Using Subaru for Finding Isolated Stellar Mass Black Holes with Microlensing

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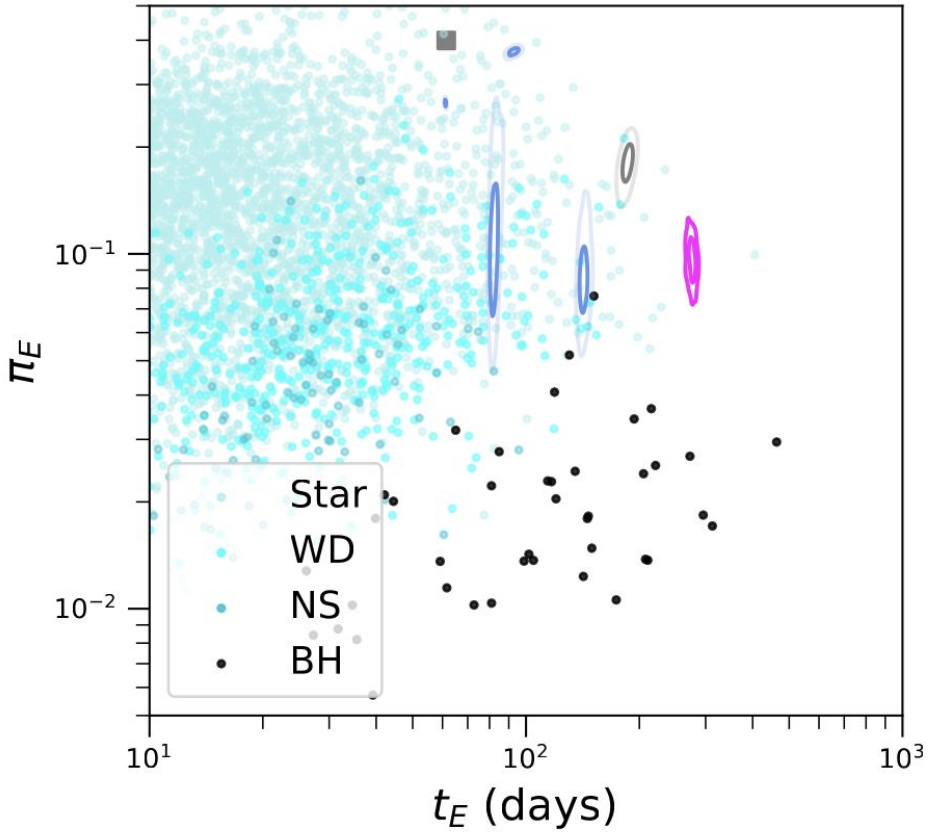
Idea 1: Use ULTIMATE Subaru to fill Roman survey season gaps.

Roman survey season gaps are problematic for black hole microlensing detections.



Free-floating black holes can be found and weighed when they gravitational lens a background star.

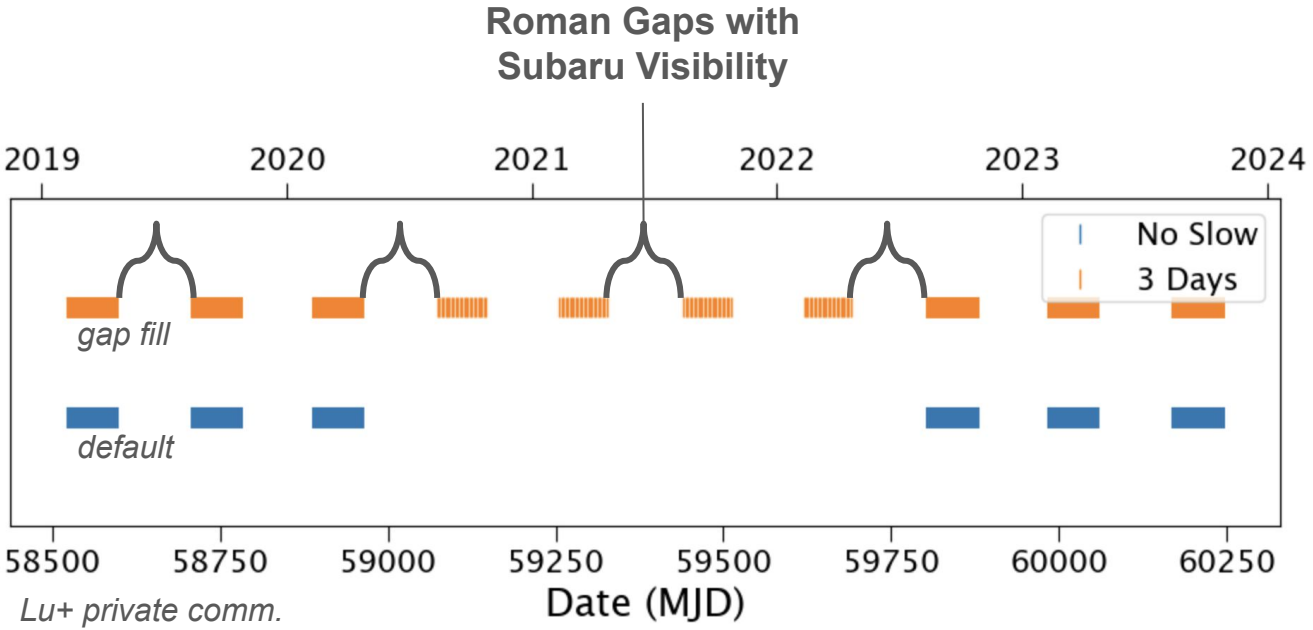
Black holes have long timescales (tE~100 days) and low microlens parallax signals (piE<0.08).

Lam+2020, Rose+2022, Abrams+ submitted

Use ULTIMATE Subaru to fill Roman survey season gaps.

- Roman only sees the Bulge in 2 x 72 day seasons centered on vernal (~Mar 20th) and autumnal (~September 20th) equinoxes.
- Subaru sees the Bulge (for > 1 hr) between March and September. Subaru can fill in the 108 day gap (mid-April through mid-August).

Subaru is preferred over PRIME thanks to GLAO improved spatial resolution.



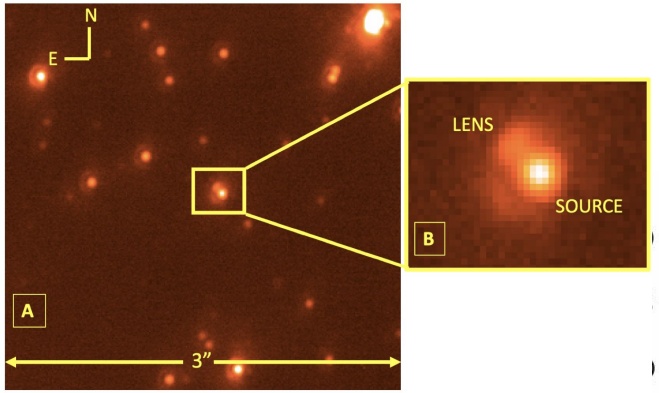
Lu+ private comm.

Considerations

- Queue vs classical mode: **Either**
- Cadence: TBD, evaluate 1, 3, vs. 10 night cadence
- Issues: The Bulge is not as visible from the North than the South

Idea 2: Use Subaru ULTIMATE-START to explore atmospheric tomography algorithms needed for future visible-light AO systems

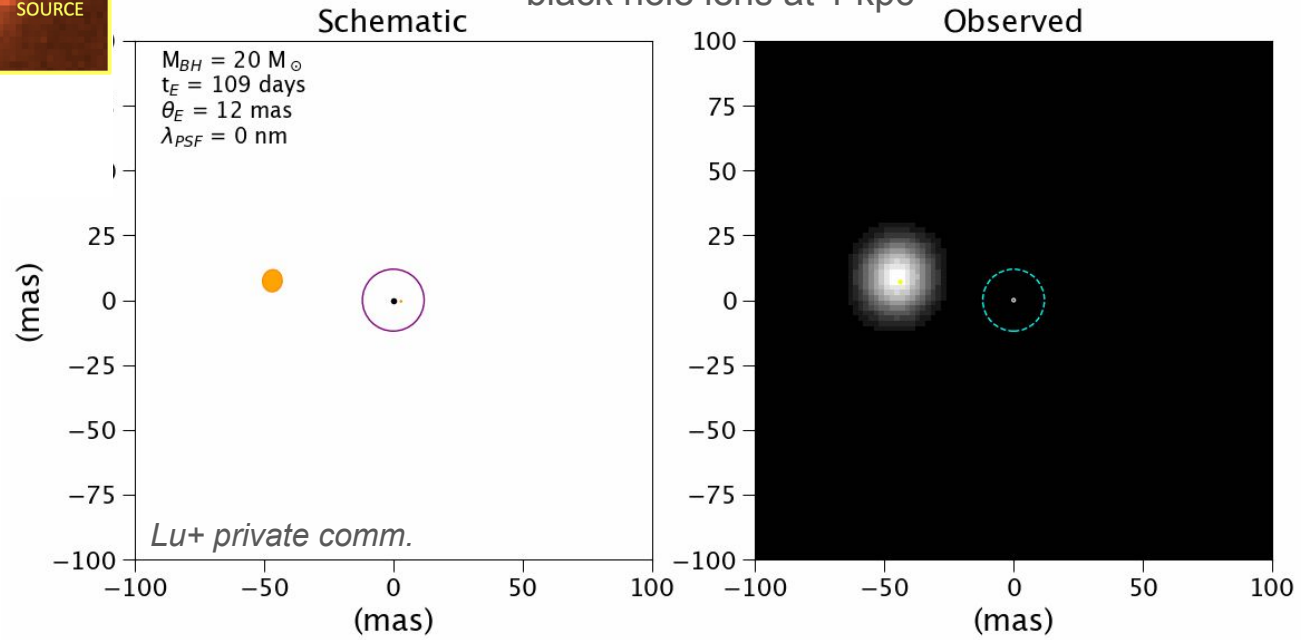
Microlensing events benefit from very high-resolution imaging during or long-after the event.



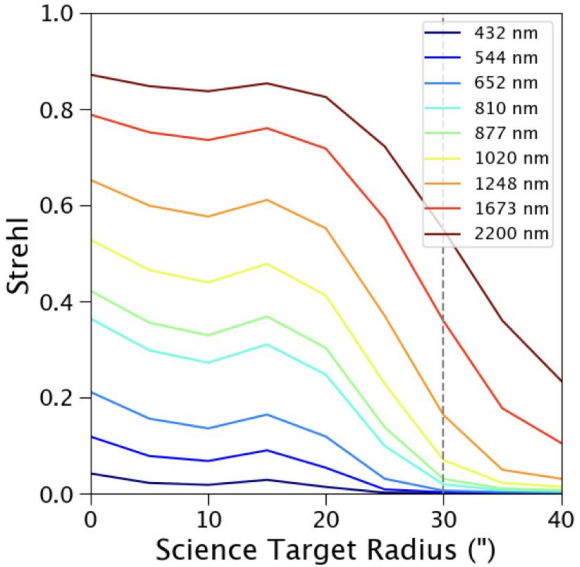
Bhattacharya+ 2023

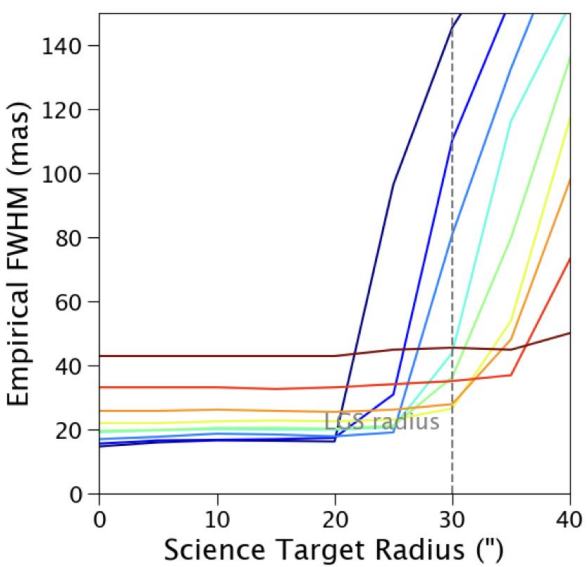
Separate lens and source <2 years after event (currently >5 years)

Resolve lensed images for 20 Msun black hole lens at 1 kpc



Diffraction limit on 8-10 m telescopes is 15-20 mas in the visible. Use Subaru ULTIMATE-START to explore atmospheric tomography algorithms needed for future visible-light AO systems (eg KOLA at Keck).





Preliminary simulations of KOLA performance. Limited by knowledge of Earth's atmospheric turbulence profile.

Lu+ 2024

Considerations

- Queue vs classical mode: **Classical mode** (mostly engineering)
- Cadence: **Just a few ½ nights.**