The Orbits and Atmospheres of Directly-Imaged Exoplanets from the Gemini Planet Imager Exoplanet Survey. J. J. Wang,[1] and the Gemini Planet Imager Exoplanet Survey Collaboration, [1] Department of Astronomy, University of California, Berkeley, CA 94720, USA (j-wang@berkeley.edu)

Introduction: While thousands of exoplanets have been discovered to date, only a limited number of them are amenable to detailed characterization. Direct imaging allows us to measure the orbits of exoplanets as well as measure light from their atmospheres. Additionally, direct imaging allows us to characterize Jupiter-like exoplanets on long period orbits, which are challenging for the transit and radial velocity detection methods. However, systems with giant planets in wide orbits will be attractive targets for future terrestrial planet searches, since giant planets may be crucial to shielding the terrestrial planet zone from bombardment [1].

Gemini Planet Imager Exoplanet Survey (GPIES): The Gemini Planet Imager (GPI) is an infrared instrument dedicated to imaging exoplanets by combining a high-order adaptive optics system to correct for atmospheric turbulence, a coronagraph to suppress the glare of the star, and an integral field spectrograph to take simultaneous images and spectra of exoplanets [2]. GPIES is a 600-star survey for young, Jovian-mass exoplanets at Solar System scales. GPIES combines the advanced instrumentation of GPI with sophisticated data analysis algorithms [3,4] to image faint exoplanets that would otherwise be swamped by the glare of their host stars.

Exoplanet Characterization with GPIES: To date, GPIES has imaged six exoplanets [2,5,6,7,8] and three brown dwarfs [9,10,11]. GPIES also has developed open-source data reduction tools necessary to characterize these companions [3,4]. I will show the orbits of the companions and discuss what inferences we can make from their dynamics. I will also present their 1 to 2.4 micron near-infrared spectra and the insights into their atmospheres. GPIES also has made use of an automated data processing infrastructure that allows for consistent data products and extremely quick follow-ups on the most promising planet candidates. I will discuss how the tools and lessons learned from GPIES will allow us to characterize potentially habitable Earth-like planets from future direct-imaging missions, especially as turnaround times need to be quick in order to follow up and constrain the orbits of Earth-like planets in the habitable zone.

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