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SYNERGY BETWEEN IRSF AND AKARI

T. Nagayama, T. Kokusho, and H. Kaneda
Department of Astrophysics, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8602, Japan
E-mail: nagayama@z.phys.nagoya-u.ac.jp
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ABSTRACT

InfraRed Survey Facility (IRSF) is our facility for near-infrared (NIR) observation located at South African Astronomical Observatory. The NIR camera SIRIUS on the 1.4m telescope provides three $7.7' \times 7.7'$ images in the J (1.25 μm), H (1.63 μm), and K_S (2.14 μm) bands simultaneously with a pixel scale of $0.45''$. IRSF has three unique capabilities, which are suitable for follow-up observations of AKARI-selected objects. Several synergistic studies with AKARI are in progress from stars to galaxies. We introduce advantages of the above unique capabilities of IRSF for further synergistic studies between AKARI and IRSF.

Key words: infrared: telescope; conferences: proceedings

1. INTRODUCTION

IRSF (InfraRed Survey Facility) is a Japanese facility with a 1.4 m near-infrared (NIR) telescope located at the Sutherland observatory in South Africa. It was developed by Nagoya University, in cooperation with the National Astronomical Observatory of Japan and the South African Astronomical Observatory. A NIR camera SIRIUS (Nagayama et al., 2003) is the main instrument of IRSF. It is capable of simultaneous imaging of the J (1.25 μm), H (1.63 μm), and K_S (2.14 μm) bands in a $7.7' \times 7.7'$ field with a pixel scale of $0.45''$. The actual spatial resolution, usually limited by seeing, is $\sim 1''$, and the typical limiting magnitudes are 19.2 mag, 18.6 mag, and 17.3 mag in the J, H, and K_S bands (900 sec. exposure, S/N = 10, in the Vega magnitude), respectively.

The main purpose of IRSF is to perform $JHKs$ surveys of the Magellanic Clouds, the Galactic Center, and any other interesting regions. We have also been monitoring the Magellanic Clouds and the Galactic bulge since 2000, and tremendous numbers of variable stars have been detected.

AKARI, which covers mid- and far-infrared wavelengths and also observed whole sky, is very useful to extend our studies based on the IRSF observation. On the other hand, IRSF has the following three unique capabilities, 1) Measurement of linear and circular polarization, 2) Photometry of bright objects with ND filters, 3) Line observation with multi-bandpass narrow band filters. They are suitable for follow-up observations of AKARI-selected objects, and several synergistic studies are already ongoing. We introduce the advantages of the above capabilities for further synergistic collaboration between IRSF and AKARI.

2. UNIQUE CAPABILITIES OF IRSF

2.1. Polarization

Wide field imaging polarimetry with SIRPOL is an unique capability of IRSF. SIRPOL is an additional unit for SIRIUS to measure linear or circular polarization. SIRPOL consists of a wire grid polarizer and a rotatable 1/2 wave-plate (Kandori et al., 2006). Polarization in NIR wavelength is, in many cases, due to scattering by dust or dichroic extinction by aligned dust. Therefore, comparison with mid- and far-infrared data of AKARI, sensitive to dust emission, is complementary.

Nagayama et al. (in preparation) have found a ring structure seen in polarized light with SIRPOL in the famous and peculiar elliptical galaxy Centaurus A (NGC 5128). The morphology is very similar to the dust ring seen in mid-infrared (Quillen et al., 2006), and therefore comparison with the data at the dust sensitive wavelength is interesting and crucial for the NIR imaging polarimetry.

2.2. ND Filters

ND (neutral density) filters with reduction rates of 10% and 1% are available at IRSF. Using these filters, we can observe even η Car, one of the brightest objects in infrared. Many objects detected by AKARI are too bright for modern NIR observations, and therefore it is difficult to find accurate photometry of them.

Ishihara and Kiriyama are looking for debris disks around main sequence stars. Their approach is to find an excess of flux in the AKARI 18 μm band against the expected flux based on optical, NIR, and AKARI 9 μm photometry. However, many of candidates found in AKARI All Sky Survey are too bright, typically 2-5 mag in the K_S band, and are heavily saturated in the frequently referred NIR all sky survey 2MASS. Therefore, accurate photometry at IRSF with the ND filters is important to ensure the baseline SED (Spectral Energy Distribution) and estimation of flux-excess at 18 μm. The detail will be found in Kiriyama et al. in this volume.

2.3. Multi-Bandpass Narrow Band Filters

We have prepared multi-bandpass narrow band filters for SIRIUS. Normal narrow band filters have only one transparent band, but our filters have two narrow transparent bands; one in the J or H bands, and another in the K_S band. These transparency peaks are tuned to the major NIR emission lines located in the J, H, or K_S bands. The following three filters are available, and more filters including continuum filters are also under preparation.

- Paβ @ 1.282 μm in the J band and
  Brγ @ 2.165 μm in the K_S band
- [FeII] @1.256 μm in the J band and
  H_2 v=1-0 S(1) @2.121 μm in the K_S band
- [FeII] @1.644 μm in the H band and
  H_2 v=2-1 S(1) @2.247 μm in the K_S band

We have carried out the observation of super nova remnant (SNR) IC443 with the above three filters (Kokusho et al., in preparation). In the SNR, the [FeII] fine structure lines are strongly detected. These emissions are induced by fast shock destroying interstellar dust. In contrast, slow shock also induces shock-excited emissions of H_2. Combination of our NIR line observations with AKARI observations of dust and PAH is powerful for studying interstellar medium not only in SNRs, but also in planetary nebulae and star forming regions.

3. SUMMURY

As we described, IRSF has several unique capabilities suited for AKARI follow-up observation, and some synergistic studies are ongoing. We hope further collaborations and productive researches start in response to this paper.

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