The LS4 Galactic Survey

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Galactic Science Working Group

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The La Silla Schmidt Southern Survey (LS4)

Basics: LS4 is a 5-year optical survey set to begin in 2024 on the 1-meter ESO Schmidt Telescope at La Silla Observatory.
Public survey: 90% of available time, split among Galactic and extragalactic projects with 1-3 day cadences
Partner survey: 10% of available time, for target of opportunity and deep-drilling projects, which will become public after a proprietary period
Alerts: identified with SeeChange and distributed for 5σ significance sources in difference imaging via AVRO packets
Commissioning: May 2024
Survey start: July 2024
First alerts: August 2024

Image from ESO

Learn more about LS4 at sites.northwestern.edu/ls4

LS4 Specifications

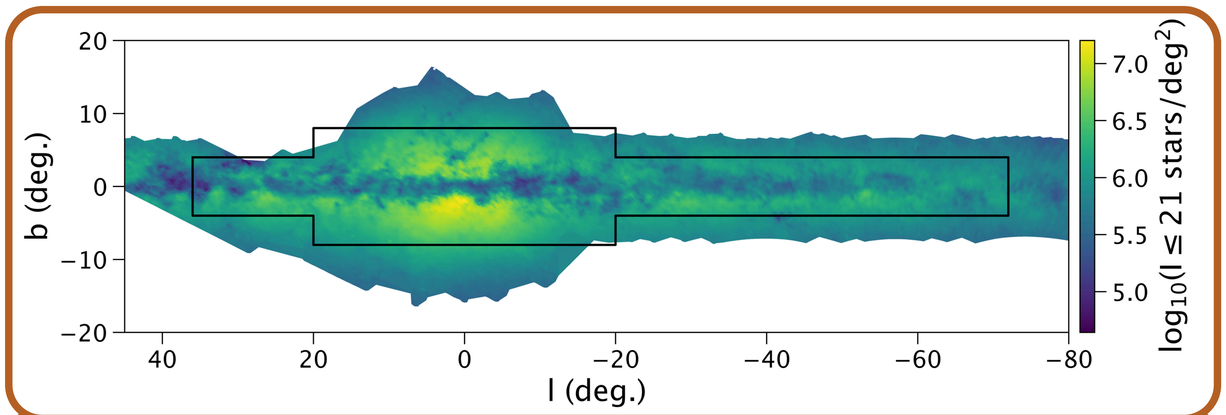
Camera	268 Megapixel QUEST camera
CCDs	32 LBNL deep-depletion well CCDs
Field of View	~20 degrees^2
Pixel Scale	1 arcsec/pixel
Exposure time	45 seconds
Readout/slew time	15 seconds
Filters	g, i, i, & z in fixed quadrants
Depth (5-sigma, dark time)	g~21.5, i~21, z~20.25

Galactic Science Cases for LS4

As a multi-filter, time-domain survey, LS4 will enable the discovery of many **gravitational microlensing** events, map the **variable star** population, search for rare **binary systems** that contain black holes, white dwarfs, and neutron stars, and monitor for **Galactic novae**, **supernovae** and other **rare transients**.
LS4 will be **complementary to the Rubin Observatory Legacy Survey of Space and Time,** with shallower photometry but a higher cadence.

The LS4 Galactic Plane Survey

Sky coverage: ~1200 degrees^2 along the Galactic plane and bulge
Cadence: Nightly observations in g, i, and z
Seasons: ~March-October yearly
Anticipated # of microlensing events per season: >1,000



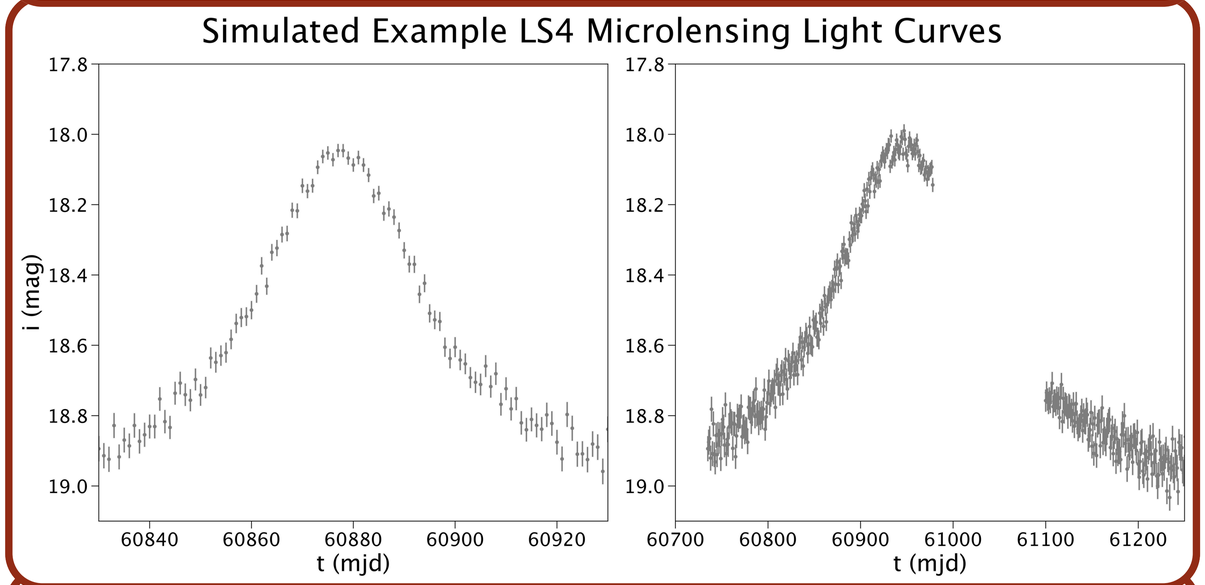
The LS4 Galactic plane survey region (black outline) plotted over star counts from the OGLE-IV survey for a limiting magnitude of I=21 (Mróz et al, 2019+2020).

*The LS4 Collaboration

The LS4 Team is led by the LS4 Founding Members and Institutional Collaborators, and includes junior and senior researchers from >20 institutions.
Director: Dr. Adam Miller
Project Scientist & Deputy Director: Dr. Peter Nugent
Founding members: Bar-Ilan University, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Millennium Institute for Astrophysics, Northwestern University, Tel Aviv University, University of California–Berkeley, University of Portsmouth, Yale University
Institutional Collaborators: DESY, IN2P3, Lancaster University, Ruhr-Universität – Bochum, Stockholm University, Trinity College Dublin, University of Southampton, Institute of Space Sciences (ICE, CSIC), University of Birmingham, Queen's University Belfast

Gravitational Microlensing in Large Surveys

Gravitational microlensing events allow for the detection of massive objects via their magnifying effects on background luminous objects. Such events are rare (~10^-6/star/year in the densest parts of the Milky Way), so we need large surveys to detect many of these events. Microlensing can probe Galactic structure and uncover dark objects like black holes, dim stars, brown dwarfs, and cool exoplanets.



Simulated light curves for two microlensing events with realistic LS4 observing cadence, seasons, and errors. Left: a typical ~30 day timescale stellar event. Right: an example ~150 day black hole lens event (modeled with BAGLE: github.com/MovingUniverseLab/BAGLE_Microlensing)