MOIRCS Upgrade Project - 'nuMOIRCS'

Unveiling the Origin of Galaxy Morphology through Multi-object and Integral-field Spectroscopy in Near-IR

Grant-in-Aid for Scientific Research (S) PI: N. Arimoto (NAOJ)

Current membership

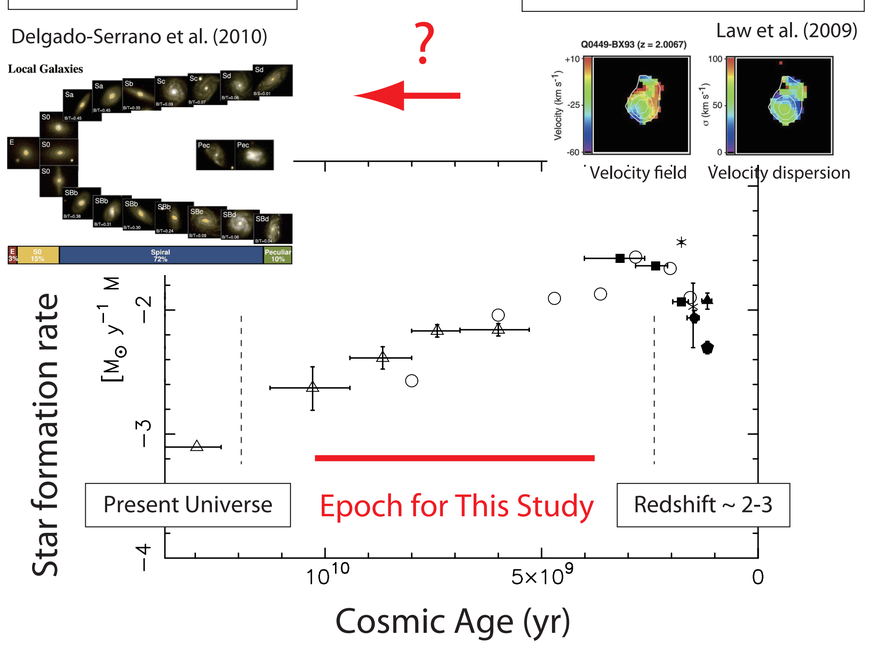
PI of the project: N. Arimoto
Project manager: T. Nishimura
Project scientist: I. Iwata (Presentor of this poster)
Support scientist for MOIRCS: I. Tanaka
Engineer: K. Omata

Scientits, Supporters:
T. Kodama, T. Usuda, S. Oya
M. Onodera, Y. Koyama, Y. Yamada
S. Ozaki, T. Ishigaki

1. Scientific Objectives

Galaxies with regulated shapes in the present-day

Irregular shapes and kinematics seen in distant galaxies



Redshift > 2: Epoch of Violent Galaxy Evolution
- Intensive star formation
- Irregular shape and internal kinematics

Explore the 'Missing Link' Between the Epoch of Violent Galaxy Evolution and the Present Epoch by:
- Large Sample of Star-forming and 'Passive' Galaxies
- Resovling Internal Structures and Gas Properties
  - Kinematics, Gas Temperature and Density,
  - Dust Attenuation, Metallicity

Present Epoch
- Quiescent star formation in many galaxies
- Regulated morphlogies (giant elliptical, spiral and so on)

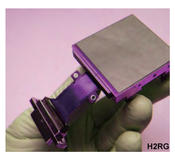
MOIRCS: Wide-field near-IR imager and multi-object spectrograph

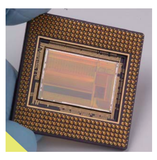
- Wide field imaging (4' x7') and especially unique capability of multi-object spectroscopy
- Explore evolution of kinematics with integral field spectroscopy

2. MOIRCS Upgrade Project

Replacement of Detectors from HAWAII-2 to H2RG

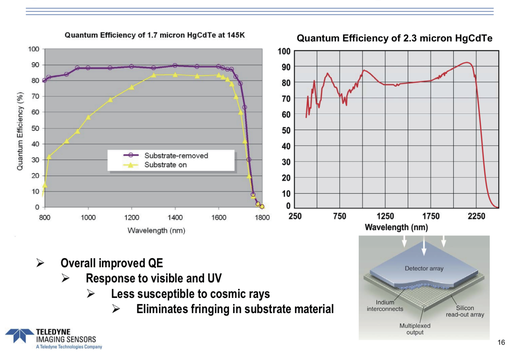
Install Latest Generation H2RG and SIDECAR ASIC.
- Improvement of Read-out Speed: >10sec to a few sec
- Reference Pixels: No Reset Anomaly
- Overall QE improvement
- Reduction of reado-out noise


H2RG Detector


SIDECAR ASIC

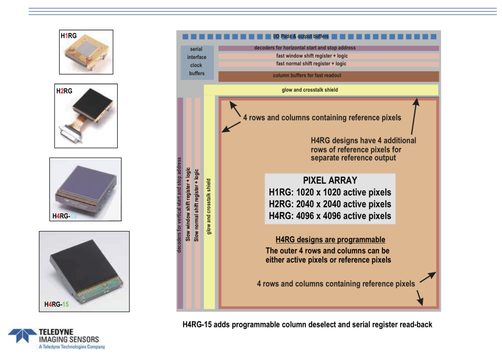
Slides by Teledyne

Quantum Efficiency of substrate-removed HgCdTe

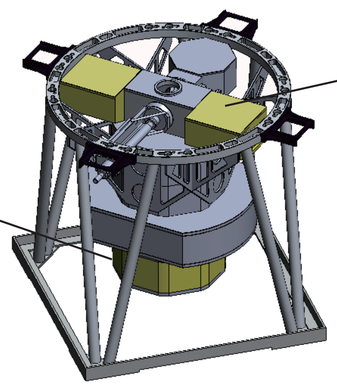


- Overall improved QE
  - Response to visible and UV
    - Less susceptible to cosmic rays
      - Eliminates fringing in substrate material

HxRG Readout Integrated Circuit (ROIC) Architecture

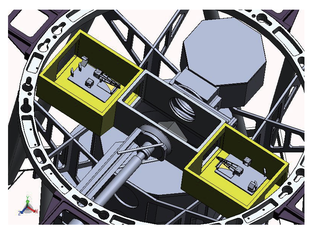


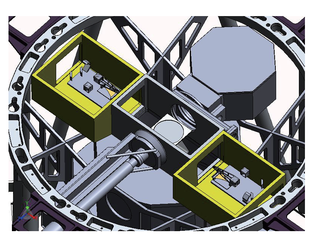
H4RG-15 adds programmable column deselect and serial register read-back

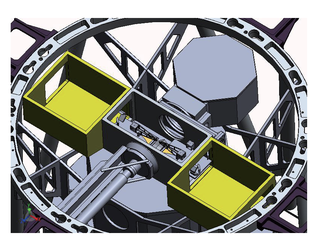


Addition of Integral Field Spectroscopy Units

- Integral Field Spectroscopy(IFS): Key Technology for Future Spectrographs
  - Powerful Tool to Investigate Internal Physics of Extended Objects
  - Efficient and Economic Use of Telescope Time
  - One of The Most Important Technologies for TMT Instruments
- The First Step of Development of near-IR IFS in Japan
  - Many Existing and Coming IFSs in Other Telescopes:
    e.g., VLT/SINFONI, Keck/OSIRIS, Gemini/NIFS, VLT/KMOS


Imaging Mode


MOS Mode


IFS Mode

Improvements of stability and Reliability

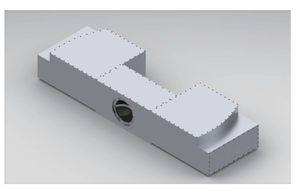
- Replace MOS-mask Exchanger for Faster, More Reliable Mask Exchange
- Fix Unexpected Image Position Changes Possibly due to Instability in Holding Optics
- Fix Focus Position Difference Between MOIRCS and AG
- Addition of Cryocooler to Improve Thermal Stability

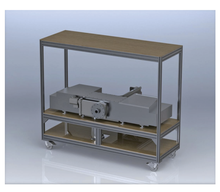
Minimize Impacts of the Upgrade Work on Open Use Operation of MOIRCS

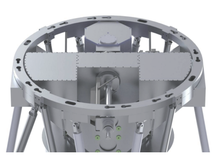
Introducing 'Mini-Lab' : Develop and Test IFS Unit Separately from MOIRCS

Development of H2RG+SIDECAR ASIC in Lab.

Hopefully Reducing Downtime to 2-3 Months?


Mini-Lab: central part is identical to MOIRCS focal plane part.


Mini-Lab can be tested in Lab independently.


Schematic view of how Mini-Lab will be installed on MOIRCS.

With this upgrade, MOIRCS will be more quick, efficient, and reliable. Also, the new function 'Integral Field Spectroscopy' will be available.

3. Upgrade Plan

Year1 (2011)
- Design of 'MiniLab' - New focal plane boxes
- Design of target arm modules for Fiber-IFU mode
- SIDECAR ASIC tests

Year2 (2012)
- Experiments of Fiber-IFU
- Experiments of MLA-IFU
- SIDECAR to drive eng. H2RG
- Software development

Year3 (2013)
- Implementation and test of Fiber-IFU
- Implementation and test of MLA-IFU
- Software integration
- Downtime of MOIRCS (2-3 months during Summer - Fall?)
  - Install H2RG arrays and electronics
  - Install IFU modules

Year4 (2014)
- Science Operation

Post-Doc Position is Now Open !

Deadline: March 30, 2012 (Hawaii Time)

Please Check Subaru Website (http://www.naoj.org)

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