

Dust Properties in Early-type Galaxies

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We have carried out optical and near-IR photometric analysis of some of the early-type galaxies with the objective of studying their dust properties, and to see how different these are from the properties of the dust in the Milky Way. In this paper we present results on some of the galaxies (NGC 1172, NGC1439, NGC2672 and NGC3489) from this programme. In this paper a detailed study of wavelength dependent properties of dust in four early-type galaxies (NGC1172, NGC1439, NGC2672, NGC3489) is presented. Optical observations of the sample galaxies were carried out in Johnson broad band filters B, V, R & I during December 1999 using 1m telescope of the State Observatory at Naini Tal, equipped with 2K×2K TEK CCD, while near-IR observations in J, H & K' bands were carried out during January 2001 using 1.2m telescope, equipped with 256×256 HgCdTe NICMOS camera at Mt Abu. Typical exposure times devoted were B(3600s), V(2700s), R(1800s), I(1200s), J(600s), H(600s), K'(300s). In order to obtain sky subtracted, geometrically aligned clean images, standard reduction procedures (such as bias subtraction, flat fielding etc) were applied to the galaxy images in optical (Goudfrooij *et al.* 1994) as well as in near-IR (Hunt *et al.* 1998) using the tasks available within the IRAF and the STSDAS packages.

Color-index maps in ($B-V$) were generated to examine dust distribution and its morphology as well as to estimate color-excess in dusty regions of the galaxies. For studying the wavelength dependence of extinction, extinction maps were obtained following the procedure as described by Goudfrooij *et al.* (1994). These maps were then used to compute the ratio $R_\lambda = A_\lambda / (A_B - A_V)$ for each galaxy, and the resulting extinction curves are shown in Figure 1, along with that of the Milky Way (Reike & Lebofsky 1985). In

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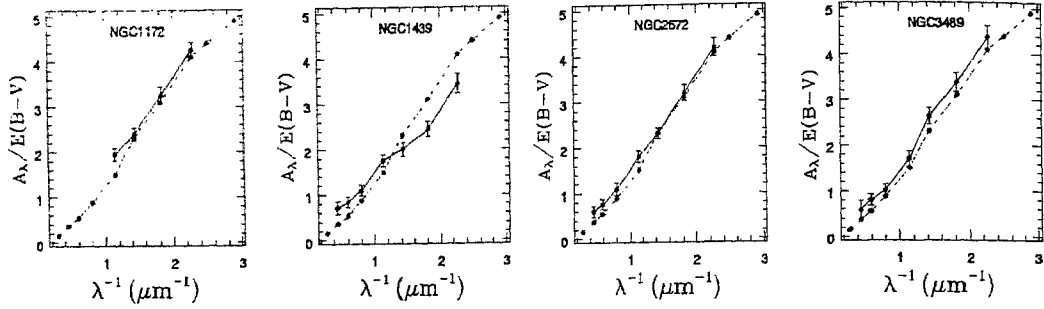


Figure 1. Extinction curves for the Milky Way(dotted line) and for the sample galaxies(full line).

general, the extinction curves of the sample galaxies are found to run parallel to that of Milky Way in the visible as well as in near-IR regions. This in turn implies that dust extinction properties in these galaxies are quite similar to those of our galaxy, as has been found for other early-type galaxies (Goudfrooij *et al.* 1994, Sahu *et al.* 1998, Dewangan, Singh & Bhat, 1999, Patil *et al.* 2001). The values of R_V , are not significantly different from that for Milky Way, except for NGC1439, in which case its value turns out to be lower than the canonical Galactic value of 3.1(see Table 1). We have also estimated masses of the dust in the sample galaxies using total extinction values A_V , the observed grain sizes, and taking the grain size distribution and other properties of dust grains from the literature (Goudfrooij *et al.* 1994). The dust masses are given in Table 1. The table also gives morphology and size of the dusty region.

Table 1. Results

	NGC1172	NGC1439	NGC2672	NGC3489
Dust Mass:	$1.5 \times 10^4 M_\odot$	$2.7 \times 10^5 M_\odot$	$6.0 \times 10^4 M_\odot$	$8.7 \times 10^3 M_\odot$
Dust extent:	2.7 kpc	1.7 kpc	5.0 kpc	2.0 kpc
Dust Morphology:	Lane	Lane	Lane	Filamentary
R_V value:	3.3 ± 0.2	2.5 ± 0.2	3.2 ± 0.2	3.4 ± 0.2

References

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