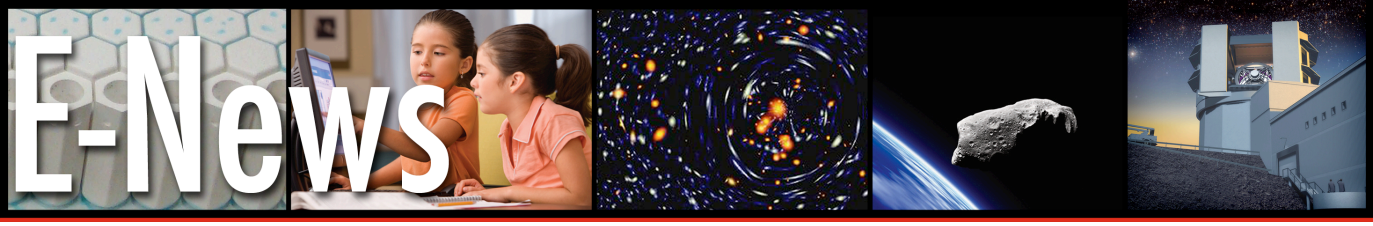
Large Synoptic Survey Telescope



LSST E- News **June 2008 Issue 2**

EDITOR'S NOTES

Suzanne Jacoby, Manager for EPO

With this second issue of the LSST E-News, we continue to inform interested colleagues and project members of recent activities as well as raise public awareness of LSST. You can read about LSST in the May issue of *Discover Magazine* ("Movie Camera to the Stars") and the upcoming September issue of *Sky & Telescope*. Our list of institutional members has grown to 24 with the addition of Rutgers University at the June Board Meeting. Our list of project members has grown as well, with almost 160 team members attending the All Hands Meeting in May. The meeting focused on preparation for the Preliminary Design Review and featured strong representation from all Science Collaboration Teams… and a soccer game!

Anna Spitz plays a big part in these newsletters as our science writer: drafting, writing, and coercing articles from the sub-system managers for each issue. And web designer Mark Newhouse makes each E-News issue look great on his screen and arrive in your mailbox or brower without distortion. Thanks to Anna and Mark and to all our readers, for your continued support and interest in LSST.

NCSA, Urbana-Champaign, IL - site of the 4th annual LSST All Hands Meeting and 1st annual LSST soccer match.

PROJECT MANAGER'S CORNER

Don Sweeney, LSST Project Manager

LSST's accomplishments in the first five months of 2008 were substantial. The M1/M3 mirror high fire was successful (http://www.lsst.org/News/highfire_event.shtml) reaching a high temperature of approximately 1165°C (2125°F) over March 28th and 29th. The LSST mirror is now annealing and cooling gradually to room temperature in the slowly rotating oven of the University of Arizona's Steward Observatory Mirror Lab. Technicians will remove it for grinding and polishing in mid-August. Competitive bidding for the secondary mirror contract is complete and a contract will be let this month.

Following the successful NSF Conceptual Design Review (CDoR) last September, the project has now moved on to preparation for the NSF Preliminary Design Review; the PDR is tentatively scheduled for Februrary 2009. We will re-baseline the LSST budget to reflect 2008 dollars and adjust the scope to include Education and Public Outreach (EPO) activities. Project teams will validate the construction schedule, budget, and refine the design concepts presented at the CoDR.

A recent endorsement of the LSST by an important Department of Energy (DOE) committee called P5 has given us encouragement that the DOE will conduct their first major review of the LSST. The review will be a formal step toward sponsoring fabrication of the LSST camera.

(Continued on p.2)

In This Issue

(Project Manager's Corner)

We are proposing this review, called Critical Decision-1, be held either in conjunction with the NSF PDR or soon thereafter.

Indications are that the LSST will be evaluated by the upcoming Decadal Survey. While the project welcomes this review, we are uncertain what impact, if any, this review will have on the LSST timeline. Also, it's likely you have heard that the NSF is once again re-evaluating the funding process for the Major Research Equipment and Facility Construction (MREFC) projects. How the outcome of this evaluation will impact us is unknown. These two items, and things like them, are very important to our project timeline but mostly beyond our control. We'll keep you informed.

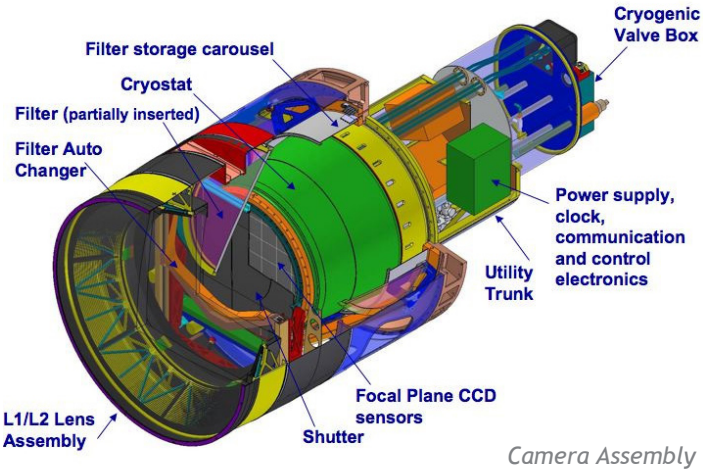
L-R: Tony Tyson, Charles Simonyi, Roger Angel, Steven Beering, Don Sweeney, and Ian Shipsey stand in front of the SOML furnace at the high fire event.

Camera Team News

The largest digital camera prepares for PDR and welcomes new international member.

The LSST camera will be the largest digital camera ever constructed. Its size of 1.6 meters by 3 meters is roughly the size of a small car and it will weight 2800 kilograms. It is a large-aperture, wide-field optical (0.3-1 μm) imager designed to provide a 3.5° field of view with better than 0.2 arcsecond sampling.

Steve Kahn and Kirk Gilmore (Stanford Linear Accelerator Center) manage the LSST camera team, which includes members from eighteen institutions. This team is refining the camera design submitted at the Conceptual Design Review to ready it for the formal inspection of the high level Preliminary Design Review expected early 2009. The team is carrying out system trade studies, camera mechanical design evolution, planning for camera integration and servicing, camera utilities and vacuum system design, and electronics and controls development.



Camera Assembly

One of the institutions now involved with the camera construction is the new international partner, Institute National de Physique Nucleaire de Physique des Particules (IN2P3). Researchers and engineers from IN2P3 bring technical and partnership experience to the LSST team. Collaboration on instrumentation began last fall and IN2P3 researchers are increasing participation in the science collaborations. IN2P3 is moving forward on securing a substantial French participation in the construction of the camera, which will add to the funding already secured and in the final approval stage.

IN2P3 is both a funding agency and a research institute. It brings over forty physicists, engineers and technicians located in university laboratories to the LSST efforts. IN2P3's researchers' main science interests are in cosmology, dark matter and dark energy. They will contribute to the supernovae, baryon acoustic oscillation, weak lensing, cluster and variable objects science collaborations. The science interests will drive their contributions to photometric calibration (instrumental and atmosphere); CCD and readout electronics for sensors; filters, filter mechanics and slow-control for filters; and software and computing. The IN2P3 experience with wide field imaging is quite valuable to the software development and data management. Dominique Boutigny and Jean-Yves Nief lead IN2P3 coordination in collaboration with Jeff Kantor and Ray Plante. This international collaboration will serve as the model for additional efforts as LSST grows.

For more information, contact Steve Kahn, Camera Scientist and Kirk Gilmore, Camera Manager.

Future issues of E-News will highlight details of camera sub-systems.

FOCUS ON... All Hands

LSST All Hands Meeting in Urbana, Illinois: Great Success in Team Building

Over 150 members of the LSST team descended on Urbana, Illinois from May 19th through May 23rd for the fourth annual All Hands Meeting. The meeting saw project management and science working group meetings, plenary sessions, breakout groups and the first inaugural East v. West soccer tournament.

Things are looking up for LSST Project Team Members at the All Hands Meeting.

Meetings for the Management Working Group, Science Council and Science Collaboration Teams all took place on Monday. The Management Working Group discussed preparations for the Preliminary Design Review (PDR) that the National Science Foundation requires as the project's next major milestone. A project timeline is available on the web for team members. PDR will require a tremendous amount of preparation: the team will revisit the scientific mission and engineering design based on comments from the Conceptual Design Review in September 2007 and developments since the review.

The Science Council discussed publication of LSST science plans and results. The Council determined that a science book detailing a roadmap for research with the LSST would be an outstanding resource not only for the team members but for the scientific community at large both for planning purposes and for stimulating interest in the science possible with LSST. The "book" will be a living document that generates new ideas and dynamic collaborations and research plans. LSST will host a meeting to produce the roadmap along the lines of the workshop on Wide Field Survey Telescopes in 2001 at the Aspen Center for Physics or the Science with the LSST and Other Large Surveys in Seattle in 2004. The publication policy draft generated significant discussion—just as the technology is breaking new ground, the sharing and publication of data prompts new guidelines. The policy must be a framework, which can incorporate publication with non-public and public data, recognize different cultural needs of collaborators, establish review committees and encourage "LSSTC-certified" papers without constraining the open use, analysis and publication of data.

The Science Collaboration Meetings provided team members with the time to discuss why their science is important to pursue with LSST, what design and operational requirements are dictated by the science, and what flagship projects they want programmed. Each group discussed the current state of research and what the next steps were in determining specific design and operational needs as well as projects. Each Science Collaboration leader presented the outcomes of the discussions to the entire LSST team at the Plenary Session on Day Two. The Science Collaborations will expand efforts to determine what their science requires of the LSST hardware and software. Eventually all collaborations' requirements will have to be considered against any others that might compete to determine exactly what LSST will provide.

The Plenary Sessions on Days Three and Four saw presentations on project status, observatory operations, data management, science, education and public outreach, camera, telescope, systems engineering, image simulations and calibration. Each presentation afforded the team members an increased understanding of their part and of how it relates to the whole.

Breakout sessions for specific functional areas focused on data management across areas. Breakout sessions included systems engineering, EPO and data management synergy, application algorithms, image simulation, data quality assurance, camera coordination, ground-based survey systematics and security. Discussions included challenges, risks and possible points of synergy.

The National Center for Supercomputing Applications (NSCA) at the University of Illinois at Urbana-Champaign, one of the LSST institutional members, hosted the meeting. NSCA's focus is on petascale computing for science and engineering. Its Blue Waters Project is the next generation in cyber environments. The LSST information system is of interest because of the data management needs—the plan to reprocess the entire data set each year and the need to leverage external platforms such as Blue Waters. NSCA brings tremendous expertise and hardware to the LSST project.

LSST Soccer (aka Football): *Where East Meets West*

Phil Marshall, UCSB, Strong Gravitational Lensing Collaboration Chair

The East Coast Hurricanes held the West Coast Earthquakes to a 1-1 draw in the inaugural annual LSST football match. With the University Illinois sports center venue packed with literally dozens of players and fans, an enthralling battle was played out in the evening sunshine, with many players rediscovering their touch of old and some young talent beginning to show. It was a game of two halves - while the bruising West players started and finished strongly, the East controlled the middle part of the game, and survived to hang on for the tie.

The West dominated proceedings early on, with veteran forwards Kantor and Gilmore harrying the East's defense. David "Beckham" Kirkby came close with a wickedly-curling trademark free-kick, that narrowly failed to clear the defensive wall; cat-like Jordan Raddick in the East goal pulled off a remarkable double save as the ball squirted loose for Silvestri; Andy Connolly provided a master class in attacking wingback play as he launched long-range shot after long-range shot in the general direction of the East's goal; but despite some clever build-up play from Becla and Delgado in midfield, the West was unable to capitalize. Instead, the East team gradually worked it's way into the game, with the ever-energetic Gawiser, and the triple man-mountain of Wood-Vasey, Krabbendam and Honscheid gaining the iron grip on the midfield, and international Frenchman Jacques Sebag showing his trademark stylish creativity, that would eventually see the Hurricanes through.

The deadlock was broken shortly after half-time, with the ball breaking free on the edge of the East penalty area for Marshall to lash home a 25 yard drive. The response from the East was immediate, and personified by full-back John Thaler who would be stopped from getting the ball by no one (least of all his own teammates). After a short break for Baker's resulting head injury to be treated, the East's midfield started to gain the upper hand, with the much-feared winger Chuck Claver causing all sorts of problems down the right wing. Lupton, holding the ball up well as the lone striker, found the strength to hold off the West defense, in particular riding a vicious challenge from his nemesis Phil Pinto that left him with a lump the size of tennis-ball on his shin. Match referee Suzy Dodd (who turned in an impeccable performance with no complaints from either side) insisted on letting the game flow though - and rightly so: the Hurricanes were hitting their stride.

Mid-way through the half their efforts paid dividends: set free by Wood-Vasey down the right, Claver played a cleverly threaded pass into the center that bamboozled the West's backs - Rob Sparks sprinted through to slot his shot into the far corner, and the crowd (on both sides) went wild. This was to be their last opportunity though: a trio of Ivezic, Cook and Jagatheesan worked hard to come out from the shade of the trees at their end and shut up shop for the remainder of the half - Andy Becker in goal provided a safe pair of hands throughout. In front of them, the energy of the younger West players began to tell: Srini Chandrasekharan, playing in his first match at this level at the tender age of just 25, came agonizingly close to scoring the winner in the dying minutes, his acrobatic volley flying inches over the crossbar.

Jeff Kantor retains control against aggressive (and well dressed) opposition.

WEST:

- Andrew Becker (Washington)
- David Kirkby (UCI)
- Francisco Delgado (NOAO)
- Jacek Becla (SLAC)
- Phil Pinto (Arizona)
- Jeff Kantor (LSST)
- Kirk Gilmore (SLAC)
- Nicole Silvestri (Washington)
- Phil Marshall (UCSB)
- Kem Cook (LLNL)
- Zeljko Ivezic (Washington)
- Arun Jagatheesan (SDSC)
- Andy Connolly (Washington)
- Srinivasan Chandrasekharan (NOAO)

EAST:

- Bill Baker (UIUC)
- Eric Gawiser (Rutgers)
- Jon Thaler (UIUC)
- Jordan Raddick (JHU)
- Kevan Hashemi (Brandeis)
- Klaus Honscheid (Ohio State)
- Michael Sivertz (Brookhaven)
- Michael Wood-Vasey(CfA)
- Robert Lupton (Princeton)
- Scott Stuart (MIT)
- Victor Krabbendam (NOAO)
- Jacques Sebag (NOAO)
- Robert Sparks (NOAO)

ATTENDANCE: 37.314

REFEREE: Suzanne Dodd (Caltech)

The editor apologizes to any indignant players whose exploits are either misrepresented or neglected in this article. Such oversights are unintentional. Feel free to contribute rebuttals or alternative narratives to the author.

LSST 'Camera' Project Exposes Long Island Student to Physics

Kendra Synder, Brookhaven National Laboratory

Rose Malinow's parents are both biologists, but the recent high school graduate will tell you that their love for life sciences isn't genetic.

"I really don't like biology," she said. "Math is different because it just makes sense; there's always a right answer. But more than anything, I just like to build stuff."

It's no surprise that Malinow, who graduated from Long Island's Cold Spring Harbor High School, plans to study engineering at Georgia Tech in the fall. Recently, however, she's gotten a taste of a different scientific flavor – physics. Since January, Malinow has worked with Brookhaven National Laboratory physicists Peter Takacs and Paul O'Connor on specialized instrumentation for the LSST.

Brookhaven has the lead role in developing the "film" for the camera, which is composed of electronic sensors – just as in a digital camera – but hundreds of times larger and sensitive to near-ultraviolet and infrared as well as visible light. These sensors, which will provide more than 3 gigapixels of resolution when complete (more than 500 times the amount of information captured by a conventional digital camera), are the focus of Takacs and O'Connor's group.

Specifically, the team is experimenting with charge-coupled devices (CCD), which will capture light that has taken billions of years to reach Earth from distant galaxies. The CCDs, each measuring just 42 square millimeters, are assembled into "rafts" made of nine sensors. Then, the rafts must be lined up to form a flat mosaic in the camera's focal plane. Precision is key here: the more than 200 CCDs must lay almost perfectly flat, with no more than a 5-micron tilt in any direction. Malinow is responsible for figuring out just how to do that.

"All of these pieces are supposed to work as one camera together and if they're not all aligned, it won't take the same picture," she said.

With a set of dummy CCDs and spacers, Malinow uses a special microscope to measure the height and orientation of the pieces at various points. Based on these measurements, she polishes down the spacers to adjust the thickness of the overall raft. Soon, she'll also experiment with built-in screws, which allow for fine adjustments without taking the pieces apart. Once the alignment technique is perfected, the group will move on to the CCDs that will be used in the actual telescope.

High school student Rose Malinow with an optical profiling instrument used in R&D for the LSST.

Malinow spends four days a week at Brookhaven, where she also assists in the Office of Educational Programs, which is funding her work.

"Rose is definitely not your ordinary high school student," Takacs said. "She has incredible talent and she is contributing a significant amount of work to this project. We are able to point her in a direction and she does it." And Malinow enjoys the opportunity to be self-sufficient.
"They always ask me what I think the best thing is and what the next step should be," she said. "They are not teaching me all of the time and I really feel like they value my opinions."

Although Malinow says her experience with the LSST project isn't likely to transform her into a physicist, it has stirred her curiosity.

"It makes me realize how little I knew about physics," she said. "Dark matter, dark energy, there's all of this stuff that I had no idea about."

"We're working to turn her into an engineer," Takacs said. "But maybe she'll get the bug to actually become a researcher too."

LSST Corporate Offices Have Moved

The LSST Corporate headquarters have relocated from our Camp Lowell Drive offices to the 5th floor of Steward Observatory on the University of Arizona campus. Tucson-based project members are now separated by no more than the width of Cherry Avenue. NOAO provides office space for both the Telescope & Site and Data Management groups; EPO and Corporate functions are housed at Steward including John Schaefer, Sidney Wolff, and Don Sweeney.

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UPCOMING ISSUES

Our next issues will provide updates about the science roadmap, M1/M3 status, simulations, EPO and data management and our feature highlighting a team member.

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