すばる望遠鏡の装置計画
Instrument Plan of Subaru Telescope

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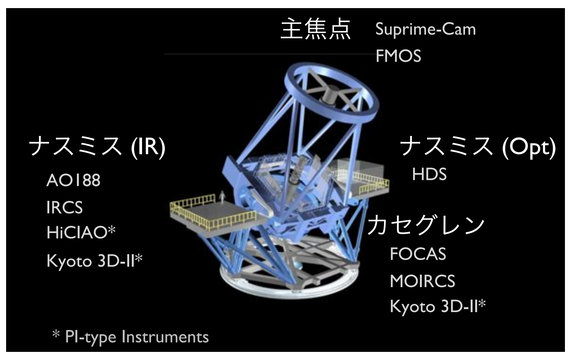
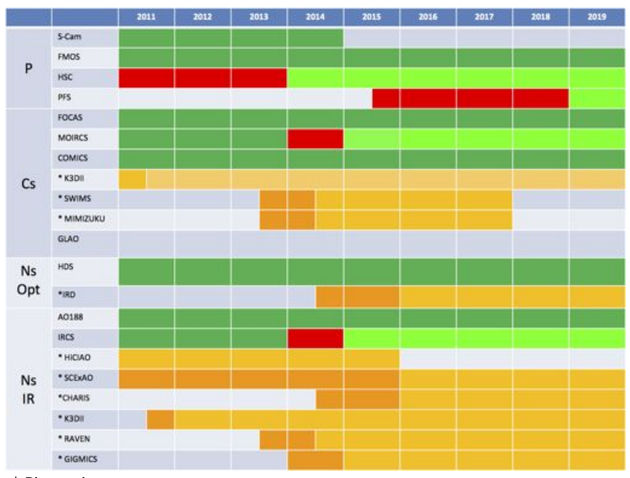
現在の共同利用観測装置



See http://www.naoj.org/Observing/Instruments/
for information of current facility instruments.

装置計画 -Time Table

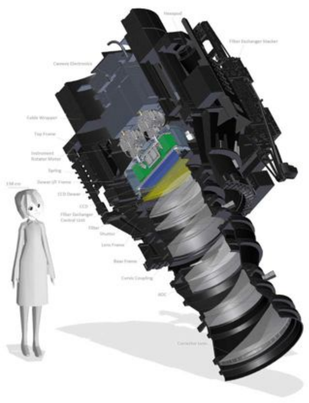


* PI-type Instruments
Facility Instruments
Commissioning / Upgrade
PI-type Instruments under development

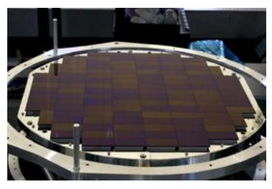
現在コミッショニング中の観測装置

Hyper Suprime-Cam (HSC)

PI: S. Miyazaki (NAOJ)

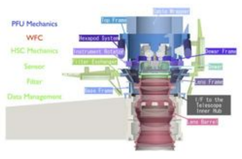


Optical image with extreme wide-field (1.5 deg., 3x diameter of the current Suprime-Cam).


116 CCDs on the focal plane


HSC installation to the Subaru top-ring


One of two filter exchange units.

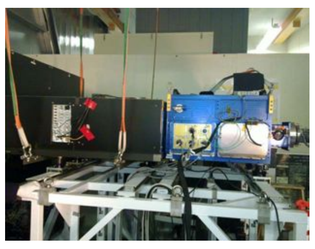


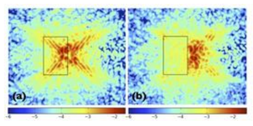
Engineering first light made in Aug. 2012.
Next engineering obs. schedule in Jan. 2013.
Expected to start open-use observation in FY2013.

Wide-field corrector consists of 7 lenses including
ADC. The first lens has 820mm diameter.

SCExAO: Subaru Coronagraphic Extreme AO

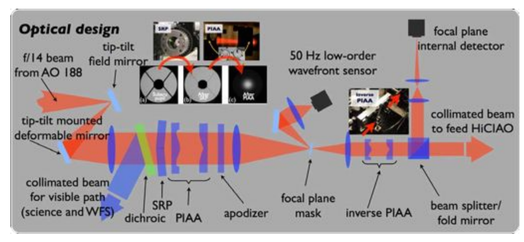
PI: O. Guyon (Subaru / U. of Arizona)





Example of high contrast result achieavable with the SCExAO coronagraph using a simple speckle nulling control loop, demonstrated in the laboratory experiment. Panel (a): the starting point of the loop, with the deformable mirror in its nominal flat-map configuration. Note that in addition to some low-spatial frequency aberrations (created by a static turbulence plate), most of the speckles present at the starting point are located along the diffraction spikes created by the spider arms of the telescope pupil. Panel (b): the result of about 50 speckle nulling iterations, working on up to 10 speckles at a time, effectively clearing a box-shaped region of speckles. (Martinache et al. SPIE 2012)

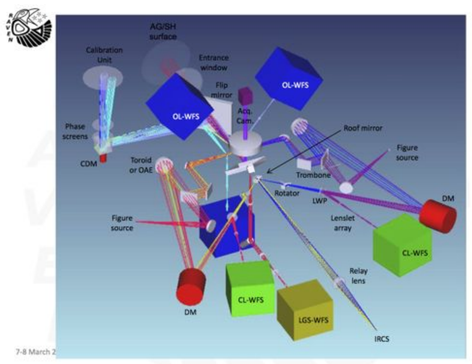
SCExAO is a flexible platform for high-contrast imaging at the high angular resolution, inserted between AO188 and HiCIAO. Currently it combines a MEMS-based wavefront control system feeding a PIAA-based coronagraph.
Started engineering observations in 2011. Science observations are expected to be commenced in 2013.

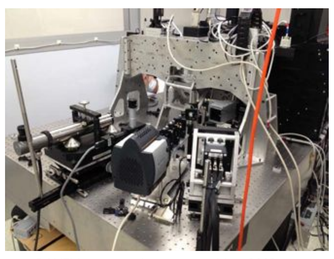


現在開発中の観測装置

RAVEN

PI: C. Bradley (Univ. of Victoria, Canada)




RAVEN optics under testing in Nov. 2012

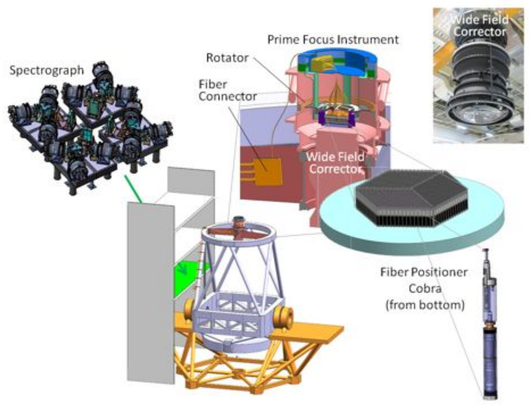
Multi-Object AO (MOAO) demonstrator
Simultaneous AO observations of Two targets in 3.5' field-of-regard.

IRCS will be used as a spectrograph.
Joint project of UVic, HIA (Canada), Tohoku Univ. and Subaru telescope

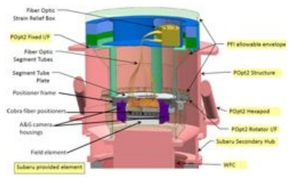
Expected shipment to Hilo in late 2013. First light in 2014.

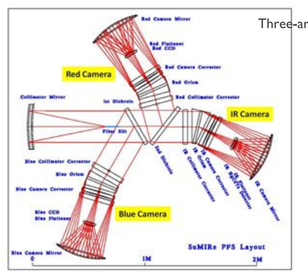
Prime Focus Spectrograph (PFS)

PI: H. Murayama (IPMU, U. of Tokyo)



PFS is a optical / near-IR multi-fiber spectrograph with 2,400 fibers within 1.3 degree diameter. Fiber positioners consist of two stages of piezo-electric rotary motors. Spectrographs are a set of four identical fast-Schmidt spectrographs with three arms (wavelength ranges from 0.38 um to 1.3 um). R~2,000-4,000.


Prime Focus Instrument with 2,400 fiber positioners



Three-arm spectrograph design.

CoDR was made in Feb. 2012. PDR is scheduled in Feb. 2013, and subsequent review by NAOJ (for its official engagement with the project) will be made in March 2013. Predicted first light in late 2017.

GIGMICS

PI: Y. Hirahara (Nagoya Univ.)

Germanium Immersion Grating Mid-Infrared Cryogenic Spectrograph. N-band (8-13um), R~40,000.
First light with Kanata 1.5m telescope in 2011.
Expected shipment and first light with Subaru in 2013.

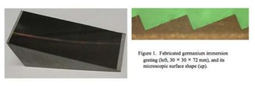
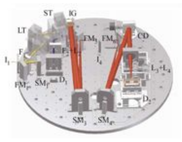


Figure 1. Fabricated germanium immersion grating (left, 30 × 30 × 72 mm), and its microscopic surface shape (up).


GIGMICS in the lab. in Nagoya Univ.


Optics of GIGMICS. The diameter of the base plate is 800mm.

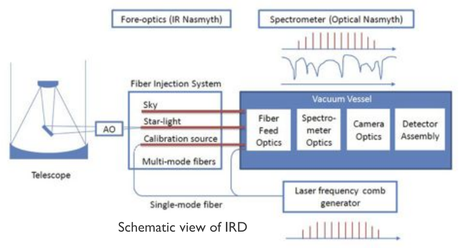
Venusian atmosphere spectrum with Kanata telescope. (Hirahara et al. SPIE 2012)

IRD

PI: M. Tamura (NAOJ)

IRD (InfraRed Doppler instrument) is a near-IR high-precision spectrograph for radial velocity search for exoplanets.

Wavelength: 1.1-1.9μm (TBD), R~70.000.
Target radial velocity measurement error is 1m/s using the optical frequency comb for wavelength calibration. Stellar light will be fed from AO188 into fibers and be mixed with comb signal and input to spectrograph.
Target first light in 2014.

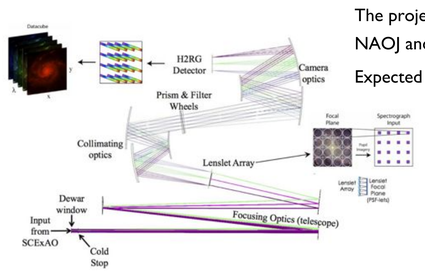


Schematic view of IRD

CHARIS

Instrument PI: N. J. Kasdin (Princeton Univ.)

CHARIS (Coronagraphic High Angular Resolution Imaging Spectrograph) is a integral-field spectrograph designed for characterization of exoplanets. The instrument will be used in combination with AO188 and SCExAO.
Lenslet array with 140 x 140 elements, R~17-60, 0.9-2.3μm, FoV 1.75"x1.75".

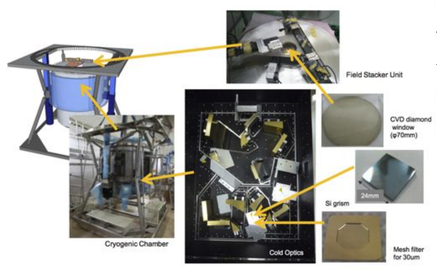


The project is based on a collaboration between NAOJ and Princeton Univ.

Expected delivery to Hilo and first light in 2015.

MIMIZUKU

PI: T. Miyata (Univ. of Tokyo)



Mid-IR (2-25μm) imager and spectrograph with capability of simultaneous obs. of two 1' x2' fields for TAO 6.5m telescope. Pixel scale: 0.1". Spectral resolution R~250 at N and Q-bands.

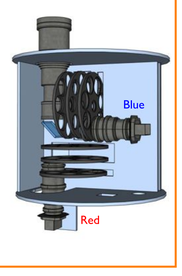
Target first light in 2014.

cf. P-22 浅野 健太朗さんのポスター

SWIMS

PI: K. Motohara (Univ. of Tokyo)

Near-IR imager and multi-object spectrograph for TAO 6.5m telescope. Two channels (0.9-1.4 and 1.4-2.5μm) are observed simultaneously. 6.6' x3.3' FoV with 4-H2RGs. Pixel scale: 0.1".
R:700-1,000 (blue) and 500-900 (red).
MOS using slit masks (~20 masks can be installed).



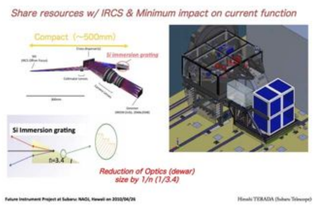
Target first light in 2014.

cf. P-23 北川 祐太朗さんのポスター

装置アップグレード計画

IRCS High Resolution Unit

Items	Specifications
Wavelength coverage	1.4—5.5μm
Resolving power	72,500 @ 2.2μm (0".15 slit width)
Pixel scale	66—72mas/pixel
Image Quality	Strehl ratio > 0.8 @ 2.2μm
System Throughput	> 15%
Sensitivity	15.3mag (@K, 1hr exposure, S/N=5)
Velocity accuracy	<10m/s



MOIRCS Upgrade Project

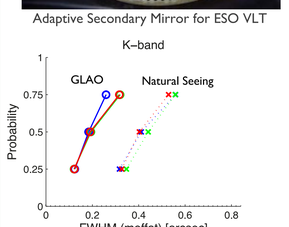
- Replacement of Hawaii-2 detectors to H2RG
- Build new Integral Field Unit(s)

検討中の計画

Next-Gen AO + New IR Instrument

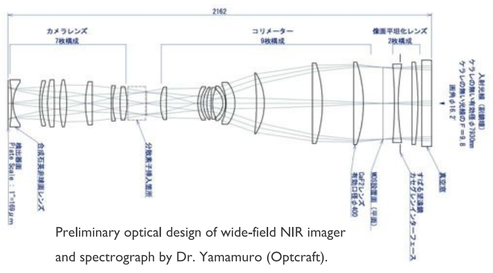

Adaptive Secondary Mirror for ESO VLT

2020 年代の 8-10m 級望遠鏡は、TMT などの超大型望遠鏡と棲み分け・相補的な観測機能をもつことが重要である。すばる望遠鏡は従来広視野観測を一つの特徴としてきたが、TMT 時代に向けて、HSC, PFS に続く広視野の近赤外線観測装置を整備することが急務である。すばる小委員会などでの議論をふまえ、ハワイ観測所を中心とする次世代 AO ワーキンググループを結成し検討を進めている。これまでの検討で、10 分角以上の広視野にわたってシーイング改善を実現する地表層補償光学系 (Ground Layer AO; GLAO) とそれに対応する広視野近赤外線装置を有力な候補とし、AO シミュレーションや装置光学系検討、サイエンス検討を進めてきている。
2011 年 9 月に次世代 AO ワークショップを開催し、2012 年 8 月には検討報告書をまとめた。すばる望遠鏡の将来計画として学術会議の中型計画評価 / マスタープラン策定にも提案している。2013 年にはコミュニティワークショップ、概念検討をまとめた文書の作成と観測所内部での (外部レビュアによる) レビューを行い、計画の推進に向けた合意形成と予算獲得にむけたアクションを進める計画である。
プロジェクトとしては 2010 年代末にファーストライトを迎えることが、TMT とのシナジー (日本独自サンプルの供給) の面から極めて重要と考えている。



Simulation of expected performance of GLAO. Atmospheric profile model is for Mauna Kea. Dotted lines: cases of natural seeing. Solid lines: those of GLAO. Different colors indicate distances from the center (blue: 10' , green: 15' , red: 20'). No significant performance degradation is found. Simulation by S. Oya (NAOJ).

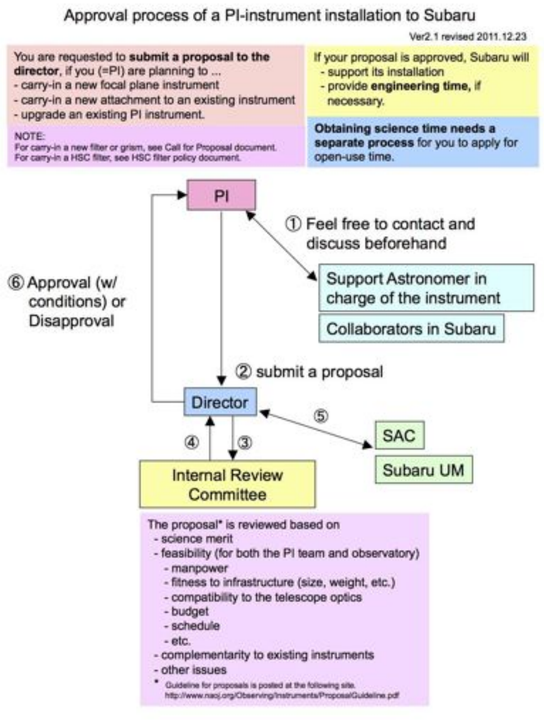
Project Web page:
http://www.naoj.org/Projects/newdev/ngao/


Preliminary optical design of wide-field NIR imager and spectrograph by Dr. Yamamuro (Optcraft).

PI タイプ装置の受け入れポリシー

Procedure for PI-type (Carry-in) instruments is available at
http://www.naoj.org/Observing/Instruments/

・すばる望遠鏡に向けた PI タイプ装置の開発は、コミュニティにおける装置開発アクティビティを維持・発展させるため積極的に支援すべきである - すばる小委員会 (SAC) の提言
・特に今後 TMT 時代を迎えるにあたり、中小規模の装置開発グループが良好な観測環境で自分たちが開発したユニークな装置でサイエンスを展開することを支援することが すばる望遠鏡の一つの役割であると考えられる。
・一方で、共同利用機関としての運用 (望遠鏡時間、観測所の人的資源など) との兼ね合いがあり、このポスターに見られるように非常に多数の装置を受け入れることは今後難しくなっていくことも予想される。
・効果的な開発支援と望遠鏡運用、科学的成果の発信を達成できるよう、観測所とコミュニティがよく連携することが大切である。



Contact: Subaru Telescope New Development
N. Takato (takato@naoj.org) and I. Iwata (iwata@naoj.org)