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# IMPROVEMENT OF AKARI NEP-DEEP 2-24 MICRON IMAGES/CATALOGUES WITH NEW CALIBRATIONS

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## ABSTRACT

We have created new catalogues of AKARI/IRC 2-24 $\mu$m North Ecliptic Pole Deep survey through new methods of image analysis. In the new catalogues the number of false detection decreased by a factor of 10 and the number of objects detected in multiple bands increased by more than 1,500 compared to the previous work. In this proceedings the new methods of image analysis and the performance of the new catalogues are described.

*Key words:* methods: data analysis; infrared: galaxies; surveys; catalogs

## 1. INTRODUCTION

AKARI has performed a deep survey in the North Ecliptic Pole region with the Infrared Camera (IRC, Onaka et al., 2007) to explore the Universe at z = 1 - 2 (Matsuhara et al., 2006; Wada et al., 2008; Takagi et al., 2012). The best advantage of AKARI is the continuous filter coverage in the wavelengths between 2 - 24 $\mu$m. Using this advantage Goto et al. (2010) have evaluated the luminosity function without uncertainty of K-correction, and Takagi et al. (2010) have found galaxies which are bright with PAH emission. However, the catalogues leave room for improvements because the previous work has the following difficulties. 1) The catalogues contain artificial sources due to the cross talk effect in the detector when the frame contains bright objects (2.4, 3.2, 4.1 $\mu$m bands). 2) The flat fields contain non-uniform scattered light (15, 18, 24 $\mu$m bands) and flux estimation differs by ∼10% among the field of view. 3) Stray light from the earth limb has prevented the detection of faint objects. 4) The pattern of flat field changes during the mission (7, 9, 11 $\mu$m bands). In this work we have solved these problems and created revised catalogues using new methods of image analysis.

## 2. IMAGE ANALYSIS WITH NEW METHODS

### 2.1. Artifacts Created by Cross Talk

Bright objects have caused cross talk and created artificial sources. Thus we masked all the contaminated pixels before stacking the images (Fig 1).

### 2.2. Scattered Light in Flat Frame

Non-uniform scattered light in the flat frames have caused systematic error of flux measurements at the rate of 10%. The scattered light was subtracted from the old flat frames to create the new ones (Fig 2).

### 2.3. Stray Light from Earth Limb

Stray light from the earth limb has prevented the detection of faint objects. The patterns have been modeled and subtracted from all the images (Fig 3).

### 2.4. Strange Pattern So Called "SORAMAME"

We found a dependence of SORAMAME on time. Thus we made the templates for each image, correcting the

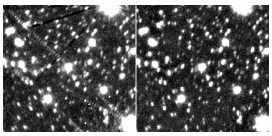

**Fig. 1.** Removing artifacts caused by cross talk.

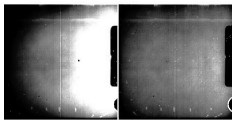

**Fig. 2.** Subtraction of the scattered light from the old flat frame.

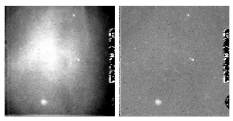

**Fig. 3.** Subtraction of the stray light from the earth limb.

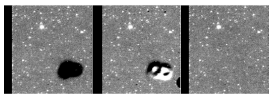

**Fig. 4.** Correction of the pattern so called "SORAMAME".

patterns more appropriately than the previous work (Fig 4).

## 3. NEW IMAGES / CATALOGUES

We produced the mosaic images and extracted the sources with 5 sigma significance, creating the revised catalogues. Then we evaluated the completeness, false detection rate, and the number of objects detected in multiple bands.

### *3.1. Completeness*

To evaluate the completeness of the source extraction we added the artificial sources into the mosaic images and extracted them in the same way as the real ones. We defined the completeness as the ratio of the number of detected artificial objects to that of added ones. 50% completeness limits for L15 is 129 $\mu$Jy.

### *3.2. False Detection Rate*

The false detection rate has been estimated using negative images with the same extraction methods as the original ones. It is defined as the ratio of the number of the detected objects in the negative image to that in the original image. The total number of the false detection decreased by a factor of 10.

### *3.3. Objects Detected in Multiple Bands*

We evaluated the number of objects detected in more than $N_{band}$ bands including MIR-S/L. There are 900 objects detected in all bands. The number of objects detected in more than one band is 6,714, having increased by more than 1,500 compared with the previous work (Fig 5).

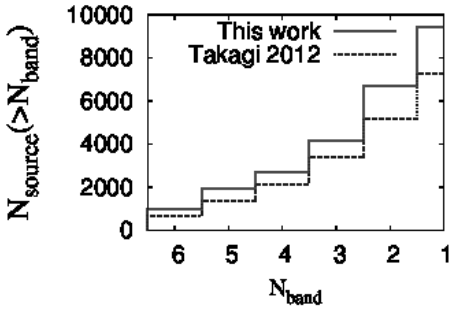


**Fig. 5.** The number of objects detected in multiple bands including the MIR-S/L bands. The solid line shows this work and the dotted line shows the previous work.

## 4. CONCLUSION

The new catalogues of AKARI NEP-Deep survey have been created through the new image analysis. The improvements on the catalogues are following.

i) The number of false detection decreased by a factor of 10.

ii) The number of objects detected in multiple bands increased by > 1,500.

## ACKNOWLEDGEMENTS

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