THE IMPACT OF NEXT GENERATION LARGE ASTROPHYSICS MISSIONS ON PLANETARY ASTRONOMY. S.N. Milam[1] and H.B. Hammel[2], [1]NASA Goddard Space Flight Center, Astrochemistry Laboratory, 8800 Greenbelt Rd, Greenbelt, MD 20771, stefanie.n.milam@nasa.gov, [2]AURA, 1331 Pennsylvania Avenue NW, Suite 1475, Washington, DC 20004.

Introduction: Next generation space-based telescopes will work in concert with future *in situ* robotic crafts and large ground-based facilities to address key questions of chemical complexity, origin of life, and molecular inheritance throughout star and planet formation, to our own solar system. Herschel, HST, and Spitzer have advanced research on virtually every topic in planetary science.

Future, large space-based telescopes offer unprecedented sensitivity and spatial resolution at wavelengths that are often inaccessible from the ground due to the Earth's atmosphere, and provide global context for *in situ* missions. Their spectral regions host a number of significant molecular lines including: CO_2, H_2, NH_3, etc. that help disentangle the various molecular formation/destruction mechanisms from the ISM to the solar system and often require a multiwavelength approach to observe all molecular phases. Additionally, they provide broader perspectives in both targets and timelines for planetary missions that orbit, land, or fly-by a given target. Space observatories are not constrained to a specific target, and provide global context as well as source to source comparisons that are not always achieved from directed missions.

JWST and WFIRST: The James Webb Space Telescope (JWST) is an infrared-optimized observatory that provides wavelength coverage of 0.6-28.5 microns, sensitivity 10X to 100X greater than previous or current facilities, high angular resolution, and low-moderate spectral resolution [1,2]. JWST can observe all planets (Mars and beyond) and their satellites in our solar system as well as Near-Earth Asteroids (NEAs), Main Belt Asteroids, minor planets, comets, as well as Trans-Neptunian Objects (TNOs). JWST is currently on schedule for full science operations 5+ years after commissioning in 2021. This mission is timely for follow-up studies from Juno, Rosetta, Cassini, and New Horizons and also provides unique timeline observations for the Galilean system prior to Juice, a Europa mission, etc.

NASA's Wide Field Infrared Survey Telescope (WFIRST) is NASA's next flagship mission following JWST. This mission has two primary instruments: the Wide Field Instrument (WFI) with a 0.25 deg^2 FOV and the Coronagraph Instrument (CGI) [3]. For the solar system, WFIRST will be able to exploit wide area surveys to identify small bodies in the solar system, including NEA and TNO populations.

Beyond: NASA's Astrophysics division has requested four new mission concept studies to follow JWST and WFIRST. These include: the Origins Space Telescope (OST) [4], the Large UV-Optical-IR telescope (LUVOIR) [5], LYNX, and HabEx. These studies are currently underway and will be completed soon. Two of these studies are strongly considering planetary science cases in constraining the design and instrumentation – OST and LUVOIR. Some of these science cases will be presented.

On-Orbit Assembly of Large Telescopes: Looking forward to the next astrophysics generation beyond LUVOIR or OST is likely to include even larger space observatories, 25m class, that consider new innovations to assemble large mirrors and components remotely [6]. This concept builds off of heritage from JWST deployment, segments, and testing as well as servicing to Hubble and the ISS. The scientific implications for 25m class space telescopes reach beyond our most imaginative expectations. With extreme sensitivity and resolution, detailed studies of habitable worlds could be readily achieved. Additionally, the capabilities within the solar system will include ground-truths of *in situ* measurements on much broader scales. Large space observatories will help reveal trace species in the solar system with unprecedented new sensitivity and capability.

Summary: NASA's Great Observatories have provided planetary scientists unique imaging and spectroscopic capabilities for many years; and are often the most widely known to the community and the public. Current and new missions are now recognizing the significance in incorporating planetary science as a major role in the design, instrumentation, and operations that will reveal unprecedented science for solar system bodies. The far future astrophysics missions with on-orbit assembly for even larger space based facilities will be even more revealing and provide remote-sensing capabilities comparable to current *in situ* state-of-the-art instruments.

References: [1] Gardner, J.P., et al. (2006) SSRev, 123, 485. [2] Milam, S.N., et al. (2016) PASP, 128, 959. [3] Spergel, D., et al. (2013) "Wide-Field Infra-Red Survey Telescope-Astrophysics Focused Telescope Assets WFIRST-AFTA Final Report", arXiv:1305.5422. [4] Meixner, M., et al. (2016) SPIE, 9904, 99040K. [5] Crooke, J.A., et al. (2016) SPIE, 9904, 99044R. [6] Feinberg, L.D., et al. (2013) Optical Engineering, 52, 091802.