CLAUDS + HSC SSP

CFHT Large Area U-Band Deep Survey

20 deg$^2$ of u=27AB CFHT imaging in the HSC Deep Layer

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on behalf of the CLAUDS team
HSC Strategic Survey Program

[Image of a diagram showing various astronomical surveys with labels such as HSC-UD, HSC-D, HSC-Wide, etc., along with a graph of wavelengths and survey areas.]
The power of U

photo-z simulations by Masayuki Tanaka:

U=25.5

\[ \sigma_{dz/(1+z)} = 0.033 \]
\[ f_{\text{outliers}} = 12.75\% \]

U=27

\[ \sigma_{dz/(1+z)} = 0.028 \]
\[ f_{\text{outliers}} = 6.64\% \]
The power of U

U-band gives:

1. **better photometric redshifts** (especially at $z<0.5$ and $z\sim2–3$): reduced scatter and catastrophic failure rates

2. $z\sim2$-3  U-dropout/BX/BM galaxy selection

3. **improved SFR estimates** (SFR=$dM/dt$) from massive young (blue) stars —> improved SED fits

4. **continuum for NB387** better than g-band —> LAEs, Ly-alpha blobs at $z\sim2.2$
CLAUDS: the survey

• Goal: match HSC-Deep in u-band
  • depth (U~27 AB, 5σ, 2"
  • seeing (<1"
  • area (20 deg²)

• Project: CLAUDS (CFHT Large Area U-band Deep Survey)
  • MegaCam on CFHT
  • Canada + France + China
  • awarded 375 hrs = 68 dark-time nights
MegaCam on 3.6m CFHT

- FOV = 1 deg$^2$
- UV-sensitive CCDs (unlike most wide-field imagers)
- Superb site —> great seeing (~0.85", in u-band)
- new high-throughput filters
HSC + CLAUDS filters

![Graph showing filter transmission](image)

- New $u$
- Old $u^*$
- Filter bands: g, r, i, z, y

(filter transmission % vs. wavelength (nm))
CLAUDS: the survey

combination of area & depth unmatched until LSST

**HSC SSP**

**CLAUDS**

CFHTLS -D "best IQ" represents 2", S/N=5 depth of the stacks (the "25%-ile stacks") with seeing comparable to that which will be delivered with the dome-vented CFHT used in this project, and thus well-matched to the Subaru HSC seeing.
CLAUDS: the survey

new (CLAUDS) archival u data
HSC Deep

XMM-LSS

DEEP2-3

E-COSMOS

ELAIS-N1
## CLAUDS: progress with data

<table>
<thead>
<tr>
<th>Year</th>
<th>Allocated</th>
<th>Allocated</th>
<th>Observed &amp; Validated</th>
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<tr>
<td>2014B</td>
<td>30+30+20</td>
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<tr>
<td>2015A</td>
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<tr>
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<td>31+31+20</td>
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<td>2016B</td>
<td>12.5+17+10.4</td>
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<td>39.9</td>
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</table>

| Total                           | 375.1 hrs | 240 hrs | 10 nights |

- Observations completed in 2016B
- Images stacked & photo calibrated
- Aligned with HSC data (astrometry, pixels)
- Partial catalogs

**TO DO:**
- Full HSCpipe-style catalogs
Data processing

• Image processing (modified MegaPipe software)
  • photometrically and astrometrically calibrated images in the HSC tract/patch format

• Photometry & catalogs
  • HSC-like u+grizy catalogs (cModel mags etc.)
  • SExtractor catalogs

• Data validation
  • tests to validate data, assess quality etc.
CLAUDS: data examples

This is ~ what the final Deep Layer data will be like
U-band number counts

u-band counts

4.5 deg$^2$ in Deep
1.5 deg$^2$ in UDDD

CLAUDS done different ways:

CLAUDS vs previous work:

![Graph showing number counts and comparison with previous work](image-url)
Photometric redshifts

photo-z’s vs spec-z’s
XMM-LSS + E-COSMOS

without u:  
with u:

\[ N_{\text{gals}} = 42044 \]
\[ \sigma = 0.048 \times (1 + z) \]
\[ \eta = 17.92\% \]
\[ \text{bias} = -0.005 \times (1 + z) \]
Photometric redshifts

- $N_{\text{gals}} = 18177$
- $\sigma = 0.026 \times (1 + z)$
- $\eta = 2.9\%$
- bias = $-0.008 \times (1 + z)$
Stellar mass functions

- 4 sq deg of data (so far)
- not incompleteness corrected yet

Total galaxy stellar mass functions

\[ \Phi(\log(M/M_\odot)) \]

- All galaxies, 0.2 < z < 0.5
- All galaxies, 0.5 < z < 0.8

Davidzon (2017)
Moutard (2016)
Tomczak (2014)
Stellar mass functions

- 4 sq deg of data (so far)
- not incompleteness corrected yet

By type: total, SF’ing, Quiescent
$z \sim 3$ LBGs in CLAUDS$+$HSC
z\sim 3 \text{ LBGs in CLAUDS+HSC}

here: 4.8 \text{ sq deg (XMM-LSS field)} \sim 100,000 \text{ LBGs}
=> 0.5M z\sim 3 \text{ LBGs in whole 20 sq deg survey}
z~3 LBGs in CLAUDS+HSC

Here: 0.6 sq deg in UDDD
(we will have 30x more objects over whole survey)

LFs:

Clustering:
Summary

• CLAUDS is u-band (AB~27) that complements HSC-Deep
• We have recently completed observing @CFHT
• Data quality tests are ongoing; data look very promising
  • u-band depth is good, number counts good
  • u-enhanced photo-z’s performing well
  • LBG selection looks good
• With the data in hand and largely reduced, we are now looking forward to doing science.
Taddy’s questionnaire

Q1. Science interests?

   Galaxy evolution at intermediate and high redshifts

Q2. Ongoing collaborations with Subaru / other partner countries?

   Yes! (See this talk)

Q3. Interest / potential for future collaborations?

   PFS SSP
   
   WF IR everything — WF complement to JWST

Q4. Size of Subaru projects?

   I am mostly interested in large, community-driven surveys such as
   HSC, PFS, and future ULTIMATE SSPs

Q5. Subaru instruments?

   Wide-field everything

Q6. Any request to Subaru science operation?

   None at present