THE ORIGINS SPACE TELESCOPE M. Meixner[1] and A. Cooray[2] and the *Origins* Study Team[3], [1]STScI/JHU, 3700 San Martin Dr., Baltimore, MD 21218, meixner@stsci.edu, [2]UC Irvine, 4186 Frederick Reines Hall, Irvine, CA, 92697, acooray@uci.edu, [3]study website: https://asd.gsfc.nasa.gov/firs/team/, https://origins.ipac.caltech.edu/page/team

Introduction: Half of the light emitted by stars, planets, and galaxies over the lifetime of the Universe emerges in the infrared. The Origins Space Telescope (*Origins*) will access this information-rich spectral region to uncover the crucial missing pieces of our cosmic history. *Origins* is a community-led, NASA-supported mission concept study in preparation for the 2020 Astronomy and Astrophysics Decadal Survey.

***Origins* Baseline Mission Concept:** The *Origins Space Telescope* [1, 2] and its suite of instruments will utilize next-generation detectors and operate with spectral resolving power in steps from ~3 to 3×10^5 over wavelengths from 2.8 to 590 μm, the telescope and instruments will be cryocooled to 4.5 K, and the light collecting area, 25 m^2, will match that of JWST. We present a low-risk design concept that has minimal dependence on deployments and leaves appropriate margin between science-driven measurement requirements and estimated performance. The telescope's 5.9 m diameter primary mirror is segmented, like JWST, but round and it launches in its operational configuration. This departure from the JWST approach is enabled by new launch vehicle capabilities now in development. The telescope is a three-mirror anastigmat with an on-axis secondary. The telescope is diffraction limited at 30 μm and is used as a light bucket at shorter wavelengths.

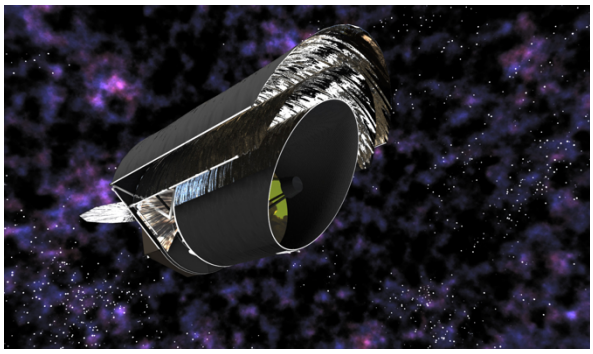

Figure 1: The Origins Space Telescope will enable high-impact science in all three of NASA's key astrophysics areas, and our concept for the mission is low-risk and executable in the decade ahead. We recommend a *Spitzer*-like architecture.

Three science instruments provide powerful, new spectroscopic and imaging capabilities: *Origins* Survey Spectrometer (OSS, 25-590 μm) [3], Far-infrared Imager and Polarimeter (FIP, 50 and 250 μm) [4], Mid-Infrared Spectrometer and Camera (MISC) – Transit spectrometer (TRA, 2.8-20 μm) [5].

***Origins* Science:** *Origins* enables revolutionary scientific discoveries in many areas including:

How does the Universe work? Origins will probe our earliest cosmic origins by charting the rise of dust and metals in galaxies over cosmic time, and determine how the coevolution of star formation and supermassive black holes leads to the diversity in galaxies today.

How did we get here? Origins will follow the trail of water from the birth of the planet-forming disk to the assembly of pre-planetary materials, and in comets to understand the origin of Earth's oceans.

Are we alone? Origins will measure biosignatures in transiting exoplanet atmospheres at mid-infrared wavelengths to assess the habitability of nearby exoplanets and search for signs of life.

Equally important to these compelling questions, OST will be a flagship general observatory which provides the astronomical community access to unprecedented discovery space in the infrared. OST will be up to a factor of 1000 more sensitive than previous far-infrared space telescopes. Its versatile instrument suite will enable deep and wide 3D surveys of the sky from the most distant galaxies to the outer reaches of our Solar system. The ultra-stable mid-infrared spectrometer will build upon JWST's expected work on exoplanets and push it to detection of biosignatures.

This presentation describes the OST baseline mission concept and spotlight its vast science potential.

References:

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[3] Bradford, C.M., Cameron, B. et al. (2018), *SPIE, 10698*, 18

[4] Staguhn, J., Amatucci, E., et al. (2018), *SPIE, 10698,* 1

[5] Sakon, I., Roellig, T., et al. (2018), *SPIE, 10698,* 17

Additional Information:

https://origins.ipac.caltech.edu

https://asd.gsfc.nasa.gov/firs/