ABSTRACT

We report on optical extinction properties of dust using BVRI surface photometry of 5 early-type galaxies. We used the multicolor broadband photometry to study dust extinction as a function of wavelength and derived the extinction curve. We compare the derived extinction curve for the program galaxies with previously obtained results of Galactic (Milky Way) and found that the extinction curves of program galaxies run parallel to the Galactic extinction curve in the visible region. Which reveals us, properties of dust grain in program galaxies are similar to those of the Milky Way. The ratio of total extinction in V band to the selective extinction in B & V bands, lie in the range of 2.70 - 3.02 with an average of 2.87 which is compared to a canonical value of 3.1 for the Milky Way. The total dust content of these galaxies estimated using the optical extinction values is found in the range of $10^4$ to $10^6 M_{\odot}$ which are smaller than those derived from IRAS measurements. Indicating that a significant fraction of dust intermixed with stars remains undetected by the optical method.

INTRODUCTION

Interstellar dust being an important constituent of the galaxy, detailed investigation of its properties in extragalactic environment are not only useful to understand its origin and fate in external galaxies, but is also useful in understanding subsequent evolution of the host galaxy. It is estimated that more than 30% of the stellar-light in the universe is absorbed and reradiated by the dust grains in the infrared bands (Bernstein, Freedman & Madore 2002). Quantifying extinction and reddening of optical starlight in the target galaxies will enable us to derive important information about the grain size, total content of the dust in the host galaxy and its dependence as a function of environment. Majority of the early-type galaxies are known to emit at X-ray wavelengths, therefore interaction of dust grains in these galaxies is responsible for the destruction of the dust grains. Given these conditions, existence of large scale dust features in the target galaxies is highly controversial.

OBSERVATION AND DATA REDUCTION

We performed the multiband (B,V,R, I & Hα) imaging observation of dusty early-type galaxies using IGO telescope, Pune. Details about observations are given in Table 1. Analysis of the deep CCD images on the target galaxies was performed using the standard tasks available within IRAF and following Patil et al. (2007). Pure emission maps were derived by subtracting properly scaled continuum (R-band image) from the Hα images. With an objective of assessing the multiphase association of ISM in these galaxies we have derived diffuse X-ray emission maps from the analysis of high resolution Chandra X-ray images on the target galaxies. Any point source seen in the X-ray emission were physically investigated and removed before deriving its emission maps. To constrain the dust mass in the target galaxies, we have performed spectral analysis of the diffuse gas alone from each target galaxy and was then compared with that derived from the optical method.

RESULTS : Multiphase ISM in NGC 1482

- Fig. 2 - (a) (B-V) colour index image, overlaid on which are the csmoothed X-ray contours. (b) X-ray emission map derived after 3 Gaussian smoothing of X-ray emission, overlaid on it are the H emission line contours. (c) Tri-colour image of NGC 1482 (d) (B-V) colour index image derived for NGC 1482, overlaid on which are the H emission line contours.

DISCUSSION AND CONCLUSION

- Extinction curves derived for galaxies studied here run parallel to the canonical curve of the Milky Way, implying that properties of dust in the extragalactic environment are similar to those of the canonical grains in the Milky Way.
- The $R_p$ value is found to vary in the range 2.70 - 3.02 with an average of 2.87, and is comparable with canonical value of 3.1 for our Galaxy, these results are well agreement with Patil et al. (2007) & Finkelman et al. (2008).
- Dust mass estimated from optical extinction values for program galaxies found to lie in the range between $10^4$ to $10^5 M_{\odot}$.
- Dust mass derived from optical extinction is found to be less than dust mass estimated from IRAS flux densities and is in agreement with that derived from the hydrogen column density from X-ray analysis.
- Our multiband imaging analysis reveals a qualitative physical correspondence between the morphologies of the Hα and diffuse X-ray emission was noticed. Similar association is also evident in the kpc-scale dust outflow and its crparnts in the emission line and hot gas.

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