Exploring Microlensing Parallax with WFIRST and LSST

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Outline

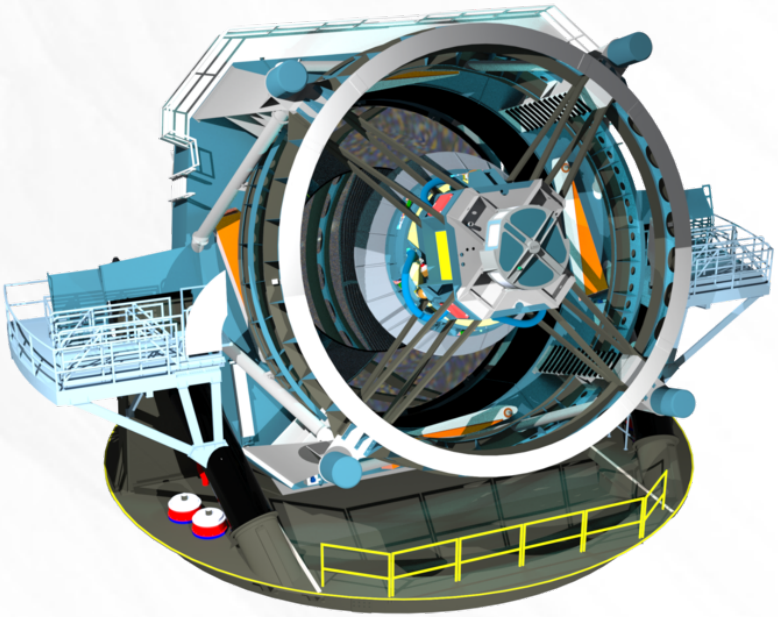
- LSST
  - What is it?
- LSST and microlensing I
  - Trigger for microlensing followup
- LSST and microlensing II
  - Microlensing parallax in combination with WFIRST

Large Synoptic Survey Telescope

- Ground-based survey telescope
- First light in 2020
- Ten year main mission
- Observe entire southern hemisphere

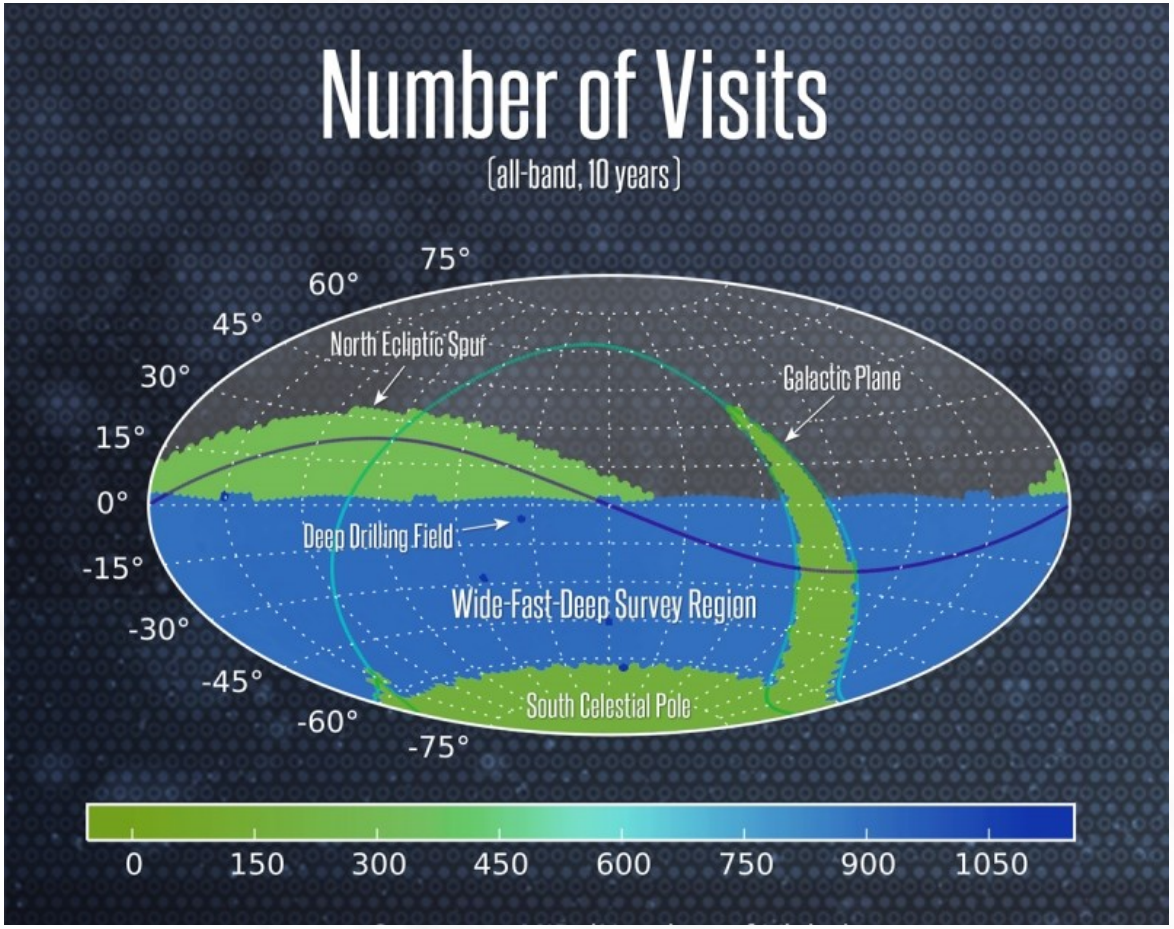
Large Synoptic Survey Telescope

- 8.4 meter telescope
- 9.6 square degree field of view
- 6 bands
  - *ugrizy*
- Light curves for 10 million objects
- Real-time alerts



By LSST Project Office

Large Synoptic Survey Telescope



Large Synoptic Survey Telescope

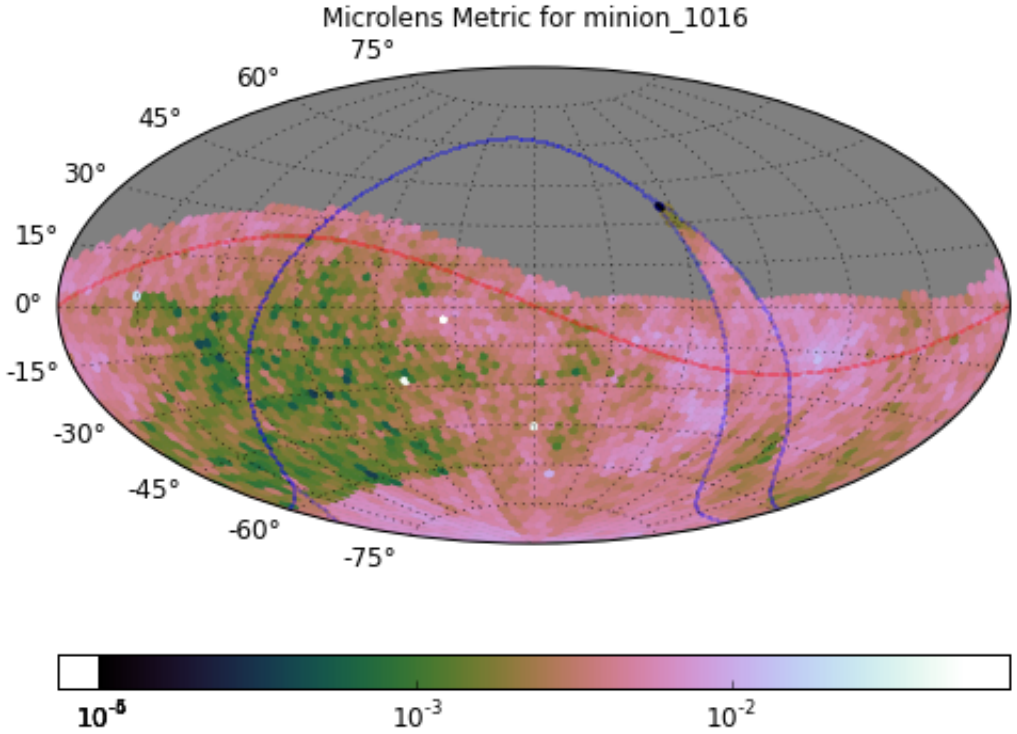
Three notable subsurveys with distinct cadences

- Wide-fast-deep survey
  - ~1000 observations
  - Represents vast majority of sky
- Deep drilling fields
  - ~10,000 observations
- Galactic plane
  - ~200 observations

LSST for triggering followup

- Idea: Can LSST discover microlensing events in order for other telescopes to observe them?
- Requirements for trigger:
  - Three observations that occur within a maximum time frame and with minimum intervals between observations

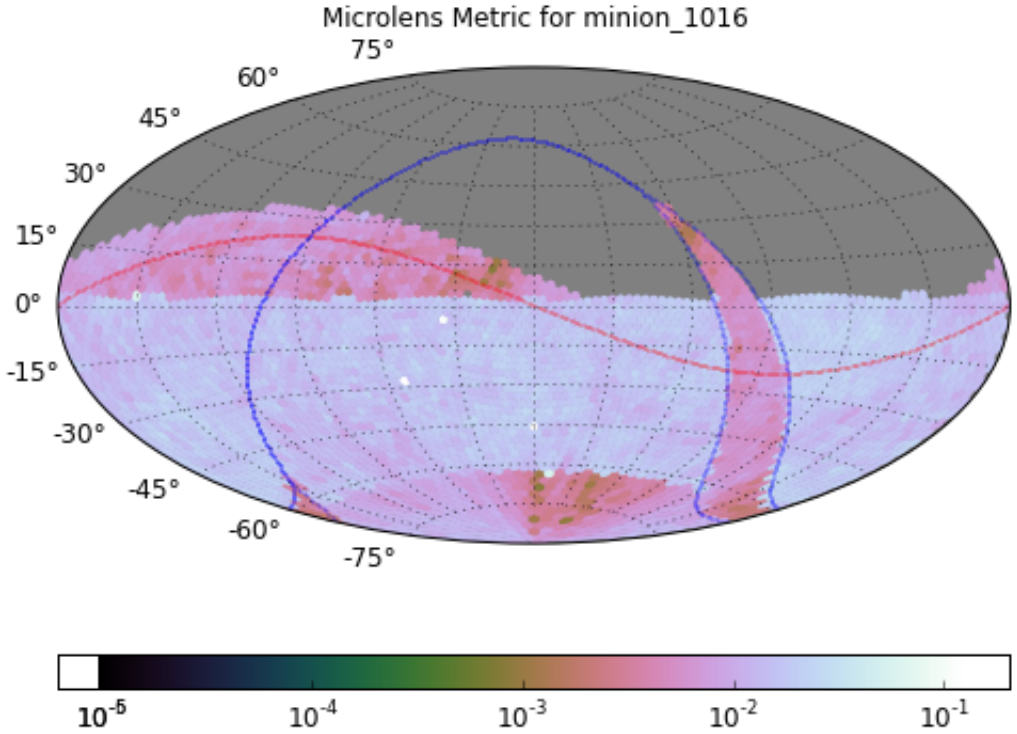
LSST for triggering followup



Fraction of time sensitive to trigger

Exoplanet trigger: Three observations in two days separated by at least one hour intervals

LSST for triggering followup

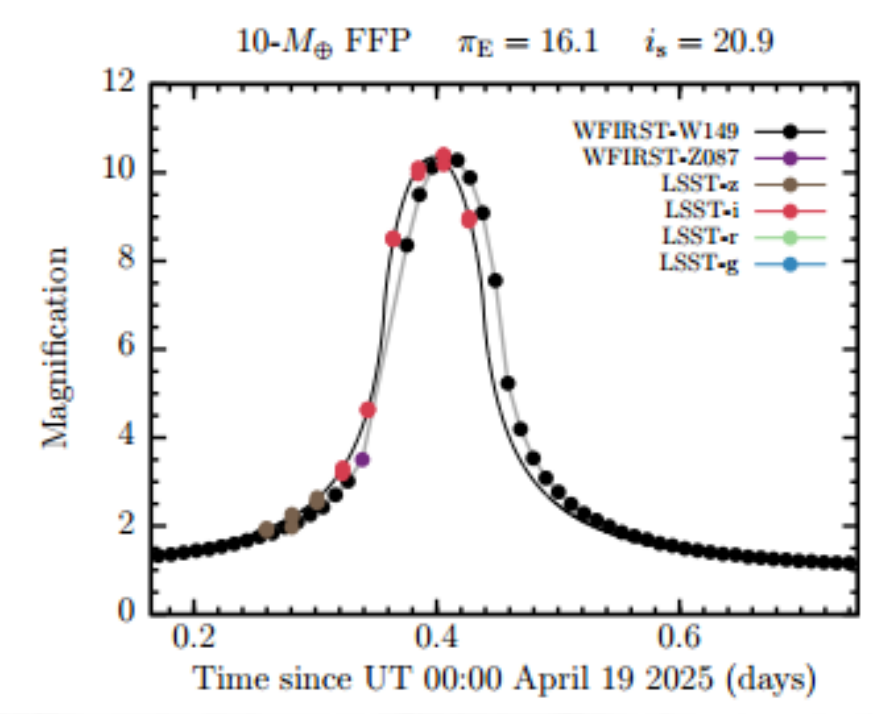


Fraction of time sensitive to trigger

Stellar trigger: Three observations in seven days separated by at least two day intervals

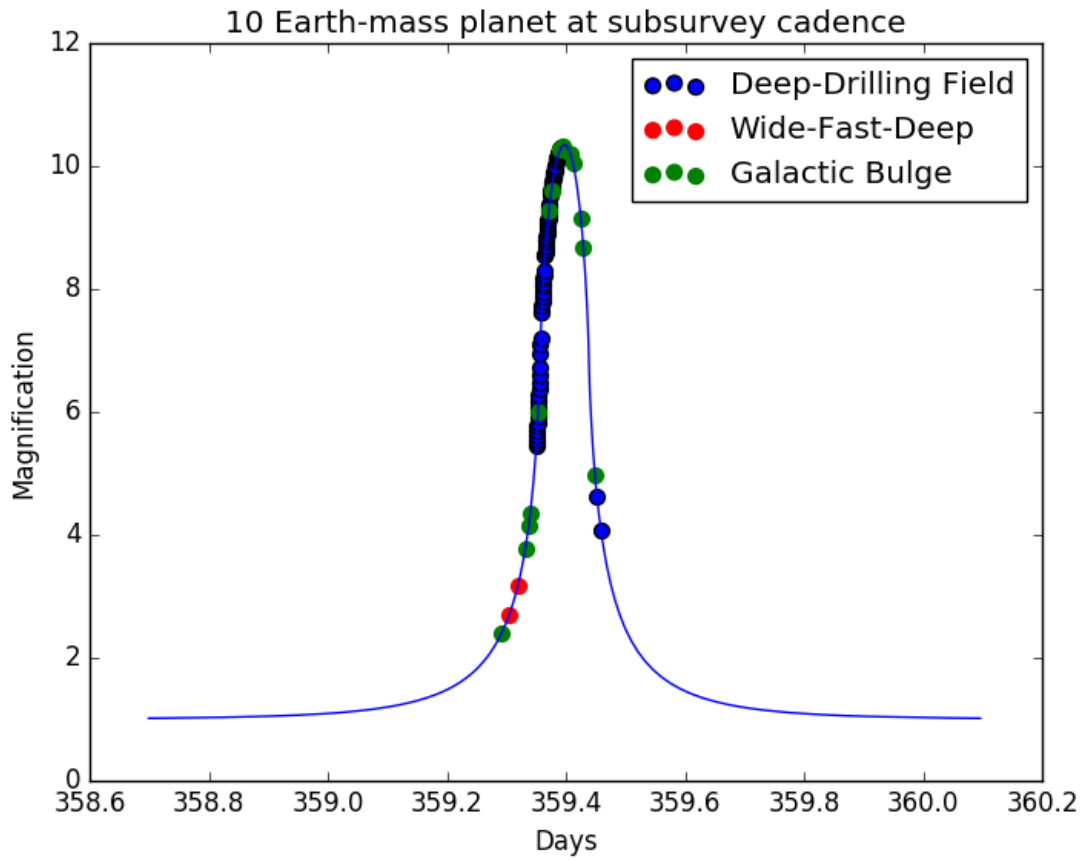
Parallax with LSST and WFIRST

- Free-floating planet in LSST and WFIRST
- LSST Observing Strategy white paper section by David Bennett, Matthew Penny, Radoslaw Poleski, Rachel Street



Penny, LSST Observing White Paper

Parallax with LSST and WFIRST



Note: Representative only if observations are taken during event

- No cadence is uniformly sampling event
- Wide-Fast-Deep cadence doesn't sample frequently enough, either

Future Goals

- Model event curves in LSST with photometric noise and measure errors in microlensing parameters
- Simulate likelihood of coverage at random points in time
- Suggest ways to improve LSST cadence for microlensing events
  - Enhanced coverage during WFIRST microlensing mission already suggested
- Thanks to microlensers that have provided help in starting my work on this
  - Rachel Street, Matt Penny, Radek Poleski, Calen Henderson