NOAO has been a leader in providing the community with wide-field instruments on its telescopes for the past two decades. The Dark Energy Camera (DECam) and Dark Energy Survey (DES) currently provide the community with a cutting-edge wide-field camera, imaging data processing system, and data products. These are expected to be joined by the massively multiplexed Dark Energy Spectroscopic Instrument (DESI) in the next few years. With such capabilities it is easy to predict that NOAO-based surveys will continue to grow in size and complexity and that more of the community will want to exploit them in their research.

continued
An Introduction to the NOAO Data Lab continued

To illustrate this trend, the image on page 9 shows a map of the DECam science observations currently stored in the NOAO Science Archive (NSA), along with the predicted coverage of the completed DES and three of the DESI imaging targeting surveys (DECaLS, DECaLS+, and the proposed MzLS). The map shows that after just two years of operation, DECam has already touched most of the southern sky through a combination of DES and community-led observations. The resulting image set totals 270TB of 32-bit floating-point data. With continued DECam observations and the completion of the DESI targeting surveys in the near future, the NSA will contain a nearly all-sky imaging survey and approach 1PB of science imaging data. These massive surveys are also producing very large catalogs, which are crucial to making scientific use of the data. The DES catalog database is expected to total 45TB, with up to tens of TB more for the catalogs from community-led programs.

We are developing the NOAO Data Lab to help the community take advantage of these and future large surveys and to prepare them for the era of LSST. The Data Lab will allow users to

1. access, search, and filter databases containing large catalogs;
2. create custom databases and analyses from large catalogs using familiar tools;
3. combine catalog databases with data from NOAO telescopes, analysis results, and data from external archives in one place;
4. share custom results easily with collaborators and create and publish catalogs derived from large data sets through a central workspace;
5. experiment with tools being developed for LSST using existing large data sets.

The goal of the Data Lab is to provide a common framework and workspace for science collaborations and individuals to use and disseminate data from large surveys, using the best available tools. It is intended to grow into a clearinghouse for knowledge on best practices for handling specific large data sets and for sharing software developed in the community to work on these data sets in an Open Source manner.

The Data Lab successfully completed a Conceptual Design Review (CoDR) in March 2015 and is now in development, with the goal of having a first public demonstration in 2016 and a first public release in 2017. Tools and services will be released to interested test users throughout the development cycle as they are finished. In particular, data services for several NOAO Survey Programs will become available in the coming months, as will a core set of tools to access and operate on these data.

For additional information and updates, see the project website at http://datalab.noao.edu/.

The Future and Science of Gemini Observatory 2015 (FSG15)
Ken Hinkle & Letizia Stanghellini

Every three years the Gemini Observatory sponsors a gathering of Gemini users and stakeholders in one of the partner countries. The 2015 meeting was held June 15–18 in Toronto. The US National Gemini Office (NGO) is based at NOAO. Letizia Stanghellini, the head of the US NGO, was on the Scientific Organizing Committee for the FSG15 meeting, and both Letizia and Ken Hinkle attended to represent the US. The program was approximately 75% science highlights, including some invited talks, with the rest of the meeting organized around perspectives and discussions on the future of the observatory.

Gemini Director Markus Kissler-Patig gave two presentations discussing the hurdles faced by Gemini over the next 5 to 10 years. Markus noted the multinational, multipartner nature of Gemini, the complex governance of the observatory, and the divergent goals of the partners. In particular, he noted that the current 65% US share of Gemini is far different from Gemini being a US telescope. His focus was largely on the 2018 assessment point leading to the renewal of the partnership in 2021. The program also included presentations by the directors of Subaru, Keck, and LSST. They focused on plans for the next decade. These observatories have much-narrower missions than Gemini, and they provided sharp contrast.

A theme of the meeting was making Gemini competitive in the era of JWST and LSST. Of particular interest to the US community were presentations by the four teams developing concepts for Gemini
**The Future of Science of Gemini Observatory 2015 continued**

Instrument Feasibility Studies (GIFS). While differing in design, all four instruments are driven by the need to investigate transient objects that will be discovered by JWST, LSST, and LIGO. All four teams pointed out that Gemini’s locations in Chile and Hawaii combined with Target of Opportunity (ToO) scheduling and a flexible instrument complement are great advantages for carrying out this work.

Possible instrument suites constrained by the Gemini four instrument plus adaptive optics (AO) model were topics of discussion. Many of the presentations can be found in pdf format on the website http://www.gemini.edu/fsg15/program.

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**The 2015 TMT Science Forum**

Mark Dickinson

The theme of the third annual Thirty Meter Telescope (TMT) Science Forum, held on 23–25 June 2015 in Washington, DC, was “Maximizing Transformative Science with TMT.” That admittedly ungainly and buzzwordy title captures two important foci of the meeting. First, there is the “transformative science” that will be enabled by a telescope whose collecting area will be an order of magnitude larger than that of today’s largest optical/infrared telescopes and whose diffraction-limited angular resolution will be nearly five times sharper than that of the James Webb Space Telescope at similar wavelengths. Second, this year’s Forum considered how to “maximize” the scientific return from TMT through innovative international collaborations, observatory operations, data management, and instrumentation.

One hundred thirty-nine participants gathered at the headquarters of the American Association for the Advancement of Science (AAAS), and at the Mayflower Renaissance Hotel, to review the status of the project, to discuss TMT science, to plan future TMT observing programs, and to consider ways to run the observatory that will yield the best and most science.

Two days of plenary sessions alternated between invited science talks and discussion sessions. The science talks used current forefront research as a springboard to the future potential of TMT for achieving new breakthroughs. Topics spanned a huge range, including small body solar system science (Karen Meech, IfA), exoplanet atmospheres (Jayne Birkby, CfA), star and planet formation (Gregory Herczeg, KIAA-PKU), stellar chemical abundances (Wako Aoki, NAOJ), nearby galaxies and near-field cosmology (Alan McConnachie, NRC-HIA), supermassive black hole demographics (Jenny Greene, Princeton), early galaxy evolution (Shelley Wright, UCSD), and the intergalactic medium (R. Srianand, IUCAA).

The discussion sessions were among the liveliest parts of the meeting. Most addressed topics related to observatory operations. Each featured two short presentations by experts from operating observatories, who highlighted past experiences and potential lessons for TMT, followed by audience discussion. Topics included time allocation and the balance of small and large science programs, observatory operations and scheduling modes, and data management and archives. Another session focused on education, public outreach, and workforce development. There were also presentations on the status of the TMT project and on planning for the next generation of TMT instrumentation. Doug Simons (CFHT) gave an inspiring presentation about astronomy, Mauna Kea, and Hawaii, which was timely and relevant given the complex challenges faced by TMT as it starts construction, including protests by some members of the Hawaiian community.

The middle day of the meeting featured parallel sessions organized by the TMT International Science Development Teams (ISDTs) on topics ranging from the solar system to cosmology. In addition to invited and contributed talks, the participants held extensive discussions about possible “key project” science programs for TMT. One lesson from past experience is that a balance of smaller and larger science programs can be important for the scientific health and productivity of an observatory. The TMT partnership has been discussing ways to enable and encourage large science projects that might span its international community, and the ISDTs have been asked to develop ideas for such projects in order to explore their scientific potential and to consider their implications for TMT operations, data management, and future instrumentation. Participants in the parallel sessions brainstormed on key project concepts, and the ISDT organizers summarized these discussions to the full conference audience on the last day of the meeting.

A few messages can be drawn from the plenary discussion sessions and the ISDT working sessions. Unsurprisingly, there were abundant ideas for large science projects with TMT, and it will be important to implement a cross-partnership time allocation mechanism for large and long-term projects. Such projects can achieve transformative science and can also generate valuable, coherent data sets that could be mined by a wider research community if they are properly reduced, archived, and distributed. Well-run data management, including data reduction software or pipelines and a suitable archive, can significantly amplify the scientific output of an observatory and would help more astronomers squeeze the most science out of precious and unique TMT data. Several of the “key projects” discussed at the Forum (and no doubt many smaller programs as well) would benefit from modes of flexible or queue scheduling, implemented for at least part of TMT’s observing time. This is particularly continued
Phoenix Moves to Gemini South

Ken Hinkle, Dick Joyce & Verne V. Smith

On the morning of June 8, Caty Pilachowski (Indiana University) took the last observation using the Phoenix near-IR spectrograph combined with the Kitt Peak Mayall 4-m telescope. This observation marks the end of Phoenix use at Kitt Peak. Phoenix was the last f/16 instrument on the Mayall, so this was also likely the last use of the f/16 secondary. The decommissioning of Phoenix at the 4-m is part of the planned move to lower-cost operations as the Mayall transitions toward DESI.

Phoenix, however, remains a popular instrument with long-slit, high-resolution capabilities over the entire 1–5 micron region that are not otherwise available. The need for a high-resolution near-IR spectrograph is particularly acute in the Southern Hemisphere since the ESO/VLT equivalent instrument CRIRES is out of commission for a few years as part of an upgrade. To fill this lack of capability in the south, NOAO and Gemini have agreed to offer Phoenix as a visitor instrument at the Gemini South telescope. Phoenix was last offered at Gemini South as a queue instrument in 2010B. Potential users should note that as a visitor instrument, observations will be blocked into a single run each semester.

Currently, Phoenix is in the Tucson lab being refitted to the Gemini instrument interface. When Phoenix was shipped to Kitt Peak in 2011, there was no plan to return it to Gemini. We believed that the Gemini interface would never again be used. Some months ago we started searching for the parts needed to prepare the instrument to go back to Gemini. Fortunately, the interface was found outside the Gemini South dome. The budget for moving Phoenix to Gemini does not include funding for upgrades, and the move will not go forward if there are major problems. However, so far all is going well, and we anticipate shipping Phoenix to Gemini South in the last quarter of 2015. The tentative plan is to schedule a block of Phoenix time in the second half (May–July) of the 2016A semester.