DEBRIS DISKS SCULPTED BY EMBEDDED PLANETS: AN HST VIEW OF THE BETA PICTORIS DEBRIS DISK-GIANT EXOPLANET SYSTEM AND IMPLICATIONS FOR IMAGING EARTH-LIKE PLANETS. Daniel Apai [1,2,3] and Glenn Schneider[1], [1]Steward Observatory, University of Arizona, 933 N. Cherry Avenue, Tucson, AZ 85721 (apai@arizona.edu), [2]Lunar and Planetary Laboratory, University of Arizona, 1640. E. University Blvd, Tucson, AZ 85721. [3]Earths in Other Solar Systems team.

Introduction: Debris disks or exozodiacal disks emerge from collisions of extrasolar minor bodies. In spite of their small total mass, these relatively bright exozodiacal dust disks are likely to pose a major limitation on future missions aiming to directly image Earth-like planets in the habitable zones of nearby stars. The frequency and brightness distribution of debris disks around nearby stars is, to large extent, determined by the interaction of the planetesimal population with embedded planets, which stir the planetesimal population and impact the structure and evolution of debris disks.

Validating Disk-Planet Interaction Models: Although a plethora of dynamical models exist for the interactions of debris disks and planets, only one single system is known to harbor a directly imaged giant planet embedded in a directly imaged debris disk. This system, Beta Pictoris, provides our best avenue for validating disk-planet interaction models.

Highest Quality Optical View of the Beta Pictoris Disk: We used the Hubble Space Telescope's STIS instrument in its coronagraphic mode to obtain the highest quality optical image of the Beta Pictoris disk. We present a detailed analysis of the complex disk structures, include the previously unexplored inner disk. We compare the disk structure with the orbit of the giant planet Beta Pictoris b and show that many, but not all, disk structures are directly attributable to the dynamical influence of the giant planet. A class of disk asymmetries, in contrast, require a different process and may indicate the presence of a yet unseen planet or a catastrophic destruction of a Mars-sized object.

Exozodiacal Dust as a Limitation for Direct Imaging of Nearby Stars: We will discuss the results on the Beta Pictoris debris disk in the conttext of the presence and physical structure of exozodical disks around nearby stars. We will also compare the brightness limits these disks may pose to the estimated sensitivity and contrast of potential near-future missions their ability to directly image earth-like planets in the habitable zones.

[1] Apai, D., Schneider, G. Grady, C. A., et al. (2015) *Astrophysical Journal 800, 136*

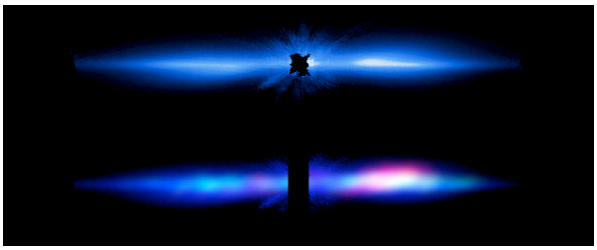

Figure 1: Thumbnails of the Beta Pictoris disk seen in visible light with HST/STIS coronagraphy, from Apai et al. (2015). The Beta Pictoris disk is the only system where a debris disk and a giant planet have been imaged, providing a unique test case for planet-disk interaction models. The upper panel shows ALMA overlays of CO gas (red) and millimeter-sized dust grains (green).