



WFIRST-AFTA: A Strategic Cosmology & Exoplanet Mission for the 2020s

Wes Traub

Jet Propulsion Laboratory, California Institute of Technology

Concurrent Astronomy Missions in the Next Decade- JWST, WFIRST, and SOFIA
American Institute of Aeronautics and Astronautics (AIAA)
Space and Astronautics Forum and Exposition (Space 2015)

Pasadena Convention Center

2 September 2015



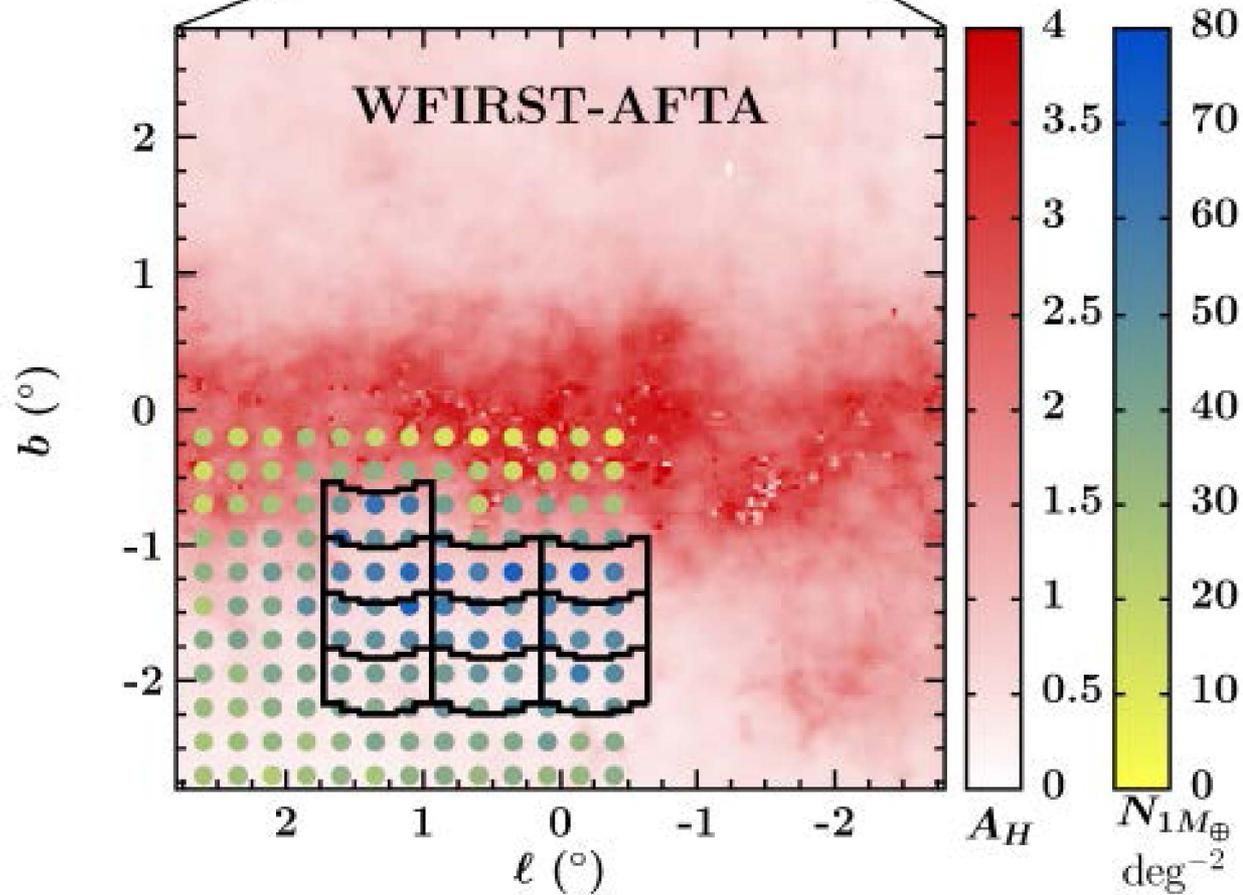
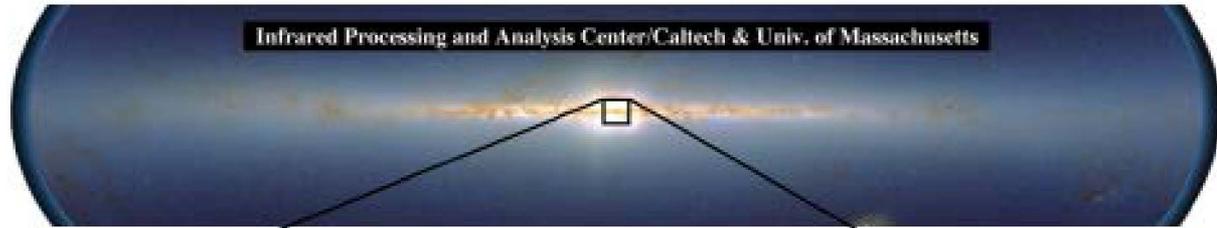
- How does the universe work?
 - Black holes, dark energy, dark matter, gravity
- How did we get here?
 - Origin and evolution of galaxies, stars, and planets
- Are we alone?
 - Discover and explore exoplanets; look for ability to harbor life
- Wide Field Instrument (WFI)
 - Hubble-like images, but 200 times the HST field of view
 - Cosmology & also gravitational microlensing of exoplanets
- Coronagraph Instrument (CGI)
 - Images & spectra of exoplanets & disks in reflected starlight

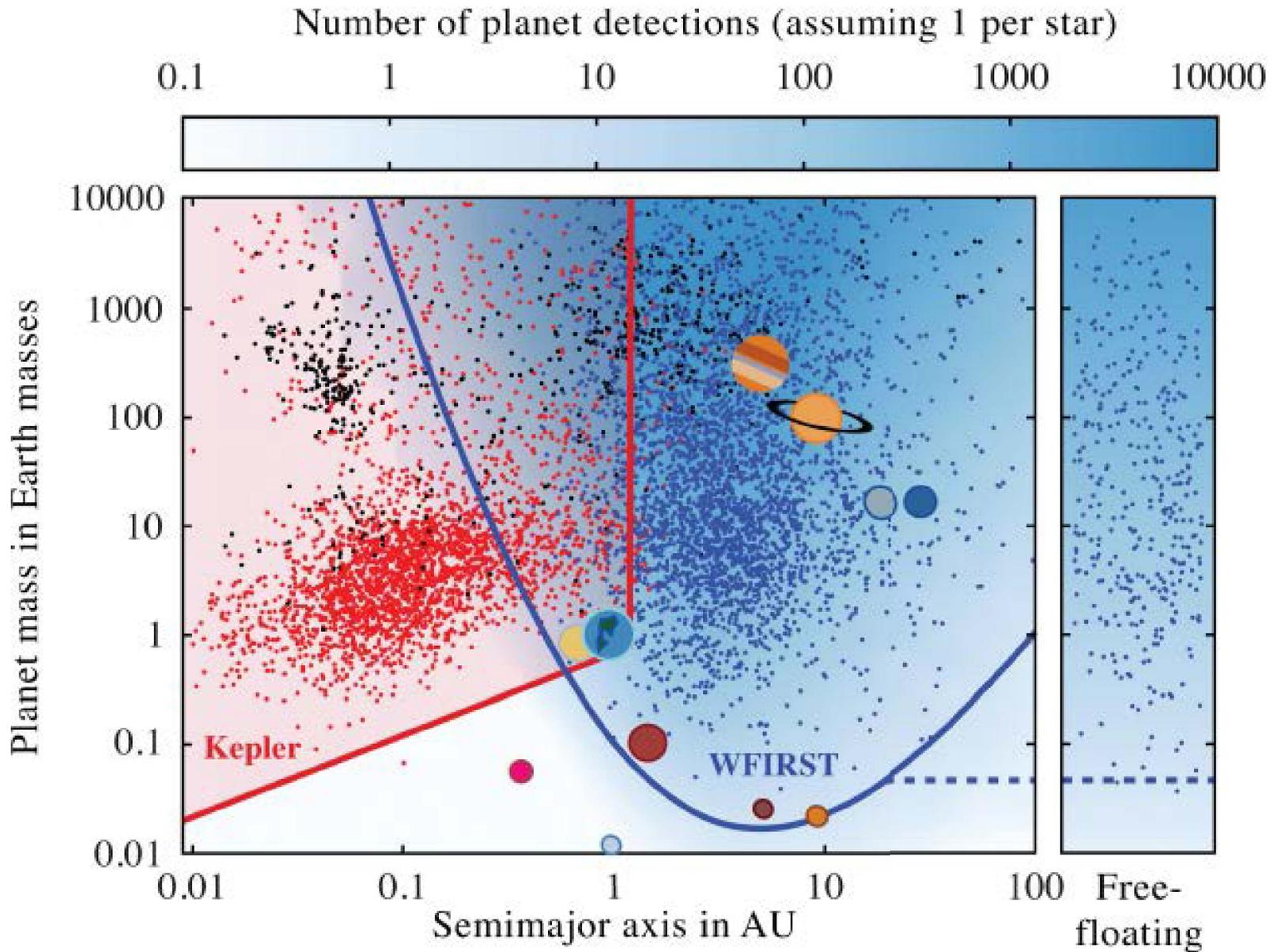
- 2 instruments on WFIRST-AFTA will detect and characterize exoplanets and disks:
 - Gravitational microlensing toward the galactic center
 - Direct imaging in the solar neighborhood
- Space-based measurements compliment ground-based ones



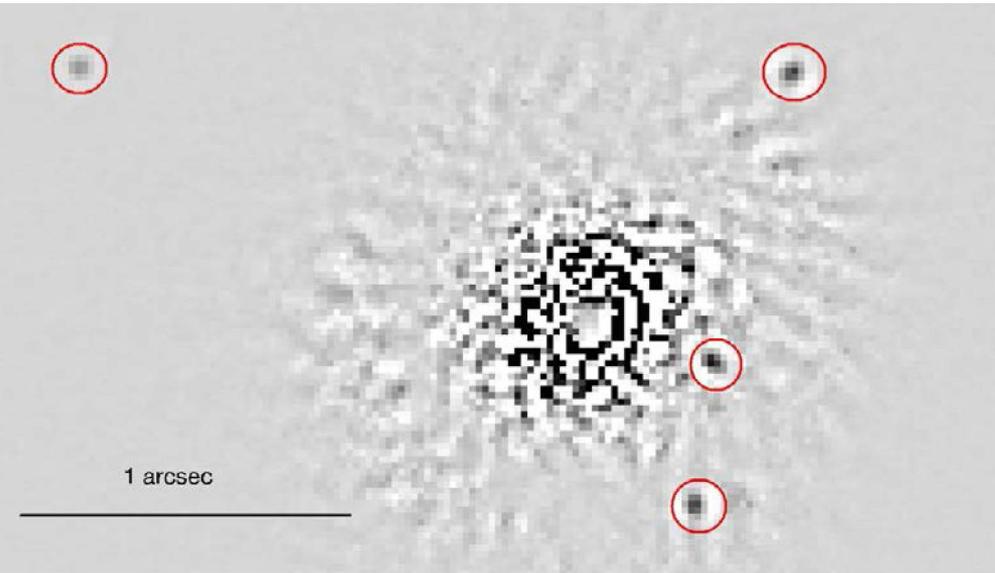
Gravitational microlensing science

AFTA WFIR
Wide-Field Infrared Survey Telescope





Coronagraph science



TODAY: 4 red-hot planets, glowing in the infrared, as seen from the ground

The star was suppressed by a coronagraph, leaving noise & scattered light

These planets are $\sim 10,000$ times fainter than their star

2024: WFIRST will image planets (Jupiters to Super-Earths), by reflected star-light, ~ 1 billion times fainter than their star.

Ref. 1: Esposito et al. A&A 549 A52 2013, Large Binocular Telescope, H-band image of HR 8799.



This is ***HARD***, like having a firefly...



AFTA WFIR T
Wide-Field Infrared Survey Telescope



... next to a searchlight ...

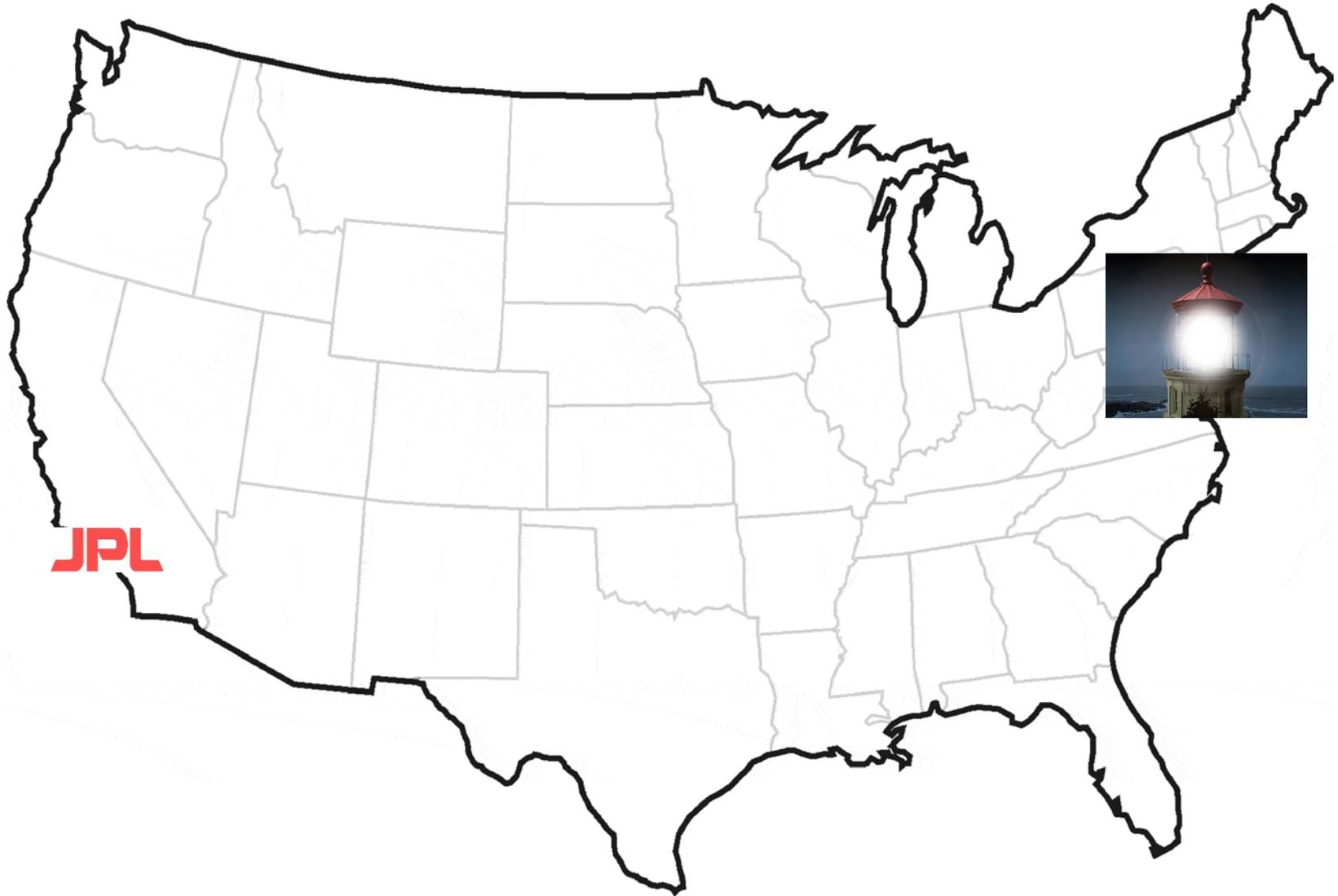


AFTA WFIR T

Wide-Field Infrared Survey Telescope



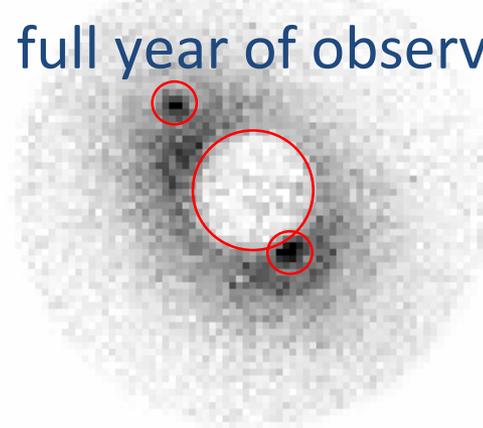
... 3000 miles away !



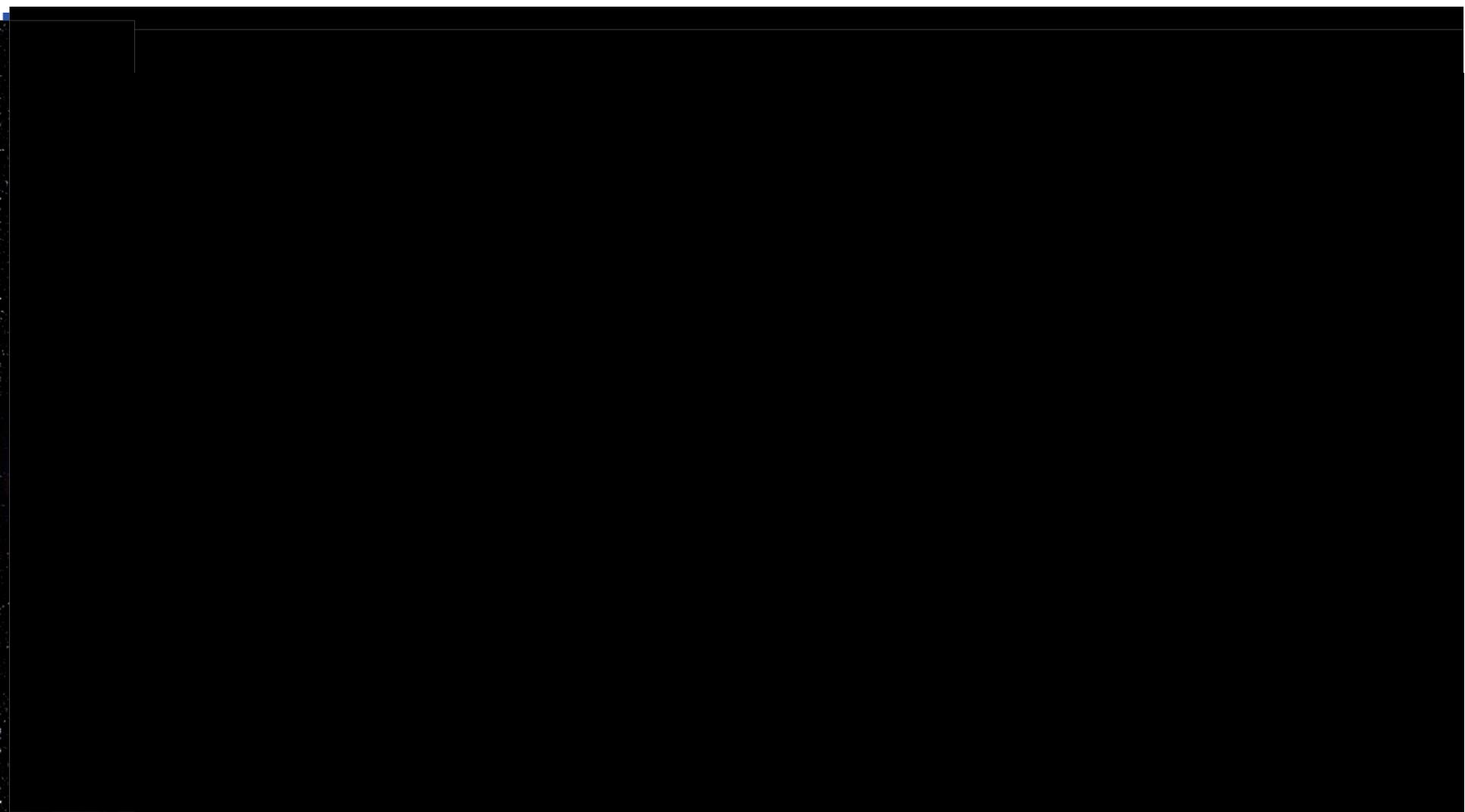
AFTA WFIR T

Wide-Field Infrared Survey Telescope

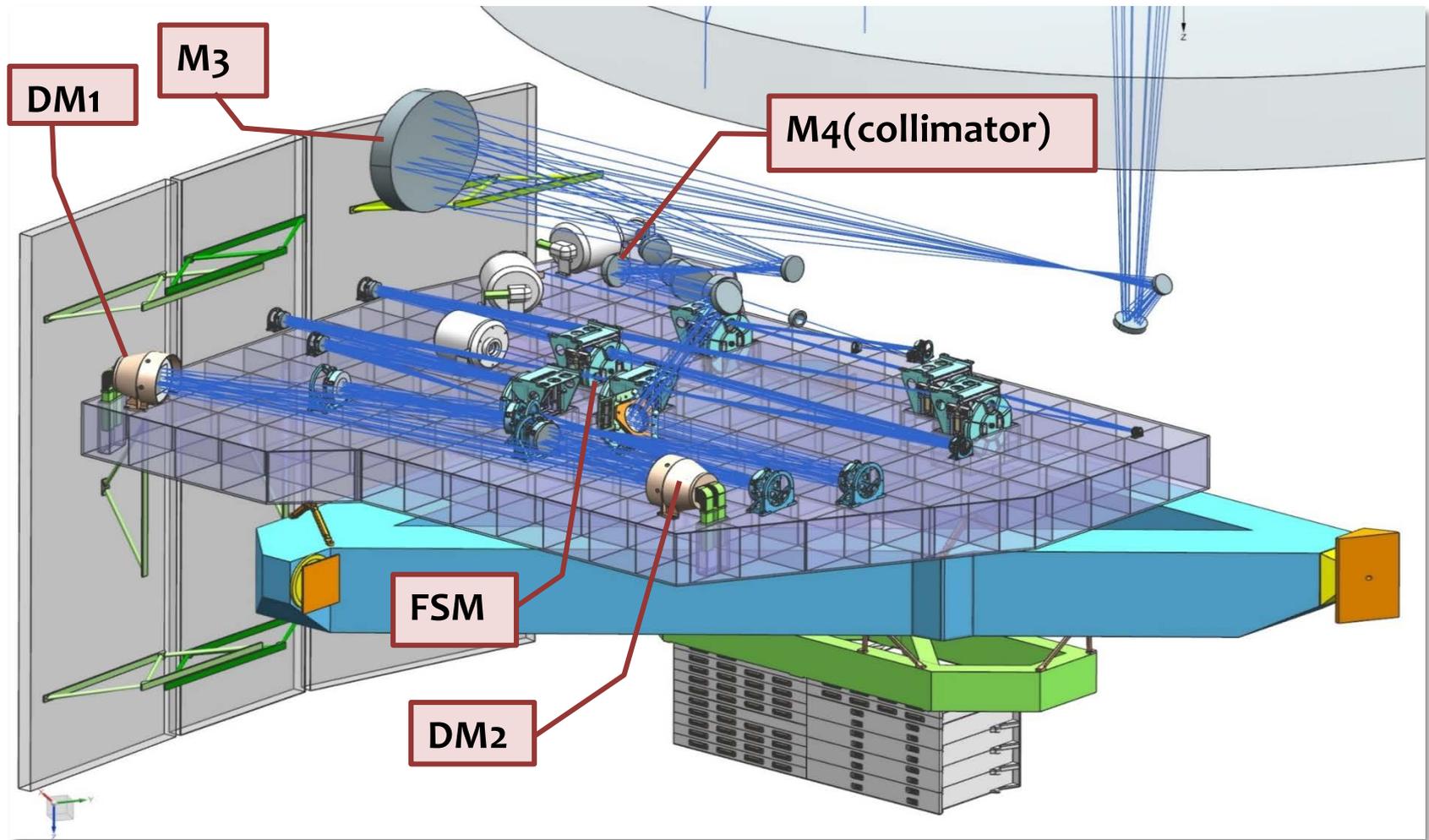
- The coronagraph on WFIRST will give full-color images and spectra of reflected-light exoplanets around dozens of stars
- The coronagraph will also image disks that are too faint and close to their stars to observe from the ground
- The coronagraph will give us a 50-50 chance to directly detect a rocky planet in a habitable zone (water on surface)
- The coronagraph will provide a technology demonstration of direct imaging in space, to prepare for the 2020s
- For these reasons, WFIRST was extended to 6 years, giving the coronagraph a full year of observing time

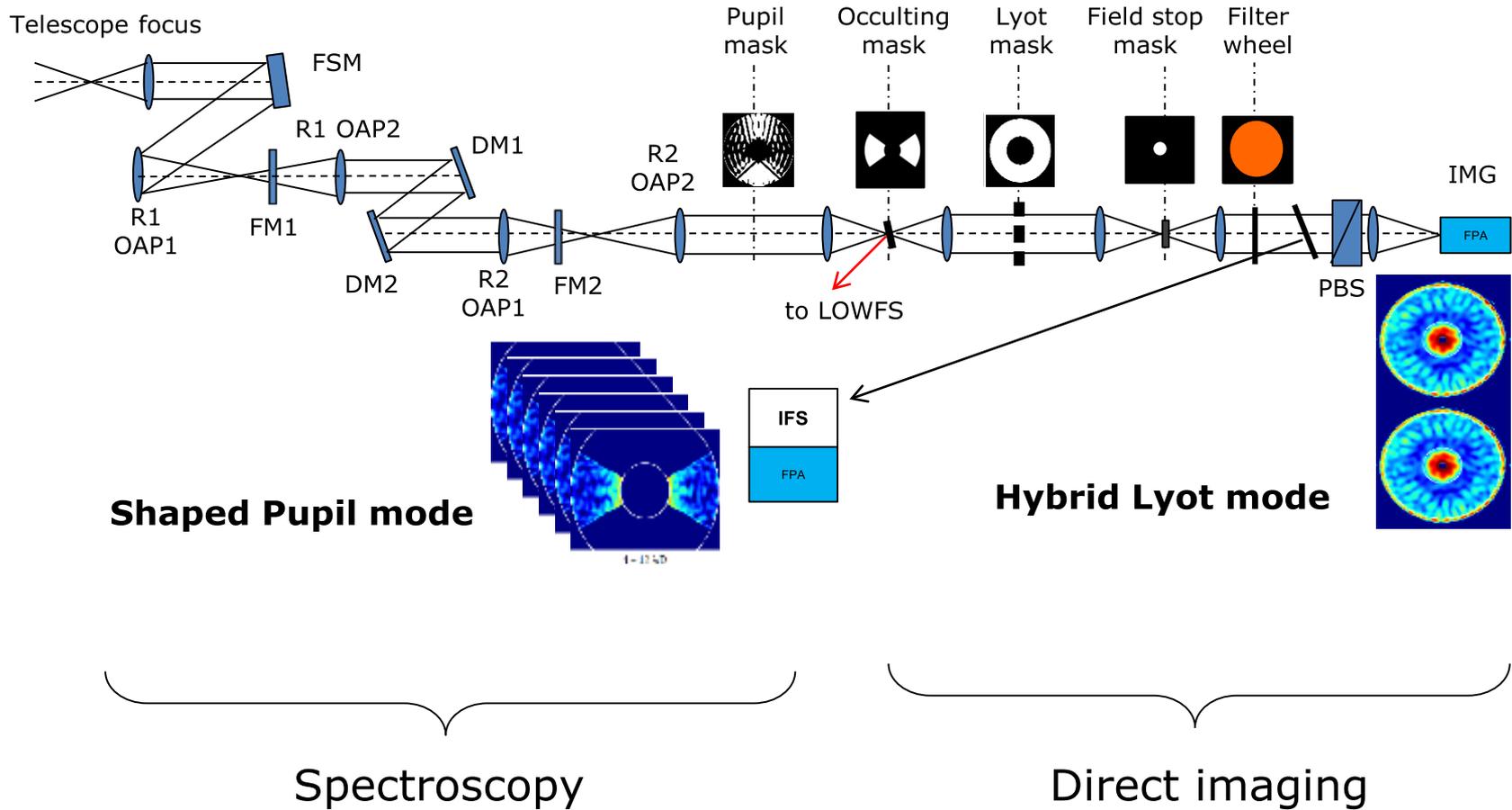


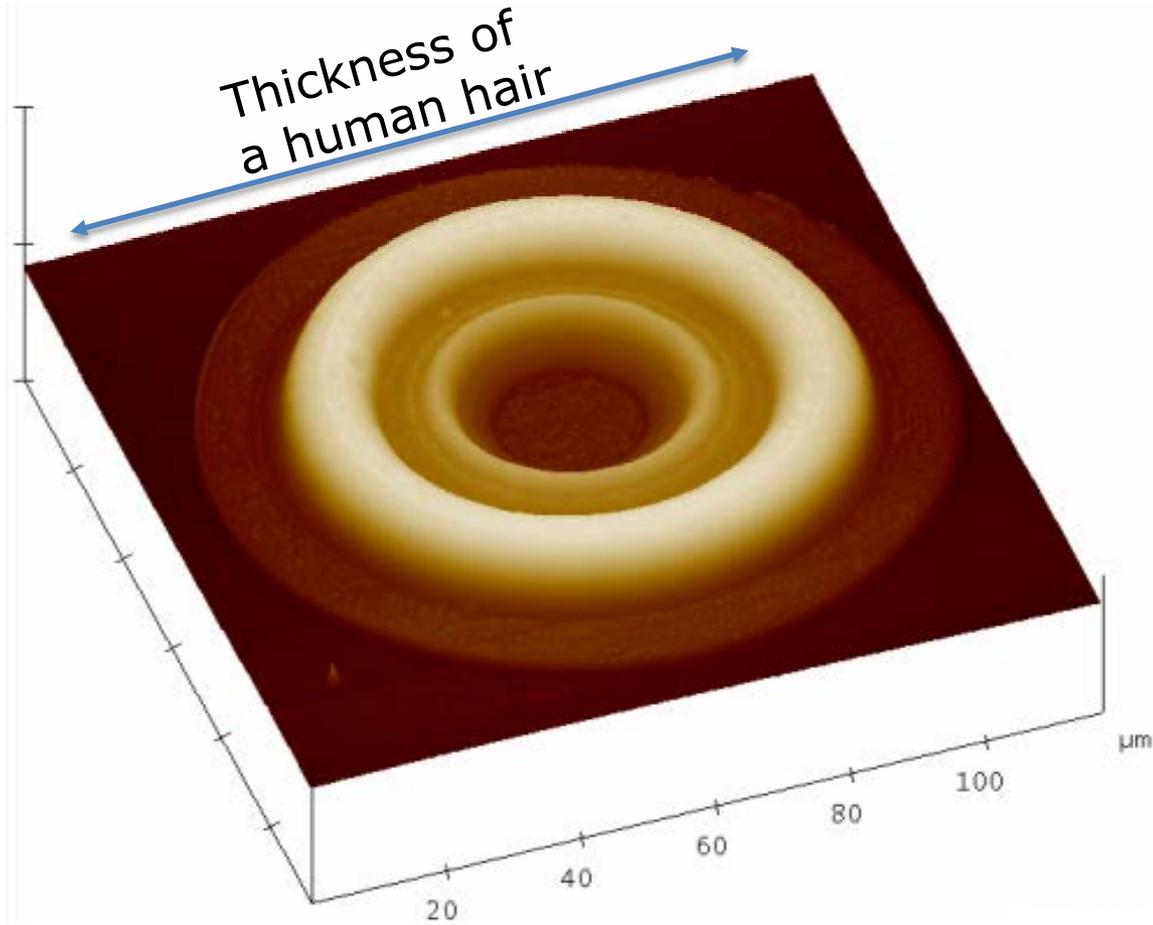
Coronagraph instrument



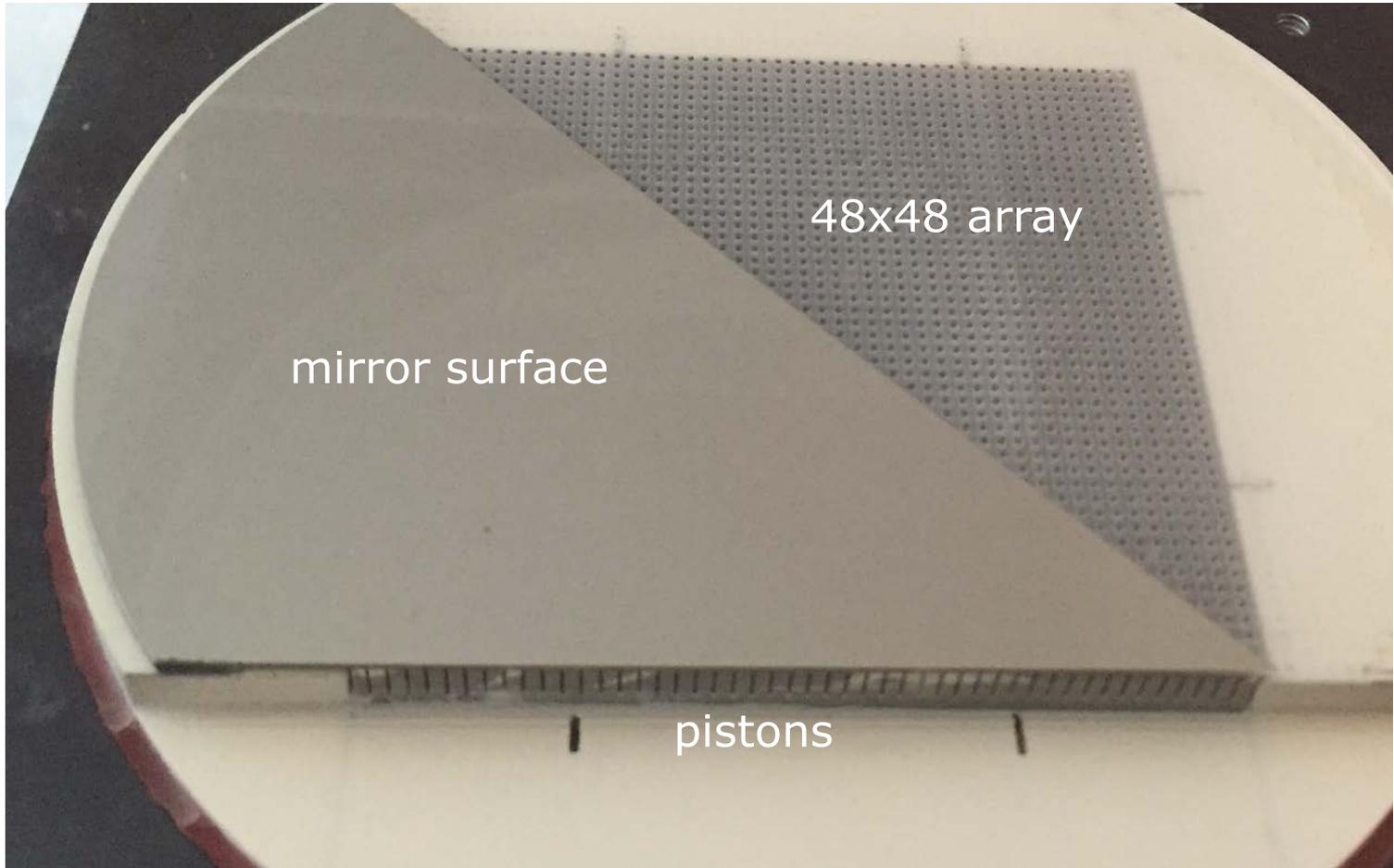
AFT
Wide-F

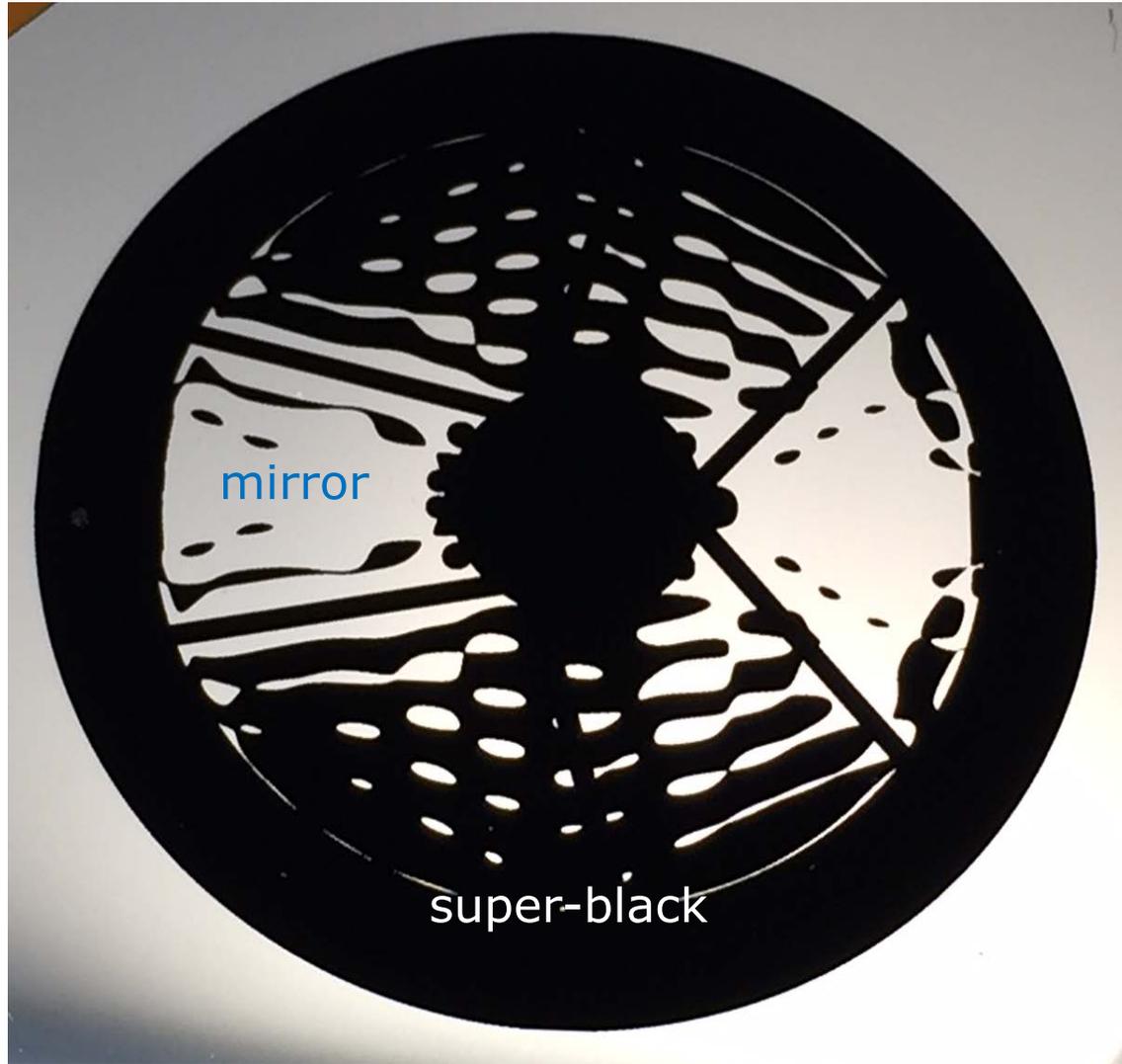




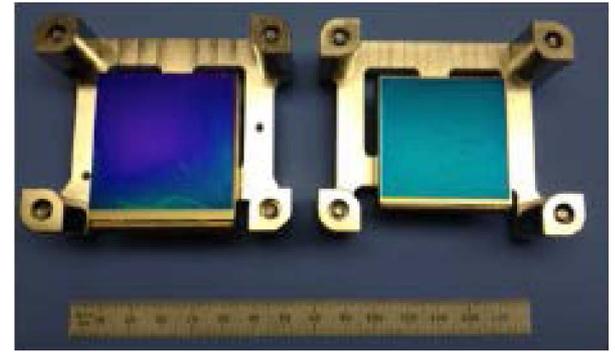


Atomic force microscope image





- \$106.5M WFIRST funding added to the NASA budget by Congress for FY14 & FY15
- Funding for pre-formulation work to reduce risks and prepare for a rapid start
- Industry engagement through an RFI
- Technology development on schedule - ready to start formulation phase in CY16



WFIRST

**Scheduled for
launch in 2024**

Delta IV Heavy



AFTA WFIRST

Wide-Field Infrared Survey Telescope



Thank you!

AFTA WFIR
Wide-Field Infrared Survey Telescope