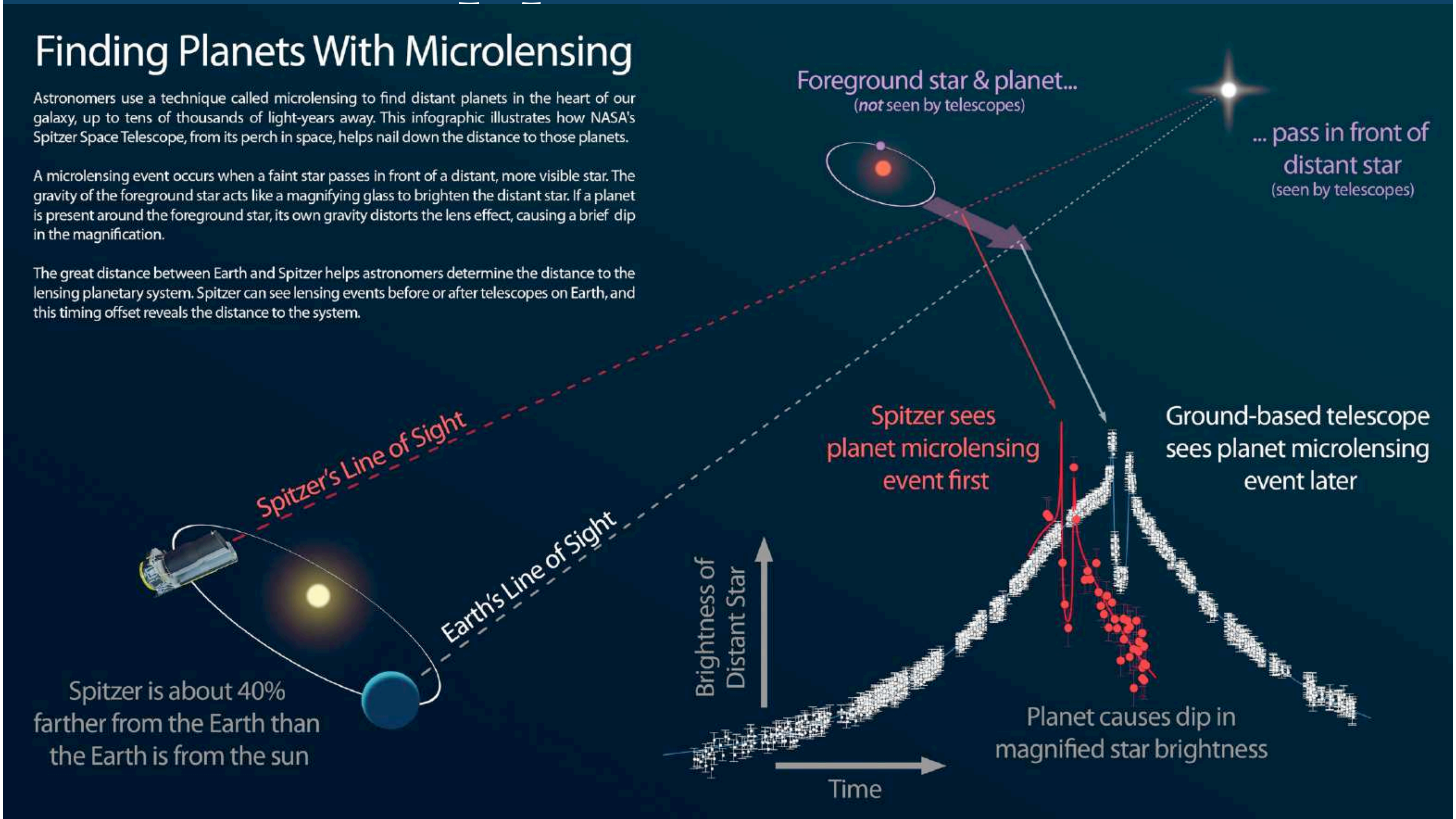
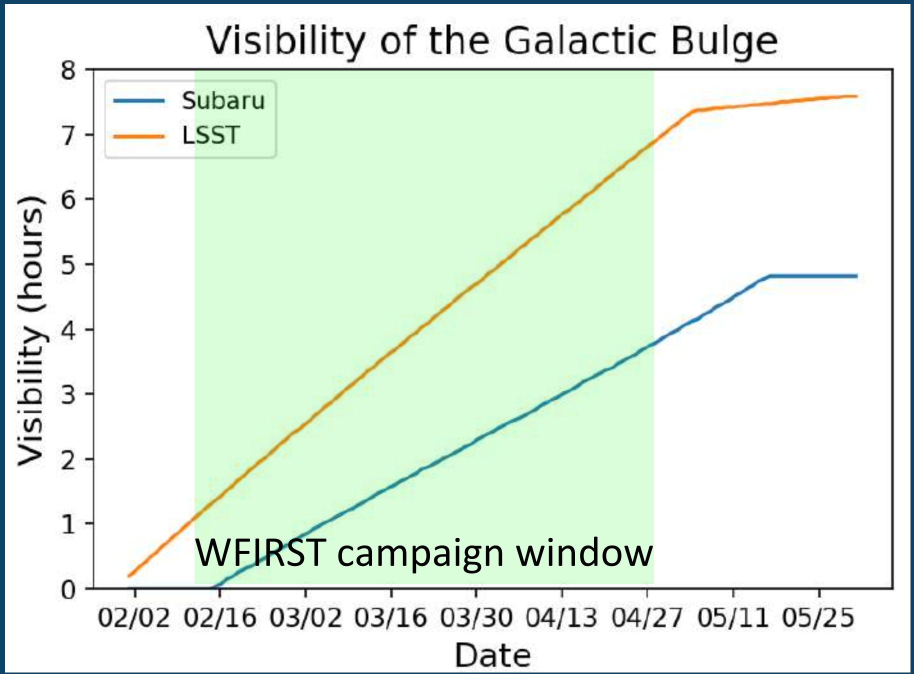
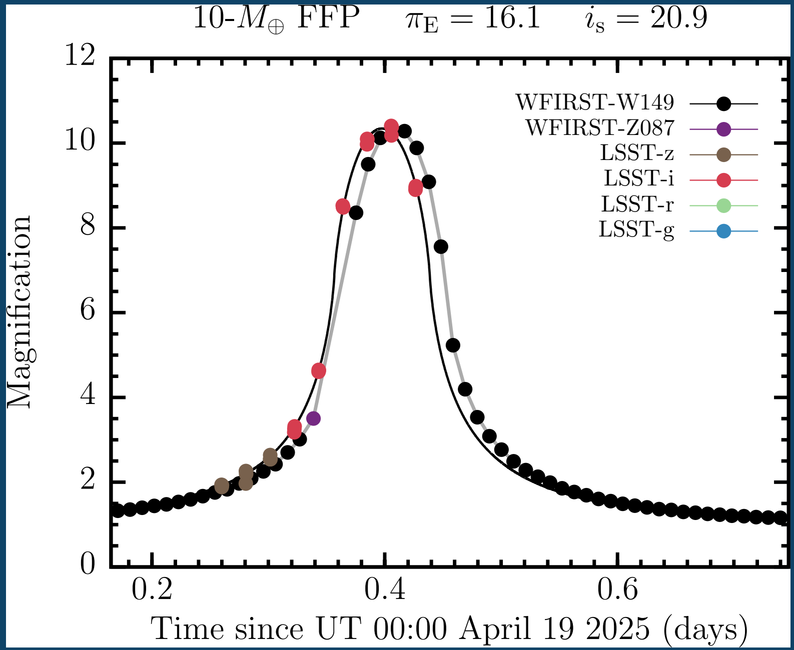
Summary report of Microlensing break out session

Toward Precise Mass



Simultaneous HSC & WFIRST Imaging

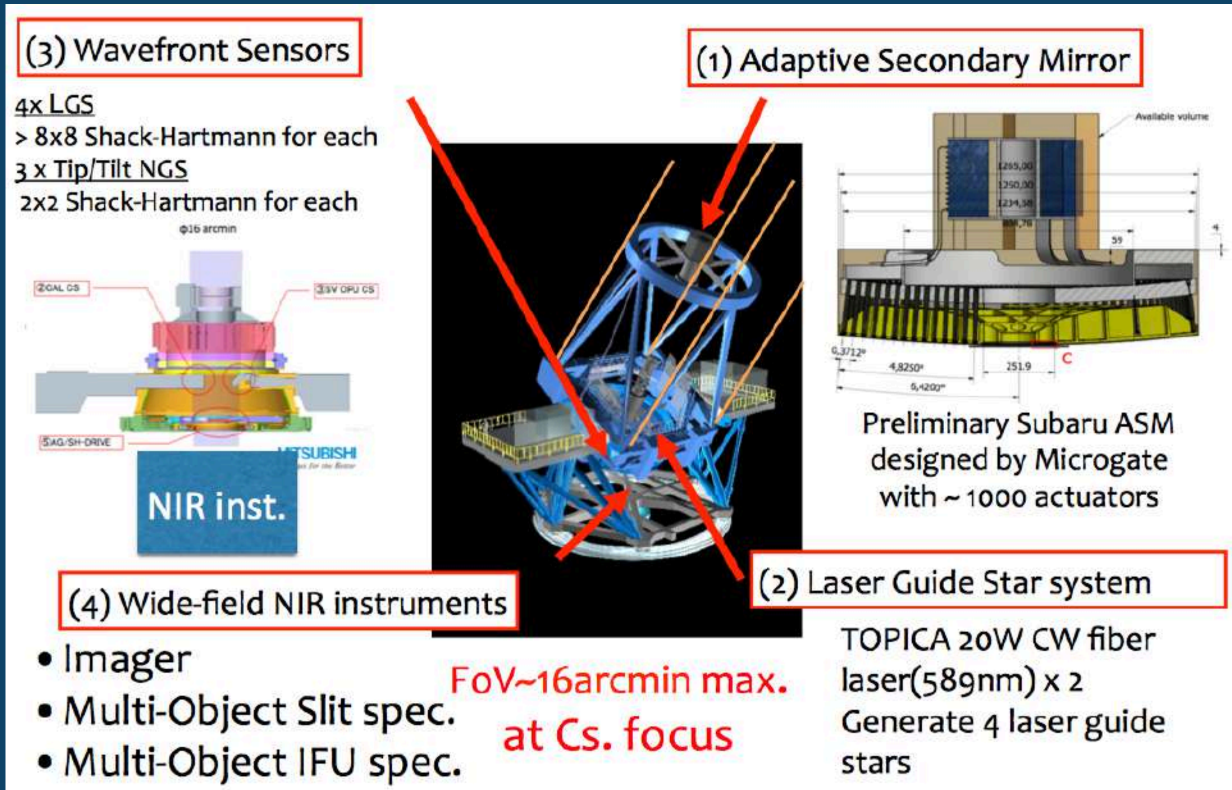


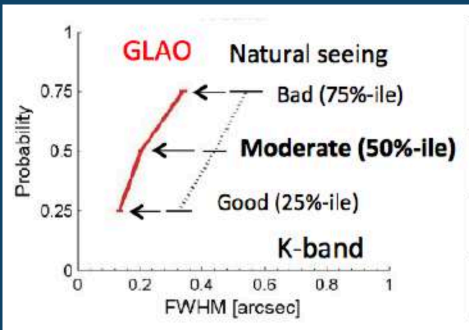


- We propose simultaneous imaging with both LSST & Subaru HSC
- 15-30 minute cadence
- WFIRST – LSST & Subaru microlensing parallax is only way to measure mass of free-floating planets
- WFIRST observing seasons are optimal for parallax signal, but not ground-based observations
- Only a small fraction of free-floating planets can be observed from the ground, but even weak detections will be useful.
- The only way to provide alerts – WFIRST will not have rapid alerts

Concurrent Observations using ULTIMATE-Subaru

ULTIMATE-Subaru





Band	Natural Seeing (")			GLAO(")		
	Good	Moderate	Bad	Good	Moderate	Bad
J	0.38	**0.50**	0.71	0.17	**0.26**	0.44
H	0.38	**0.46**	0.60	0.15	**0.23**	0.39
K	0.33	**0.44**	0.54	0.14	**0.20**	0.34

- FWHM ~ 0.2-0.3'' for φ15' @K-band
- Completion will be ~2025

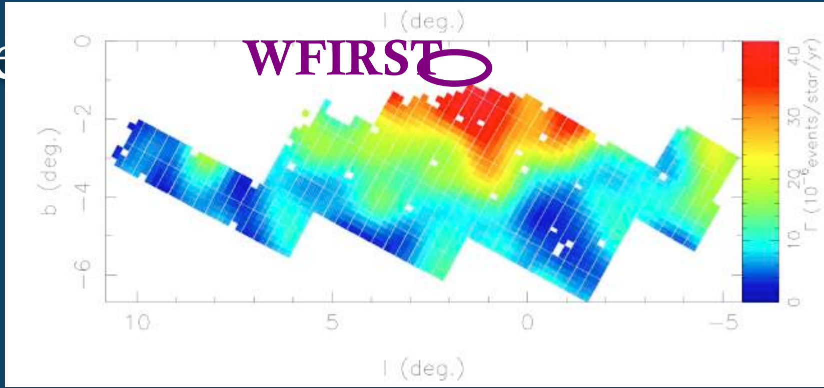
From fact sheet: https://www.naoj.org/Projects/newdev/ngao/20170316/materials/fact_sheet.pdf

Concurrent Observations using ULTIMATE-Subaru

Advantages

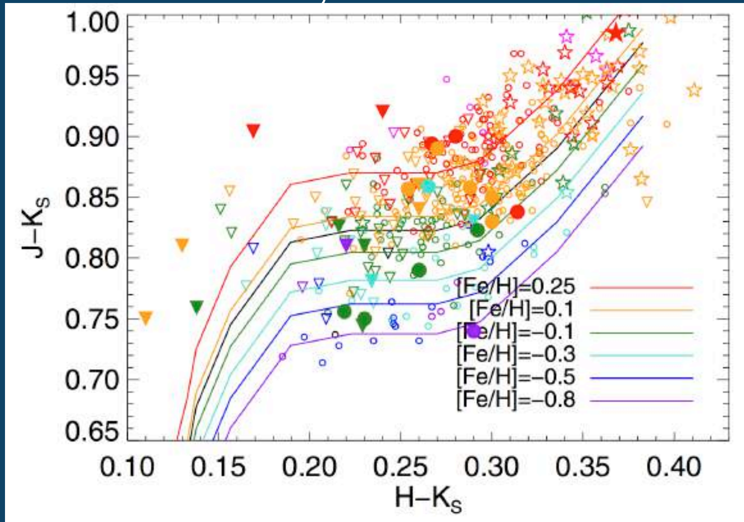
- NIR -> can go closer to central bulge
  - Higher event rate
  - Complement to LSST/HSC
- High resolution -> less blending
  - Fainter events
  - Lens flux
- K band capability -> lens' colors
  - Complement to WFIRST (< H band)
  - (Z087 – K) and (W149 – K) colors
  - Metallicity of M-dwarf host stars can be estimated

Event rate toward the galactic bulge



Sumi & Penny 2016

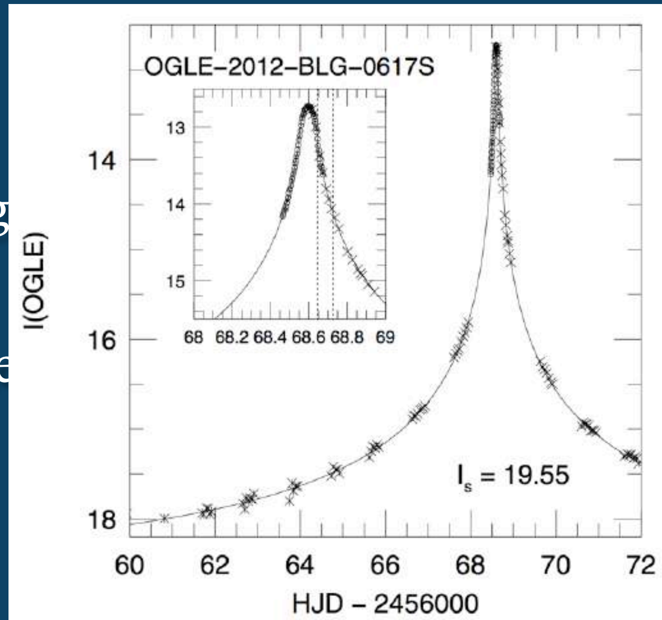
NIR color-color diagram of nearby M dwarfs



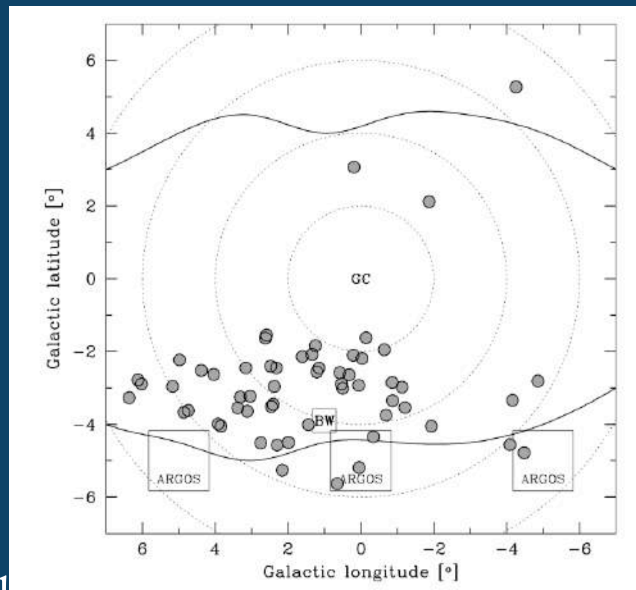
Newton et al. 2014

NIR Spec. of Bulge Dwarfs through High-mag μlens

- Environment study of the central bulge
  - WFIRST can examine the dependency of planet abundance on the stellar properties (e.g stellar age, metallicity, and kinematics)
  - Recent studies support the presence of younge (~a few Gyr) populations



- High-mag (A_{max}>50) μlensing events will allow IR spectroscopy of bulge dwarfs
  - A_{max} > 50: H=19 ⇒ H < 14.8, mid R w/ IRCS (or PFS)
  - A_{max} > 500: H=19 ⇒ H < 12.3, high R w/ IRCS or IRD



(This idea is also proposed by N. Matsunaga @Univ. of Tokyo)

Bensby et al. 2013

a) List possible Scientific programs.
b) Possible feasible scenario

1, HSC concurrent observation, 30min cadence, ~2 hours/night, Feb-May,
30sec expusre+30sec readout+throw time, (2filed ~ 7 WFIRST field)
5min/2 fields, x 4 /night x72 = 24 hours/8hr=3nights/season= 18 nights/6season
(3/4)=13.5nights/6season (bright night)

2, Ultimate, concurrent survey (WFIRST observe 7 fields.)
0.5min.+0.5min. 32 fileds (32filed = 6.4 WFIRST field) x2 / night
1hr /night x 72/8 = 9 nights / 1season. 54nights/6 season.
(x3/4)=40.5night/ 6season (bright night)

3, IRD, follow-up for high mag, measure extinction, metallicity of source.
Precursor observation during bright time. S/N=50, 30min exp+ 30min overhead.
J<12mag, 1.5hrs per target.
1.5 x 15 alerrts / yr =22.5 hrs/ yr. /8hr = 2.8night /yr. 11.2night / 4yrs. (60events)

c) Procedure to decide the observational programs.

WFIRST ML science team including Japanese representative decide