CIB Sciences with MIRIS

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Origin of Near-IR Excess

- Excess emission in near-infrared
  - High-redshift objects
  - Low-redshift objects
Brightness of CIB

- **Absolute brightness**
  - Resolution & sensitivity
  - Removal of foreground sources
  - Stacking pixels

- **Origin?**
  - Zodiacal light
  - Lyman $\alpha$ or Lyman break: drop at $\lambda \sim 1\mu m$
  - Pop. III (first) stars or first galaxies
  - TeV Gamma-ray photons from blazars
  - Intra-Halo Light
Intra-Halo Lights

- Stripped stars from galaxy mergers
- Spectrum & fluctuation
  - Flat near $1\mu m$
  - $<1\mu m$ spectrum
  - Fluctuation up to 300 kpc
Fluctuation of CIB

- Smoothed image
- Correlation & fluctuation
- Fluctuation strength: ~2% of sky brightness
- Fluctuation at >100 arcsec
- Smooth fluctuation from ZL (Pyo et al. 2012)
- Upper limit of fluctuation: ~0.02% of sky brightness

Matsumoto, Seo, Jeong et al. (2011)
Fluctuation of CIB

- Fluctuations from
  - AKARI observation (~ 100"")
  - MIRIS: large scales > 3°
  - NISS: medium scales but, continuous
  - SPHEREx: large scales & continuous
MIRIS Observations

- Large Area Surveys of Pole Regions
- NEP (North Ecliptic Pole) Monitoring Observations
Large Area Surveys

- Targets: NEP, NGP, SGP
- 7×7 pointing observations with 50% overlap → 4 times observations of ~10°×10° area
- Wavelengths: 1.1 μm and 1.6 μm bands
- Observe for 8 minutes for each band (effective exposure: 6.5 minutes)

- Additional observations: NEP Monitoring
- Observe NEP every two days (1.1 μm and 1.6 μm bands)
- Can be used to study zodiacal light and for instrument calibration
Large Area Surveys

\[ \delta = 70^\circ \]

\[ \delta = 65^\circ \]

\[ \delta = 60^\circ \]

\[ \delta = 55^\circ \]

\[ \alpha = 20h \]

\[ \alpha = 16h \]

\[ \alpha = 18h \]

\[ \sim 10^\circ \]

\[ \bullet \text{NEP} \]
Large Area Surveys

- NEP Wide Field Observations (2014. 3.)

1.1 μm band

1.6 μm band
Large Area Surveys

- NEP Wide Field Observations (2014. 9.)

1.1 μm band

1.6 μm band
Large Area Surveys

• NGP Wide Field Observations (2014. 3.)

1.1 $\mu$m band

1.6 $\mu$m band
Large Area Surveys

• SGP Wide Field Observations (2014. 10.)

1.1 μm band

1.6 μm band
NEP Monitoring

- **NEP Monitoring Observations**
  - Observe the north ecliptic pole every another day
  - Monitoring and calibration of the detector condition
  - Variation of background brightness due to ZL
    → Useful for ZL study, but no good data in near-IR

@ 9 μm (Pyo et al. 2010)

@ 3.6 μm (Krick et al. 2010)
NEP Monitoring

1.1 μm band

1.6 μm band

2014 April 16       June 17       August 16       October 16
NEP Monitoring

1.1 μm band

1.6 μm band

Background brightness [ADU]

Earth’s heliocentric ecliptic longitude [degree]
Cosmic Infrared Background

- Observations of Deep Fields
CIB Observations

• Guest Observations
  – Observations of **Dark Clouds**
    (Prof. Matsuura, ISAS)
    • On and off observations of dark clouds to study extragalactic background light

  – Observations of **Galaxy Clusters**
    (Prof. Matsumoto and Mr. Min Gyu Kim)
    • To study intrahalo light of galaxy clusters
Future Plans

• Large Area Surveys are completed.

• NEP Monitoring will continue by 2015 Mar.

• Issues
  – Background matching
  – Subtraction of ZL and DGL components