OPTICAL/NIR IMAGING OF AKARI NEP-WIDE SURVEY FIELD

Yiseul Jeon and Myungshin Im
Center for the Exploration of the Origin of the Universe (CEOU),
Astronomy Program, Department of Physics & Astronomy, Seoul National University, Seoul 151-747, Korea
E-mail: ysjeon@astro.snu.ac.kr and mim@astro.snu.ac.kr
(Received June 29, 2012; Accepted August 09, 2012)

ABSTRACT

We present the results from $B$-, $R$-, $I$-, $J$- and $H$-band observations of the NEP-Wide survey field. The NEP-Wide survey is an AKARI survey of the North Ecliptic Pole covering $\sim 5$ square degrees area. Our optical/NIR imaging supports the AKARI IR imaging data by providing a crucial coverage in the optical/NIR. The optical data were obtained in 2007 using the 1.5 m telescope and SNUCAM at Maidanak Observatory, Uzbekistan. The NIR data were obtained in 2008 with FLAMINGOS on the KPNO 2.1 m telescope. We used IRAF, SExtractor, SCAMP, and SWarp for reducing the raw data, $I$-band fringe pattern removal, astrometry, standard photometry calibration, and source detection. Our optical–NIR data reach the depths of $B \sim 23.4$, $R \sim 23.1$, $I \sim 22.3$, $J \sim 21.05$, and $H \sim 20.64$ AB mag at 5-sigma. Here, we present the astrometric accuracy, galaxy number counts, completeness, and reliability, as well as redshift tracks of some normal galaxies and quasars on the $B - R$ vs. $R - I$ color–color diagram. The photometric data are being used for identifying optical counterparts of the IR data provided by AKARI, studying their SEDs, and selecting interesting objects for spectroscopic follow-up studies.

Key words: catalogs: galaxies; photometry: surveys; conferences: proceedings

1. INTRODUCTION

AKARI (Murakami et al., 2007) is an infrared space telescope launched in 2006. Since AKARI is capable of observing in the range from 2.5 to 26 $\mu$m, its data offer contiguous wavelength coverage, especially between 11 and 15 $\mu$m where the Spitzer space telescope could not observe. During its Sun-synchronous orbit, AKARI carried out deep observations at the North and the South ecliptic poles. Therefore, the North Ecliptic Pole (NEP) survey is one of the important extragalactic surveys of AKARI. The NEP survey has two major programs, NEP-Wide and NEP-Deep surveys. Compared to the NEP-Deep field, the NEP-Wide survey covers a wider area of 5.8 deg$^2$, with shallower depth (Matsuhara et al., 2006). Since the NEP-Wide field has the advantage of wide area coverage, contiguous NIR–MIR wavelength coverage, and low extinction value at the center, it is suitable to study extragalactic objects like infrared luminous galaxies or AGNs.

Since AKARI has relatively low spatial resolution, the optical/NIR imaging can help identify optical/NIR counterparts of many infrared sources, enhance astrometric accuracy, and deblend confused objects. Also, the multi-wavelength data including optical/NIR bands can be used to construct more reliable SEDs to understand the properties of infrared sources. Because there was no deep optical/NIR data for the whole NEP-Wide area, we observed this field in optical $B$, $R$, and $I$ filters and in NIR $J$, $H$ filters.

2. OBSERVATION AND DATA REDUCTION

The NEP field is located at R.A. = 18:00:00, Dec. = +66:36:00. The optical $BRI$ data were obtained in 2007 with SNUCAM on the 1.5m telescope at Maidanak observatory, Uzbekistan. It covers 4.9 deg$^2$ out-
side of the central 2 deg$^2$ area covered by CFHT imaging (Hwang et al., 2007; dashed squares in Fig. 1). The NIR data were obtained in 2008 with FLAMINGOS on KPNO 2.1 m telescope. Its area coverage is 5.2 deg$^2$ for $J$ band and 5.4 deg$^2$ for $H$ band. Fig. 1 shows the coverage of the NEP-Wide field with optical (grey area) and NIR (green squares) bands. The red solid circle indicates the AKARI NEP-Wide field (5.8 deg$^2$ coverage) and the cyan solid circle is for the AKARI NEP-Deep field. Table 1 summarizes our observations.

3. PROPERTIES OF THE DATA

We used IRAF packages for preprocessing and SCAMP for finding astrometric solutions. The 1σ astrometric errors are $\sim 0.16''$ for $BRI$ data and $\sim 0.7''$ for $JH$ data. We performed photometric calibration (i) using Landolt standard stars for the $BRI$ band and (ii) using the 2MASS catalog for the $JH$ band. Using SExtractor, we detect 63,333 sources at $B$, 96,460 at $R$, 70,492 at $I$, and 225,361 sources at both $J$ and $H$ band. The readers can refer to Jeon et al. (2010) for the detection parameters.

4. SUMMARY AND FUTURE WORK

We present the $BRI$ and $JH$ band observations of the NEP-Wide survey field. The optical $BRI$ catalog is published in Jeon et al. (2010) and the NIR data are in preparation. The data are being used for identifying optical/NIR counterparts for accurate astrometry. Also, since our data provide multi-wavelength coverage with wide field area, we can study the physical properties such as photometric redshifts and stellar masses (e.g., Ko et al., 2012), and select interesting objects like high-redshift quasars. Spectroscopic follow-up surveys are being carried out on infrared luminous objects using the information from this imaging survey.

ACKNOWLEDGEMENTS

This work was supported by the the Creative Research Initiative program, No. 2010-0000712, of the National Research Foundation of Korea (NRFK) funded by the Korea government (MEST).

REFERENCES

Matsuhara, H., et al., 2006, Deep Extragalactic Surveys around the Ecliptic Poles with AKARI (ASTRO-F), PASJ, 58, 673

other is by comparing our galaxy number counts with other studies. The results are summarized in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Observation Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>$B$</td>
</tr>
<tr>
<td>$R$</td>
</tr>
<tr>
<td>$I$</td>
</tr>
<tr>
<td>$J$</td>
</tr>
<tr>
<td>$H$</td>
</tr>
</tbody>
</table>