THE NEXT GENERATION OF OBSERVATIONS OF PLANETS BEYOND OUR SOLAR SYSTEM.

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This presentation will give an overview of the capabilities of the Large UV-Optical-Infrared (LUVOIR) Surveyor, a mission concept being studied by NASA in preparation for the 2020 Astrophysics Decadal Survey. LUVOIR is a general-purpose space-based observatory with a large (8+ meter) aperture and a wavelength range spanning from the far-UV to the near-infrared. This observatory will enable revolutions in many areas of astronomy, including planetary science within and beyond our Solar System.

Because LUVOIR is being considered for the next decadal survey, is must be capable of advancing our understanding of astronomical targets, including exoplanets, far beyond what will be achieved by the next two decades of observations from other space- or ground-based facilities. This means that the mission must move past the detection of potentially habitable worlds and their astrophysical characterization. Detection of such worlds is happening now with Kepler and ground-based measurements and will continue with TESS (Transiting Exoplanet Survey Satellite) and WFIRST (Wide Field Infrared Survey Telescope). It must also move beyond the chemical characterization of gas giants, which is something that has begun with observations from Spitzer, Hubble, and ground-based telescopes and will see major advances with JWST (James Webb Space Telescope) and WFIRST with a coronagraph. What will remain is the chemical characterization of potentially habitable worlds, and through that characterization an assessment of their habitability and a search for signs of global surface (or very near surface) biospheres.

Therefore, 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 (Figure 1), analyze the chemistry of their atmospheres, and obtain top-level information about their surfaces. Such observations will allow us to evaluate the habitability of these worlds, and search for potential signs of life in their spectra. We will review the specific observational strategies needed for astrobiological assessments of exoplanetary environments, including the wavelength range and spectral resolution required for these habitability analyses and biosignature searches. For comparison with Solar System science, we will discuss how the strategies required by LUVOIR to search for habitability and life are similar and different to assessments of potentially habitable environments within our Solar System. Further, we will discuss how the observational requirements to make measurements of "Earthlike" worlds in the habitable zone will allow high-quality observations of a wide variety of extrasolar planets that are outside the habitable zone or too large to be considered potentially habitable. The survey of the atmospheric composition of hundreds of worlds will also bring about a revolution in our understanding of planetary formation and evolution, and help place the chemical analyses of planets inside our Solar System in a broader comparative planetology context.

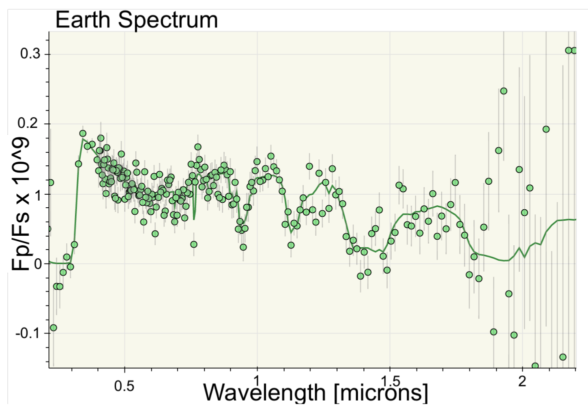

Figure 1. The spectrum of Earth at 10 parsecs observed by a 10-m LUVOIR-class telescope in 24 hours. The resolution (R) for $\lambda < 0.4$ μm = 20; R = 150 for $0.4 < \lambda < 1$ μm; and R = 100 for $\lambda > 1$ μm. Molecular features from water and O_2 and O_3 can be easily detected at wavelengths shortward of 1.8 μm, but an assumed telescope temperature of 270 K makes measurements impossible for $\lambda > 1.8$ μm.