Abstract

A study of star formation of galaxies in a nearby group, NGC 4095 group is presented. Photometric observations were taken using the 2.4 m Thai National Telescope (TNT) at Doi Inthanon, Chiang Mai, Thailand for BVR, broad-band and [S II], Red-continuum narrow-band filter systems. This study shows that late type galaxies tend to be bluer and have higher Hα emission line than early type galaxies. Twelve of thirteen in our sample galaxies are ongoing star formation activity, which could be triggered by galaxy-galaxy or tidal interactions. All less massive galaxies in our sample are late type and tend to have bluer color and have higher Hα emission than more massive galaxies. Furthermore, mean stellar age and metallicity of the galaxies in this group were estimated by using the stellar population synthesis model of Pietrinferni et al. (2004). The model grid shows that spiral galaxies tend to have younger mean stellar age than elliptical galaxies, consisting with gas deficiency in early type galaxies.

Introduction

Galaxies in dense environment are possibly affected by surrounding objects to trigger star formation. Bretherton et al. (2013) found many evidences of disturbance in rich clusters. In this work, sample galaxies are in a nearby compact group, called NGC 4095 group, with recession velocities in the range of about 6,000 - 8,000 km s⁻¹. We investigate some physical properties and star formation activity in term of equivalent width of Hα emission line for galaxy members in this group.

Methods of the Study

Observations

The observations were taken on the 2.4 m Thai National Telescope (TNT) at Doi Inthanon, Chiang Mai. Filter systems were used for this work are BVR, broad-bands and SII, Red-continuum narrow-bands. NASA/IPAC Extragalactic Database (NED) was used for some available useful data.

Calculate of Hα equivalent width

The Hα equivalent width, EW(Hα), is calculated by using the following equation (Gavazzi et al. 2006)

$$EW(H\alpha) = \frac{T_\beta(\lambda) d\lambda}{C_{\text{H}\alpha}} \int n_{\text{H}\alpha} \, \lambda \, \text{CC}$$

where T_β(λ) is transmissivity of the [S II] filter, z is redshift of galaxy, C_{Hα} is Hα emission line flux counts, and C, is continuum flux counts.

Estimate of mass, mean stellar luminosity-weighted ages and metallicities of galaxies

Mean stellar luminosity-weighted ages and metallicities of galaxies were estimated by using the population synthesis model of Pietrinferni et al. (2004). We adapted equation from Girardi et al. (2002) to calculate mass of the sample galaxies.

$$M / M_\odot = 10^{-3.596 \pm 0.031} \left( \frac{L_B}{L_{B,\odot}} \right)^{0.138 \pm 0.013}$$

where M is a mass of galaxy, M_⊙ is mass of the sun, L_B is luminosity of galaxy and L_{B,\odot} is luminosity of the sun in the B band.

Results and Discussion

This study presents thirteen sample galaxies, consisting of four elliptical, eight spiral and one irregular galaxies. Twelve of these galaxies show emission line with S/N > 3, indicating significance of star formation in galaxies. The result indicates that late type galaxies tend to have higher Hα emission than early type galaxies. In addition, the higher Hα emission galaxies tend to be bluer than lower Hα emission galaxies.

![Figure 1. B-V vs. log (M/M_⊙)](image)

Figure 1 shows that less massive galaxies (M < 10¹² M_⊙) are bluer than more massive galaxies. Moreover, the less massive galaxies tend to have slightly higher Hα emission than the other ones as shown in Figure 2. Therefore, this denotes that the lower-mass galaxies that are late type galaxies remain interstellar medium to feed formation of young massive stars, i.e. O-B stars.

![Figure 2. Hα equivalent width vs. log (M/M_⊙)](image)

The result shows that some sample galaxies were outside the grid of model. The data distribution indicates that elliptical galaxies tend to be older than spiral galaxies. There are two young spiral galaxies have lower metallicities than other galaxies.

Conclusions

The result shows that the late type galaxies tend to have higher Hα emission line than early type while higher Hα emission galaxies tend to be bluer than lower Hα emission galaxies which could support similar conclusion found in a study of Gavazzi et al. (2006). Star formation activity could be triggered by galaxy-galaxy or tidal interaction with the potential well of the galaxy group, similar to those found in eight low-redshift clusters (Moss 2006). Moreover, this study shows that all less massive galaxies are late type with relatively blue color with respect to the others. The less massive ones have slightly high amount of young stars. Furthermore, this study indicates that most of spiral galaxies tend to be younger than elliptical galaxies. Our result has agreed with Mouhcine et al. (2011) that found in Abell 1367.

Acknowledgments

We thank to the National Research Council of Thailand, and the National Astronomical Research Institute of Thailand (NARIT), the NASA/IPAC Extragalactic Database (NED), SIMBAD Astronomical Database, and the Science Achievement Scholarship of Thailand. We are very grateful for all supports.