308.13 — Accretion Disk Modeling of FU Ori Stars

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FU Ori stars are a class of young stellar object (YSO) currently seen in an outburst state. Approximately half of the known FU Ori stars were detected during their transition from quiescence to outburst via optical/infrared brightness increases on the order of four to five magnitudes. It is generally accepted that the outbursts are caused by the onset of rapid accretion at rates three to four orders of magnitude larger than those of quiescent-state young T Tauri stars. During the ensuing decades- to century-long outbursts, the disks outshine their central stars by factors of 100-1000, leading to models of the outburst radiation as being purely due to a rotating accretion disk. We present new optical and near-infrared observations of the newest confirmed FU Ori stars (Gaia 17bpi and HBC 722), and discuss the successes and limitations of the conventional FU Ori model. Our model is a Keplerian disk featuring a modified Shakura-Sunyaev temperature profile, with each annulus radiating as an area-weighted spectrum given by a NextGen atmosphere at the appropriate temperature. We consider the overall SED as well as medium-resolution spectra in considering best-fit models to the data. Both sources have lower luminosity than the conventionally studied FU Ori outbursts, and correspondingly are fit by lower accretion rate disks with lower maximum temperatures: 5600K and 5000K.

308.14 — Young Binaries as Laboratories for Disk Evolution: Angularly Resolved Determinations of Stellar and Circumstellar Characteristics

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Detailed properties of the primordial planet-forming disks and of the stars in young multiple systems provide powerful inputs with which to explore the factors controlling the early stages of disk evolution. Because a large fraction, if not most, stars form in pairs, triples, or higher order configurations, characterizing the properties of these systems that dominate disk evolution is key to development of a broad understanding of planet formation. Using adaptive optics fed high-resolution infrared spectroscopy and imaging, we are studying the individual components in systems with separations of a few to a few hundred AU in a sample of 100+ pre-main sequence binaries in the nearby Taurus, Upper Scorpius / Ophiuchus, and TW Hya associations. We present initial results of this survey, including evidence for more rapid disk evolution in lower mass pairs and a paucity of cool primary stars in wide pairs. The advent of the K2 Taurus and Upper Sco / Oph campaigns, as well as the growing wealth of angularly resolved ALMA imaging of disks in these young systems, provide rich, complementary data sets with which to further interpret our results. Ultimately, our spectra and higher-level products of our analysis will be publicly available to the community at http://jumar.lowell.edu/BinaryStars/. Support for this research was provided in part by NSF award AST-1313399 and by NASA Keck KPDA funding.

308.15 — The Peculiar Morphology of the Gas-rich Circumstellar Disk Wray 15-788

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High resolution observations of circumstellar disks around young, nearby stars have provided valuable insight into the initial conditions and physical mechanisms involved in planet formation. The Wray 15-788 (~11 Myr, K3IV) circumstellar disk was first discovered as part of a high contrast imaging survey of young solar analogs in the Scorpius-Centaurus Association. Here we present a higher fidelity dataset where the disk has been resolved in both polarized and total intensity with the SPHERE/IRDIS instrument in H band. These data reveal a bright inner ring at a projected separation of 28 au interior to a partially depleted gap and a bifurcated outer ring at 56 au. The northwest side of the disk appears depleted in both total and polarized intensity to a degree that is difficult to reproduce with scattering effects alone. This could be the result of shadowing by a misaligned inner disk or a local change in the disk opacity. Preliminary radiative transfer modelling of the disk polarization fraction is able to place limits on the grain properties in the disk while 5sigma contrast curves are used to constrain masses and positions of potential planetary mass companions causing the peculiar disk morphology. There is a slight offset between the outer ring center and the star, likely due to a projection of the disk scattering surface height above the mid-plane. For an inclination of ~21 degrees, this would require a disk scale height of ~7 au at a radius of 56 au. This suggests that the disk remains gas rich and is at an early evolutionary stage. Wray 15-788 is the secondary component in a wide binary (7000 au) with HD 98363 (A2V). The primary hosts a debris disk with a needle-like morphology (similar to systems like HD 106906) first resolved in scattered light with the Gemini Planet Imager. This curious dichotomy between the evolutionary stages of the two circumstellar disks provides an excellent laboratory for further study of disk evolutionary processes and their dependence on stellar mass.

308.16 — Asymmetric profiles of eccentric transition disks

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The search for planets in protoplanetary disks is technically challenging and thus far less successful than expected. Direct imaging has produced few detections of planets to date, possibly because planets are fainter than "hot start" models predict, though potential signposts are common. Spectroscopy of the disks' gas provides a complementary means of investigation by focusing on dynamical effects within the disk. Planets may produce eccentricities in the inner edge of their host circumstellar disk as they form and accumulate their own circumplanetary disk, which can be identified through molecular emission in the form of asymmetric line profiles. Here we present some infrared observations of such features as part of ongoing efforts to survey nearby transition disks.

308.17 — Hints of a Population of Solar System Analog Planets from ALMA

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The recent ALMA DSHARP survey provided illuminating results on dust substructures in planet forming disks, revealing a diverse array of gap and ring substructures. These substructures trace pebble-sized grains accumulated at local pressure maxima, most likely due to either planet-disk interactions or other planet formation processes. However, DSHARP sources are heavily biased to large and massive disks that only represent the high (dust flux) tail end of the disk population. Thus it is unclear whether similar substructures and corresponding physical processes also occur in the majority of disks which are much fainter and more compact (radii less than 20 au). Here we explore the presence and characteristics of gap and ring features in an example of a compact disk, R ~ 18.62 au, around GQ Lup A. We present our analysis of ALMA 1.3mm continuum and CO line observations of the GQ Lup System, comprised of a T Tauri star, GQ Lup A, with a substellar companion. By fitting visibility profiles of the continuum emission, we find substructures including two gaps around 10 au and 32 au. GQ Lup's compact disk exhibits similar substructures to those in the DSHARP sample, suggesting that mechanisms of trapping pebble-sized grains are at work in small disks as well. Characterization of the feature at 10 au, if due to a hidden planet, is evidence of planet formation at Saturnian distances. Our results show that there is likely a rich world of substructures to be identified within the common population of compact disks, and subsequently a population of solar system analogs within these disks. Such study is critical to understanding the formation mechanisms and planet populations in the majority of protoplanetary disks.

308.18 — Protoplanetary Nurseries: Identifying Planetary Gaps in Circumstellar Disks

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Gaps found in circumstellar disks surrounding young stars can often be indicators of planet formation. We present a study of the parameters that affect gap visibility, including position, size, angle of viewing, and accretion rate from a heuristic model of a young Herbig Ae/Be star of 2.5 Msun. This model, built off of the parameters from Dullemond and Dominik (2004) and using the radiative transfer model RADMC, allows for a wide variety of parameter changes, including accretion rate onto the central star, accretion onto the planet itself, number of gaps, and position and size of those gaps. The spectra results from these models reveal several key features that could be use to quickly get a rough idea of the features of a gap by taking ratios between the minimum and maximums. Furthermore, we look at the