Probing star forming galaxies at $z<1.5$
with wide-field HSC-SSP narrowband data

Masao Hayashi (NAOJ)
and members of HSC-SSP projects #110, #113, #114
Subaru Strategic Program (SSP) with Hyper Suprime-Cam (HSC)

300 nights over 5-6 years since March 2014

Masao Hayashi (NAOJ)

http://hsc.mtk.nao.ac.jp/ssp/

Deep:
7 deg² x 4 fields

Ultra-Deep:
1.8 deg² x 2 fields

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**NB filters used in HSC-SSP**

Redshift of nebular lines that can be observed with the NB filters

<table>
<thead>
<tr>
<th></th>
<th>NB387</th>
<th>NB816</th>
<th>NB921</th>
<th>NB101</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyα 1216</td>
<td>2.18</td>
<td>5.73</td>
<td>6.58</td>
<td>7.30</td>
</tr>
<tr>
<td>[OII] 3727</td>
<td>0.04</td>
<td>1.19</td>
<td>1.47</td>
<td>1.71</td>
</tr>
<tr>
<td>[OIII] 5007</td>
<td>---</td>
<td>0.63</td>
<td>0.84</td>
<td>1.02</td>
</tr>
<tr>
<td>Hα 6563</td>
<td>---</td>
<td>0.24</td>
<td>0.40</td>
<td>0.54</td>
</tr>
</tbody>
</table>
Evolution of star-forming galaxies after cosmic high noon

- History of star-formation and/or quenching of SF in galaxies
- Evolution of large-scale structures of star-forming galaxies

Madau & Dickinson (2014)
NB data available in \textit{dr1\_s15b} data release

**NB0816**

UD: 1 FoV (4 hrs)  
D: 3 FoVs (1 hr)  
\textbf{5.68 deg$^2$}

**NB0921**

UD: 2 FoVs (5-7 hrs)  
D: 10 FoVs (1-2 hrs)  
\textbf{16.9 deg$^2$}

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**Depth of NB data and number count of NB-detected galaxies**

Catalogs of clean objects are retrieved from the HSC-SSP database, and then NB-detected galaxies are selected based on the flags that the catalogs have.

Each field shows the consistent number count, and the number counts of galaxies from HSC data are consistent with the previous studies.

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Selection of NB emitters and identification of nebular emission

Example of NB0921 in UD-COSMOS

For the NB emitters selected

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Number count of NB emitters

As a function of NB magnitude

![Graph showing number density vs NB magnitude for NB0816 and NB0921.]

There is a large variation in bright end of NB0921 number count.
Number count of NB emitters

As a function of NB emission line flux

There is a large variation in bright end of NB0921 number count.
Spatial distribution of HAEs at $z=0.24$ and $0.40$

**NB0816**

5.68 deg$^2$

# 4,480

(with enough detection completeness)

**NB0921**

16.9 deg$^2$

# 13,441

(with adequate detection completeness)
Spatial distribution of O3Es at $z=0.63$ and 0.84

**NB0816**
5.68 deg$^2$
# 5,990
(with enough detection completeness)

**NB0921**
16.9 deg$^2$
# 9,415
(with adequate detection completeness)
Spatial distribution of O2Es at z=1.19 and 1.47

NB0816
5.68 deg^2
# 12,486
(with enough detection completeness)

NB0921
16.9 deg^2
# 14,634
(with adequate detection completeness)
Luminosity functions of HAEs, O3Es, and O2Es

Hα emitters (HAEs)

There is a large variation between the fields, which may suggest that larger survey volume is required.

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There is an excess in the number of bright emission line galaxies.
**Luminosity functions of HAEs, O3Es, and O2Es**

[OII] emitters (O2Es)

**NB0816_O2E (z=1.19)**
- Corrected for detection completeness
- \( \log_{10}(\phi^*) = -2.820 \)
- \( \log_{10}(L^*) = 42.018 \)
- \( \alpha = -1.994 \)

**NB0921_O2E (z=1.47)**
- Corrected for detection completeness
- \( \log_{10}(\phi^*) = -2.696 \)
- \( \log_{10}(L^*) = 42.039 \)
- \( \alpha = -2.313 \)

Consistent with previous studies.
Summary

- Subaru Strategic Program (SSP) with HSC and its narrow-band data

- One of the largest samples of emission line galaxies at 0.2 z<1.5
  - 4 separate fields over 22.5 square degrees in total
  - Complete down to NB=23.5 in Deep fields and NB=24.0 in Ultra-Deep fields (corresponding to 2-3x10^{-17} erg/s/cm2 and 1-2x10^{-17} erg/s/cm2)
  - ~18,000 HAEs, ~15,000 O3Es, and ~27,000 O2Es

- Large scale structures and luminosity function
  (HSC-SSP project #113 by M. Hayashi et al.)
- Candidates of metal-poor galaxy which have large [OIII] equivalent width
  (HSC-SSP project #114 by M. Hayashi et al.)
- Hybrid Search (red sequence galaxies and SF galaxies) for Clusters with HSC
  (HSC-SSP project #110 by M. Yamamoto and T. Kodama et al.)