

X04a Search for Optically Dark Infrared Galaxies without Counterparts of Subaru Hyper Suprime-Cam in the AKARI North Ecliptic Pole Wide Survey Field

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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 ($\sim 5 \text{ deg}^2$). Because the HSC limiting magnitude is deep ($g_{AB} \sim 28.6$), these are good candidates for extremely red star-forming galaxies (SFGs) and/or active galactic nuclei (AGNs), possibly at high redshifts. We compile multi-wavelength data out to $500 \mu\text{m}$ 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 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) $3.6 - 4.5 \mu\text{m}$ 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 (Toba et al. 2020c, ApJ, 899, 35).