Dust properties of optically dark IR galaxies without Counterparts of Subaru HSC in the AKARI NEP field

Yoshiki Toba∗1, Tomotsugu Goto2, Nagisa Oi3, Ting-Wen Wang2, Seong Jin Kim2, Simon C.-C. Ho2, Denis Burgarella4, Tetsuya Hashimoto2, Bau-Ching Hsieh5, Ting-Chi Huang6, Ho Seong Hwang7, Hiroyuki Ikeda8, Helen K. Kim9, Seongjae Kim7, Dongseob Lee10, Matthew A. Malkan9, Hideo Matsuhara11, Takamitsu Miyaji12, Rieko Momose13, Youichi Ohyama5, Shinki Oyabu14, Chris Pearson15, Daryl Joe D. Santos2, Hyunjin Shim10, Toshinobu Takagi16, Yoshihiro Ueda1, Yousuke Utsumi17, and Takehiko Wada11

1Kyoto University [Kyoto] – Japan
2National Tsing Hua University [Hsinchu] – Taiwan
3Tokyo University of Science [Tokyo] – Japan
4Laboratoire d’Astrophysique de Marseille – Aix Marseille Université : UMR7326 – France
5Academia Sinica – Taiwan
6Graduate University for Advanced Studies [Hayama] – Japan
7Korea Astronomy and Space Science Institute – South Korea
8National Astronomical Observatory of Japan – Japan
9Department of Physics and Astronomy [UCLA, Los Angeles] – United States
10Kyungpook National University [Daegu] – South Korea
11Institute of Space and Astronautical Science – Japan
12Universidad Nacional Autónoma de México – Mexico
13The University of Tokyo – Japan
14Tokushima University – Japan
15STFC Rutherford Appleton Laboratory – United Kingdom
16Japan Space Forum – Japan
17Stanford Linear Accelerator Center – United States

Abstract

We present the physical properties of AKARI sources without optical counterparts in optical images from the Hyper Suprime-Cam (HSC) on the Subaru telescope. Using the AKARI infrared (IR) source catalog and HSC optical catalog, we select 583 objects that do not have HSC counterparts in the AKARI North Ecliptic Pole wide survey field (∼5 deg2). Because the HSC limiting magnitude is deep (gAB ∼ 28.6), these are good candidates for extremely red star-forming galaxies (SFGs) and/or active galactic nuclei (AGNs), possibly at high redshifts. We compile multiwavelength data out to 500 µm and use them for fitting the spectral energy distribution with CIGALE to investigate the physical properties of AKARI galaxies without optical counterparts. We also compare their physical quantities with AKARI

∗Speaker

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mid-IR selected galaxies with HSC counterparts. The estimated redshifts of AKARI objects without HSC counterparts range up to $z \sim 4$, significantly higher than for AKARI objects with HSC counterparts. We find that (i) 3.6 - 4.5 $\mu$m color, (ii) AGN luminosity, (iii) stellar mass, (iv) star formation rate, and (v) V-band dust attenuation in the interstellar medium of AKARI objects without HSC counterparts are systematically larger than those of AKARI objects with counterparts. These results suggest that our sample includes luminous, heavily dust-obscured SFGs/AGNs at $z \sim 1$-4 that are missed by previous optical surveys, providing very interesting targets for the coming era of the James Webb Space Telescope (Toba et al. 2020, ApJ, 899, 35).