LUVOIR: SURVEYING THE COSMOS AND CHARACTERIZING EXOPLANETS. D. A. Fischer[1], B. M. Peterson[2,3], A. Roberge[4], S. Domagal-Goldman[4], and the LUVOIR Science and Technology Definition Team. [1]Yale University (52 Hillhouse Ave, New Haven, CT 06511, debra.fischer@yale.edu), [2]The Ohio State University, [3]Space Telescope Science Institute, [4]NASA Goddard Space Flight Center.

Introduction: The Large UV-Optical-Infrared (LUVOIR) surveyor is one of four NASA mission concepts under study for the 2020 Astrophysics Decadal Survey. The telescope would be located at L2 and designed for decades of use as a serviceable space observatory. The telescope must be capable of advancing our understanding of cosmic origins, exoplanets, and the solar system far beyond what will be achieved by the next two decades of observations from other space- or ground-based facilities. LUVOIR will make significant astrobiological discoveries having to do with the origins of and evolution of material incorporated into planetary bodies, the search for signs of habitability and life on exoplanets, and detailed spatial mapping of habitable environments within our solar system.

The Science Technology Definition Team (STDT) is considering the trade-offs between a 9-m and 14-m aperture supported by a suite of imagers and spectrographs. Four instrument design studies are underway. (1) An optical-NIR coronograph reaching contrasts down to 10^{-10} over a bandpass from 0.4 to 1.8 microns with low resolution spectroscopy. (2) A far-to-near UV spectrometer (with medium to high $R \sim 10^5$ resolution and polarimetry). (3) An optical-NIR high-definition imager with a 4 – 6 arcmin field of view and capability to do high precision astrometry. (4) An optical-NIR spectrograph with multiple resolutions up to 10^5.

Cosmic Origins: LUVOIR's unprecedented resolution will resolve 1 parsec sized star-forming regions at distances of up to 10 – 25 Mpc and 100 parsec sized structures anywhere in the universe. The telescope will map the distribution of dark matter in the nearby universe, isolate gravitational wave sources, identify the first starlight in the universe, uncover the archaeology of early galaxies and find the first black holes. This suite of observations will inform our understanding of how matter has evolved in the Universe and is incorporated into potentially habitable worlds.

Exoplanets: LUVOIR must move beyond the chemical characterization of exoplanets by Spitzer, Hubble, and ground-based telescopes and beyond the advances expected with JWST (James Webb Space Telescope), TESS (Transiting Exoplanet Survey Satellite), and WFIRST (Wide Field InfraRed Survey Telescope). One of LUVOIR's main science objectives will be to directly image rocky-sized planets in the habitable zones of other stars, measure their spectra, and analyze the chemistry of their atmospheres (**Figure 1**) to search for biomarkers. Additionally, the survey of the atmospheric composition of hundreds of worlds will bring about a revolution in our understanding of planet formation and evolution, and help place the planets in our Solar System in a broader comparative planetology context. Access to many molecules and many bands of the same molecule is essential for understanding the state of the atmosphere and for ruling out false positive biosignatures. The LUVOIR spectral bandpass from 0.2 to 2.4 microns contains absorption bands for O_2, O_3, O_4, H_2O, CO, CO_2, CH_4.

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Solar System: LUVOIR will be able to image auroras and icy plumes from giant planet moons, resolve surface and cloud features as small as 50 km for outer planets and will have a resolution of 200 km for objects at the distance of the Kuiper belt.

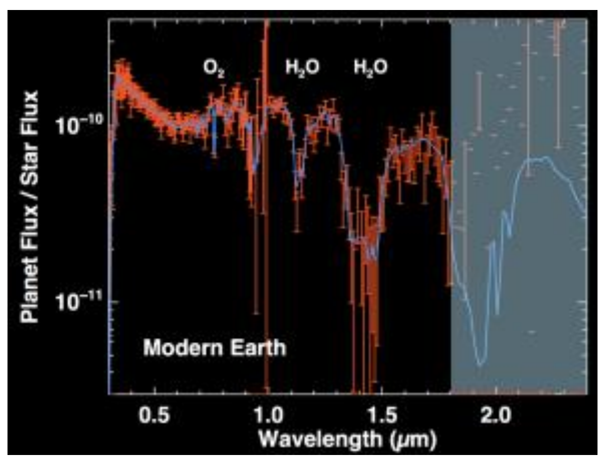

Figure 1. *Simulated reflected light spectrum (R=150) for an Earth analog at a distance of 10 parsecs after 50 hours of integration with a 12-m telescope. With an ambient temperature of 270K, the telescope dominates the thermal background beyond 1.8 microns.*

Additional Information: Online simulation tools (https://asd.gsfc.nasa.gov/luvoir/tools/) show exoplanet yields and simulate exposure times for the instruments under study by the STDT.