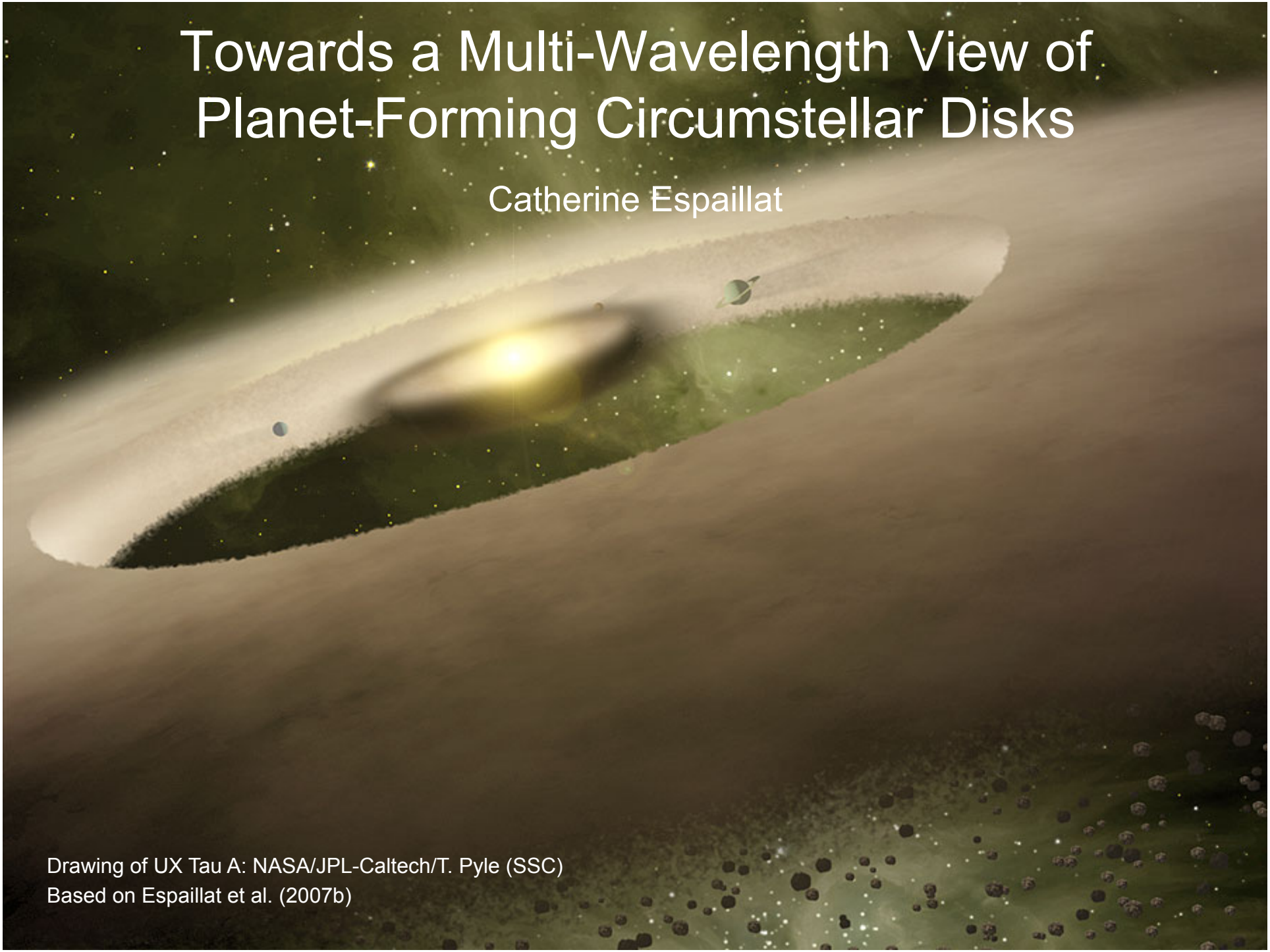
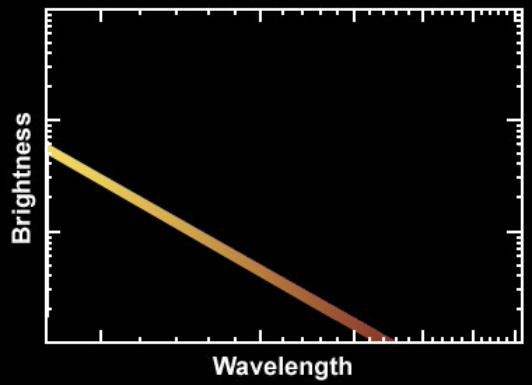
Towards a Multi-Wavelength View of Planet-Forming Circumstellar Disks

Catherine Espaillat

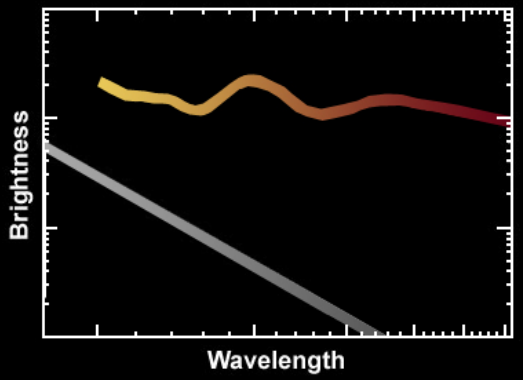


Drawing of UX Tau A: NASA/JPL-Caltech/T. Pyle (SSC)
Based on Espaillat et al. (2007b)

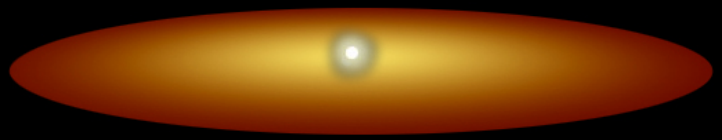
Evidence of Disks around Young Stars

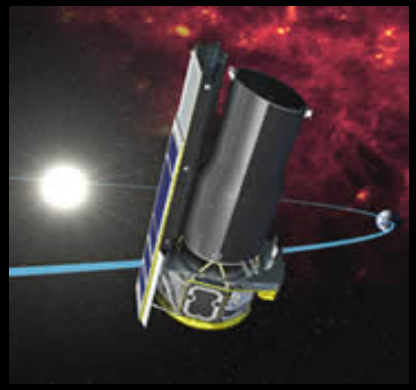


Star



Star with full disk





The Spitzer Space Telescope (left) was used to collect infrared spectra of young stars. The spectra show that some young stars are isolated (top left) while others are surrounded by disks top (right).

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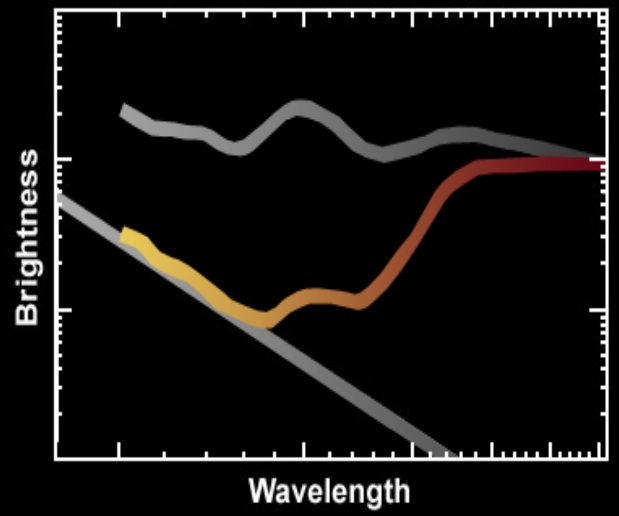
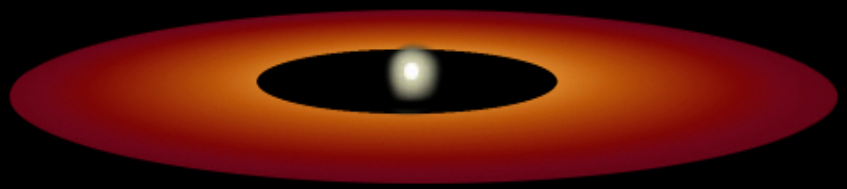
Transitional Disks: Disks with Holes





There are a few young stars whose spectra indicate that there is a large hole carved out of the disk. Planets are suspected to be the cause since they are expected to sweep out and accrete the material around themselves as they form.

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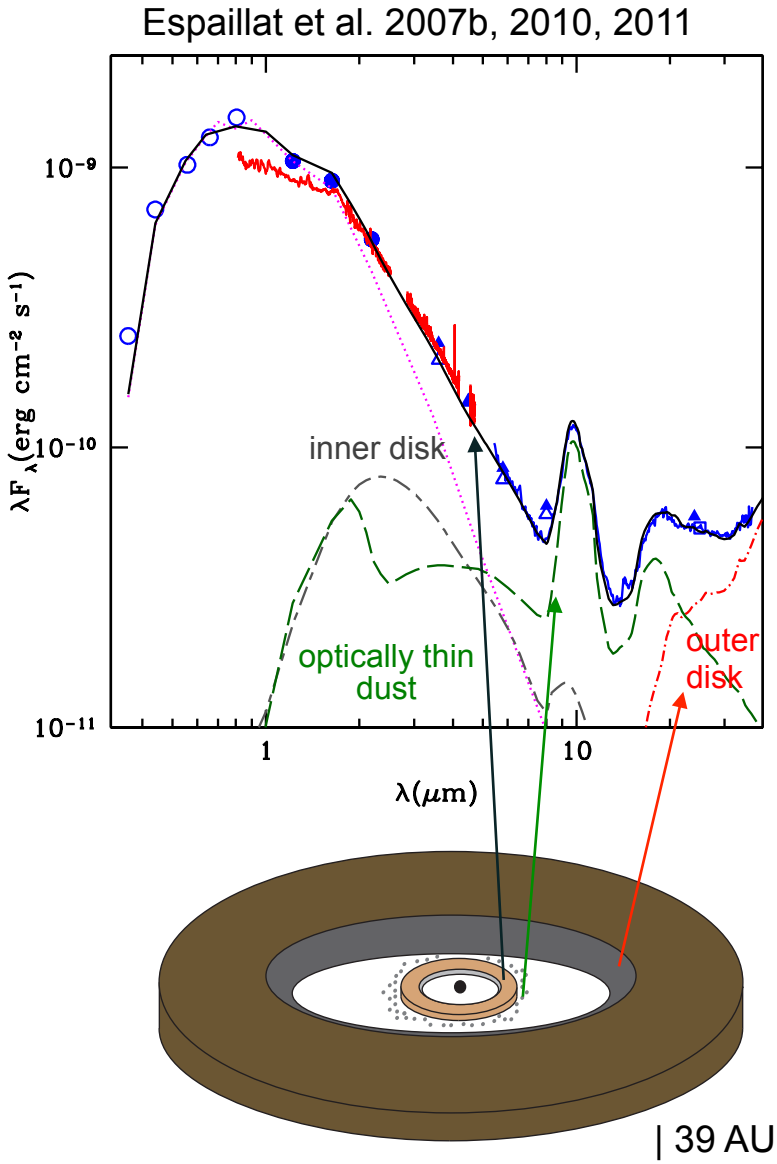
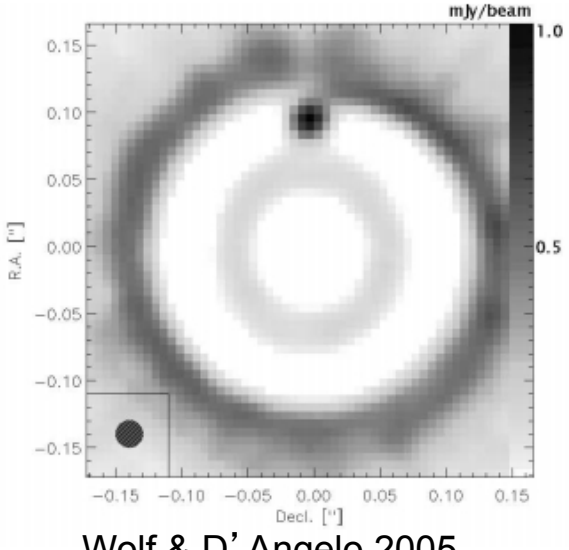
Pre-Transitional Disks: Disks with Gaps

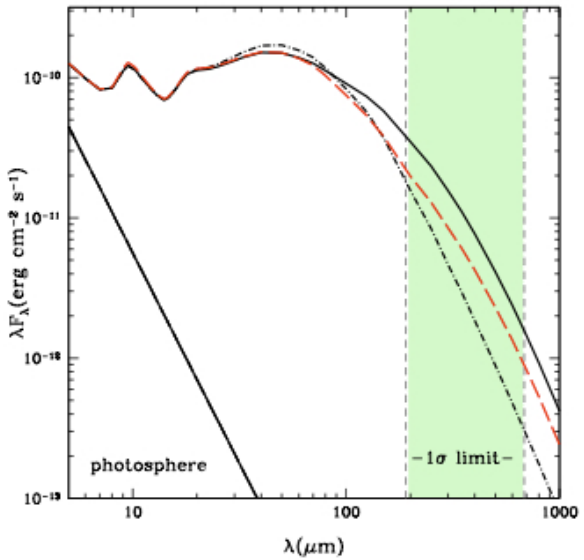


Combining more data (left; blue and red) and detailed models (solid and broken lines), I identified a new type of disk that has a gap. These "pre-transitional" disks have an inner disk, a cleared area, and an outer disk. Pre-transitional are the most likely candidates for hosting planets since their gapped structure is predicted by theoretical models.

Issues to be Addressed



Wolf & D' Angelo 2005



Espaillat et al. 2012, in preparation

In the future, I will use the millimeter ALMA telescope to find the smallest gaps and holes in disks (see simulated image on left), indicative of the earliest stages of planet formation.

I will also use the far-infrared and sub-millimeter Herschel Space Telescope to measure the sizes of dust grains in pre-transitional and transitional disks (see simulated data at left). Dust grains are the building blocks of planets. By measuring dust grain sizes, I will be able to infer a disk's planet forming potential.