Subaru Telescope Ground Layer AO System
すばる望遠鏡 次世代広視野補償光学システム

岩田 生 (New Development Group, Subaru Telescope, NAOJ)
Subaru Next-Gen AO Working Group

• M. Akiyama, Y. Ohno (Tohoku Univ.)
• K. Motohara (Univ. of Tokyo)
• NAOJ:
  • PI: N. Arimoto
  • Y. Hayano, S. Oya, Y. Minowa, M. Hattori
  • T. Usuda, T. Kodama, N. Takato, H. Terada, I. Tanaka, T. Hattori
  • H. Takami, M. Iye

• Founded in 2011
• 2011/09: Subaru Next-Gen AO WS @ Osaka Univ.
• 2012/08: Study Report
• 2012/11: 光赤天連による中規模計画評価
  • 学術的価値=S、各分野での検討=S、緊急性=A
Ground Layer AO + New NIR Instrument

1. Ground Layer AO with Adaptive Secondary Mirror
2. New Near-IR Instrument (Wide-field Imager + MOS)
   • → Seeing Improvement (FWHM 0.4″ → 0.2″) over FoV > 15′
     • **High Spatial Resolution Competitive to HST**
     • **Higher Sensitivity Equivalent to 2x Telescope Aperture**\(^*1\)
     • **6x Wider Field of View**\(^*2\)
   • Targeted to Start Operation in 2020

\(^*1\) For point sources.
\(^*2\) Relative to MOIRCS
Ground Layer Adaptive Optics (GLAO)

- Adaptive Secondary Mirror (ASM)
- Multiple Laser Guide Stars, Multiple Wavefront Sensors
- Tomography of Earth Atmosphere
- Correct Ground Layer Turbulence with ASM

FoV: 10 arcmin
fwhm: < 0.4 [arcsec]
survey possible
Adaptive Secondary Mirror for VLT UT4
Expected Performance of Subaru GLAO: FWHM Improvement

K–band

Distance from Center
10’ 15’ 20’

by S. Oya
Wide-Field NIR Imager + Multi-Object Spectrograph

- Optical Design by Optcraft, Inc.

FoV 16.2'
### WFNIRIMOS - Specifications under Consideration

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>0.9-2.5μm</td>
</tr>
<tr>
<td>Plate Scale</td>
<td>0.07-0.1”/pix</td>
</tr>
<tr>
<td>FoV</td>
<td>13.6‘×13.6’</td>
</tr>
<tr>
<td>Filters</td>
<td>Broad+Narrow</td>
</tr>
<tr>
<td>MOS</td>
<td>Multi Slit Mask</td>
</tr>
<tr>
<td>λ Dispersion</td>
<td>2000(TBD)</td>
</tr>
<tr>
<td>Wider with Split FoVs?</td>
<td></td>
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<tr>
<td>Under Investigation</td>
<td></td>
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Science Objectives

• Understanding History of Galaxy Evolution with Huge Imaging + Spectroscopic Sample of High-z Galaxies
  • ~Several Thousands of 1<z<3 Galaxies - Morphology, Kinematics, SF Diagnostics, Environmental Effects etc.

• Detection of the Most Distant Galaxies w/ Narrow-band Imaging
  • Finding Galaxies at z>7.5, Exploration of the Cosmic Reionization

→ **Unique Samples for TMT**

• ‘Upgrade’ of Subaru Telescope, Benefit for Various Science Cases

  Study Report by Many Contributions:
  http://www.naoj.org/Projects/newdev/ngao/
Galaxy Evolution

Galactic Archaeology

Exoplanets

Distant Galaxies

Galactic Center

SXDF-NB1006-2

SMBH

HVS

NSC

Stream

Stream

1秒角
Why GLAO+WFNIRIMOS?

• Need of Competitive NIR Instrument(s) - Based on Recommendations by SAC

• ‘Large Survey’ is Subaru’s Strategy in TMT era

• Uniqueness of GLAO + >10’ NIR instrument

• Mauna Kea is Suited for GLAO

• Key Elements of AO for TMT (Tomography, Multiple Laser and WFS, ASM)

• Pathway from Subaru to TMT
Issues

- Are Science Cases Strong Enough?
- Funding
- Human Resources
  - Conflict with Resources for TMT?
  - International Collaborations?
Schedule


概念設計レビュー
基本設計レビュー
詳細設計レビュー
製作
望遠鏡改造
設置・調整・試験
サイエンス観測

AO188/LGS
HSC
PFS
GLAO
Current Activities and Plans for 2013

• Conceptual Study
  • Feasibility of WFNIRIMOS
  • GLAO Development Plan
  • More Detailed Simulations for GLAO and Observations
• Kakenhi for AO188 (LGS/WFS) Upgrade Submitted
• GLAO Science WS: 2013/5/16-17?
• Internal Review in Summer 2013
  • Review Points: Scientific Importance, Technical Feasibility, Funding, Consistency with Overall Roadmap of NAOJ / Subaru Telescope / TMT
Your Inputs are Necessary

• This Project is Based on Recommendations by SAC.
• Science Cases
  • What is Required for Subaru in >2020?
  • Next-Gen AO WS, Study Report
  • → Community WS in May, 2013
• Instrument Development
  • Any interests in Japanese Institutes?
  • International Collaborations