The Nearest Herbig Ae Star Transitional Disks

C.A. Grady
(Eureka Scientific & Exoplanets and Stellar Astrophysics Lab, GSFC),
J. Wisniewski (U. Washington),
M.L. Sitko (U. Cincinnati & SSI),
B. Woodgate and M. Kuchner
(Exoplanets and Stellar Astrophysics Lab, NASA's GSFC),
G.M. Williger & K.A. Collins (U. Louisville)

As a result of more than 20 years of infrared astronomy from space, circumstellar disks can be most easily identified from excess light over that expected to be produced by the photosphere of the star. The shape of this IR spectral energy distribution (SED) has been used to infer the accretion rate onto the star and the the degree of dust grain growth and settling in protoplanetary disks. We test how robust the inferences of the SED fitting for a sample of Herbig Ae stars with accretion rate data from the NIR and FUV, as well as optical or near-IR coronagraphic disk imagery. In particular, we focus on Herbig Ae stars originally identified as flared disk candidates, based on ISO data. Flared disks are expected to have disk surface brightness which drops shallowly with increasing radius as $\sim r^{-2}$ if the gas and dust are well-mixed, and the dust has a particle size distribution similar to interstellar grains. Steep radial surface brightness profiles, closer to r^{-3}, are expected if the dust grains have grown and settled toward the disk midplane. Of the nine Herbig stars classified as having Meeus group I SEDS, which were expected to be associated with flared disks, 8 have optical or near-IR disk radial surface brightness profiles for their outer disks dropping as steeply or more steeply than r^{-3}, consistent with the outer disk being stratified. The observed radial surface brightness profiles are indistinguishable from disks classified as Meeus group II, indicating that the shape of the SED *alone* cannot be used to infer the geometry and degree of stratification of a disk.

By combining FUV spectroscopic detections and limits on excess light with accretion rates based on Brγ data from the literature, we find that several of the stratified disk Meeus group I sources have accretion rates in the range proposed by Najita et al. (2007) for transitional disks. These transitional disk candidates include 2 systems where central cavities have been independently detected in the UV or at sub-millimeter wavelengths. Our finding suggest s that transitional and pre-transitional disk candidates can be identified without reference to the average SED for classical T Tauri stars in Taurus. This in turn, permits identification of transitional disks associated with stellar spectral types which are not well-represented in Taurus. Combining accretion rate data with cavity sizes estimated from fits to the IR SED which are constrained by the measured disk inclination and outer radius also permit us to diagnose the origin of the central cavity. In two cases, the cavity size and current accretion rate onto the star for our Herbig Ae transition disks are inconsistent with production by either photoevaporation or magneto-rotation instabillity (Murray-Clay& Chiang, 2008),

favoring a dynamical origin.