

SSC Report

June 20, 21

UCSC

Jean Brodie and Chuck Steidel

SSC co-chairs

April Action Items-1

- Prepare comparison of NIRES, NIRSPEC low RES, and MOSFIRE sensitivities in at least 1 band **BY SCIENCE MEETING**
- Prepare comparison of NIRES and X-shooter sensitivity at all NIRES wavelengths **BY SCIENCE MEETING**
- TDA readiness of all instruments be summarized in a table on a TDA page
MARC KASSIS WILL COMPILE
- Present metric showing load of prioritized tasks on staff to ensuring efficiency and avoiding overload.

IN OBSERVATORY REPORT

April Action Items-2

- By May 4th each partner will provide WMKO Director with the name of its GW TDA advisory committee representative **DONE - EVAN KIRBY, XAVIER PROCHASKA, MIKE LIU, DAVE HELFAND.**
- SSC will consider suggestions for augmenting the KCRM KSOC with other experienced instrument people **DONE - IAN MCLEAN ADDED**
- SSC members to give feedback to Marc Kassis on his new model for instrument development **DONE**
- SSC/Kassis will send out White Paper announcement, interface with potential PIs, SSC co-chairs will assign reviewers in advance of June SSC meeting **DONE**

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FY 18 White Paper Report: NIRC2 (PI Mawet)

Context

- * Subaru/SCEXAO in operation, GPI coming to Gemini-North in 2019/2020
- * VLT/ERIS behind AOF will be strongest competitor in 3-5 um rang
- * Keck KPIC system now being assembled: NIR PyWFS + FIU

Phase 1 (inside NIRC2): Keith Matthews ready to go now on this

- * M-band vortex mask + Lyot stop + new (centered) mounts
- * R~100 prism (1-5 um) with possible multi-band coverage (J+H, etc.)
- * Polarimetry mode with 1-4 um Wollaston prism

Phase 2 (outside NIRC2): possible NSF ATI for Fall 2018

- * new detector electronics (for faster readout)
- * new host computer
- * “facilitization” of speckle nulling: fast readout would allow real-time focal-plane wavefront sensing ⇒ better PSF, better contrast, “cube” readout mode

FY18 White Paper Report: Liger (PI Larkin) - 1

Liger = Hybrid of elements from existing Keck/OSIRIS and planned TMT/IRIS

Plan is to keep OSIRIS modes at 20, 35, 50 mas with $R=3500$ (same H2RG) and add from IRIS some slicer optics providing 75 and 150 mas at $R=4000$ and $R=8000$ (requiring a new H4RG). For the 75mas scale, $FOV=3.4'' \times 6.6''$ and $3.4'' \times 3.3''$, respectively.

Context:

-OSIRIS: coarse scale (100 mas/pix) problems, but desired for exgal work- will be replaced by proposed slicers.

-TMT/IRIS: much design work done, could easily clone slicer spectrograph part

- * in final design phase, operates down to Ca triplet (0.84 μm)

- * slicer modes have $>15\%$ spectral bandpasses

- * can support $R=8000$ with broadband coverage

-JWST NIRSpec IFU will have low resolution ($R \sim 1000-2000$), small FOV ($3'' \times 3''$)

FY18 White Paper Report: Liger (PI Larkin) - 2

Propose to take OSIRIS (imager + lenslet spectrograph) and add a slicer spectrograph channel and H4RG

- * benefits: larger FOV, higher spectral resolution, bluer wavelengths
- * not doing the entire IRIS design for Keck: too complicated & expensive

* would also mitigate risk for TMT/IRIS: procurement of TMAs & 88-slice unit

Could have many modes, and thus need to consider carefully

* which filters and gratings will be most scientifically productive

*cost & calibration demands

Phase-A request to Keck is to move to preliminary opto-mechanical design

FY18 White Paper Report: GLAO (PIs Chun & Lu) - 1

UH88 Imaka experiments over $0.3 \times 0.4 \text{ deg}^2$ FOV show:

- 2x gain in noise-equivalent area (proportional to integration time at fixed S/N)
- increased image stability

Working on GLAO simulations using 2 different packages

- * inconsistent results, though promising leads to resolve
- * VLT on-sky results do match simulations

Working on existing Keck instrument feasibility for GLAO

- * instrument image quality? space for GLAO wavefront sensors? ADC?
- * LRIS: archival data analysis done, flexure may be an impediment
- * DEIMOS: analysis of pinhole mask shows good images (0.28" median)
[cf. 0.23" for LRIS-B, 0.32" for LRIS-R]
- * MOSFIRE: some preliminary work - most promising to benefit from

GLAO

*studies of KCWI and FOBOS planned

Wavefront sensor feasibility study - need space for 4 LGS WFS

FY18 White Paper Report: GLAO (PIs Chun & Lu) - 2

Competitive landscape:

- *VLT and LBT have GLAO operational; Subaru soon

- * VLT: ASM+4LGS, feeding MUSE & HAWK-I, ~0.3" at R- and K-bands

- * LBT: ASM+3LGS for each telescope, feeding LUCI (NIR MOS)

- * Subaru/ULTIMATE: CoDR this fall, 15'x15' FOV planned

Relative to previous generations, recently installed ASMs at ESO have better reliability and improved calibration.

For Keck, Adoptica has done a pre-feasibility study of 1.4m, 1254 actuator ASM (full design study to conceptual design underway now for TMT)

Next steps for GLAO group:

Correct/validate performance simulations, science case simulations, DEIMOS WFS feasibility study, ASM feasibility study, first ROM costing

To ensure better progress, plan to focus work in 1-2 people (students & postdocs)

FY19 White Paper Phase A proposal: HISPEC (Mawet, Caltech)

- Requesting funds to allow MRI submission in the next call (early 2019).
- Retooling/de-scoping of “MODIUS” concept from 2017 submission.
- R=100,000-200,000 near-IR single-mode fiber-fed AO echelle (0.8-2.4 microns)
- optimized for exoplanet detection and characterization
- precision radial velocities for cool stars (to ~15 cm/s) using laser comb reference
- requesting support to allow MRI submission in the next call (January 2019).

FY19 White Paper Phase A proposal: SCALES (Skemer, UCSC)

- Santa Cruz Array of Lenslets for Exoplanet Spectroscopy
- Requesting funds to allow MRI submission in the next call (early 2019), bypassing feasibility study stage.
- Baseline instrument is a low-spectral-resolution microlens-based 3-5 micron IFU for use behind facility AO system, with vortex coronagraph.
- Add-on capabilities include intermediate resolution spectroscopy, separate imager (3-5 microns, possibly into near-IR).
- Optimized for characterization of directly-imaged exoplanets

FY19 WP proposal: BIRES (Cohen, Caltech)

- 0.31-1.0 micron echellette spectrograph (blue and UV-optimized, but capturing the full optical (CCD) spectrum, $R=4000-5000$ with a 0.75" entrance slit.
- Feasibility study to evaluate space envelope and strawman optical design for placing the instrument at a Keck 1 bent Cass port
- Instrument could be mounted permanently and always be science-ready (for ToO and for scheduled science) via the K1 DM3.
- Capabilities would largely replace those of ESI, with broader wavelength coverage and higher throughput and
 - would eliminate the need to equip Keck 2 with a DM3 (since ESI is the last Cassegrain instrument on K2).
- BIRES would be compact, would have a single observing mode, and cooled with a closed-cycle system to vastly reduce WMKO staff labor in supporting ToO and/or cadence observing in the optical, and would be much less disruptive than having ToO programs reconfigure scheduled science instrument.

FY19 WP Proposal: DEIMOS (Kirby, Caltech)

- Evaluate availability/suitability of options for replacement of CCD mosaic in the DEIMOS spectrograph focal plane (currently 8 2k by 4k MIT-LL detectors, acquired twenty years ago.).
- possible to eliminate spectral gap in mosaic using 8k detectors,
- eliminate time lost (currently ~45 minutes per DEIMOS night) reading out detectors by using devices with parallel “frame store” areas (the next exposure is started as the previous one reads out).

FY19 WP Proposal: LRIS (Kassis/Rockosi, WMKO/UCSC)

- Replace the current LRIS-R detector mosaic (older LBNL, two 2kx4k with 30" gap between, poor cosmetics, ailing electronics) with 4k monolithic detector from MOSAIC3 detectors (developed for LSST, and as planned for KCRM).
- deploy new CCD readout electronics to be first in a series of replacements badly needed for several CCD systems on other instruments.
- use the existing cryostat from the first LRIS-R upgrade for the new system.

FY19 WP Proposal: AO (Ragland, WMKO)

- Proposal to set up a working group and study issues related to the performance of the Keck telescopes and AO systems for extreme AO applications.
- focus on primary mirror phasing, speckle control, including implementation of a direct-phase wavefront sensor (with a Zernicke phase mask added as part of the coronagraph upgrade to the fiber injection unit).

FY19 WP proposal: FOBOS (Bundy, UCO)

- Proposal to advance the design for a fiber-fed (@ Nasmyth focus) multiobject spectrometer envisioned to use the entire 20' diameter telescope focal plane addressed by 400-600 fiber collectors.
- Spectrographs could be copies of those being built for DESI, though custom spectrographs with mini-IFU 7-fiber collectors would provide some spatial resolution. Also possible to have multi-IFUs, higher-R mode, etc.
- Immediate work to be done is evaluating science and technical feasibility of extending wavelength coverage to 0.31 microns (DESI spectrometers reach 0.36 microns at the blue end).
- Concept is being developed in parallel with one for a similar instrument on the TMT.
- Capitalize on UCO- and TMT-funded development work over the last 1.5 years.

Executive Session

Discussion of white paper and phase A proposals

PM Phasing / AO

- Valuable project to investigate & improve PM phasing

BIRES

- Low / medium resolving power, large bandpass echellette spectrograph to replace ESI
 - Very useful for TDA
 - KI bent Cass placement allows punting on K2 DM3

DEIMOS CCD Upgrade

- Proposal to explore new detector mosaic for DEIMOS to improve efficiency and QE at wavelength edges
 - Now losing ~45 min (~\$2700) night due to efficiency
 - Estimate \$2 – 3M eventual cost

FOBOS

- Propose a concept study for a bench-mounted fiber-fed spectrograph. Will investigate:
 - UV sensitivity, spectral resolution, spatial sampling

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MARC KASSIS WILL COMPILE
- Fix projector in ISB 102 prior to future SSC meetings