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LSST

Rendering of the LSST at its site in Chile.

Unusual new telescope gets green light

By Daniel Clery (/author/daniel-clery) | 5 August 2014 3:30 pm | 5 Comments (/funding/2014/08/unusual-new-telescope-gets-green-light#disqus_thread)

The Large Synoptic Survey Telescope (LSST), the top-priority ground-based instrument for U.S. astronomers, has gotten the green light to go ahead (http://www.lsst.org/lsst/news) with construction, with a view to seeing its first light in 2019. On 1 August, the National Science Foundation moved to release the first major chunk of construction funding—$27.5 million—for the $473

million project. The Department of Energy will also chip in about $165 million for the scope's camera and related instruments.

LSST has a highly unusual design, with a very wide field of view so it can scan the entire sky every few nights. "This concept is the next stage in the technological revolution that is going on in astronomy," says Gerry Gilmore of the University of Cambridge in the United Kingdom. Instead of looking at distant and faint objects for long periods to get enough light, LSST will look at things that change fast. "This next step will look at a big enough patch of sky and cover it repeatedly and rapidly. We're all looking forward to it," Gilmore says.

The development of LSST has been going on for more than a decade. In the National Research Council's 2010 decadal survey of astronomy and astrophysics, researchers put it at the top of their wish list for ground-based telescopes. LSST is expected to begin full science operations in 2022 and will survey the sky for 10 years from Cerro Pachón in northern Chile.

"After a rigorous design and development phase, the project team is ready to get down and dirty and actually build this amazing facility," said LSST Project Manager Victor Krabbendam in a statement. Gilmore says that the United Kingdom is now negotiating joining the project as an international partner.

LSST will view a patch of sky 3.5° across; that's seven times the diameter of the sun or moon. It will focus light onto a 3.2-gigapixel camera that takes an exposure every 20 seconds. This wide viewing angle is achieved by having three mirrors rather than the usual two: An 8.4-meter primary mirror reflects light onto a 3.4-meter secondary and from there onto a 5-meter tertiary mirror sitting in a large hole in the middle of the primary. So the primary is like a giant ring. "It's a big telephoto lens," Gilmore says.

LSST will map out the faint variable stars that are used to measure distances in the local universe and the flashgunlike supernovae that help gauge longer distances. It will measure weak gravitational lensing deep in space as a way of detecting dark energy and dark matter. Researchers will use it to study the flashes of light given out when black holes, including the giant ones at the centers of galaxies, consume stars and other material. Closer to home, LSST will map near-Earth asteroids and Kuiper belt objects in the far solar system.

One of the project's biggest challenges will be coping with the volume of data

the telescope will produce, far too much to be processed by human beings. “This is big data in extremis. It’ll be like a gigantic video stream pouring down from the sky,” Gilmore says. The telescope is expected to produce about 30 terabytes of data per night and advanced data-mining techniques will need to be developed to find objects of interest in the stream of images. Automated systems will also be needed to spot fast-changing objects in the sky and alert other telescopes to home in on them quickly for more detailed study, similar to the existing system for studying gamma ray bursts. “We’ll need to move another couple of steps up the complexity ladder,” Gilmore says.

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It seems to me, as an amateur, and as an interested citizen of the U.S., that the more we learn about things closer to us in space time, the more we learn about the here and now on and near Earth. Whereas, when we look beyond, say, one light year's distance, we do not look at current things but, rather, things as they were one year ago. What we see as 500,000 light years away, on the other hand, is not what's out there now but what was out there 500,000 years ago. And, even if we could travel at the speed of light to get to such an object, we would not arrive there until 500,000 years after today.

If we are going to learn how to travel in some way that will get us to from Earth to something 500,000 years travel in a day or so, the best place to work on that would be right here on Earth. And if we are going to study to learn whether planets that are not Goldilocks planets like ours, can be mined or in some other way exploited to extend the useful life of Earth, then the nearer in space time the better.

Hopefully I've not said anything here that will be interpreted by any other commenter as an attack on his or her pet project or goal or area of expertise or view of science.