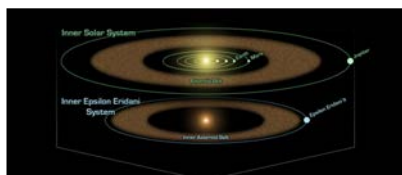


Planetary Imaging Concept Testbed Using a Recoverable Experiment - Coronagraph (PICTURE – C): A high altitude balloon experiment to directly image and characterize debris disks around nearby stars

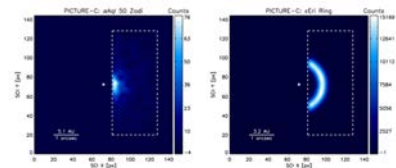
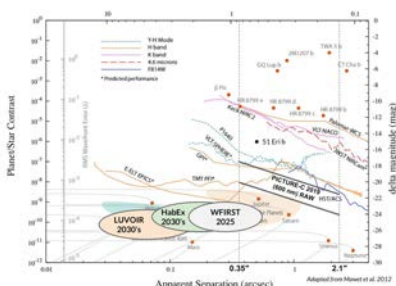
S. Chakrabarti, C. Mendillo, K. Hewawasam, G. Howe, J. Martel, S. Mukherjee, T. Cook, S. Finn, K. Cahoy, M. Kuchner, N. Lewis, D. Mawet, B. Mazin, E. Serabyn, D. Stuchlik, M. Swain

Send correspondence to: Supriya_Chakrabarti@uml.edu; University of Massachusetts Lowell, Lowell, MA

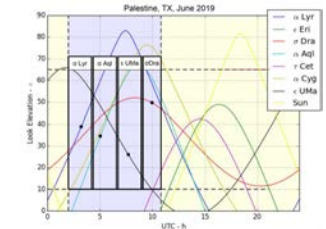
Background and goals



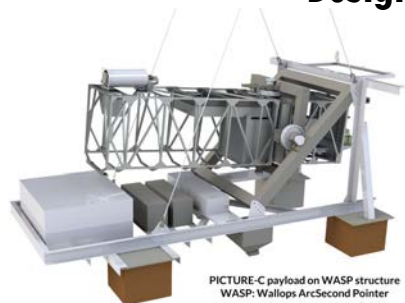
The goal of the PICTURE-C is to directly image and spectrally characterize dust and debris orbiting nearby stars with the possibility of discovering bright, gas giant exoplanets. This dust fills the exoplanetary habitat, thermally emitting in the infrared and reflecting visible starlight.



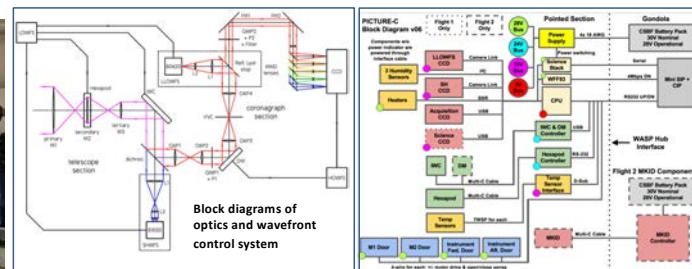
PICTURE-C will characterize the brightness, morphology, composition and grain size distribution of this dust. These properties inform our concepts of planetary formation and help place our own Solar System in a larger context.



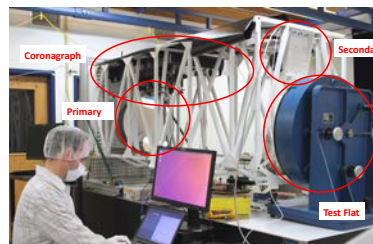
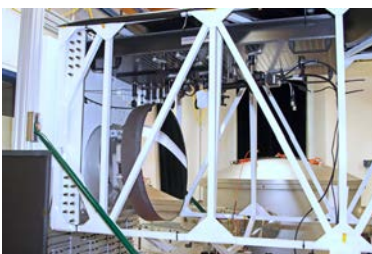
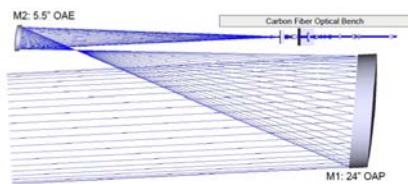
Design, implementation, laboratory test results and status



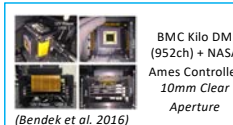
WASP



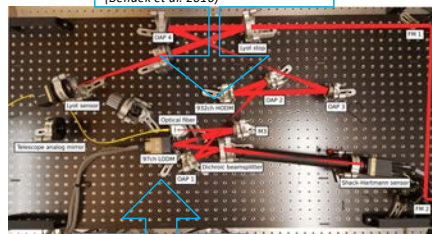
Block diagrams of optics and wavefront control system



Aperture	Bandpass	FOV	Contrast (flight 1 flight2)
24"	540-660 nm	0.35" - 2.1"	< 10 ⁻⁴ / < 10 ⁻⁷

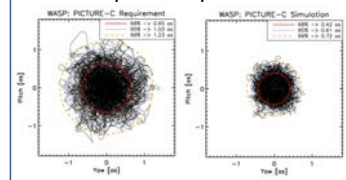


BMC Kilo DM (952ch) + NASA Ames Controller 10mm Clear Aperture (Bendek et al. 2016)

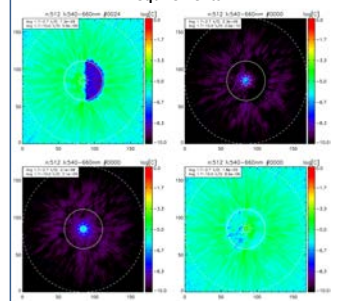


ALPAO 97ch DM + Tip/tilt 13.5mm Clear Aperture

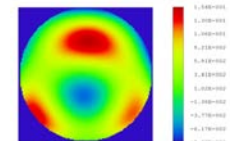
WASP gondola's pointing performance is within experiment requirements



Expected contrast (2nd flight) meets experiment requirements



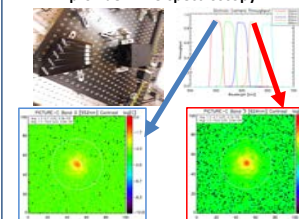
Thermal + Despace + 1g: Corrected with Hexapod (M2)



Corrected: WFE: 0.240 waves P-V (72 nm surface)

Hexapod-corrected wavefront error after thermal and gravitational distortion is comparable to the surface polishing errors.

First light from a simple 5-color imager to provide R ~25 spectroscopy



Summary

- PICTURE-C is the third in a series of suborbital experiments specifically designed to develop and validate key technologies needed for direct imaging of exoplanets, their environments and their spectral characterization.
- The previous two sounding rocket experiments (PICTURE and PICTURE-B) demonstrated space operations of a visible nulling coronagraph, a MEMS-based 1,000-channel deformable mirror and a 5-mas fine pointing system.
- Utilizing these developments, PICTURE-C will obtain direct images and low-resolution spectra of three known targets
- Its first flight scheduled for June, 2019.



AGU 100 FALL MEETING Washington, D.C. | 10-14 Dec 2018

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