NOAO Users Committee 2017 Report

May 2017

This report from the Users Committee of the National Optical Astronomy Observatory (NOAO) is based upon its annual meeting at NOAO, which was held in Tucson on May 16-17, 2017. The 2016 charge for the UC requested input on the following:

1. Please comment on the overall NOAO mission. NOAO seeks to provide excellence in open access to telescopes, data, catalogs, and tools for the US community. Most helpful will be comments on NOAO's engagement with the community and the new data oriented mission.
2. Please comment on current operations and community engagement with DECam at CTIO.
3. Please comment on how NOAO can best support the community to maximize and prioritize science opportunities from DESI given the nature of the key project. Opportunities to consider include a) the imaging data sets from DECaLS, MzLS, and Bok, b) the public release of the key project spectra, Bright Galaxy Survey spectra and Milky Way Survey spectra (all initially proprietary), c) the Next DESI Survey.
4. Please comment on how NOAO can best support the community to maximize and prioritize science opportunities from the new NNEXPLORE spectrograph NEID (NNEXPLORE Exoplanet Investigations with Doppler spectroscopy) on WIYN.
5. Please comment on the on-going use of KOSMOS and COSMOS, ARCoIRIS (TripleSpec4), Goodman and SAM.
6. Please comment on current plans for the NOAO Data Lab and associated catalog-based research services, with a particular emphasis on the first suite of user tools (both basic and advanced) to released in June 2017 and priorities for deploying future tools and associated data sets.
7. Please comment on current plans for the NOAO ANTARES prototype Event Broker, with a particular emphasis on desired user capabilities (both basic and advanced) to be deployed in a full-scale version.
8. Please comment on how US observers can best exploit the Gemini telescopes. The Committee should comment on how current processes and capabilities can be improved to enhance the user experience, increase the publication rate, and/or maximize science return on investment.
9. The committee should comment on relevant merits of individual Gemini programs, fast turn-around queue, and Large-Long Programs (LLP).

10. Please comment on current NOAO plans/development for community support of LSST science and follow up observations.

The current NOAO UC includes six members, Elizabeth Buckley-Geer (Fermilab, Chair), Karen Meech (Hawaii), Casey Papovich (Texas A&M), Mark Brodwin (University of Missouri-Kansas City), John Moustakas (Siena College) and Christy Tremonti (University of Wisconsin-Madison). The committee reviewed a number of relevant documents, listed in the charge, in preparation for the meeting. Five of the members participated in the UC meeting (Brodwin, Buckley-Geer, Meech, Moustakas, Tremonti); Papovich was unable to attend. The recommendations in this report reflect the consensus of the entire UC.

We structure the remainder of the report in sections aligned with the items in the charge.

1. Overall Mission

Please comment on the overall NOAO mission. NOAO seeks to provide excellence in open access to telescopes, data, catalogs, and tools for the US community. Most helpful will be comments on NOAO's engagement with the community and the new data oriented mission.

The UC commends NOAO for its leadership and forward looking development of resources for the community in an era of big data where the LSST will be the new pillar for ground-based astronomy in the coming decade. The UC also commends NOAO for a marked improvement in addressing issues related to planetary and time-domain science. NOAO's mission is "to provide access to forefront astronomy research capabilities without regard to institutional or collaborative affiliation" *or scientific expertise*.

Recommendation 1: NOAO has made impressive progress on the development of the Data Lab and the Science Data Archive over the past year. In order to keep the momentum going, there needs to be a long-term plan to maintain these projects.

Recommendation 2: The UC noted that the web pages have improved significantly, but the UC recommends that NOAO implement a way to report broken links.

Recommendation 3: Many NOAO efforts are working somewhat independently (e.g., Data Lab, the Science Data Archive, ANTARES), and we encourage close coordination to ensure that there is no duplication of effort.

Recommendation 4: We recommend that NOAO continue to explore new avenues for effectively communicating with the full US astronomical community on the new NOAO, the Data Lab, ANTARES and other new initiatives. Some suggestions include: increased social network presence, continuation of focussed workshops and training sessions demonstrating the Data Lab.

2. DECam

Please comment on current operations and community engagement with DECam at CTIO.

We commend NOAO for implementing remote observing. We strongly encourage them to continue to support graduate student travel to learn to use DECam at Cerro Tololo, and for subsequent travel to Tucson for remote observing.

We commend the effort to poll the community via *NOAO Currents* and email to assess the types of scheduling modes that will be needed for DECam to support time domain surveys (and planetary science). It is likely that queue scheduling will need to be implemented.

Recommendation 1: We encourage NOAO to start the process of knowledge transfer for DECam operations in the post-DES era.

Recommendation 2: In the light of the likely extension of DES to an extra ½ year we encourage NOAO to make sure that the community gets access to DECam for a full 5 years after the actual end of the DES survey.

3. DESI

Please comment on how NOAO can best support the community to maximize and prioritize science opportunities from DESI given the nature of the key project. Opportunities to consider include a) the imaging data sets from DECaLS, MzLS, and BASS, b) the public release of the key project spectra, Bright Galaxy Survey spectra and Milky Way Survey spectra (all initially proprietary), c) the Next DESI Survey.

The panel recognizes and commends NOAO for joining the DESI project and for playing a leading role in the precursor public imaging surveys (DECaLS, MzLS, and BASS). In particular, NOAO's involvement in executing, reducing, and delivering the imaging survey data has created many exciting opportunities for the community to do cutting-edge science, and have also spurred much additional activity within NOAO (e.g., the Data Lab). On the other hand, the

extent to which the community will be able to access the DESI data and, in the next decade, become involved in the Next DESI Survey or DESI-2, is currently less well-defined.

Recommendation 1: We recommend that NOAO continue to advertise to the community the Legacy Survey Data Releases through the AAS, the Data Lab, *NOAO Currents*, and other channels, and, in particular, to highlight the specific enhancements to the catalogs with each new release (e.g., improved star-galaxy separation, WISE light curves, single-epoch forced photometry).

Recommendation 2: Although the DESI Collaboration has not yet formalized the structure and timing of its public data releases, we encourage NOAO to advocate for as liberal (i.e., both rapid and thorough) a data release policy as possible. In addition, we encourage NOAO to continue planning (e.g., using the SDSS data releases) how to best serve these data—including the raw and pipeline-processed 1D and 2D spectra and value-added catalogs—to the community immediately upon their release.

Recommendation 3: Although the UC acknowledges that NOAO has not had the staffing or funding to pursue making the ~400 hours of the brightest time during DESI available to the community, we nevertheless encourage NOAO to continue to seek out opportunities for the community to access the instrument during this time to the greatest extent possible.

Recommendation 4: We recommend that NOAO continue to advocate through the Decadal Survey process and other future meetings and workshops for the community to gain partial or full access to the DESI instrument once the DESI survey has been completed in 2023.

4. NN-EXPLORE

Please comment on how NOAO can best support the community to maximize and prioritize science opportunities from the new NN-EXPLORE spectrograph NEID (NN-EXPLORE Exoplanet Investigations with Doppler spectroscopy) on WIYN.

We commend NOAO for substantially improving the pointing, guiding, and baffling at WIYN. We are pleased to see that the community time has resulted in publications.

Recommendation 1: We encourage NOAO to continue advertising the development milestones, capabilities, and timetable for NN-EXPLORE. Future capabilities should be listed in the call for proposals to help make the community aware of this opportunity.

5. KOSMOS, COSMOS, TripleSpec, Goodman and SAM

Please comment on the on-going use of KOSMOS and COSMOS, ARCoIRIS (TripleSpec4), Goodman and SAM.

We commend NOAO for brokering the move of ARCoIRIS over to SOAR and working with Katelyn Allers to develop an IDL-based data reduction pipeline and associated tutorials. We were also pleased to see the red CCD upgrade of the Goodman spectrograph and work beginning on pipeline development.

As we move into the era of LSST follow-up, we consider it important for NOAO to support their spectrographs at the same level as they support their imagers, in particular by providing open source data reduction pipelines that could be used for both quick-look and final reductions. While we recognize that NOAO is time- and resource-limited, we believe that this task is well aligned with their strategic goal of supporting LSST. In addition, an open source effort could leverage substantial community input.

We believe that LSST follow-up will engage a new generation of users with NOAO facilities. It will be important to have exposure time calculators in place so they can easily determine the feasibility of follow-up observations. This may be especially critical in the case of ToOs where a decision to trigger follow-up spectroscopy must be made quickly.

Another capability that will become increasingly important is the ability to determine if a given object had a spectrum taken of it. Ideally, the Data Lab should be able to query both large surveys (SDSS, DESI) and spectra obtained by individual PIs on NOAO telescopes. As a first stage of implementation, we suggest that NOAO review the metadata associated with spectroscopic observations, to insure that such queries will be straightforward to implement.

On a minor note, we encourage NOAO to tailor the UC charge and presentations to obtain the most useful feedback from us. For example, there is not much reason for us to comment on KOSMOS as it has been recently de-commissioned. In addition, the presentation did not cover SAM.

Recommendation 1: We encourage NOAO to keep the web pages of their spectrographs up to date. Specifically, it would be helpful to those planning future observations if the current status of KOSMOS and ARCoIRIS was indicated on the web.

Recommendation 2: We encourage NOAO to begin working on an open source, python-based general purpose spectroscopic data reduction package that could be adapted to all of their spectrographs over time.

Recommendation 3: We encourage NOAO to develop exposure time calculators for their spectrographs, or, at minimum, to scope the effort needed for this task. In particular, we suggest that they investigate a community-developed universal spectroscopic exposure time calculator that is currently being used for eBOSS and DESI: http://specsim.readthedocs.io

Recommendation 4: We suggest that NOAO review the current spectrograph metadata to ensure that spectroscopic products can be easily ingested into the Data Lab at a later date. In the archive, it is important that science data and relevant calibration data be linked.

6. Data Lab.

Please comment on current plans for the NOAO Data Lab and associated catalog-based research services, with a particular emphasis on the first suite of user tools (both basic and advanced) to released in June 2017 and priorities for deploying future tools and associated data sets.

The UC is extremely impressed with the vision, plans and tremendous progress in developing the Data Lab which is creating tools for science exploration. The UC believes this resource will be highly valuable for the community to visualize and access existing complex datasets and strategically plan for the era of LSST. The UC applauds the ingestion of the SDSS data into the Data Lab.

The UC is very pleased to see that the Data Lab is now developing tools for identification of moving objects in the data.

Recommendation 1: The UC commends NOAO's efforts to advertise the Data Lab through workshops, hacking sessions and student training through Big Data Science Cafe presentations. NOAO should also explore the possibility of training sessions at selected astronomical centers outside of the traditional AAS meeting venues.

Recommendation 2: After the first public release in June 2017, NOAO should prioritize the release of moving object searches in the Data Lab. NOAO's mission to provide access to research opportunities needs to include all areas of specialization.

Recommendation 3: The Data Lab should next investigate connecting to MAST and IRSA.

Recommendation 4: The UC continues to encourage the Data Lab to consider a way to store user queries linked to published papers. This would provide users with useful examples and ensure the repeatability of the analysis.

Recommendation 5: As a long-lead item, the UC encourages NOAO to investigate ways to incorporate basic searches on spectroscopic data. Users should be able to determine if spectra were taken of an object and what the wavelength range, resolution and exposure time were.

7. ANTARES

Please comment on current plans for the NOAO ANTARES prototype Event Broker, with a particular emphasis on desired user capabilities (both basic and advanced) to be deployed in a full-scale version.

The UC recognizes that the NOAO ANTARES project has captured a leadership position in the quest to establish an event broker facility that will enable LSST follow-up science. We commend NOAO's cross-disciplinary collaboration with the University of Arizona computer science and math departments.

The UC is not well poised to address the question of desired user capabilities given that our committee does not include experts in time domain science. In addition, it was a little unclear how the user interacts with the system.

Recommendation 1: NOAO should develop a forum for user community input into the development of ANTARES. It is important to involve the community early, and we encourage NOAO to make the code open access as soon as possible.

Recommendation 2: The UC recommends continuing to interface ANTARES with existing public data streams and ramping up efforts to train people to use the system.

8. US observer exploitation of Gemini

Please comment on how US observers can best exploit the Gemini telescopes. The Committee should comment on how current processes and capabilities can be improved to enhance the user experience, increase the publication rate, and/or maximize science return on investment.

We are pleased to see that the effort in putting together the GMOS data reduction cookbook has been appreciated by the community. NOAO should continue to interact with the community in this way. The oversubscription pressure should guide which instrument manual should be developed next.

Recommendation 1: The UC requests that NOAO advocate for the US community that better data reduction tools are developed and that Gemini ensures that high quality science calibration

is obtained. Additionally or alternatively, Gemini could implement a level 1 pipeline processing for imaging and simple long-slit 2D spectral data (bias subtraction, flat-fielding, gain correction, combine chips into a single image, WCS for imaging and wavelength solution for spectra). These efforts will lead to an increase in publication rate.

9. Exploiting Gemini

The committee should comment on relevant merits of individual Gemini programs, fast turn-around queue, and Large-Long Programs (LLP).

There was confusing information presented about the oversubscription rates of the fast-turnaround program, the regular queue, and LLPs.

Recommendation 1: The UC would like to get information about oversubscription rates. Additionally, the UC would like to see oversubscription statistics by subject panels, by instrument, and by instrument mode (i.e. long slit vs. MOS vs. imaging for GMOS).

10. LSST Community support and Follow up

Please comment on current NOAO plans/development for community support of LSST science and follow up observations.

The UC commends NOAO for beginning to develop an end-to-end system to allocate resources for LSST follow-up. In order for the Community Science and Data Center (CSDC) to adequately fulfill its mission, it needs to involve the breadth of the science community. The CSDC is to be commended for setting up a diverse working group to develop the initial strategy document for community support.

Recommendation 1: The UC should ensure that the community is made more aware of this activity so that they can be fully engaged.

11. Other

The UC is pleased to see continuing efforts to tackle implicit bias in the NOAO TAC.

Recommendation 1: As we shift to a data-driven model, there are fewer opportunities for student training at the telescope. We encourage NOAO to continue to support the travel and on-site expenses of PhD students, and other students where funds allow. To highlight this opportunity, we suggest adding a bold-faced “Travel Support” section to the Call for Proposals.

Recommendation 2: In order to get more relevant feedback for ANTARES, it is important to add members to the UC who have expertise time domain astronomy. Additionally, for feedback on other forefront issues, we recommend adding members with expertise in exoplanets, LSST, and DESI. Increasing the UC to 8 members would more broadly sample the user community and offer some redundancy for in-person attendance.

Recommendation 3: We encourage NOAO to send out the Call for Proposals a month before the deadline by email, in addition to the current reminder two weeks before. For the last several semesters the call has included a 3-paragraph section on survey programs even though no new survey time was offered. We suggest that this be removed until a decision is reached about the future of survey programs. At the end of the Call for Proposals, we suggest adding a section summarizing upcoming opportunities.

Recommendation 4: NOAO should review the overall effectiveness of its survey program and poll the community about the appropriate balance of survey and PI programs in future semesters.