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MULTI-COLOR PHOTOMETRY OF NEARBY GALAXIES

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ABSTRACT

We have started multi-color imaging program of nearby galaxies since last year and present preliminary result here. We selected 12 nearby galaxies classfied from E to Sab type and observed in BVRIJHK' bands. Photomtric parameters such as isophotal diameter, axial ratio, isophotal magnitude were measured and observed colors were compared with theoritical model. We find a standard evolution model agrees well with observed results.

Key Words : galaxy, multi-color, photometry, wide-field

I. INTRODUCTION

Nearby galaxies are suitable samples to understand structure of galaxies because of their large apparent size and they are also the basis of study of galaxy evolution. Accordingly, in order to clarify the structure and evolutionary processes of galaxies, it is indispensable to understand properties of nearby galaxies deeply.

Besides optical observations, near-infrared observations are important to trace global structures and dust distributions of galaxies. So far, There are several studies which observed galaxies in both optical and near-infrared (de Jong *et al.*, Bothun and Gregg, Peletier and Balcells). Some of these studies, however, were aperture photometries which had little structural informations, and others did not have enough imaging area for an accurate photometry especially in near-infrared region. Recent developement of infrared array detector allows us to make near-infrared wide-field imaging observation.

The combination of 1K×1K CCD camera and near-infrared camera of Kiso observatory makes it possible to observe nearby galaxies from 0.44μm to 2.2μm (BVRIJHK') with almost the same spatial resolution.

II. OBSERVATION

We selected 12 nearby galaxies from E to Sab. Optical observations were performed with Kiso single CCD camera. This camera was attached to the prime focus of Kiso Schmidt. The spatial resolution is 0.75"/pixel and the field of view is 12.5′ × 12.5′. Typical exposure time were 1200sec in the B band and 300sec in other optical bands. Standard reduction processes (bias subtract, flat-fielding, flux calibration) were done.

Near-infrared observations were performed with Kiso observatory near-infrared camera (Yanagisawa *et al.*, Itoh *et al.*, Ichikawa *et al.*). The spatial resolution is 1.06"/pixel and the field of view is 18.4′ × 18.4′. This field of view is about 20 times as large as typical near-infrared imaging cameras. Typical exposure time is 5 minutes and we added several object frames to get high signal-to-noise ratio.

III. RESULTS

We measured surface brightness and drew major and minor axis profiles. Fine features are correlated well with each other among optival profiles. Though the signal-to-noise ratio becomes worse as longer wave length, we can see the profil of the J and H band maintaine a meaningful signal level even near D_{25} region. On the contraly, K' band images are much influenced by thermal radiation from the telescope. Then the detection limit of the K' band is much shallow.

We integrated the signal within the $\mu_B = 25$mag/arc sec^2 isophotal area. We use elliptical apertures, which were determined from ellipse fit for each images, for integrations. The typical error is 0.04-0.06 mag for optical bands and 0.05-0.08 mag for near-infrared bands. We need to correct the reddening due to the galactic interstellar dust (Burstein and Heiles). Reddening corrections were done using Rieke and Lebofsky's formula(1985). Because observed galaxies are early types, we did not correct the internal extinction of each galaxies.

Finally we compared our observed results with a theoritical model. The model we referred to was Yoshii and Takahara (1988) model. This is one of the standard evolution models. We compared Yoshii and Takahara's E/S0 and Sab models with observational results. Observed results are well fitted by E/S0 model though (V-I_c)-colors are slightly bluer than E/S0 model. There are two Sab galaxies in our sample, but we did not find any systematic differences between E/S0 galaxies and Sab galaxies.

IV. SUMMARY AND FUTURE WORKS

Developement of two dimensional infrared array detector allow us to constructing a wide-field imaging camera. Wide-field camera is a powerful tool to study nearby galaxies, which are the basis to understand distant galaxies and universe. We observed 12 nearby galaxies from E to Sab types with BVRIJHK bands. We simply compared their colors with a theoritical model and found the model agreed well with observed

results.

This is the first results of our project, in which project we will observe more than 60 nearby galaxies from E to Sc types with UBVRIJHK bands. We are going to continue the observation and analyze data more detail. The next step we are going to do is the decomposition of spiral galaxies into bulges and disks. As color-magnitude diagrams of elliptical galaxies provide the important clues of galaxy formation sinario, we think color-magnitude diagrams of bulges and disks and SED of each components must be one of the most important information to understand galaxy evolution.

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