光赤天連シンポジウム2019

PRIME

PRime-focus Infrared Microlensing Experiment

Daisuke Suzuki

(ISAS/JAXA)

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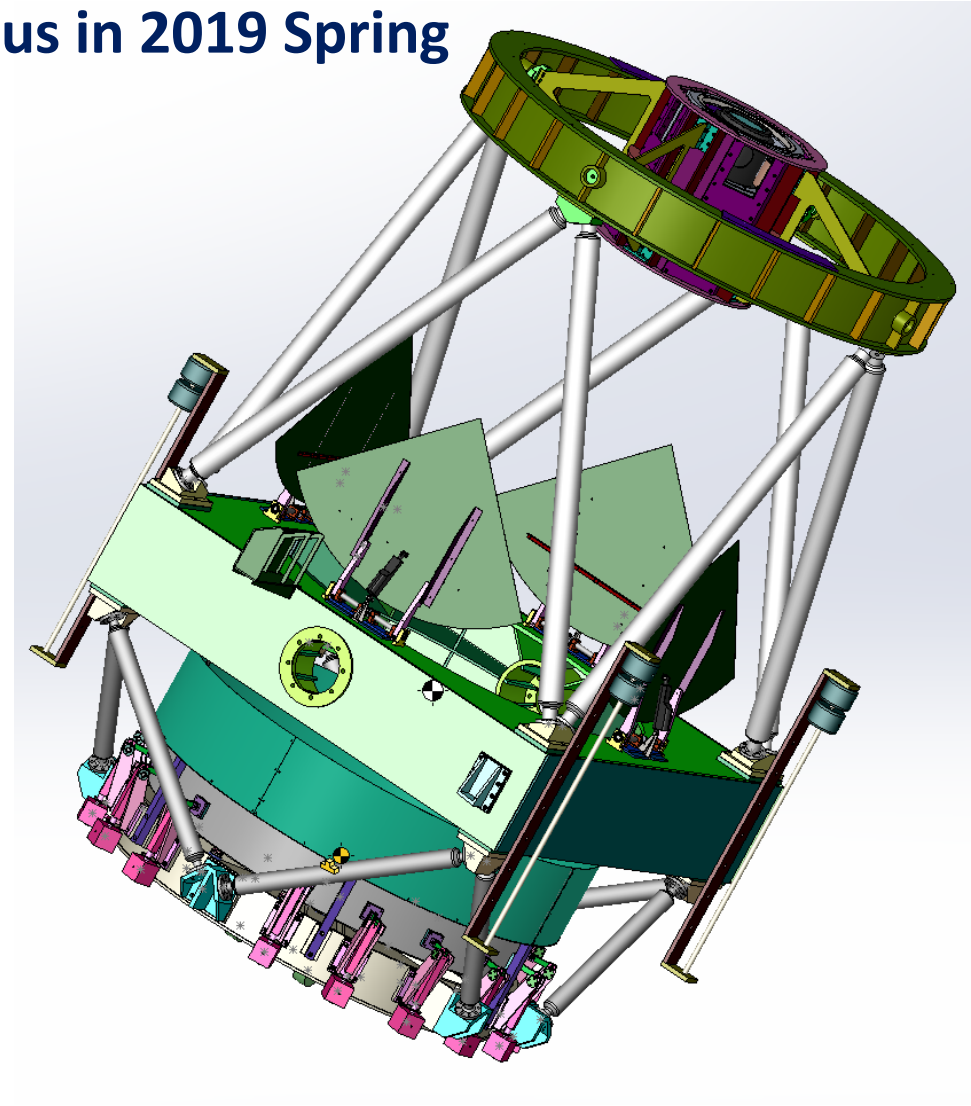
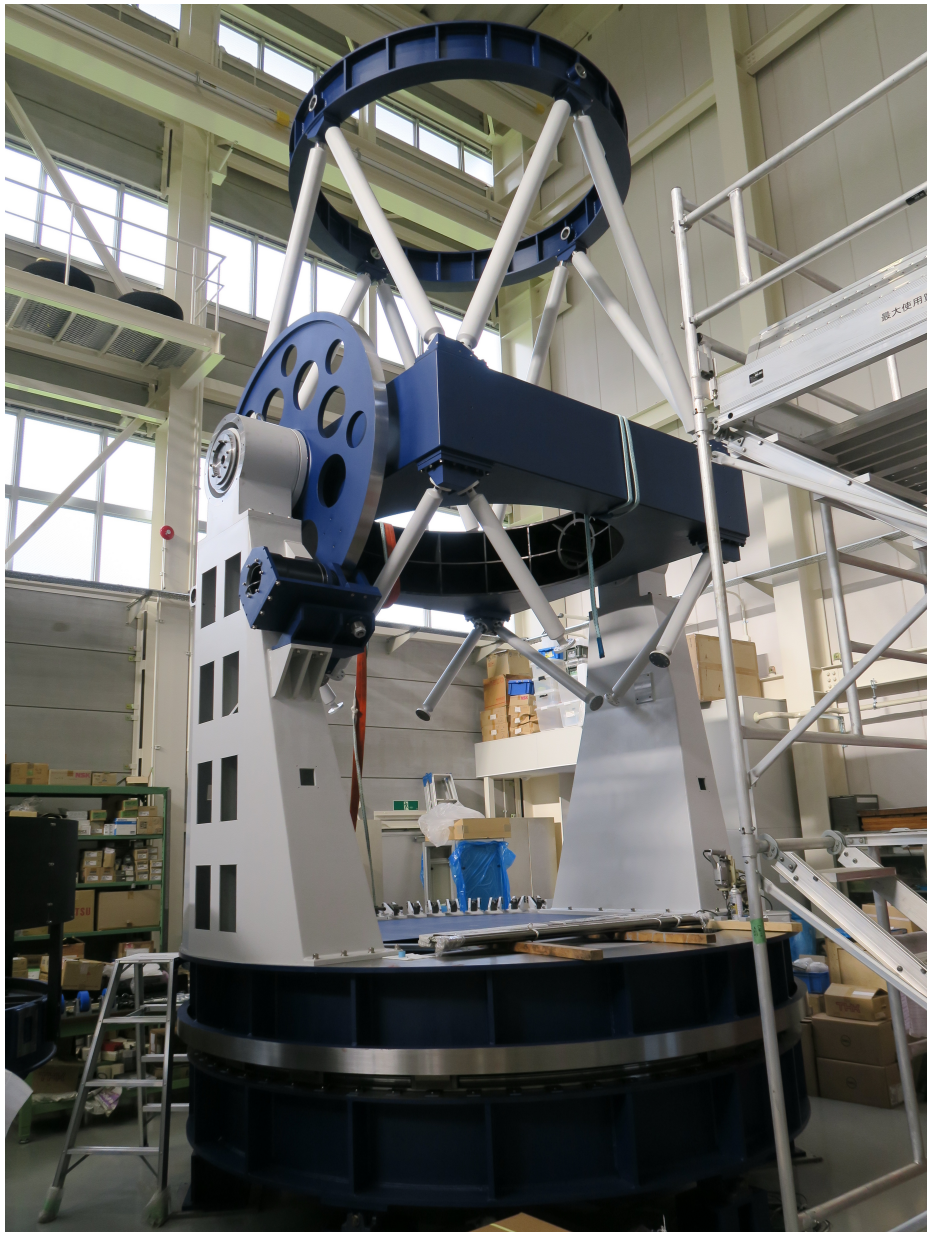
on behalf of the PRIME collaboration

Status in 2019 Spring





Status in 2019 Autumn

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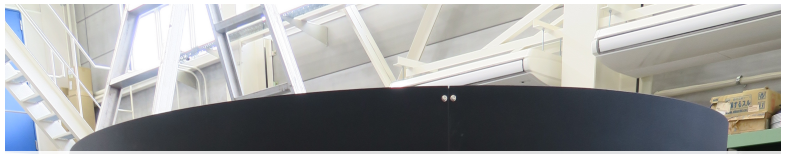
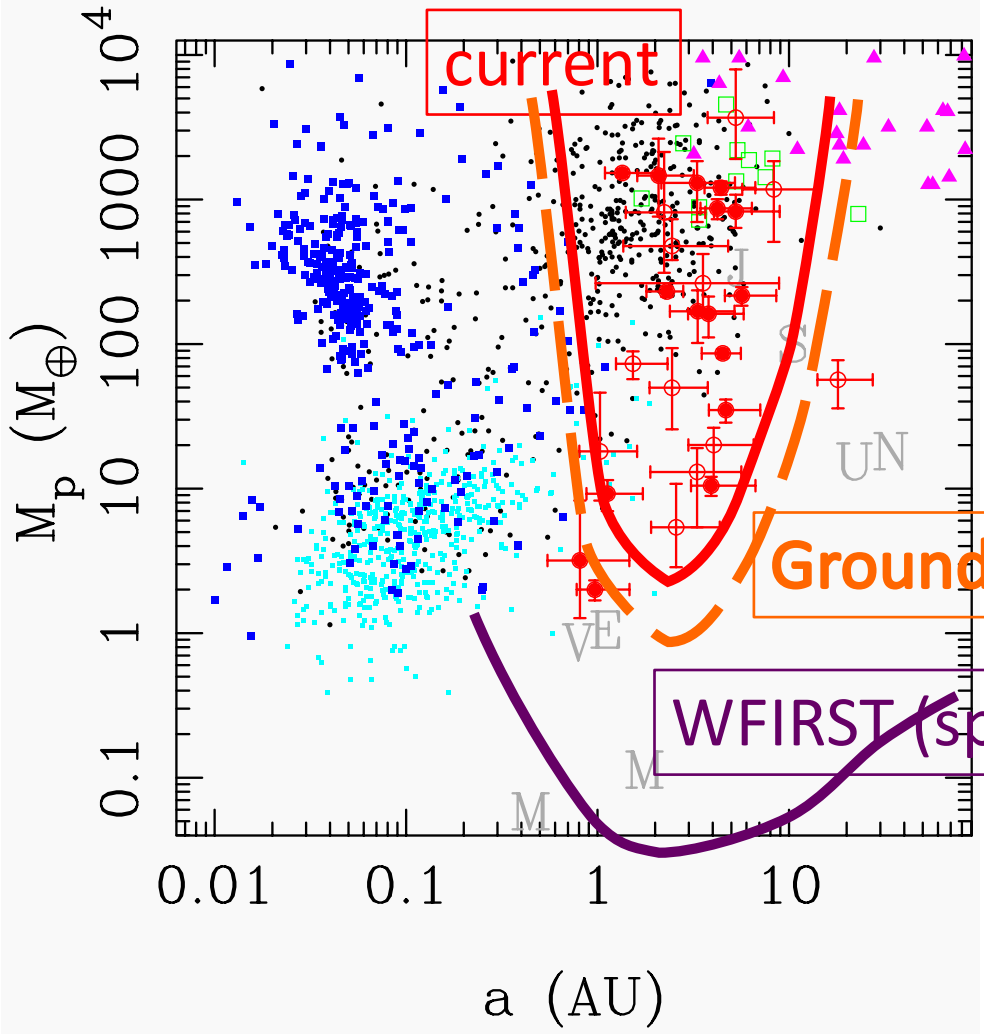


PRIME:

First dedicated NIR microlensing planet survey to study low-mass planets outside snowline

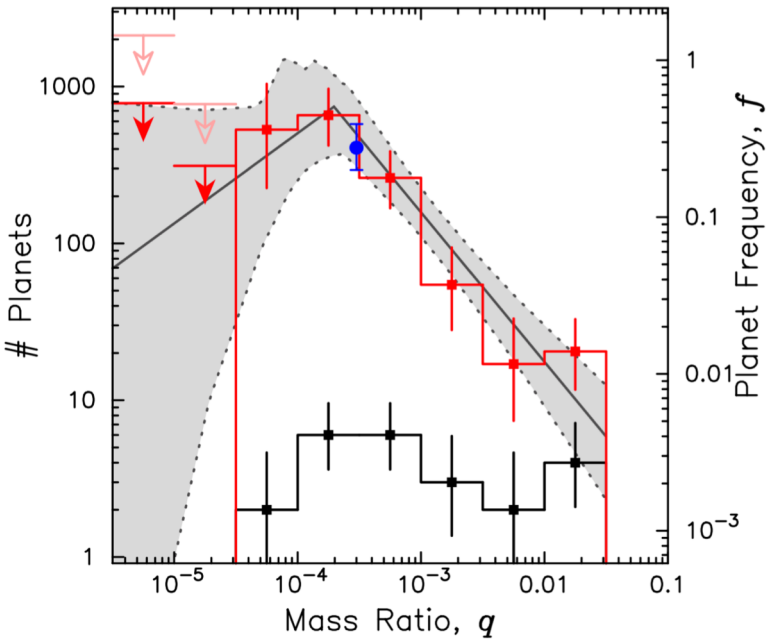
- Wide FOV
- NIR (mainly H-band for the survey)
- SAAO

Discovered Planets and microlensing Sensitivity



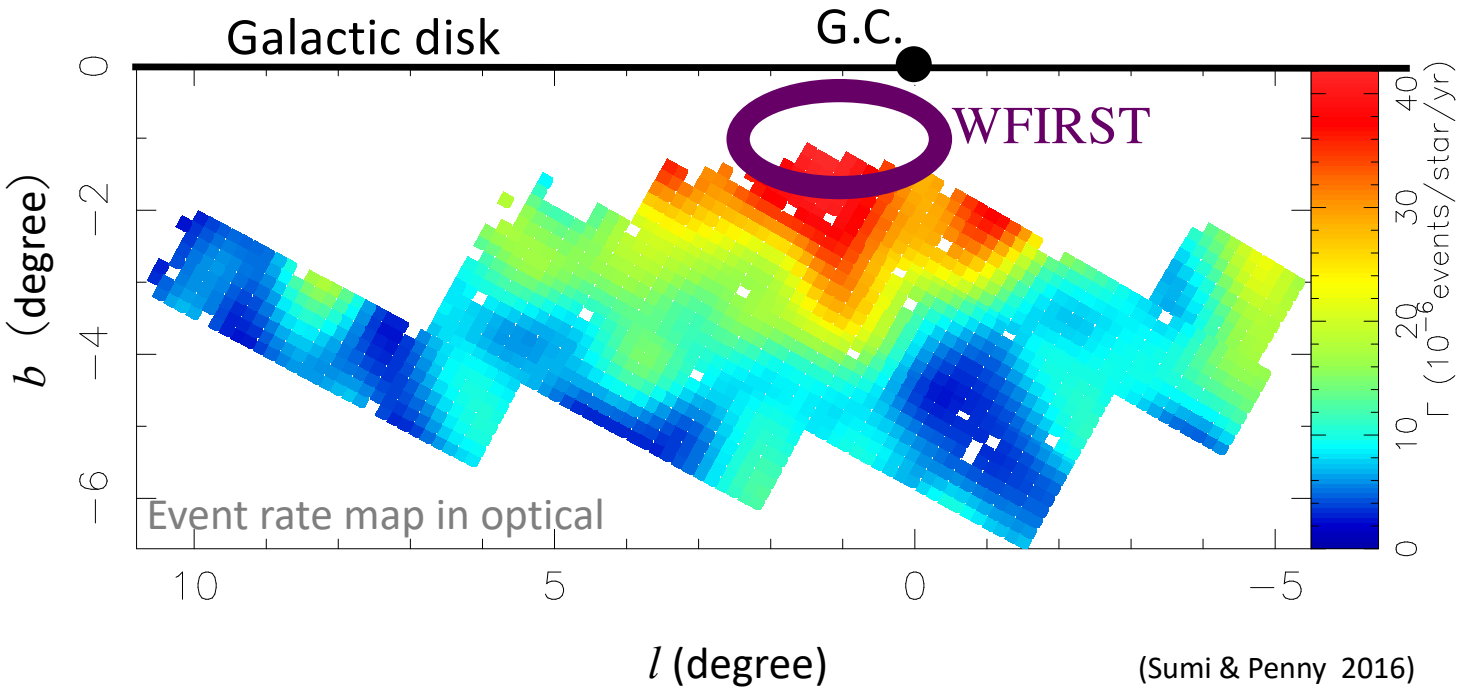
- RV
- Transit (*Kepler*)
- Direct imaging
- Microlensing
  - ● Mass measurements
  - ○ Mass by Bayesian

Suzuki+16



Precursor obs.

Optimize WFIRST microlensing survey fields by mapping the event rate in NIR



(Sumi & Penny 2016)

Event rate varies by a factor of 2（peak is at $l = 1$）

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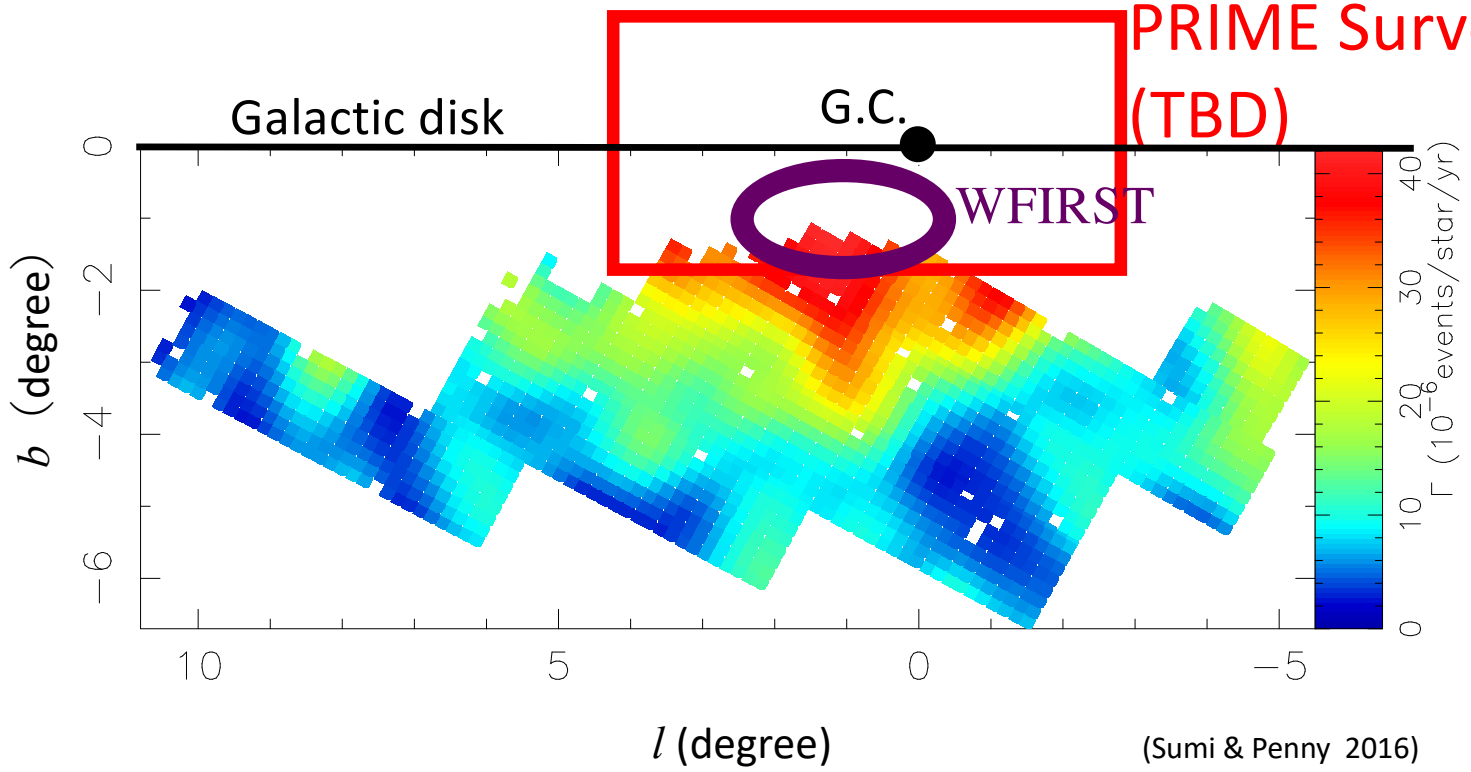

(Sumi & Penny 2016)

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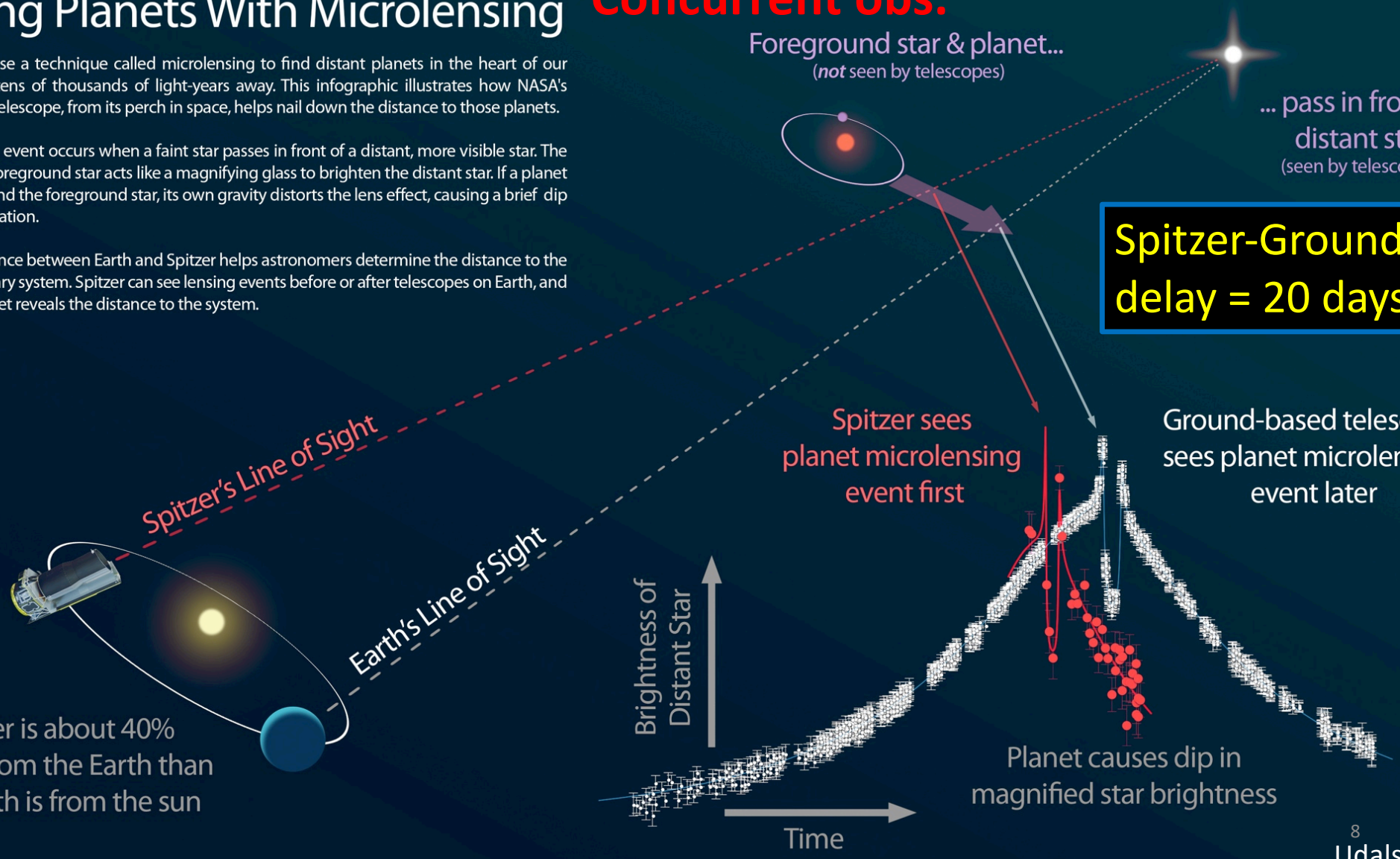
Finding Planets With Microlensing

Concurrent obs.

Astronomers use a technique called microlensing to find distant planets in the heart of our galaxy, up to tens of thousands of light-years away. This infographic illustrates how NASA's Spitzer Space Telescope, from its perch in space, helps nail down the distance to those planets.

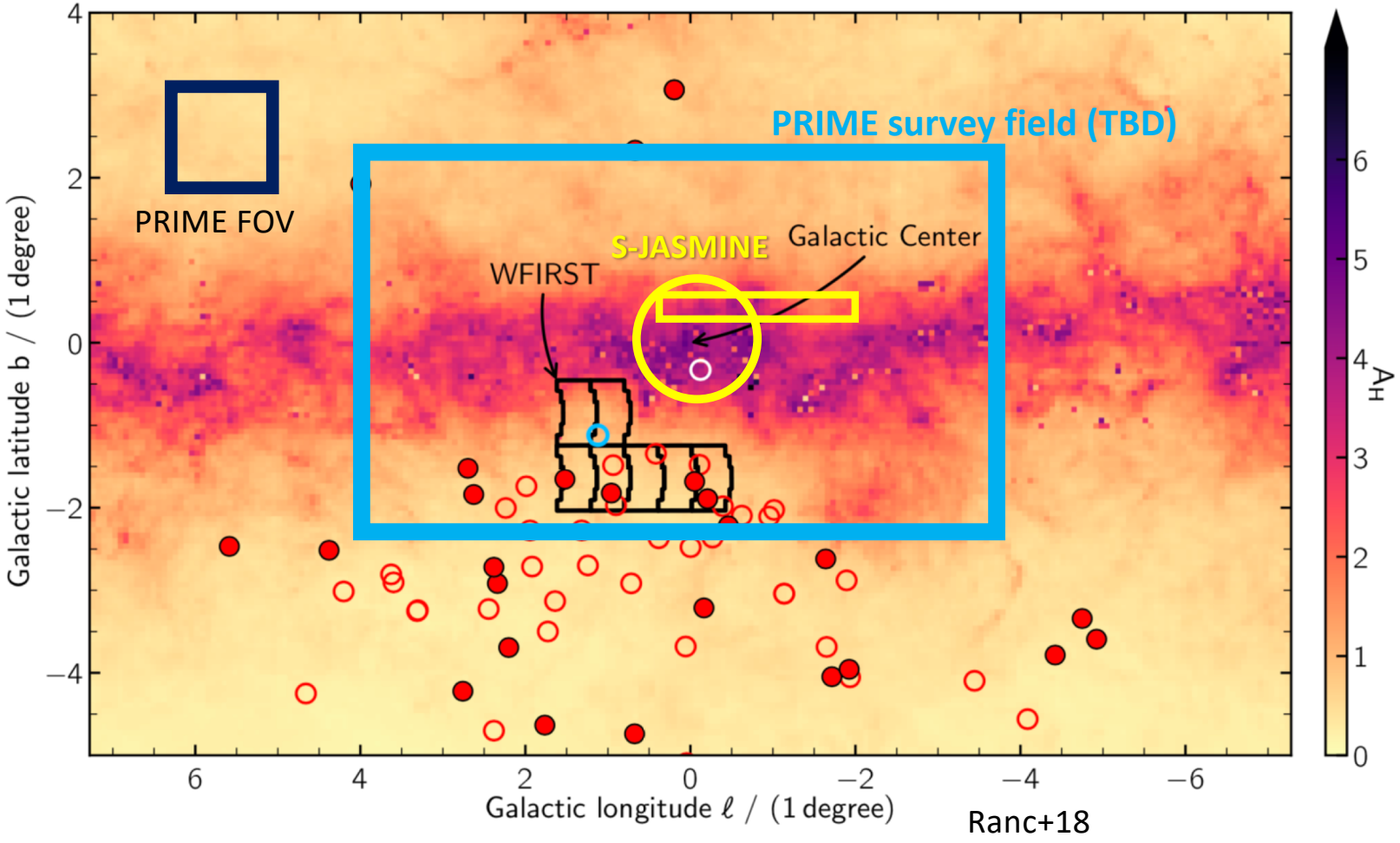
A microlensing event occurs when a faint star passes in front of a distant, more visible star. The gravity of the foreground star acts like a magnifying glass to brighten the distant star. If a planet is present around the foreground star, its own gravity distorts the lens effect, causing a brief dip in the magnification.

The great distance between Earth and Spitzer helps astronomers determine the distance to the lensing planetary system. Spitzer can see lensing events before or after telescopes on Earth, and this timing offset reveals the distance to the system.



Udalski+15

Galactic bulge surveys in 2020s



Ranc+18

PRIME Objectives

Bulge Season (primarily Apr-Sep)

- The first dedicated NIR microlensing survey
  - Study Earth-mass planets outside snowline
  - Planet frequency toward the Galactic Center
  - Optimize the WFIRST microlensing field (Precursor Obs.)
  - Concurrent observations with WFIRST

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Off Bulge Season (primarily Oct-Mar)

- NIR RV for habitable planets around M-dwarfs (SAND)
- NIR transit for M-dwarfs
- Transient GW, High-z GRB, SNe, etc (TBD)

Off-bulge season/time sciences (50% of time)

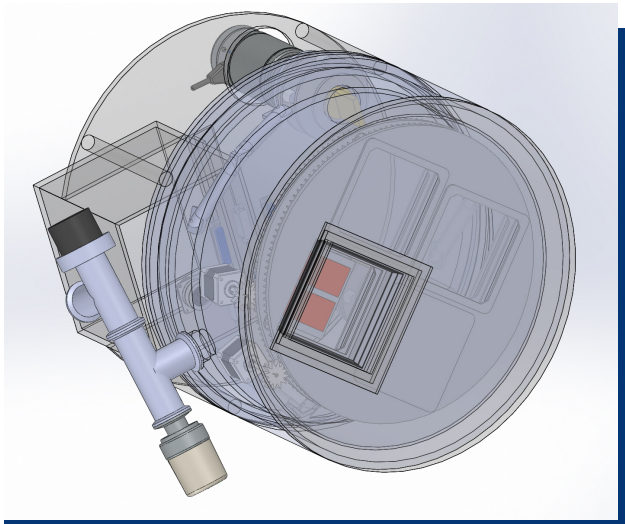
- NIR RV planet survey (12% for ABC time)
- 12% for Osaka U time
- 12% for UMD/NASA/WFIRST time
- 14% for SAAO time

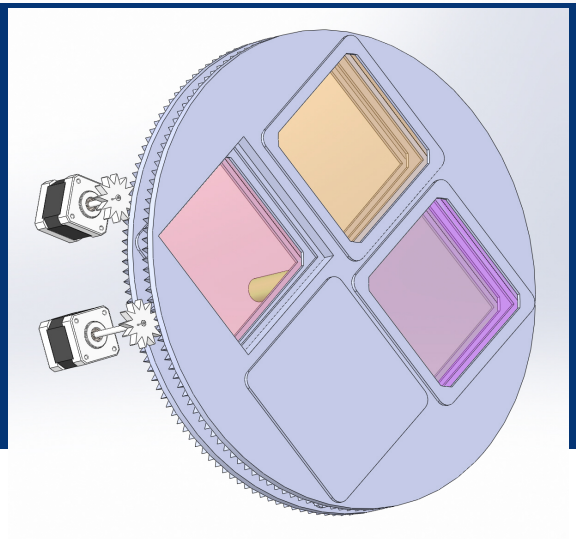
PRIME

(PRime-focus Infrared Mirolensing Experiment)

PI: T.Sumi (Osaka U)

Funded by JSPS





- Primary diameter: 1.8m (f/2.29)
- FOV: 1.56 deg^2 (0.5”/pix)
- Ave. Seeing: 1.4” (best: 0.7”)
- Detector: 4 x H4RG
- Filters: *Z*, *Y*, *J*, *H*, Narrow-bands
  - 1.06μm low OH
  - 1.19μm low OH, Lyα@z=9, [OII]@z=2.2, Hβ@z=1.5
  - 1.62μm Hα@z=1.5

Schedule (as of 2019 Sep)

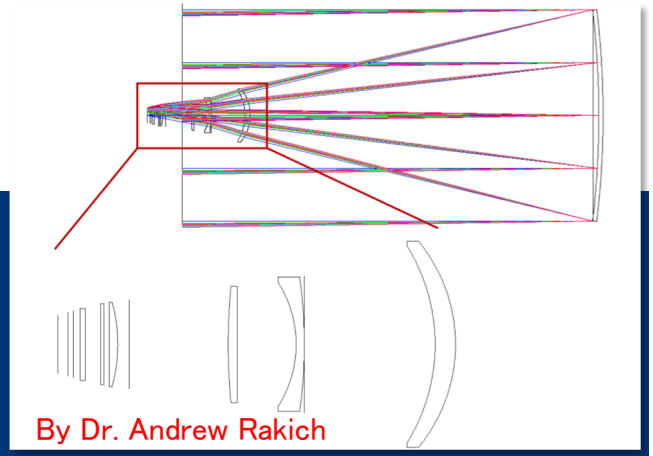
- 2019 manufacture, construction
- 2020 camera install, first light
- **2021 microlensing survey starts**

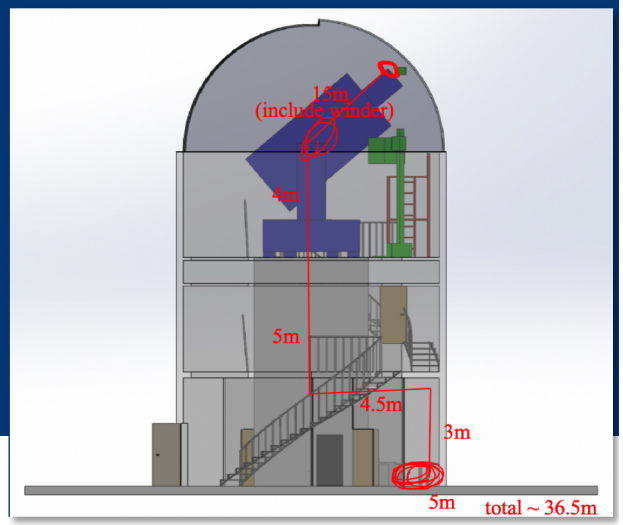
- 2023 create event rate map in the bulge
- 2025 WFIRST launch, concurrent obs. starts

- 2030 continue to the end of the WFIRST

Updates…

- Primary Mirror
  - Ready to be exported to Japan from Russia
- Lenses
  - AR coating for L1-L4 is done
  - Transmittance in *Z*-band (AR coating for L2-4) is worse than expected, but negligible for the microlensing survey
  - Will be shipped to Japan from NZ soon.
- Dome and Building
  - Construction will start in FY2019
- Test Camera





Summary

PRIME: PRime-focus Infrared Microlensing Experiment

- @SAAO, FOV = 1.56 deg^2, D= 1.8m, seeing= 1.4”, NIR
- $Z_{AB,\,Lim}$= 21.7, $Y_{AB,\,Lim}$= 21.0 , $J_{AB,\,Lim}$= 21.0 , $H_{AB,\,Lim}$= 20.4 (5σ, 300s exp., TBD)
  理想フィルタープラン
- **NB filter**:
  - 1.06μm (*Y*-band) low OH
  - 1.19μm (*J*-band) low OH, Lyα@z=9, [OII]@z=2.2, Hβ@z=1.5
  - 1.62μm (*H*-band) Hα@z=1.5
- **Off-bulge time science**…
  - NIR RV planet survey (w/ SAND), NIR transit planet survey, transient (GW, GRB, SNe…), Narrow Band survey, etc
- **First Light in 2020**