AAS Splinter Session "Planets, Exoplanets, and Planet Formation with Gemini LLP programs"

To be held at the 235th meeting of the American Astronomical Society, 9:30-11:30 am, Tuesday January 7, 2020 at the Hawaii Convention Center, Room 303B

Organized by NSF's OIR Lab astronomers (Letizia Stanghellini, CSDC, Alison Peck, Gemini, and Ken Hinkle, CSDC).

All scientists, especially current and potential Gemini users, are invited to participate in this splinter meeting, where science results from Gemini Large and Long Programs (LLP) will be showcased. The program will focus on mature LLPs in the field of planets and their formation. Talks will present the science results along with data analysis strategies.

INVITED SPEAKERS, TOPICS, AND ABSTRACTS

Joseph Masiero (NASA Jet Propulsion Lab)
Chasing Near-Earth Asteroids at the Bottom of the Sky
When near-Earth asteroids are discovered, rapid followup is essential to ensuring that their orbits are well-constrained and that their uncertainties do not grow so large that they become lost as the move across the sky. While followup assets are abundant in the northern hemisphere, they are much sparser in the south. This was identified in 2013 as a potential problem for the recently reactivated NEOWISE spacecraft, which scanned the entire sky and found objects at very low declinations. Our Gemini Large and Long program to support followup of these objects became a critical component in the world-wide network of asteroid followup systems. We will describe the outcome of our LLP program, and highlight some of the interesting results.

Henry Hsieh (Planetary Science Institute)
Oddball Snowballs: Gemini Observations of Main-Belt Comets
Main-belt comets are rare objects that are dynamically indistinguishable from main-belt asteroids, yet display cometary activity indicative of sublimating ice. Their apparently icy nature, indications that they formed in situ in the asteroid belt, and dynamical models showing that icy asteroids may have been a significant source of Earth's present-day water have made them a subject of great interest for astrobiology and planetary science. Main-belt comets represent an exciting opportunity to probe the distribution and abundance of volatile material in the asteroid belt, and gain insights into the formation of our solar system in general. We have been conducting a multi-year, multi-facility optical observational campaign to study the long-term active behavior of main-belt comets and also characterize their nucleus properties, for which Gemini Large and Long Program (LLP) observations have been a central component. Gemini observations have specifically been crucial for recent confirmations of recurrent activity in main-belt comets 133P, 238P/Read, 288P/(2006 VW139), 313P/Gibbs, and 358P/PANSTARRS, confirming that sublimation is the most likely driver of 358P's activity and providing opportunities

to characterize the evolution of the activity strength of the other objects, which has implications for constraining their active lifetimes and improving interpretations of discovery statistics. I will present key results from our completed 2016-2019 Gemini LLP (GN/GS-LP-11) and also discuss scientific prospects for our currently running 2019-2022 LLP (GN/GS-LP-104).

Christine Chen (Space Telescope Science Institute)

Multi-Band Imaging of Debris Disks with the Gemini Planet Imager

Some exoplanetary systems contain not only planets but also minor body belts, analogous to the asteroid and Kuiper belts in our Solar System. Planets in these systems gravitationally perturb minor bodies, placing them on crossing orbits where they collide, creating debris dust. Detailed studies of the scattered light from the debris disks can be used to (1) search for structures indicating the presence of planetary mass companions or dust enhancements indicating recent giant collisions and (2) constrain the size and porosity of the grains and therefore the mechanisms by which the dust and parent bodies are processed. The Gemini Planet Imager (GPI) has provided high Signal-to-Noise Ratio (SNR) spectroscopic and polarimetric observations of predominantly bright, highly inclined debris disks. These observations have enable detailed measurements of the disk geometric parameters, dust surface density, total intensity and polarization fraction phase functions, and the near- infrared reflected light spectrum. We present some recent results using GPI to constrain the properties of debris disks from the Gemini Large and Long Program "Characterizing Dusty Debris in Exoplanetary Systems".

Elizabeth Mattews (MIT Kavli Institute)

Validating TESS planets with AO imaging

The presence of faint stellar companions to a transit planet host dilutes the lightcurve, thus causing the measured planet radius to be smaller than its true value. To correctly interpret the mass-radius diagram for small planets it is therefore crucial that this systematic bias is taken into effect. Perhaps even more importantly, background eclipsing binaries and massive planets can appear identical to much smaller planets orbiting foreground stars if only the lightcurve is considered. A key goal of the TESS mission is to understand the mass-radius diagram, and many of the TESS planets are prime targets for RV measurements and transit spectroscopy. It is important that the telescope resources required for there projects are not used to study false positives.

We have been conducting a program to collect high resolution images of the most interesting candidate planet hosts with Gemini. Our program makes use of both speckle and AO imaging, and have identified companions within a few hundred milliarcseconds of the planet hosts. In some cases we are able to use isochrones to determine whether these visual companions are bound or background stars, and when this isn't possible we use statistical arguments to determine the likely state of the system. Our survey is conducted in target of opportunity mode so as to enable a quick response when new TESS objects of interest are announced. We are able to process data within days of it being collected and enable quick validation and publication of interesting TESS objects, before further characterization takes place. In this talk I will present some of our early results from the survey including the detection of several faint companions to TESS planet hosts.

Time permitting, I will also discuss our work using this dataset to study the multiplicity of TESS planet hosts. TESS typically detects planets roughly twice as close as those identified by Kepler, and so we are able to probe for binary companions at smaller angular separations and determine the most compact binary systems where planets can be found. This dataset will facilitate a broader study of the multiplicity of TESS planet hosts, for which we plan to combine GAIA and our high resolution data.

Evan Rich (University of Michigan)

Gemini-LIGHTS Survey: Herbig-Ae/Be protoplanetary disks imaged with GPI

I will present initial results from the Gemini-LIGHTS survey, where we observed ~40 Herbig Ae/Be and massive T-Tauri protoplanetary disks with the Gemini Planet Imager (GPI) in polarized light in J- and H- bands. I will first present a cursory look at our entire sample and discuss specific examples of systems that have already been analyzed. In particular, I will show the first images of transitional disk HD 34700A (Monnier+ 2019) that hosts a large cavity and multiple spiral-arm structures, and five other targets with irregular dust features (Laws+ 2019). I will also discuss strides we have made to improve the data reduction techniques used for GPI, including improving the centering algorithm for objects with bright companions, and how to better remove stellar and instrumental linearly polarized light from the observations. These improvements are important as we aim to allow robust detections of faint polarized signals from dim protoplanetary disks in our sample.