Next generation AO system of Subaru Telescope

Working group of next generation IR instrument and adaptive optics for Subaru Telescope
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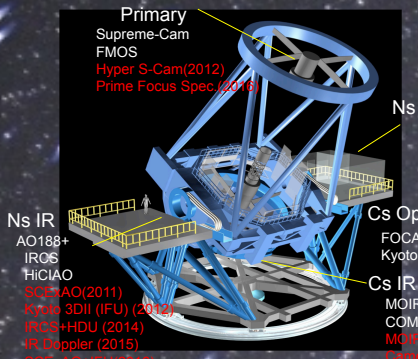
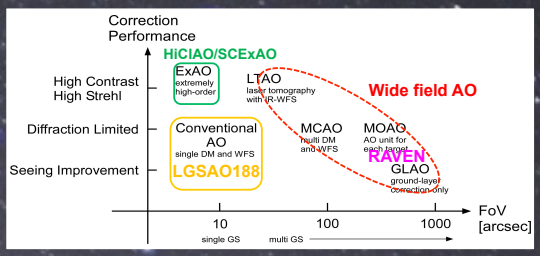
Working group of next generation instrument and adaptive optics at the near infrared wavelength for Subaru Telescope has formed last year, 2010. Working group has picked two instruments, wide field near infrared camera and spectrograph and multi-object adaptive optics, out of four instruments which are suggested by Subaru Advisory Committee as preferable future instruments of Subaru Telescope. Discussion among the working group led us to start a feasibility study of wide field adaptive optics and infrared instruments. This poster introduce a basic concept of Subaru future instrument plan first. Then preliminary performance simulation study of GLAO and MOAO and science benefit of wide field adaptive optics are shown next.

Current and next generation instruments at Subaru Telescope



New parameter field for Subaru AO -> wide field AO



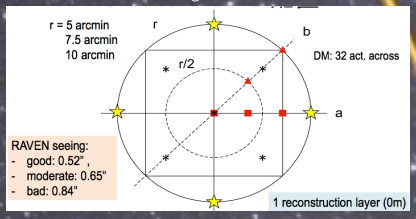
Wide field AO and infrared camera and spectrograph will be a complementary instrument with Hyper Supreme Camera and Prime Focus Spectrograph.

Performance simulation of wide field AO at Subaru Telescope

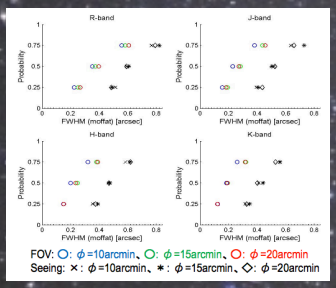
Atmospheric model

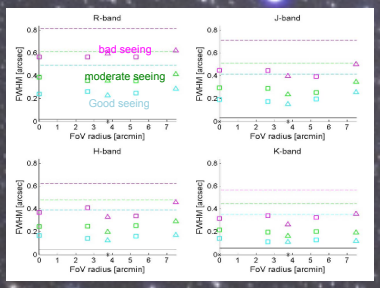
h km	Fractional 25%	Layer 50%	Strength 75%
r_0	19.4 cm	15.6 cm	12.1 cm
0	0.6823	0.5960	0.4971
0.5	0.0611	0.0963	0.1382
1	0.0212	0.0325	0.0577
2	0.0172	0.0372	0.0642
4	0.0757	0.0869	0.0833
8	0.0486	0.0684	0.0895
16	0.0939	0.0826	0.0700

Guide star configuration of GLAO

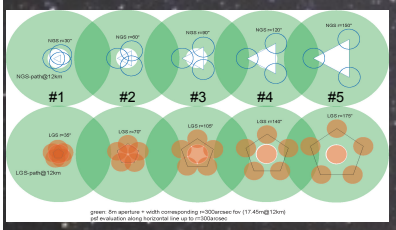


Results of GLAO simulation

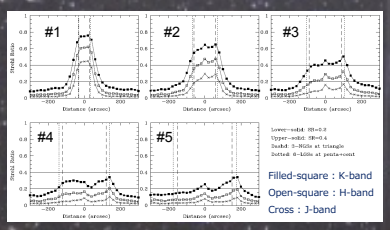


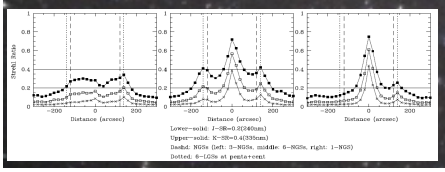


Guide star configuration of MOAO



Results of MOAO simulation



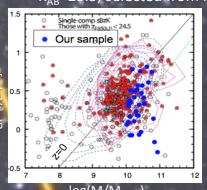


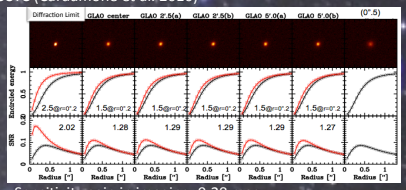
- Number of TT GSs is critical to obtain good performance across a large FOR.
- ELT has much advantage to use fainter TT GSs than 8m-class telescope.
- IR TT-WFS has a merit, because TT GSs become closer to diffraction limit size.

Science case study of GALO at Subaru Telescope

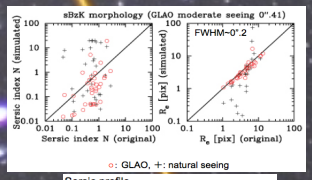
Morphology study BzK galaxies at z=2 (imaging)

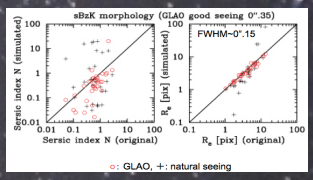
Star forming BzK galaxies ~40 at GOOD-S
z =2.1 – 2.6, selected from CANDELS (Koekemoer et al. 2011)
K_{AB}<23.9, selected from MUSYC (Cardamone et al. 2010)





Sensitivity gain in imaging: 0.28 mag
Sensitivity gain in spectroscopy (0.4" slit): 0.44 mag





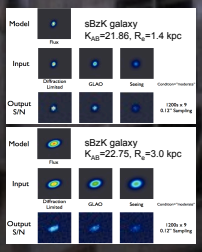
Sersic profile $\Sigma(r) = \Sigma_0 \exp\left\{-b_n\left[(r/r_e)^{1/n}\right]\right\}$

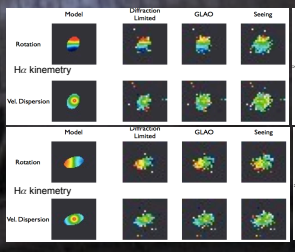
Effective Radius are well defined.
Sersic index are defined under good seeing

Kinematics study of galaxies at z=2-3 (spectroscopy)

Spectrograph specification
Dispersion: 7.5A (R=2500 at 2.2μm)
Spatial Sampling: 0.12"
Coverage: 1.3 - 2.5 μm
Dark: 0.1e-/sec
Readout noise:10e-/pix

Throughput:
5 optical components for spectrograph, each 90%
Primary and secondary mirrors, each 90%
Disperser: Grism at HK, R=500
H2RG QEfromTeledyne





Single object study is investigated by SINFONI and OSIRIS at 8-m class telescope.
Wide field (~10' x 10') multi-object (~100) spectroscopy with IFU is preferable.
Not so easy to investigate kinematics of faint galaxies. (<23 K_{AB})
Rotation curve is well defined for brighter galaxies.
Velocity dispersion at the center of galaxies are diluted.