Subaru Measurement of Images and Redshifts (SuMIRe): Hyper SuprimeCam (HSC) & Prime Focus Spectrograph (PFS)
Sloan Digital Sky Survey (SDSS)

- most ambitious sky survey to date
- among the most productive observatories
- powerful combination of imaging and spectroscopy
- public release of high quality data
Milky Way's structure

- Hercules-Aquila Cloud
- Sagittarius Stream
- Palomar 5
- Virgo Overdensity
- Orphan Stream
- Monoceros Ring

- first methane dwarf
- new astroid family

- faintest satellite galaxies
- clusters of galaxies
4000 Million Light Years

300 Thousand Light Years

Primordial sound wave, now 500 Million Light Years across.

large samples of supernovae

Gunn-Peterson Trough

most distant quasar

$z = 6.4$

baryon acoustic oscillation

3D map of the universe
now, we are doing what SDSS has done, but at $z \sim 1$ and beyond!

enter Subaru::SuMIRe
Subaru

- 8.2m optical/near-IR telescope at summit of Mauna Kea
- Strong structure at prime focus, capable of wide field imaging/spectroscopy
- Current generation of instruments
  - SuprimeCam
  - MOIRCS
  - FMOS
  - HiCIAO
  - AO+laser guide star
Subaru

- 8.2m optical/near-IR telescope at summit of Mauna Kea

- Strong structure at prime focus, capable of wide field imaging/spectroscopy

- Current generation of instruments
  - SuprimeCam
  - MOIRCS
  - FMOS
  - HiCIAO
  - AO+laser guide star
• **Hyper-SuprimeCam** (HSC)
  - 1.5 deg diameter FOV (3 full moons!), 1.77 deg²
  - 106 CCD mosaic; high quantum efficiency to ~1μm
  - first light in 08/2012
  - exquisite imaging quality, suitable for wide-field weak lensing surveys
  - ASIAA built the filter exchange system

• **Prime Focus Spectrograph** (PFS): *very, very bad name!*
  - slightly smaller FOV than HSC
  - 2400 fibers ⇒ thousands of spectra in one take!
  - 3 channels: blue, red, and near-IR (0.38 to 1.26μm)
  - no redshift desert! powerful machine for galaxy/AGN evolution study
  - ASIAA building the metrology camera & top unit
HSC survey

- collaboration: Japan, Taiwan, and Princeton University
- PI: Satoshi Miyazaki (NAOJ)
- NAOJ granted 300 nights over 5 (6) years (2014-2019)
- science goals: growth of cosmic structure through gravitational lensing, nature of dark matter & dark energy, formation & evolution of galaxies
- three layer, wedding cake-like design
  - wide (1400 deg², 3 fields, grizy, r~26): cosmology, galaxy evolution, AGN census
  - deep (27 deg², 4 fields, grizy+3NB, r~27): galaxy evolution with SDSS precision and statistical power at z>1
  - ultradeep (2 pointings, grizy+3NB, r~28): cosmic reionization, supernovae cosmology
GAMA14h field, ~10 deg²

14:26, 0:36
2.5m, 1min, 1/3 of sky
8.2m, 10min, 1/30 of sky
remember, YOU can use these data!
get involved

- HSC email lists
- HSC wiki
- think of interesting projects and propose!

http://jeeves.astro.princeton.edu/mailman/listinfo/
Welcome to HSC Survey

Official HSC webpage: http://www.naoj.org/Projects/HSC/
SuMIRe project: http://sumire.ipmu.jp/en/

What's new
- survey plans for 2014A
- HSC collaboration meeting 2014 August (8/25–26)

Introduction
- Information for new members
- Survey policies

Projects and Publications
- List of projects at http://hsca.ipmu.jp/hsc/projects/cgi-bin/projects.pl (need password)
- List of publications at http://hsca.ipmu.jp/hsc/projects/cgi-bin/publications.pl (need password)

Survey/Science Discussions
- Survey information and discussions
  - [wide] [deep] [ultra-deep]
- Survey Design Committee meeting (biweekly)
HSC collaboration policy

version 15, October 3, 2012

October 3, 2012

Contents

1 Preface 1

2 HSC organization 1

3 HSC Survey Data Access and Authorship Rights 1
   3.1 Definitions: ................................................................. 1
   3.2 Classes of Survey Participants: ........................................... 2
      3.2.1 Builders ................................................................. 2
      3.2.2 Survey Members ....................................................... 2
      3.2.3 External Collaborators .............................................. 2
      3.2.4 JPT Fellows ............................................................ 3
      3.2.5 JPT Students .......................................................... 3
   3.3 Types of Data Access and Authorship Rights ......................... 3
      3.3.1 General Authorship Right ........................................... 3
      3.3.2 Specific Authorship Right ........................................ 3
      3.3.3 Full Data Access ..................................................... 3
      3.3.4 Limited Data Access ............................................... 3
      3.3.5 Admin Supervised Data Access ................................... 3
      3.3.6 Supervised Data Access .......................................... 3
   3.4 Association of Participant Class with Authorship Rights and Data Access 4

4 Science Policies 4
   4.1 Announcement of Projects .............................................. 4
   4.2 Student Theses .......................................................... 5
   4.3 Science Projects and the Roles of the Working Groups ............. 5

5 Publication Policies 5
   5.1 Authorship ............................................................... 5
   5.2 Technical Papers ........................................................ 6
   5.3 Internal Review .......................................................... 6
HSC Projects

As agreed in the earlier years of HSC collaboration, we will follow the SDSS-type collaboration policy to carry out any science project (see the publication policy here). In brief, all science projects should be announced to the collaboration via this page and the collaboration mailing list. Any already-announced projects are open to the collaboration. The goal of the project announcements is to facilitate collaborations. If you are interested in joining an ongoing effort, please email the project leader listed below. Although it is a good idea to coordinate some efforts, overlapping projects are fine.

For specific publications (a project can have many publications), please use the publication submission page here.

Add a new project to the list.

If you need personal attention, contact steven.bickerton@gmail.com.

---

Select Projects to List:

Scientist: [ ]
Project Leader [ ]
All Participants [ ]

Search Title: [ ]

Project Categories:
[ ] All
[ ] Instrumentation
[ ] HSC
[ ] Other
[ ] Thesis

(You may choose more than one.)

Science Categories:
[ ] All
[ ] Galaxies
[ ] AGN/QSO
[ ] Weak-lensing
[ ] Strong-lensing
[ ] Clusters
[ ] Transients
[ ] Milky Way
[ ] Solar System
[ ] Other

(You may choose more than one.)

Project Status:
[ ] All
[ ] Date of initial posting
[ ] Leader
[ ] Category
[ ] Announcement date

List projects started between: [ ]

Sort by:
[ ] Date of initial posting
[ ] Leader
[ ] Category
[ ] Announcement date

Collaborators shown in listing:
[ ] Leader
[ ] Everyone

---

Project 117 October 2013 HSC (Just starting)
Multi-band photometric properties of quasar host galaxies
(Yoshiki Matsuoka)

Project 116 September 2013 HSC, Thesis (Just starting)
HSC Broad-Band [III] Selection of AGN Ionized Bubbles
(Al-Lei Sun)

Project 115 July 2013 HSC (Just starting)
Constraining on Outflow Events and Star-Formation Quenching through Volumetric-limited Search for Oxygen-line Blobs at z=1-2
(Suraphong Yuma)

Project 114 July 2013 HSC (Just starting)
Probing young metal-poor galaxies with large equivalent width of nebular emission at z<1.7
(Masao Hayashi)

Project 113 July 2013 HSC (Just starting)
Constructing the largest sample of line emitting galaxies at z=0.04-1.71
(Masao Hayashi)

Project 112 July 2013 HSC, Other (Just starting)
High-z galaxy, QSO and supernova science with SPLASH (Spitzer+HSC)
(John Silverman)

Project 111 July 2013 HSC, Other (In Progress)
SNAWS: a new semi-analytical galaxy and SMBH/AGN formation model
(Motohiro Enoki)

Project 110 June 2013 HSC (Just starting)
Mapping Large Scale Structures and Tracing Galaxy Evolution with a Combined Technique of Multi-Color Selection and Narrow-Band Imaging
(Tadayuki Kodama)

Project 109 June 2013 HSC (Just starting)
Systematic test of weak lensing measurement through galaxy-galaxy lensing
(Hironao Miyatake)

Project 108 June 2013 HSC (Just starting)
Detection of filament structure through weak lensing by sucking galaxy-cluster pairs
(Hironao Miyatake)
what kind of data do YOU need?

- just catalogs?
- stacked images?
- raw images?

email me (ytl@asiaa.sinica.edu.tw) what you need and we’ll see how to most efficiently gather the data.
PFS

- collaboration: Japan, ASIAA, Caltech/JPL, Princeton, Johns Hopkins, Brazil, Marseille...
- PI: Hitoshi Murayama (Kavli IPMU)
- first light expected in 2017; survey to start in 2019(?)
- extremely powerful synergy with HSC: SDSS at z-1!
- principle science drivers
  - cosmology from BAO/RSD
  - galaxy/AGN evolution to z-7
  - Galactic archeology
- ASIAA responsible for metrology camera & prime focus instrument
- prototype spectrograph constructed this month!
- collaboration meeting @ ASIAA Dec. 15-19
PFS

prime focus instrument

blue arm

red arm

near-IR arm

Cobra fiber positioner
PFS prime focus instrument

blue arm

cobra fiber positioner

red arm

blue arm

ear-IR arm

prime focus instrument

near-IR arm

Subaru Telescope

Fiber cable

Prime Focus Instrument

Fiber connectors

Wide-field corrector

2400 fibers steered by positioners

Metrology camera as a Cassegrain instrument

Tertiary mirror floor (IR side)

4 spectrographs

Fiber cable
Major Milestones

Jan 2011 endorsement by Subaru community
Dec 2011 MOU between IPMU & NAOJ
Mar 2012 CoDR
Jul 2012 collaboration MOU
Oct 2012 Requirement Review
Feb 2013 PDR
Nov 2013 this meeting
now subsystem CDRs
Jul 2016 System Integration, tests
Jun 2017 Operational Readiness Review
Jul 2017 First Light (engineering)
Review

Extragalactic science, cosmology, and Galactic archaeology with the Subaru Prime Focus Spectrograph

Masahiro Takada, 1,• Richard S. Ellis, 2 Masashi Chiba, 3 Jenny E. Greene, 4 Hiroaki Aihara, 1,5 Nobuo Arimoto, 6 Kevin Bundy, 1 Judith Cohen, 2 Olivier Doré, 2,7 Genevieve Graves, 4 James E. Gunn, 4 Timothy Heckman, 8 Christopher M. Hirata, 2 Paul Ho, 9 Jean-Paul Kneib, 10 Olivier Le Fèvre, 10 Lihwai Lin, 9 Surhud More, 1 Hitoshi Murayama, 1,11 Tohru Nagao, 12 Masami Ouchi, 13 Michael Seiffert, 2,7 John D. Silverman, 1 Laerte Sodré, Jr., 14 David N. Spergel, 1,4 Michael A. Strauss, 4 Hajime Sugai, 1 Yasushi Suto, 5 Hideki Takami, 6 and Rosemary Wyse 8

1Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU, WPI), The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, Chiba 277-8583
2California Institute of Technology, 200 East California Blvd, Pasadena, CA 91125, USA
3Astronomical Institute, Tohoku University, Aramaki, Aoba-ku, Sendai 980-8578
4Department of Astrophysical Sciences, Princeton University, 4 Ivy Lane, Peyton Hall, Princeton, NJ 08544, USA
5Department of Physics, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033
6National Astronomical Observatory of Japan, 2-21-1 Osawa, Mitaka, Tokyo 181-8588
7Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, La Cañada Flintridge, CA 91011, USA
8The European Space Agency, Postfach 2946, D-8047 Sondershausen, Germany
9Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA
10Ruprecht-Karls-Universität Heidelberg, Astronomisches Institut, Philosophenweg 12, D-69120 Heidelberg, Germany
11Division of Physics, Applied Physics and Astronomy, University of California, 6435 Murray Hall, Berkeley, CA 94720-7300, USA
12Department of Physics, University of Chicago, 5640 South Ellis Avenue, Chicago, IL 60637, USA
13Research Institute for Applied Mechanics, Kyushu University, 744-0351 Fukuoka, Japan
14Instituto de Física, Universidade Federal do Rio de Janeiro, 21941-970, Rio de Janeiro, RJ, Brasil

• Current Address: Waseda Institute of Advanced Study, Waseda University, 4-6-1 Ohkubo, Shinjuku-ku, Tokyo 169-8555, Japan
future collaboration with Subaru

- in the TMT era, Subaru will mainly host 3 facility instruments, taking its advantage of wide FOV
  - HSC
  - PFS
  - (ground layer AO + wide field near-IR instrument)