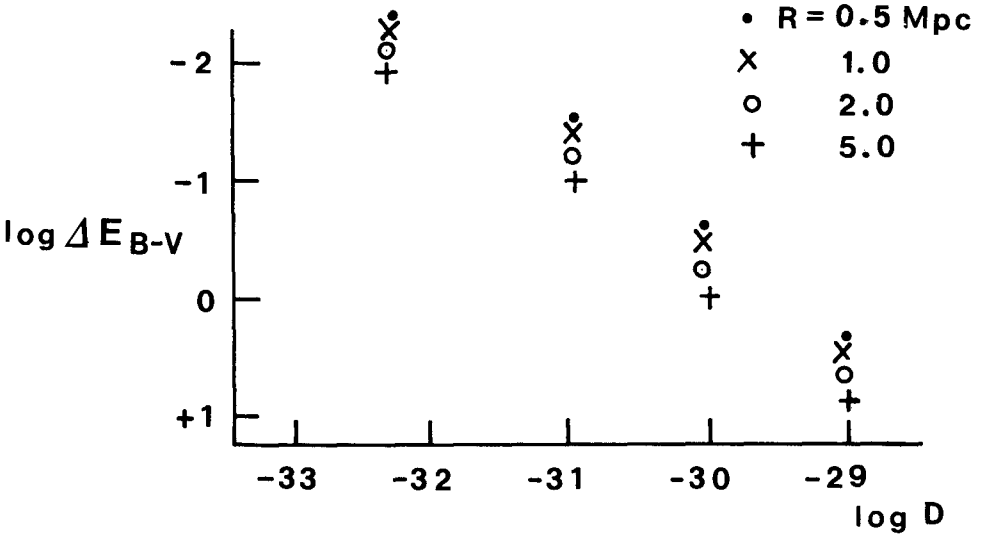

Figure 2

Partly the colour excess of the cluster galaxies can be explained by the effect, supposed by Van den Bergh (1975), partly by dust inside the clusters.

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