

Lothringer, Joshua

## Determining the Atmospheric Nature of Super-Earth and Sub-Neptune Exoplanets

Proper characterization of the atmospheric composition of super-Earth and sub-Neptune planets will constrain the models that describe the formation and evolution of exoplanetary systems, yet the transition between Earth-mass and Neptune-mass exoplanets is still poorly understood. Due to degeneracies between the bulk density and composition of planets in this range, even the basic make-up of many planets is unknown. We will present preliminary analysis and data reduction techniques for an ongoing large-scale Hubble Space Telescope survey of five planets between 1 and 22 Earth-masses. Using optical and infrared primary transit spectra from both the Space Telescope Imaging Spectrograph (STIS) and the Wide Field Camera 3 (WFC3), we will measure molecular signatures in the atmospheres of these small, cool planets, as well as any high-altitude clouds and hazes that may dampen such signatures. These clouds and hazes seem to be common in small, cool planets, so measurements of any scattering at optical wavelengths using STIS will help constrain cloud properties such as particle size and composition.

Characterization of super-Earth and sub-Neptune planets, and the transition thereof, is vital for a comprehensive theory of exoplanet formation and evolution. Our observations will be a significant step toward this characterization. Results from this investigation will pave the way for future observations of small planets, especially in preparation for the James Webb Space Telescope (JWST) and the Transiting Exoplanet Survey Satellite (TESS). Authors: Joshua Lothringer [1], Ian Crossfield [1], Bjoern Benneke [2], Heather Knutson [2], Diana Dragomir [3], Jonathan Fortney [4], Andrew Howard [5], Peter McCullough [6], Ron Gilliland [6], Eliza Kempton [7], Caroline Morley [4] Institutions: 1. University of Arizona, 2. California Institute of Technology, 3. Las Cumbres Observatory Global Telescope Network, 4. University of California- Santa Cruz, 5. University of Hawaii, 6. Space Telescope Science Institute, 7. Grinnell College