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Currents

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***NOAO Data Lab Demo at June AAS Meeting**:* Have you been wondering if there's a better way to interact with large datasets? NOAO is developing the NOAO Data Lab to enable exploration and analysis of survey datasets generated by its wide-field telescopes. Drop by the NOAO booth at the June AAS meeting to see a demonstration of Data Lab capabilities and provide feedback to the development team. Read more…

***Maximizing Science in the Era of LSST**:* What supporting OIR capabilities will be needed to maximize the science enabled by the Large Synoptic Survey Telescope (LSST)? An ongoing study led by NOAO and LSST aims to identify, quantify, and prioritize these. Over the past few months, 6 community-based study groups have developed detailed science cases and quantitative resource requirements, which they have prioritized across all study groups. The study report will be published later this summer. Read more…

***GMOS Data Reduction Cookbook Now Available**:* Are you interested in reducing your Gemini GMOS data but don't know how to get started? The US National Gemini Office has developed a data reduction cookbook for the twin GMOS spectrographs, which are the most heavily used instruments on the Gemini telescopes. Data reduction tutorials include start-to-finish scripts (for both the IRAF and PyRAF environments) and detailed instructions for reducing data from actual observing programs. Read more…

***LSSTC Data Science Fellowship Program**:* Graduate students, are you eager to learn about data science and techniques for dealing with big data? Consider applying for the LSSTC Data Science Fellowship Program, a supplement to graduate education in astronomy that is designed to teach essential skills for the LSST era. The application deadline is **10 June 2016**.

***NOAO in the News**:*

Young Mammoth Cluster of Galaxies Sighted in the Early Universe: Astronomers using data from KPNO and Keck Observatory have uncovered evidence for a vast collection of young galaxies 12 billion light years away, one of the most massive structures known at that distance.

New Light on the Big Bang: Spectra from the KPNO Mayall led to the discovery of a small blue galaxy with a near-pristine chemical composition, close to that of the early universe.

A Giant Planet Discovered Around a Very Young Star: A young giant planet, still embedded in its natal disk of gas and dust, has been detected by the

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wobble it induces in the star it orbits. Spectra from the KPNO 2.1m and Mayall telescopes were used in the discovery.

Puffy Planet Discovered by KELT-S Transit Survey: A robotic survey designed to detect planets orbiting bright stars, reports its first discovery: a highly inflated giant planet. NOAO astronomer David James is a founding member of the survey.

Read more…

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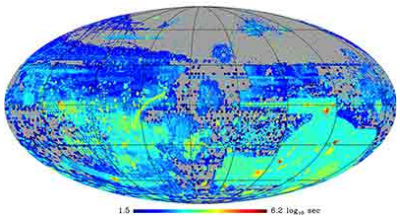
NOAO Data Lab Demo at the June AAS Meeting

As part of its growing data mission, NOAO is developing the NOAO Data Lab to allow for efficient exploration and analysis of the large pixel and catalog datasets being generated by its wide-field telescopes. These data currently include the DECam Legacy Survey (DECaLS), the Survey of the Magellanic Stellar History (SMASH), and the publicly available data from the Dark Energy Survey (DES), with the total volume growing at a rapid rate.

NOAO will be hosting a demo of Data Lab capabilities at its booth at the San Diego AAS meeting. The demo will focus on the science case of the discovery of faint Milky Way dwarf companions, while including forays into the time domain and other science. The demo will show how prototype Data Lab infrastructure allows users to

- Discover the data best suited for specific analyses
- Interact with a subset of the data to develop intuition and
- Automate scripted analyses to operate on large datasets.

The public release of the Data Lab is planned for mid-2017. Drop by the NOAO booth at the AAS meeting to see the demo, and give feedback to our development team!



Caption: Exposure map of all Mosaic and DECam science images in the NOAO archive, illustrating the developing crowd-sourced survey of the sky.

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Maximizing Science in the Era of LSST: A Community-based Study of Needed US OIR Capabilities

An ongoing study aims to quantify and prioritize the supporting OIR capabilities that are needed to maximize science in the era of the Large Synoptic Survey Telescope (LSST), i.e., the 2020 decade. While many discoveries will be made using LSST data alone, others will require supporting OIR capabilities, i.e., resources such as observing time on telescopes, instrumentation, software, computing and data management resources, access to archival data, etc. The study, led by NOAO and LSST, is funded by the Kavli Foundation and endorsed by NSF/AST.

Study Structure and Goals. To build on the report commissioned by NSF and the National Academy of Sciences (*Optimizing the U.S. Ground-Based Optical and Infrared Astronomy System in the Era of LSST*, the "Elmegreen report"), the study works out representative science programs in detail to illustrate how science goals

are linked to needed capabilities, which are quantified and prioritized. The study also highlights ways in which existing and planned resources can be positioned to accomplish the science goals, and it identifies high priority future investments for OIR infrastructure.

Study Topics and Groups. Broad community input for the study was solicited in January 2016 through an online survey, with over 100 responses received. The input was used in assembling study groups with the following participants and topics:

- **Characterizing Primitive Small Bodies of the Solar System:** David Trilling (study lead), Lori Feaga, Henry Hsieh, Vishnu Reddy, Christina Thomas
- **Stellar Rotation and Magnetic Activity in the Field and Open Clusters:** Suzanne Hawley (study lead), Ruth Angus, Derek Buzasi, James Davenport, Mark Giampapa, Vinay Kashyap, Soren Meibom
- **Mapping Galaxies to Dark Matter Halos:** Josh Simon and Douglas Finkbeiner (study leads), Eric Bell, Alex Drlica-Wagner, Puragra Guhathakurta, Kathryn Johnston, Ting Li, Bryan Miller, Connie Rockosi, Eric Tollerud, Branimir Sesar
- **Explosive Transients:** Ryan Foley (study lead), Wen-fai Fong, Jennifer Hoffman, Tom Matheson, David Sand
- **Co-evolution of Baryons, Black Holes and Cosmic Structure:** Greg Rudnick (study lead), Mark Dickinson, Dawn Erb, John O'Meara, Brant Robertson, Jon Trump, Ben Weiner
- **Cosmology:** Jeff Newman (study lead), Adam Bolton, Will Dawson, Mark Dickinson, Eric Gawiser, Elise Jennings, Eric Linder, Rachel Mandelbaum, Phil Marshall, Chad Schafer, Sam Schmidt, Anja von der Linden, Ben Weiner

In addition to the six science-based study groups, an additional group was convened to address common infrastructure issues:

- **Time Domain Follow-up and Evolution of Observing Paradigms:** Rachel Street (study lead), Steve Ridgway, David Ciardi, Adam Bolton, Chad Schafer, Jay Elias, Tom Matheson, Erik Tollerud

Current Status and Milestones. Over the past 3 months, the science-based study groups have developed detailed science cases and resource requirements. Their arguments were refined at a workshop held near Tucson in early May 2016, and the needed capabilities quantified and prioritized across all study groups. The study report, currently in development, will be published later this summer. The report will be informational to federal and private funding sources as well as public and private observatories to (i) guide funding priorities and (ii) facilitate cross-facility and cross-science field collaborations.

Questions and Comments: Please contact Joan Najita (najita@noao.edu) or Beth Willman (bwillman@lsst.org) with questions about this study. Further details about this study are available at the study website.

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The GMOS Data Reduction Cookbook

Dick Shaw and Dara Norman

The twin GMOS spectrographs have been the most heavily used instruments on the Gemini telescopes since their installation in the early 2000s. They are popular in part because of the variety of available observing configurations: imaging, and low- and intermediate- resolution long-slit spectroscopy, MOS spectroscopy, and IFU spectroscopy. However, the flexibility means that data reduction can be a complex

task for even straightforward observing programs.

To streamline the reduction process, we have developed the *GMOS Data Reduction Cookbook*. A web-based document, the *Cookbook* provides a high-level overview of the workflow and a comprehensive overview of the prerequisite set of tools and reference material. It also steps through a set of detailed examples in which real data are reduced. Individual chapters of the *Cookbook* provide

- A brief overview of the GMOS instrument.
- A guide to getting started, with instructions on installing the processing software and retrieving data.
- Detailed tutorials on processing images as well as long-slit, MOS, and IFU spectra.
- Extensive supplementary material that describes supporting tasks and includes calibration reference files and references to external calibration data.
- Links to other on-line sources of information, including other GMOS data reduction presentations, software tools, and relevant literature references.
- A glossary of technical terms used in describing GMOS reductions.

The data reduction tutorials include start-to-finish scripts (for both the IRAF and PyRAF environments) and detailed instructions for reducing data from actual observing programs. These scripts can easily be generalized to other GMOS datasets.

To view the *Cookbook*, direct your browser to the website of the US National Gemini Office and follow the link to GMOS data reductions, or go directly to: http://ast.noao.edu/sites/default/files/GMOS_Cookbook/

Your comments and corrections are welcome. Please write to the Gemini Helpdesk at: http://www.gemini.edu/sciops/helpdesk/

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NOAO in the News:


Protocluster

Newly discovered protocluster of galaxies located in the Bootes field of the NOAO Deep Wide-field Survey.

Young Mammoth Cluster of Galaxies Sighted in the Early Universe

Astronomers have uncovered evidence for a vast collection of young galaxies 12 billion light years away. The newly discovered "proto-cluster" of galaxies, observed when the universe was only 1.7 billion years old (12% of its present age), is one of the most massive structures known at that distance. The discovery was made using telescopes at KPNO and Keck Observatory. NOAO Astronomer Arjun Dey is the lead author of the study. Read more in NOAO Press Release 16-01.

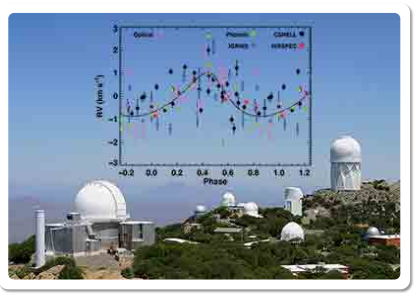
Small blue galaxy could shed new light on Big Bang

Located 30 million light-years away, the dwarf galaxy AGC198691 contains the lowest level of heavy elements ever observed in a galaxy. The low abundance indicates a near-pristine chemical composition, very close to that of the early universe, that has been little "polluted" by earlier generations of stars. Spectra obtained with the KPNO 4-m Mayall telescope led to the discovery. Read more in the Indiana University Press Release.

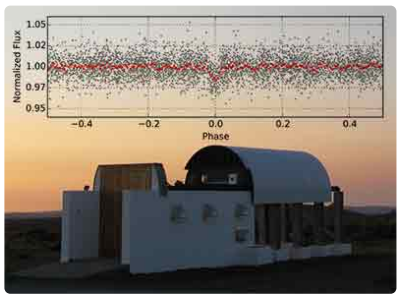
Giant Planet Discovered Around a Very Young Star:

In a rare find, astronomers have detected a young giant planet still embedded in its

natal disk of gas and dust. The planet was detected by the wobble it induces in the star that it orbits. The discovery may lend new insights into how planets form. Spectra from the KPNO 2.1m and Mayall telescopes were used in the discovery. Read more in the Rice University press release.



Puffy Giant Planet



The KELT-S Telescope with discovery light curve overlay.

Discovered by KELT-S Transit Survey

Transiting planets orbiting bright stars provide a golden opportunity to learn about the nature of exoplanets, their composition and origin. KELT-S, a robotic survey of the southern sky that is designed to detect transiting planets orbiting bright stars, reports its first discovery: a highly inflated giant planet. The planet, KELT-10b, is an attractive target for future studies aimed at characterizing planetary atmospheres. NOAO astronomer David James is a founding member of the survey. Read more…

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Contact Us

Your input is welcome on any of these issues. Please send your thoughts to: currents@noao.edu.

Currents is a sparkplug for communication between NOAO and our community. It provides updates—and solicits community input—on NOAO observing opportunities and NOAO programs and policies on a more rapid timescale than is possible with the *NOAO Newsletter*.

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