Multi-wavelength Surveys of the North Ecliptic Pole Region

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Survey Overview

- North Ecliptic Pole (18^h 00^m 00^s, 66^d 30^m 00^s)
- A region with exceptionally high visibility for space missions with specific orbit (e.g., AKARI IR telescope)



Figs from Kim et al. (2012)

Survey Overview

 AKARI mapped ~5.4 deg² around NEP with 9 MIR bands, completely covering 2-24µm wavelength range.



multi-band follow-up This is what we had done by AKARI 3rd conference in Oxford



Most of the follow up observations were carried out over NEPD. Only shallow(r~23mag) optical (*BRI*) data cover NEPW.

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Slides from H. Matsuhara, N. Oi (Nov 2017) $_{\scriptscriptstyle \Box}$

multi-band follow-up This is what we got after the AKARI 3rd conference upto today





Slides from H. Matsuhara, N. Oi (Nov 2017)

JCMT Observation Proposal

- Inner 1 deg² was covered by JCMT SCUBA-2 Cosmological Large Survey (S2CLS, Geach et al. 2016)
- Our survey aims to observe <u>remaining ~4 deg²</u>
 - PONG1800 observations
 : 1-σ semsitivity of 1.83 mJy
 - Expected Observing time
 - : 400 hours
 - : 21 fields × 28scans × 40min



Science Drivers

- Resolving the Extragalactic Background Light
 - The intensive coincident near-infrared data useful for detecting cosmic near-infrared background atvarious angular scales
 - the wealth of multi-wavelength data that enables good characterization of the foreground populations
- Dust Enrichment and Obscured Star Formation in Low- and High-redshift Galaxies
 - Red objects
 - Star formation and dust processing
- Co-evolution of SMBH and their Host Galaxies
 - Identification of galaxies that harbour an actively accreting SMBH and reliably decomposing its emission from that of its host galaxy.

Resolving Cosmic IR background

• Cross-correlation between NIR and FIR CIB fluctuation signal is a test marker that can constrain the cause of CIB fluctuation.



Dust in local and high-z galaxies

 Uncertainties in the FIR SED fitting are mainly due to the dust temperatures and dust composition, which would greatly be reduced with the addition of 850µm.



Dust in local and high-z galaxies

 The correlation between the MIR (8µm) luminosity function and the total IR luminosity function would provide the zevolution of dust properties.



Figs from Kim et al. (2015)

 The (possible) suppression of the star formation by radioloud AGNs should be investigated further with the 850µm.



- Samples of differently selected AGNs over the wide NEP region would enable study of the contribution to cosmic star formation by AGN host galaxies as a function of redshift.
- Radio selected AGNs
- X-ray selected (Compton-thick) AGNs
- Optically selected (spectroscopically confirmed) AGNs
- MIR selected AGNs (based on the MIR PAH features)
- SED selected AGNs (benefited by the multi- λ data)



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Dey+ (2009) **SMG**

\rightarrow DOG

Slides from H. Seo (Jan 2018)

- Earlier-stage of merger
 - F dominated
- Late-stage of merger
- SF dominated phase
- AGN dominated phase

Contribution of AGN in SMG Contribution of AGN in DOG

Current Status

- 64 members enrolled from CA, CN, JP, KR, TW, UK
- Observations have been carried out for 12 days from July to October in 2017
- Total observing time was 25.7 hours (37 out of 588 pointings, 6% of the allocated time)
- Observations will resume in April 2018
- production of the first mosaic map (using the JCMT pipeline suited for deep blank field observation)
- data quality check

Current Status





Survey Depth Estimation

• Central ~15 arcmin has uniform depth of 2.5mJy/beam





Source Extraction

- 24 sources are detected at > 4σ
- The number will be ~500 once the survey is completed



850µm Source Number counts



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Future Plans

 Pilot studies on several topics are ongoing using S2CLS data over NEP-deep (~1 deg²)

- We are preparing resources for data reduction so that the mosaic map and/or source catalog can be distributed within the team just in time.
- So please stay tuned!