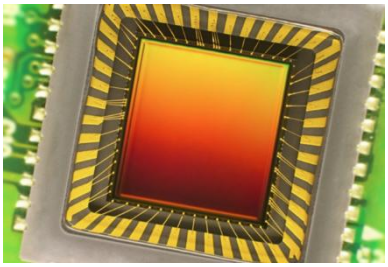
A NEW EYE ON THE SKY

A new observatory is coming on-line, and in its own way, is going to have an impact similar to what we are seeing with the James Webb Space Telescope. This new observatory, the Vera C. Rubin Observatory (VRO), located in Chile, houses a new, hi-tech telescope, the Large Synoptic Survey Telescope (LSST). This will be monitoring the whole southern sky with high resolution, with the entire coverage taking only a few nights. If anything out there has moved or changed, or if something new appears, the observatory will spot it. The observatory is named after a scientist who, with her colleagues, examined thousands of images of galaxies and other objects in search of changes and in trying to learn more about one of the most puzzling things in our universe, dark matter.

For most of our history of astronomy, our telescopes have enabled us to see small objects in the sky in great detail. We have certainly learned a lot, but using such instruments is like looking through a keyhole. You don't get the big picture, and if anything is happening elsewhere in the sky, or even nearby, you won't see it. On very rare occasions, a telescope just happened to be pointing in the right direction to spot something unexpected and new. However, with the competition to use the larger telescopes, the committees evaluating observing proposals are very unlikely to grant observing time to large-scale surveys and general searches for interesting objects or things that might happen. What we would like is an instrument that has a wide field of view but can "see" very fine detail and to not need long exposures to make images. This would combine our need for data on individual objects that might be very small in the sky, while at the same time be capable of surveying the sky looking for anything that is

new or changing. The data from such an instrument could be made available to many scientists, each of whom is searching for something completely different. There are four main reasons why it has taken so long to produce an instrument that many of the research community wanted.

First the telescope would need a optics including a large mirror, which would have high resolution for fine detail, "see" a large area of sky and collect enough light to provide high quality images with short exposures, so that the whole sky could be covered in a reasonable time. The LSST has an 8.4m diameter mirror to collect the light and form the images. It sees a patch of sky 3.5 degrees in diameter. It will be able to complete a survey of the southern sky every few days.



Secondly to record a large image in extreme detail will require a camera with an extreme number of pixels. The finest detail discernible with the telescope must be recorded with high quality. The LSST has a camera recording images with 3.2 billion pixels, which is more than any existing camera. This presents another problem. Each image file will be huge, and they will be produced at quite a high rate. The rate of data production will be high. Some projects, which require a small number of high-resolution images of specific objects, will be possible with minimal digital assistance, but large-scale searches will probably involve some sort of AI processing. Sieving through the output from this telescope for anything at all that might have changed, appeared or disappeared since last time that part of the sky was imaged, will be an enormous task.

Some years ago, an Australian radio telescope just happened to be pointing in the right direction to detect the first ever Fast Radio Burst, The CHIME radio telescope, which can see a large part of the sky at once, has now detected thousands of them. What will the VRO's LSST be showing us?

Saturn lies low in the south-east and Venus low in the east before dawn. Mars is very low in the west after sunset. The Moon will be Full on the 10th.

Ken Tapping, 8th July, 2025

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