

# Keck SSC Meeting – July 9, 2014

(University of California, Santa Cruz)

Judith Cohen and Crystal Martin

# Thank you Sandy !

- The SSC wishes to express our thanks to Sandy Faber for her many years of dedicated service to the Keck Observatory in many different roles, as a key advocate and one of the authors of the Blue Book, as a long time SSC member, as the PI of DEIMOS, as a member of the CARA board, and as the interim director of UCO/Lick.

# Observatory Report

- Grant Proposals

- KWCI-R:

- The Keck SSC congratulates the KWCI team for the success of their NSF/MRI proposal to build the red-side of KCWI, completing the original vision for this instrument

- NGAO:

- The Keck SSC is disappointed to learn that NGAO, in spite of great reviews, was not funded, but recognizes the mis-match between the advertised scale of the MSIP program and the reality of this new funding program (much smaller with only a total of \$26M compared to anticipated \$40M; the largest single program funded was \$9M)
    - *SSC reiterates that it is vital that the Observatory develop a viable plan forward for AO, a field in which Keck has tremendous leadership and that is important for TMT.*

- NIRSPEC:

- Awaiting news on this proposal

# Adaptive Optics

- The Keck SSC recommends that the AOAG be engaged to prepare
  - Near term proposals for next year's NSF ATI/MRI programs
  - Full prioritized list of Improvements to be made on existing AO system.
    - Issues include:
      - AO pupil misalignment
      - Low bandwidth wavelength sensor performance inadequate
      - 3.8 micron elongation
  - Evaluation of possible choices for long-term strategic direction of AO at Keck as part of strategic planning process

# Updates on Instruments in Progress

- KCWI
  - SSC is pleased to see a new project manager – many thanks to JPL for this - and good progress.
  - *SSC echoes concern that project will need to plan carefully to ensure KWCI-R doesn't impact delivery schedule for KCWI-B*
- NIRES
  - Status is good, await installation of detectors, now in-hand, to finalize delivery schedule (now expected Sep 2014)

# KCWI-b Current Status

- Project continues to make technical progress
  - Project manager identifies no major show-stoppers
  - Plan to mitigate optics bonding at 40°C & CaF2 lens coating
- Mechanical designs completed by August
- Sub-assembly testing proceeding on camera articulation unit and blue side grating /filter exchanger
- FM3/FMD successfully coated and ready for bonding
- FM1/collimator optics coating done by August
- Software server build/release on schedule
  - Ready to support sub--system testing
- Progress with electronics (understaffed)
  - Project watching closely—continues to balance cost/schedule
- Budget constraints expected to remain through delivery/commissioning
  - Uncommitted contingency appears low before the start of I&T
  - Schedule remains steady and continues to track to a June 2015 delivery to Keck

# Updates on AO Projects in Progress

- IR Tip/Tilt & Center Launch
  - Both projects are nearing completion
  - Commissioning has been hampered by bad weather.
  - *SSC recommends that adequate time be allocated to get systems to promised improved performance, and would like a report on system performance at the next meeting.*
  - *SSC recommends board approve \$32,000 to PI Chris Baranec to implement a better system for interacting with US Space Command*

# Updates on Other Projects in Progress

- K1 Deployable Tertiary
  - The Keck SSC congratulates the team on a successful interim PDR April 2014
  - Schedule: Two months slip from the start date of Oct 2013, when commissioning planned in Nov 2016
  - Budget: Within Preliminary Design
- Telescope Control System Upgrade
  - Appears to be progressing well. It will improve the absolute pointing, offsetting, and tracking.
- Keck Observatory Archive
  - All instruments except LWS in archive (LWS data has been processed but not yet ingested)
    - NIRC & ESI added since last meeting
    - Suggest more outreach to key community people re pipelines



# Segment Repair Project

- Management review passed in April 2014, final report received.
  - Key project actions in response: develop emergency repair plan, investigate crack monitoring plan, ramp up staff, accelerate testing to estimate repair life
- Recent progress: key work has been on designing + procuring the 2 grinding tools (axial & radial)
- Based on Board inquiry, assessment of timeline acceleration considered & not recommended (mainly due to +\$1M cost)
  - cons: more exchanges needed (i.e. lost observing time), more segment handling, scarcity of technicians
  - pros: mitigates risk of rapid fracture growth, completes WMKO's biggest project sooner, reduced insurance cost
- *SSC applauds continued progress on this critical infrastructure project.*

# K1DM3 Status

- Interim PDR held 7/7/14. Basic design passed with recommended changes.
- Mirror support concept changed
  - Original concept used axial support holes but this introduces a risk for crack issues.
  - Revised support concept from J. Nelson uses balanced surface mount axial and radial pads
- Test bed under development to evaluate position accuracy and repeatability
- Risks identified and mitigation plans identified: highest are bearing performance (identify funds for custom bearing) and mechanism reliability (test bed proof of concept).
- Summary:
  - 2 month slip since 10/13 due to design change and test bed development.
  - Revised Schedule: DDR 1/16; PSR 9/16; Commission 11/16
  - Project remains on-budget.
- *SSC applauds continued progress on this important project.*

# SHREK

- Key driver is earth-sized/mass planets
  - Establish occurrence, mass, density (composition) via Doppler monitoring.
  - Needs higher precision than HIRES (1.5-2 m/s).
- Modern spectrometer designs for this purpose have higher (0.3-0.5 m/s) accuracy, better stability, and higher throughput
  - Enables characterization of known (Kepler) earth-like planets down to  $V = 14$  mag.
  - Opens up characterization of TESS northern candidates — HIRES reaches only a fraction
- SHREK is a stable bench mounted spectrometer; uniform illumination; reference calibration sources; image slicing (because of  $A\Omega$ );  $R = 85,000$ ; green channel with red upgrade path;  $> 20\%$  throughput
- SHREK design should accommodate a later addition of the red channel

# SHREK

- Steps towards a conceptual design (current state of project):
  - Located in beam combining room
  - Vacuum chamber, thermally isolated (HARPS model)
  - Optical fiber from F/15 focus -> F/3.5 into fibers, including science, sky, and calibration fibers
  - Design heritage from HARPS/ESPRESSO
  - Grating is a 200 mm wide R4 Richardson mosaic (420 mm long is the max for a single replica). 14-month lead time. \$380k quote.
  - Camera design: 8° F/3
    - Four points of comparison for cost (DESI, HERMES, ESPRESSO, KCWI) \$250k-\$800k. Coatings and glass selection for SHREK is easier because of narrower wavelength range
  - Fiber slicer and scrambler needed
  - VPH grating for cross-dispersion
  - CCD detector: 4k x 4k; 15 $\mu$ m pixels (WMKO compatible readout)
  - Room-within-room for thermal isolation
  - Compact fiber injection module at F/15 focus
  - Fiber injection and performance is key. In house characterization of non-circular (rectangular/hexagonal) fibers that scramble near-field image
- Needs error budget (see report of site visit by Adkins, Cohen, Graham)
- Project schedule follows standard Keck development stages but needs schedule contingency

# Slitmask design tools (Goodrich presentation)

- Status of 3 slitmask design codes:
  - AUTOSLIT in good shape, but need instructions for installation.
  - DSIMULATOR more problematic – has bugs. Doesn't run on latest IRAF.
  - MAGMA is JAVA, platform independent. No problems
- Transfer plan:
  - Phase I transfer AUTOSLIT, fix problems, produce binaries for easier transfer
  - Phase II DSIMULATOR 1<sup>st</sup> half of 2015, fix more bugs, more work but same sort of work.
  - MAGMA is ok.
- Long term plan:
  - Replace the 3 codes with one web-accessible tool.
  - Extend MAGMA to LRIS & DEIMOS; cost and effort of this work not yet known.

SSC congratulates Keck management for great progress on this issue

# Data Reduction Pipelines (Goodrich presentation)

- MOSFIRE DRP; Still in original pipeline. Users community grown and offering contributions. Support is on a best effort basis. Latest release March of '14 with bug fixes and other features. Installation via UREKA.. More interactive than previous version, which not everyone likes.
- Proposed model is that WMKO takes this over, with encouragement to community for their contribution and with support from SA.
- Use a more formal ticket-tracking system, with new releases posted regularly, and with news and tips.
  
- Advantages: Community contributions included, along with discussions. Closer communication between observers and WMKO, better coordination with KOA.
- Costs in SA and programmer labor; \$72 FY15, \$35K in FY16.
- Timeline: Nov.'14 repository & download read, in one more month Newsgroup goes live. Jan '15 Pipeline guidelines released. FY 15/16 Bug fixes & requests for features incorporated.
- KOA can support some of this development; parts needed for archive itself.
- Need to test and integrate community contributions. Need feedback from observers/users.
- Could have a positive and rapid impact on getting data out quickly.

# NIRES

## Hardware

- Detector arrived from Canada; gift from the Dunlap Institute, Thank You!
- All parts there; must be integrated, KM ready to do that.

## Software (DRP)

- Tom Barlow (with guidance from Cohen) is working on Palomar/TSPEC data reduction pipeline which will then be used for NIRES. Going at its own rate because of Tom's partial availability and volunteer effort.
- Existing TSPEC pipeline from Cushing is not suitable for KOA use because of the highly interactive nature of that pipeline.
- Coding close to complete with pipeline that is not interactive but does have assumptions (a bright star is an A star, for example). Additional header keywords can be inserted later to solve many of these issues.
- In progress: optimizing telluric correction, monitoring S/N in real time at telescope, flux calibration. May add optimal extraction.

**Suggest visit** to Pasadena (i.e. Caltech and Palomar Obs.) by Hien Tran to see Triplespec in use etc.

# Key Issues for Strategic Retreat

- Charter: What does Keck want out of the retreat?
- Starting point: What is KECK good at, where is its impact, how has the context changed? How do we keep Keck's high impact level in the future?
- Serious discussion of where AO should be going on Keck given that NGAO not funded by MSIP.
- Four topics, ½ day each.
  
- **Suggested Themes (after intro and charter):**
  - Surveys & time domain
  - Future big telescopes and Keck synergy with them (LSST, ALMA, GAIA)
  - Complementarity and critical alignment with JWST and other NASA missions, e.g. WFIRST, EUCLID, TESS
  - The future of AO on Keck.



# KECK Strategic Retreat

- Rejection of MSIP proposal for NGAO makes this retreat yet more important.
- 22 Keck insiders, 3 from SUBARU, 2 Yale, 1 JWST, Stanford, Exo-solar planets, Planetary science; expect 43 attendees.
- Suggested topics, white papers for each; 1. First rumble from advanced LIGO. 2. Keck & Era of TMT, GMT, EELT, 3. Keck & Subaru, 4. Keck & NASA, 5. Keck & LSST, How to prepare for this? 6. Other AO directions: GLAO, Deformable Secondary + (tactical issues: 7. Modalities of observing. 8. Instrumentation. 9. Pipelines & Archive 10. Infrastructure improvements)
- Crystal Martin, Chris Baranec, Rich Dekany organizing small workshop re GLAO and adaptive secondaries (September 14 pm and all day Sep 15)
- Emphasize strategic issues and goals rather than detailed tactics.

# Town Hall@Keck Science Meeting

- Opportunity for community input into SSC & WMKO management
- Intro from SSC Co-Chairs
- Inform community of supported white papers
- Summarize discussions from strategy meeting, including discussion of AO after MSIP decision
- Implementation of Time Domain Astronomy and Deployable Tertiary
- New Technologies: MKIDS, near term AO,
- Archives and Data pipelines
- K1/K2 imbalance
- SHREK and NIRES
- ATI/MRI opportunities

# Keck Science Meeting Town Hall (Draft Agenda)

- Introduction [SSC Co-chairs]
  - Recent & forthcoming whitepaper calls and budget, response & selection from most recent call
  - Questions raised by the Strategic Planning Retreat
    - What is the direction of the WMKO AO program in light of MSIP results?
    - What are the unique and/or synergistic capabilities of **current and planned** Keck instruments?
      - Next 5 years? Next 10 years?
    - What **new** unique and/or synergistic capabilities could be developed for WMKO?
    - Keck in context of space (JWST/GAIA/WFIRST) and ground (ALMA/LSST/TMT/VLT/EELT)

# Keck Science Meeting Town Hall (Draft Agenda, cont'd)

- Implementation of plans to enable and enhance time domain astronomy.
  - Starting point: Plan outlined in the approved K1DM3 NSF proposal
  - TDA Working Group formed to suggest ways to achieve this goal in a manner that can be supported by all Keck communities and users
  - Initial step: TDA WG Questions for community

# Keck Science Meeting Town Hall (Draft Agenda, cont'd)

- WMKO Support for Data Reduction
  - Not supported in the past
  - Distinction between pipelines and tools
  - New developments
    - Support of OSIRIS pipeline
    - Potential support of MOSFIRE pipeline and of all slitmask design programs (LRIS, Deimos, MOSFIRE) by Keck Obs.
    - Funded whitepaper (Holden+) for study of LRIS pipeline
  - What does the community want? And at what opportunity cost ?

# Keck Science Meeting Town Hall (Draft Agenda, cont'd)

- Potential new capabilities
  - SHREK
  - AO (whatever we are proposing to ATI/MRI)
  - MKIDS
  - Upgraded NIRSPEC (basic and enhanced)
- Helping resolve K1/K2 imbalance, NIRES at K2, KCWI at K2, SHREK at K2

## Action Items

- Co-chairs + Hilton – draft letters to Marcy re SHREK
- Co-chairs – arrange speakers for Keck Town Hall
- Assignments to prepare white papers for strategic retreat
- AO working group near term future - next set of proposals – think about science
- Next SSC meeting – progress on center launch telescope, what improvement has been made ?
- KOA – interact more with user groups, i.e. AOWG