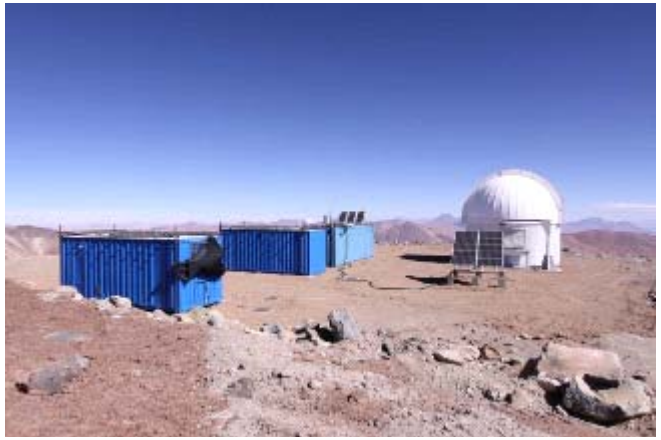
SWIIMS
A New NIR MOS Spectrograph for TAO 6.5m Telescope

K. Motohara, M. Konishi, S. Sako, N. Mitani, T. Aoki, K. Asano, M. Doi, T. Handa, K. Kawara, K. Kohno, S. Koshida, T. Minezaki, T. Miyata, T. Nakamura, T. Soyano, M. Tanaka, T. Tanabe, K. Tarusawa, Y. Yoshii

TAO

The University of Tokyo Atacama Observatory Project

* Construct an infrared-optimized 6.5m telescope at the world's highest site of 5650m(18000ft) altitude, Co. Chajnantor at Atacama desert, Chile
* Current status:
  * Installed a 1m telescope (called miniTAO), and started observations in the near- to mid infrared

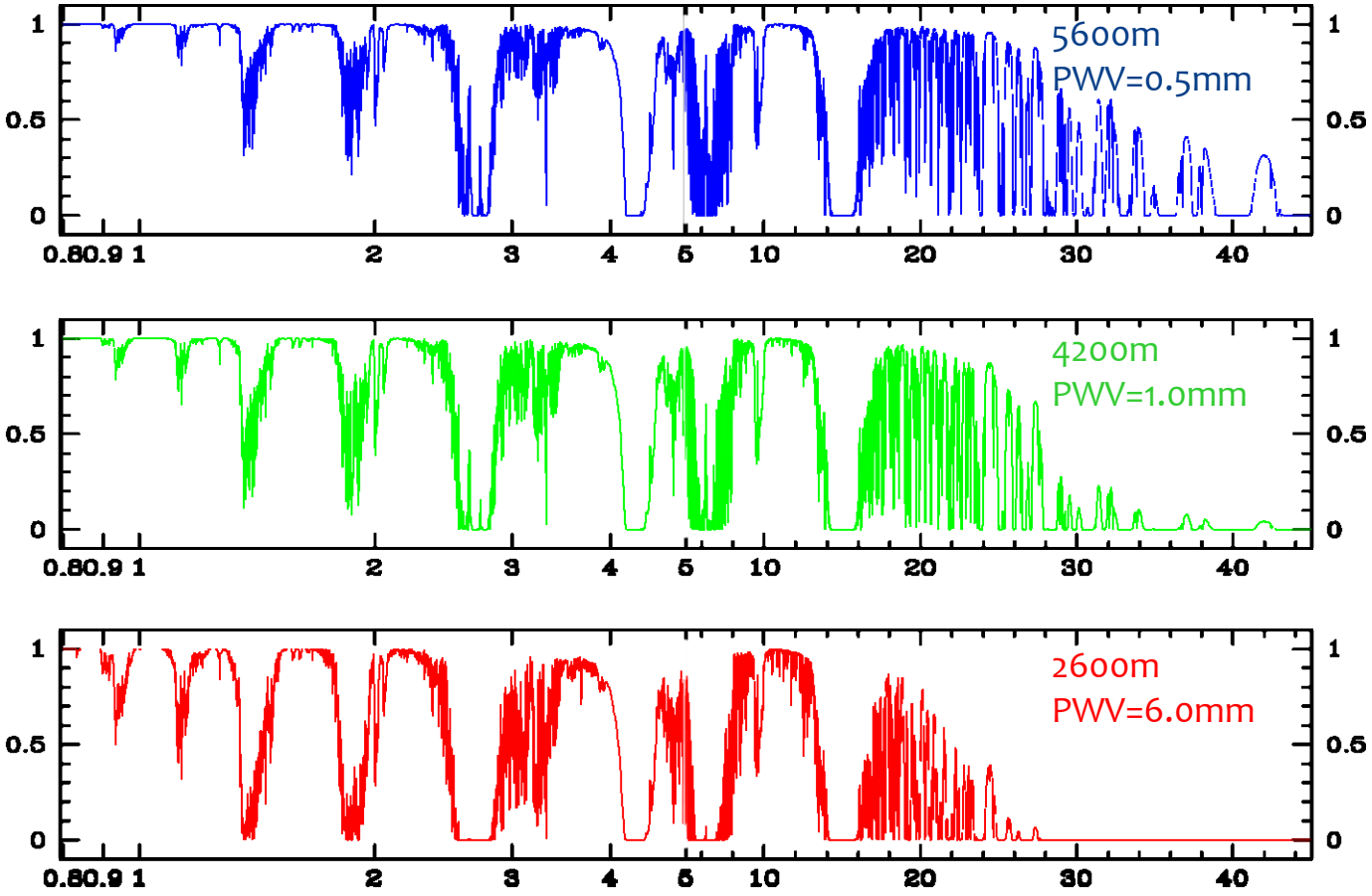


Advantage of Co. Chajnantor

* Nice climate, with photometric nights > 60%, and usable >80% (Miyata+08)
* Seeing is as good as Mauna Kea; DIMM measurement shows median seeing of 0.7” (KM+08)

* Thanks to the low pressure (<0.5atm) and dry climate, extremely low perceptible water vapor (PWV) is achieved : 0.5mm (25%tile) (MK has 1mm)
* This results in excellent observational condition in both NIR(1-2.5μm) and MIR (5-40μm)

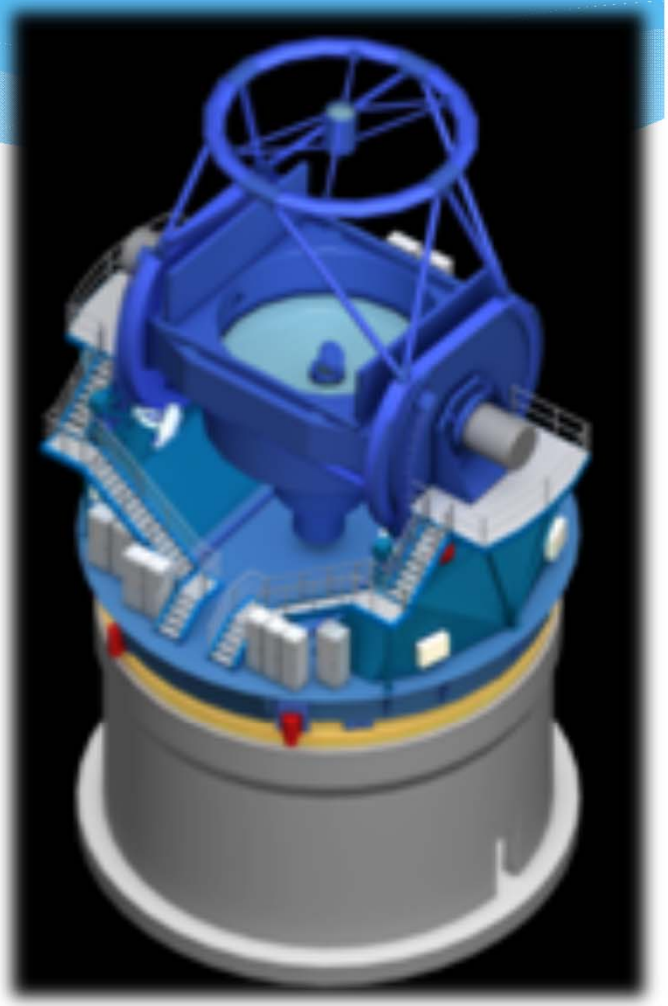
Atmospheric Transmittance



The 6.5m Telescope

Optics	Ritchey-Chretien
Primary Mirror	Φ 6,500 mm (effective Φ 6,154 mm)
2ndry Mirror	Φ 897 mm
Foci	Cassegrain, Nasmyth x 2
FoV	Φ 25'
PM F-ratio	1.25
Final F-ratio	12.2

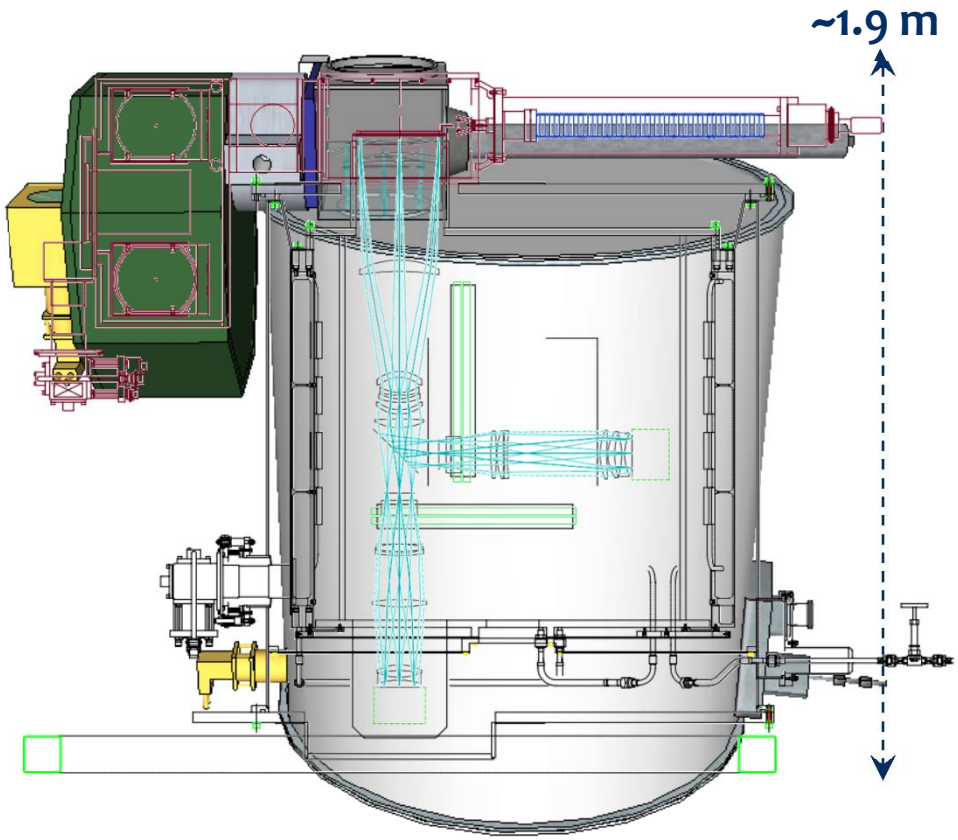
Synergy with the Subaru Telescope



SWIIMS

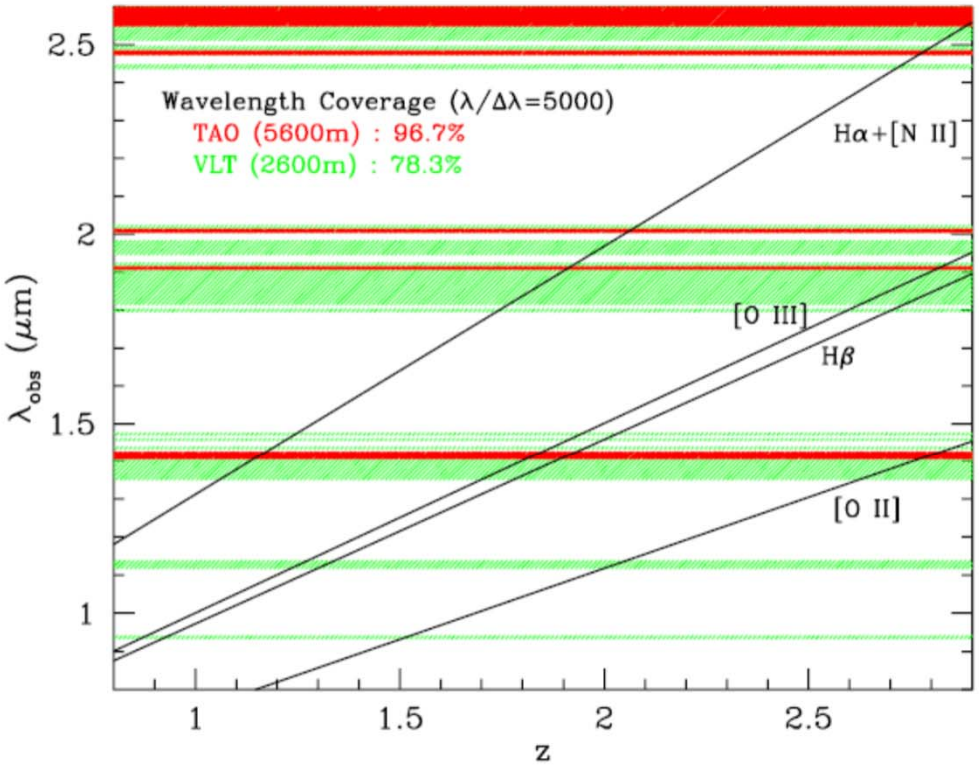
Simultaneous-color Wide-field Infrared Imager and Multi-object Spectrograph

* NIR Spectrograph for TAO 6.5m
  * Wide-Field (9.6' Φ FoV on TAO)
  * MOS Spectrograph
  * 2-band simultaneous Imaging/Spectroscopy
    : 0.9-1.4 and 1.4-2.5μm



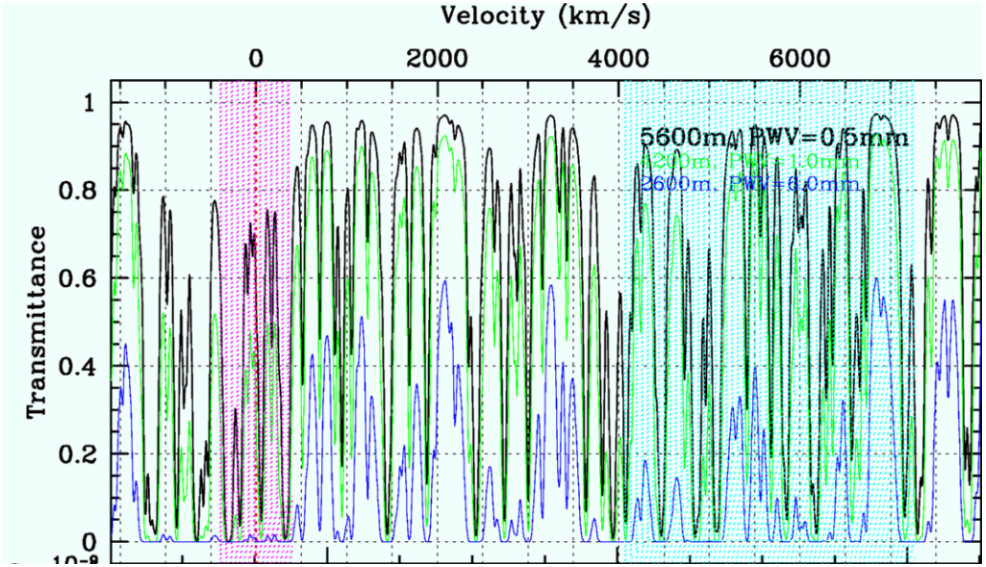
Science with SWIIMS

* High transmittance at TAO site
  : Ideal for the redshift survey in the infrared
* Full 0.9-2.5mm spectra can be obtained simultaneously
  : precise continuum / line ratio measurement possible
* Simultaneous Hi-z Narrow-band Imaging (e.g. Hα/OIII, Hβ/OII)

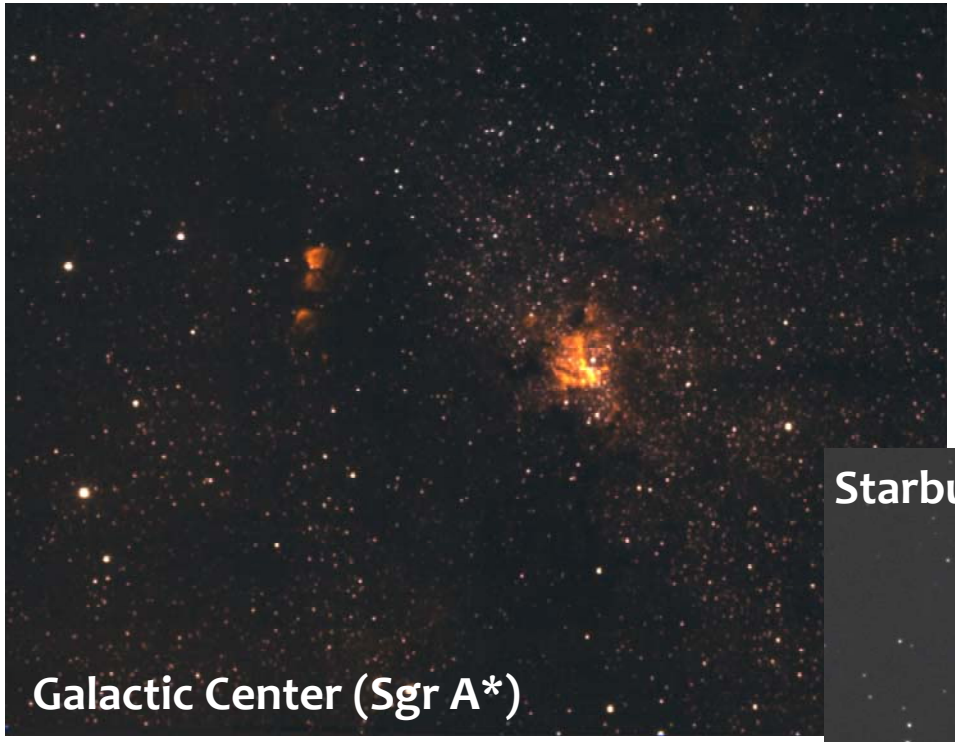


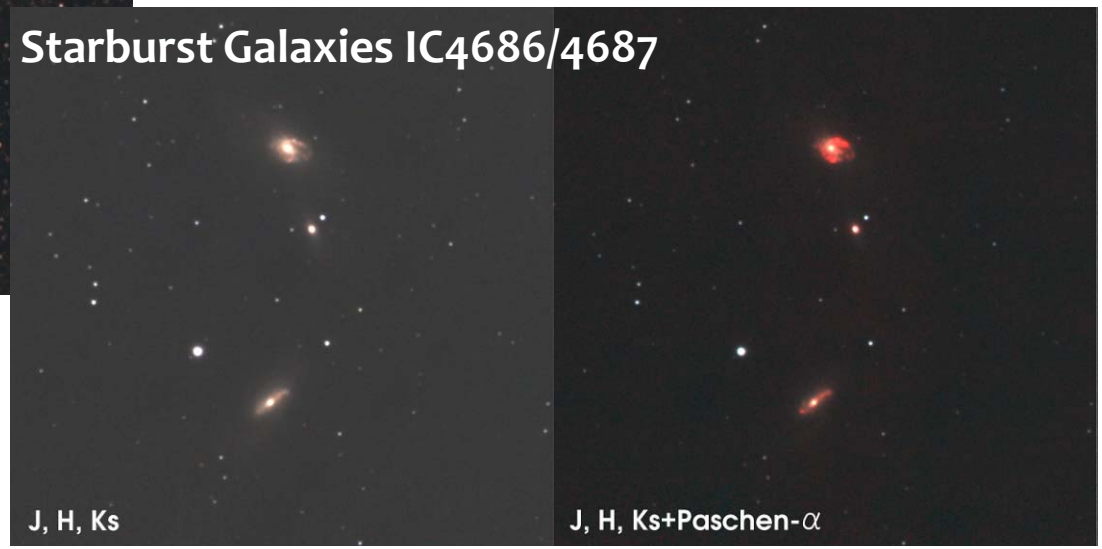
Paschen α at Co. Chajnantor

* Hydrogen Paα line (1.8751mm) available
  * Strongest Hydrogen Line in NIR
  * Good probe in dusty environment



Paα Imaging with ANIR at Co. Chajnantor

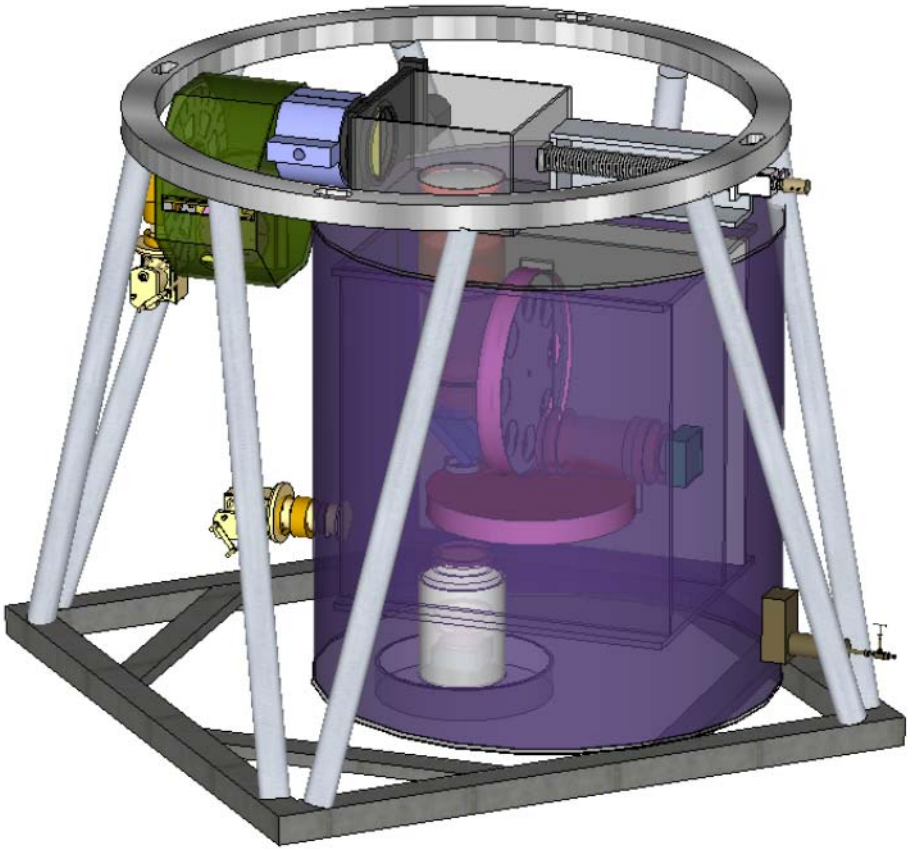




1st SWIIMS Science Workshop (Sep. 11, 2009)

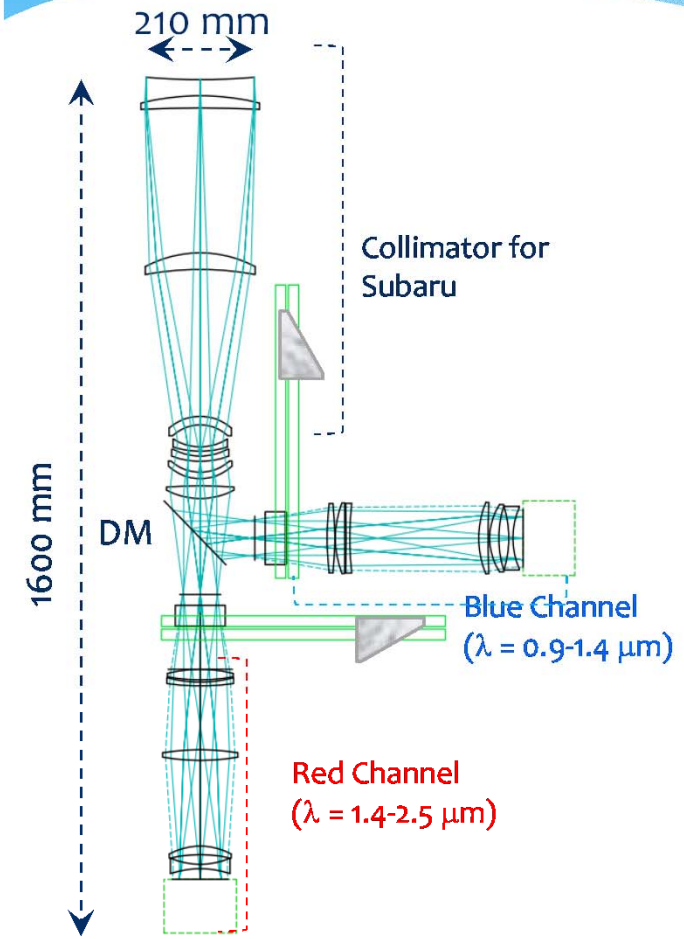
* Hi-z Cluster Survey by NBFs
* YSO eclipsing binary survey
* Elliptical Galaxy distance measurement by Mira variables
* Chemical properties of Hi-z QSOs
* SN follow-up
* AGN monitoring
* Synergy with ALMA
* Synergy with HSC
* GRB follow-up
* …

SWIIMS on Subaru/Cassegrain

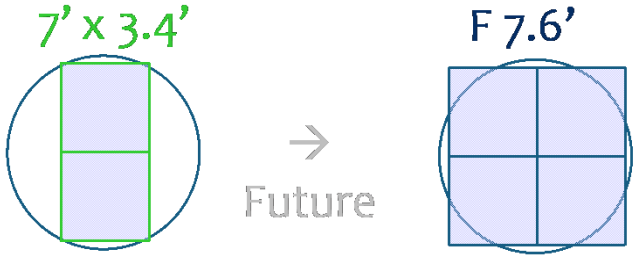


* TAO 6.5m not available before 2015
* First science with Subaru
* Collimator design optimized for Subaru
* FoV of 7’ x 3.4’ (MOIRCS : 7’x4’)

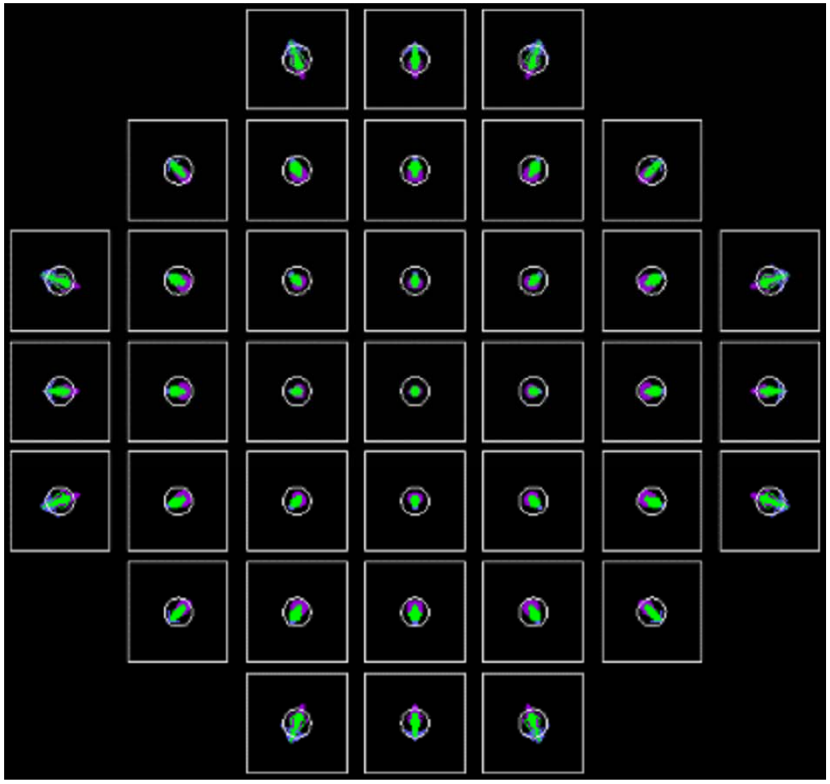
SWIIMS Optics for Subaru

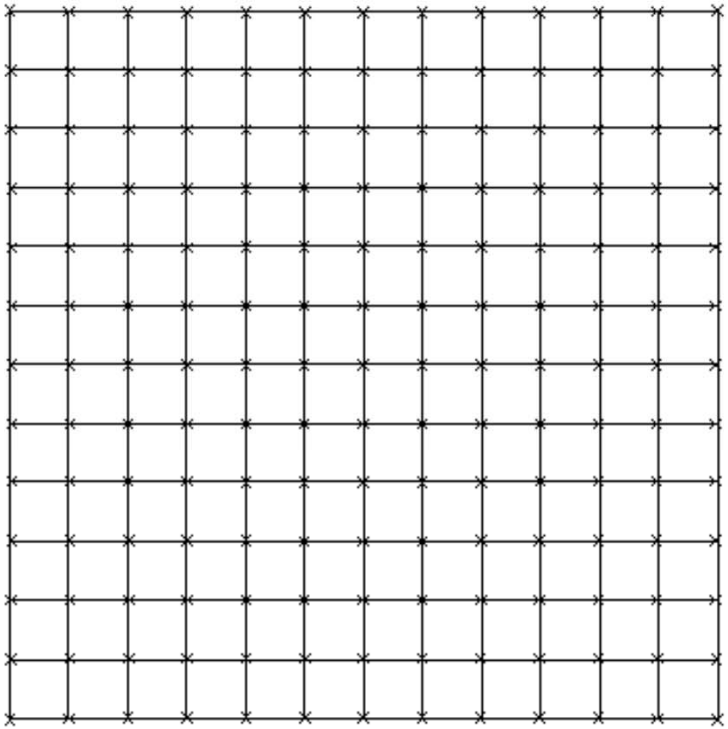


* Split collimated beam using a Dichroic Mirror(DM) at 1.4mm
* Final F-ratio=4.8
* As only 4 arrays were procured, each focal plane is covered by 2 HAWAII2-RGs with FoV of 7'x3.5'

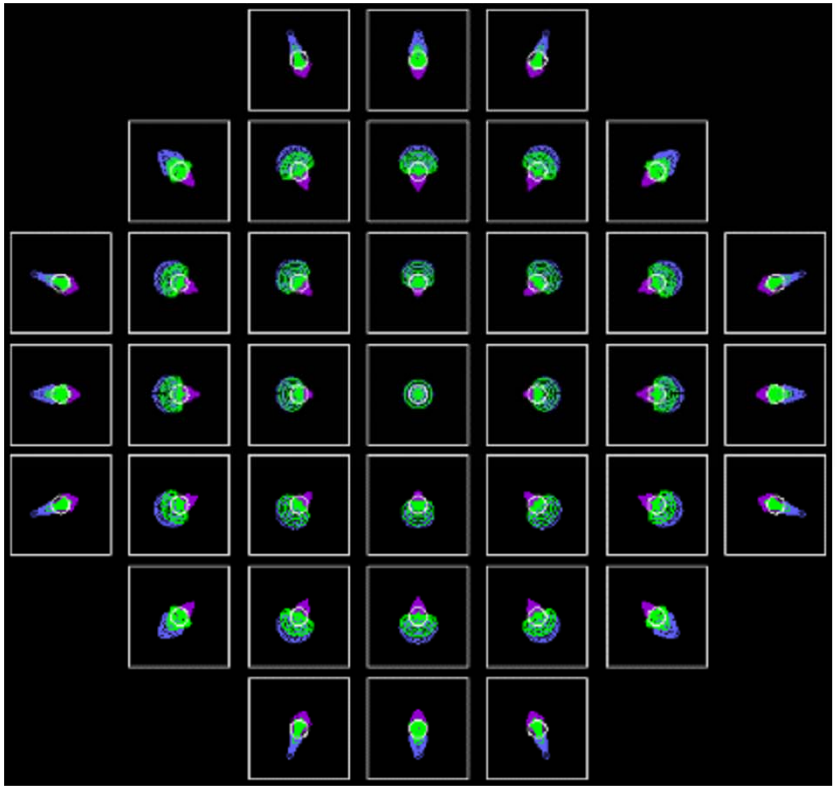


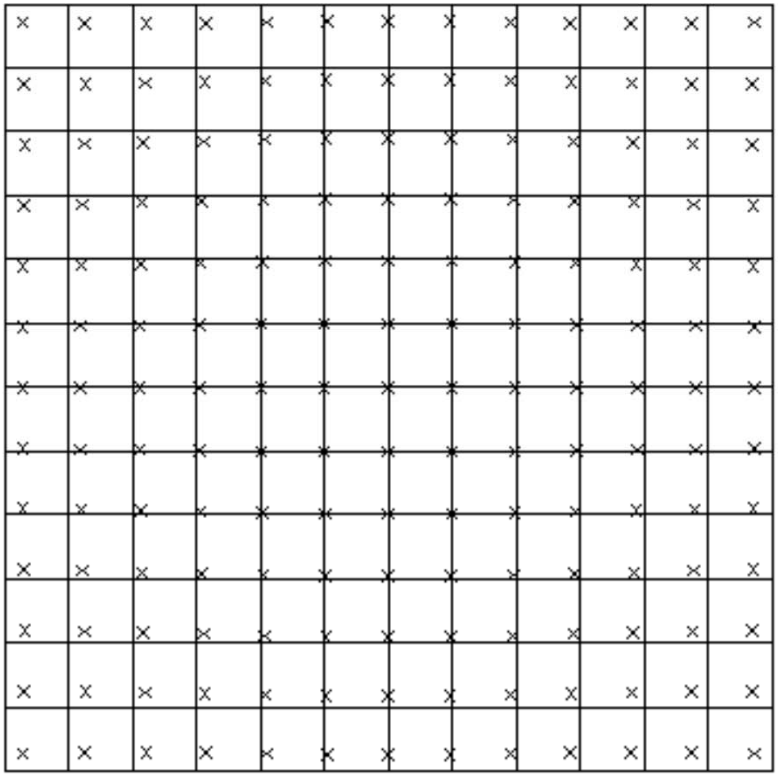
Performance of Optics
(Red Channel)





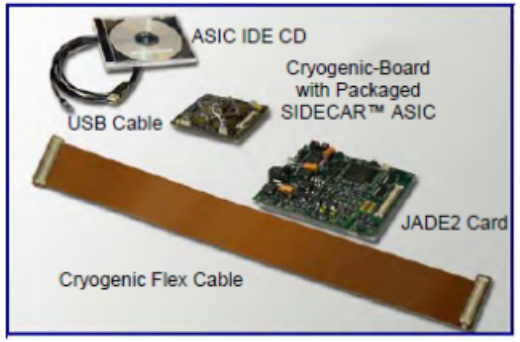
Performance of Optics
(Blue Channel)



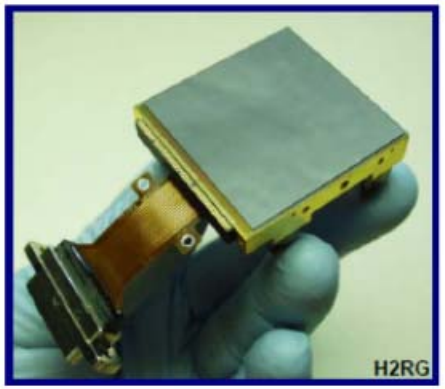


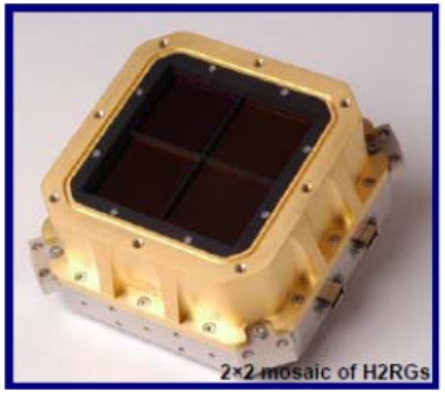
Focal Plane Arrays

* 4 HAWAII2 RGs / 2.5μm cutoff
* SIDECAR ASICs for readout
* Covers central 7'x3.5' FoV
* 0.1"/pix sampling



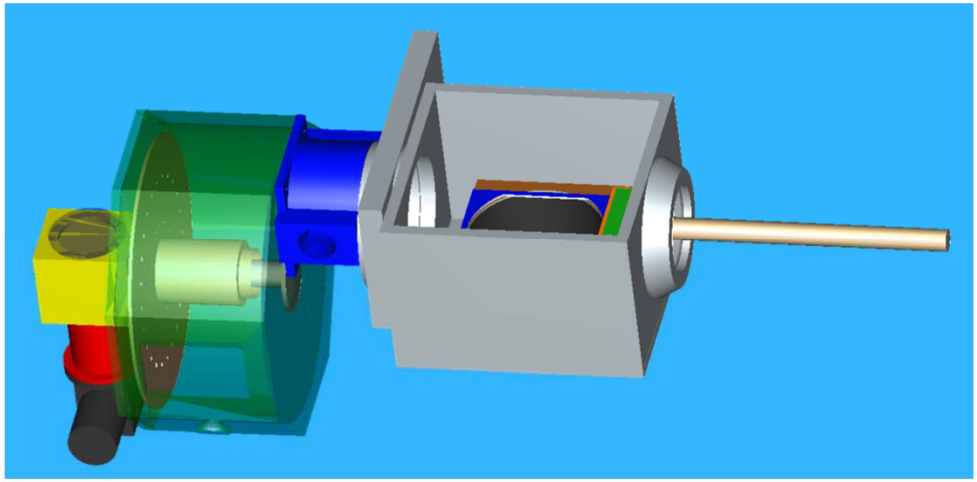
Contents of the ASIC Cryogenic FPE Kit (Temp: 32 to 300 K)





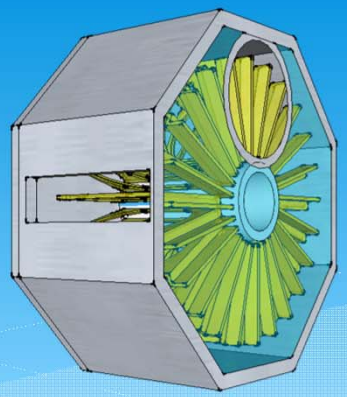
MOS Slit Plate Exchanger

* Based on the design of MOIRCS
  * Turret-type mask stocker
  * Robotic mask exchanger

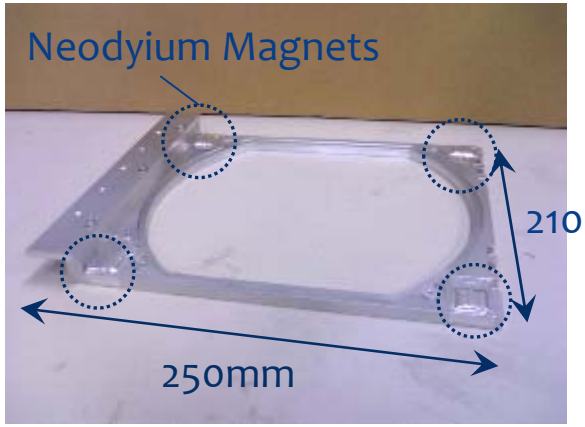


2.3m

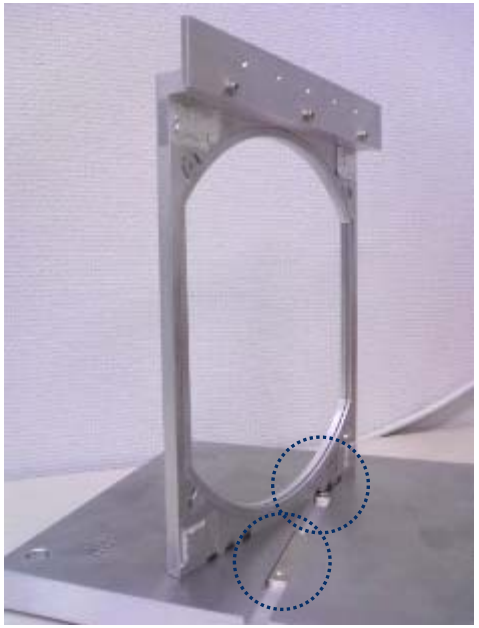
MOS Unit



- Maximum # of mask slit : 20 or more
- New design with high reliability
  - Magnet – latch (Both at the focus and the stock)
  - Operative even at the TAO Nasmyth focus
  - Curved mask possible



Prototype Mask Holder



Schedule

* 2010/Q3 : Fix the design of dewar, MOS, optics
* 2010/Q4 : Array delivery
* 2011/Q1 : Delivery of the dewar, MOS, optics componetns
* 2011/Q2-2012/Q2 : Assembly, adjustment, etc…
* 2012/Q3 or later : Transport to Subaru, setup
* 2013/Q1 : First Light at Subaru ?