IDSW 2013 - Aranjuez

Disk evolution in the solar neighborhood

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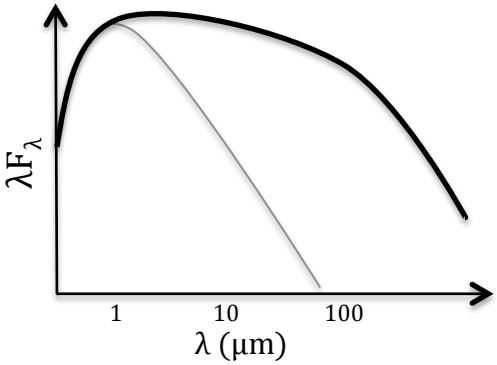
To better understand…

1) evolution of protoplanetary disks
2) formation of exoplanets

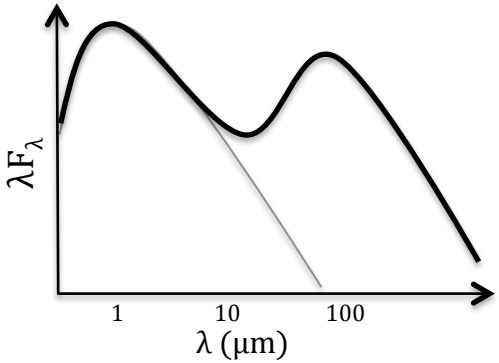
We have…

1) …studied outer regions of planet-forming disks with the Herschel Space Telescope (Ribas et al. 2013a, A&A, 552, A115)
2) …compiled a lot of information to study disk evolution coherently (Ribas et al. 2013b, in press)

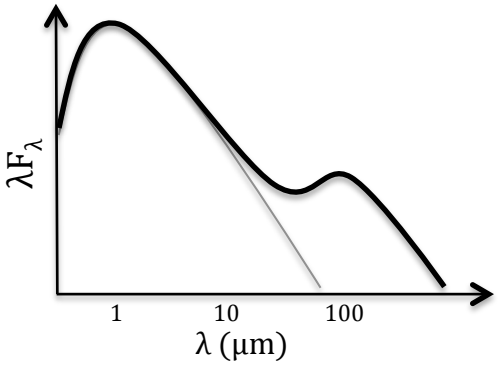
Evolution of protoplanetary disks



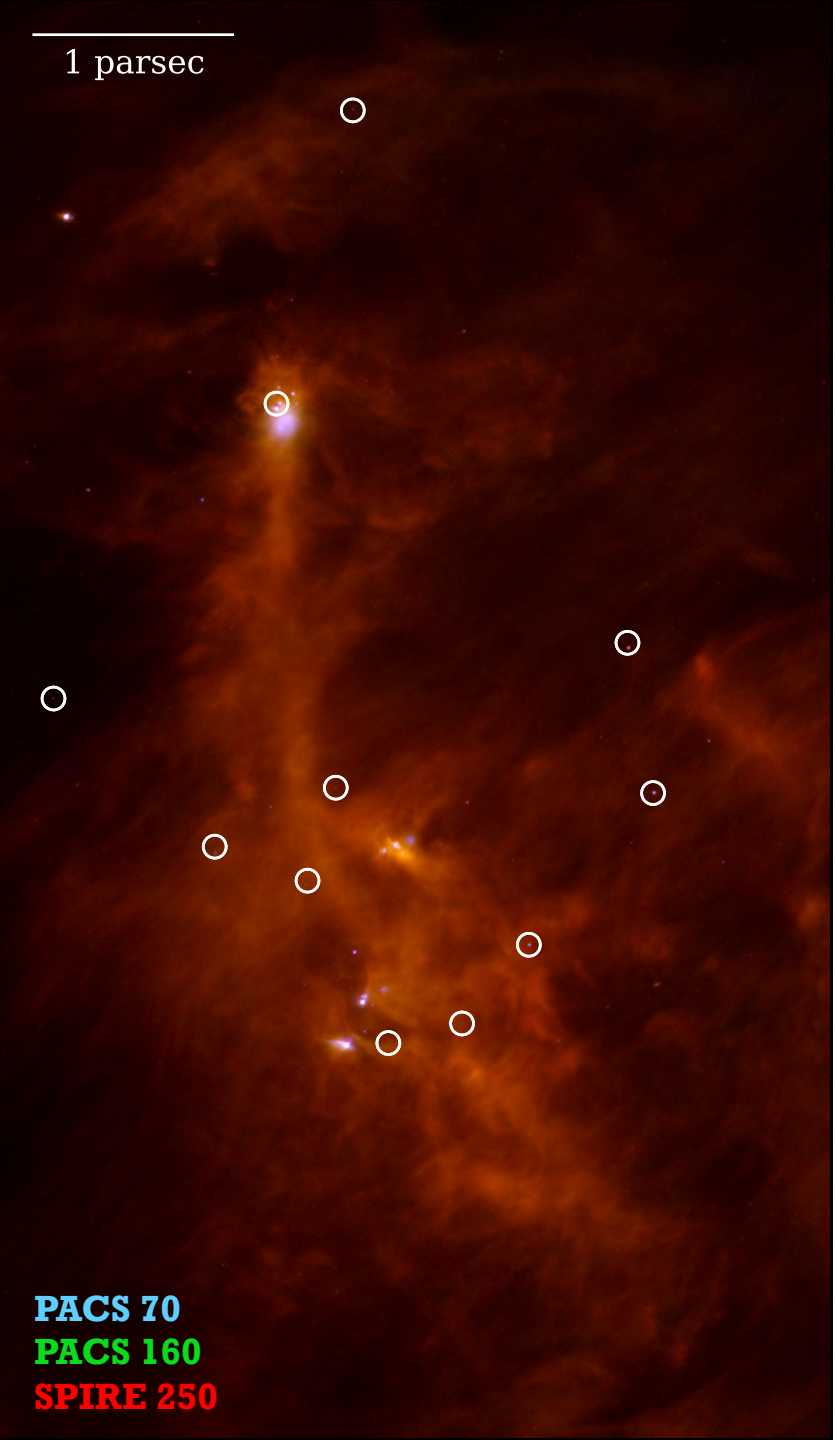
Protoplanetary disk



Transitional disk



Debris disk



Herschel data allows to discard/reclassify transitional disk candidates

Designed a new method to identify transitional disks

Transitional disks in Chamaeleon are brighter than protoplanetary disks at PACS wavelengths

Ribas et al. 2013a, A&A, 552, A115

We have built a large and homogeneous database…

2340 sources in 22 star-forming regions:

- close (<400pc)
- young (<100Myr)

One order of magnitude larger than previous studies!

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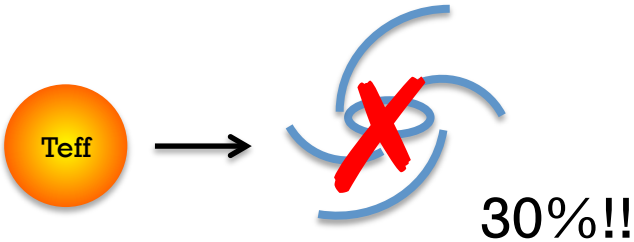
From O to M stars



30%!!

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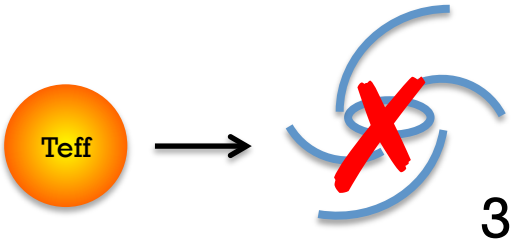


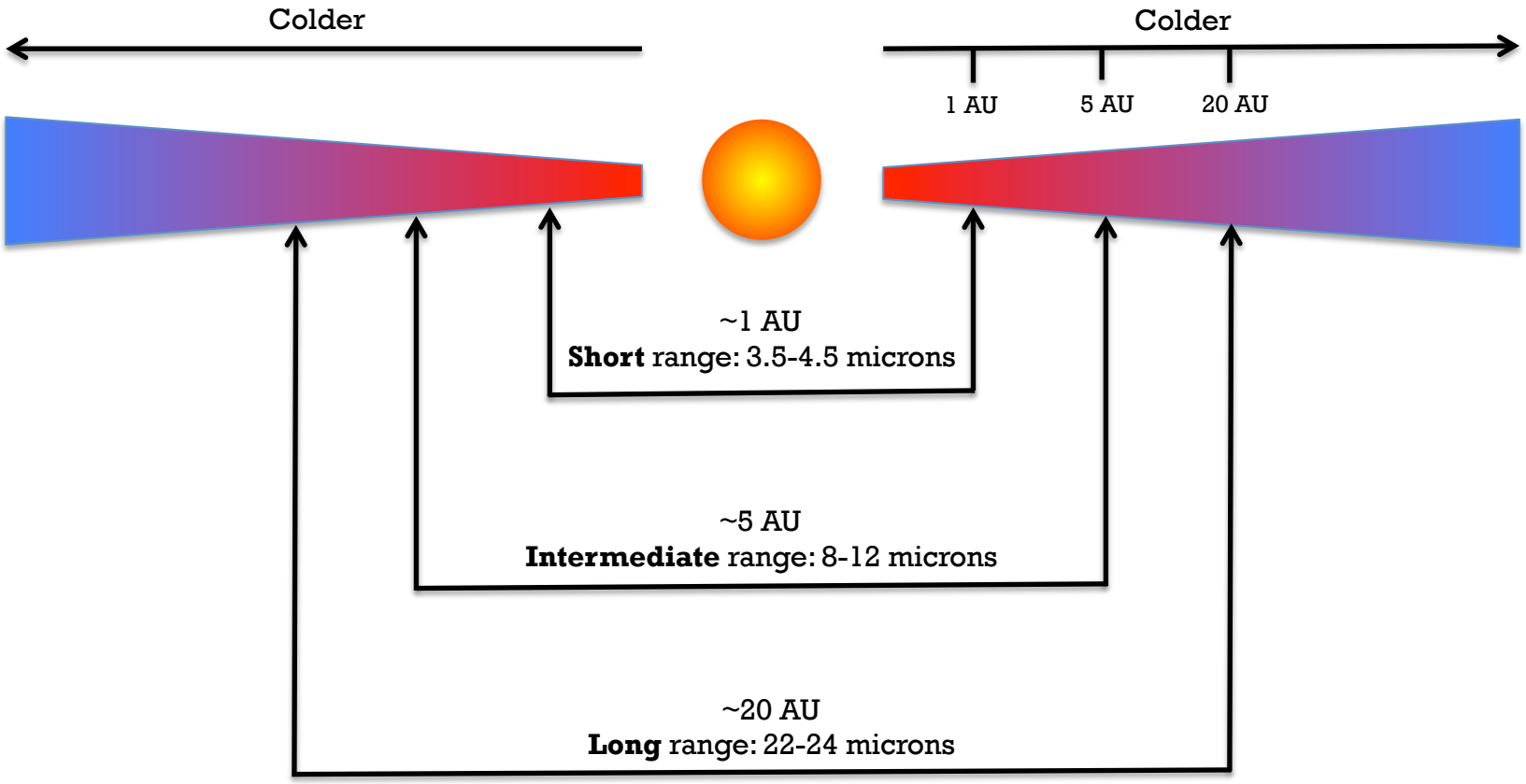
30%!!

Quality-check process

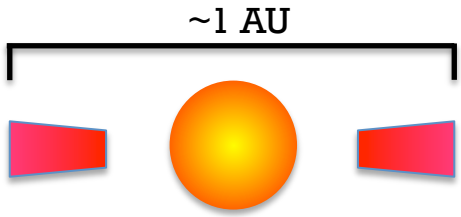
- Astrometry
- Photometry from 8 surveys
- Visual inspection of each Spectral Energy Distribution

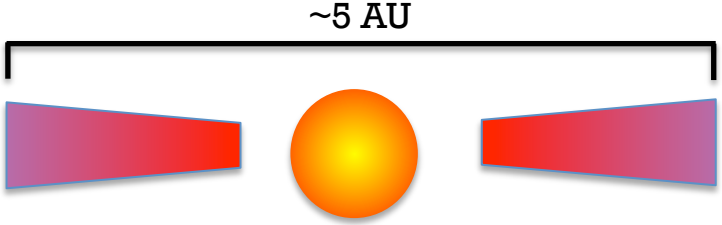
From optical to mid-IR:
35 photometric bands!

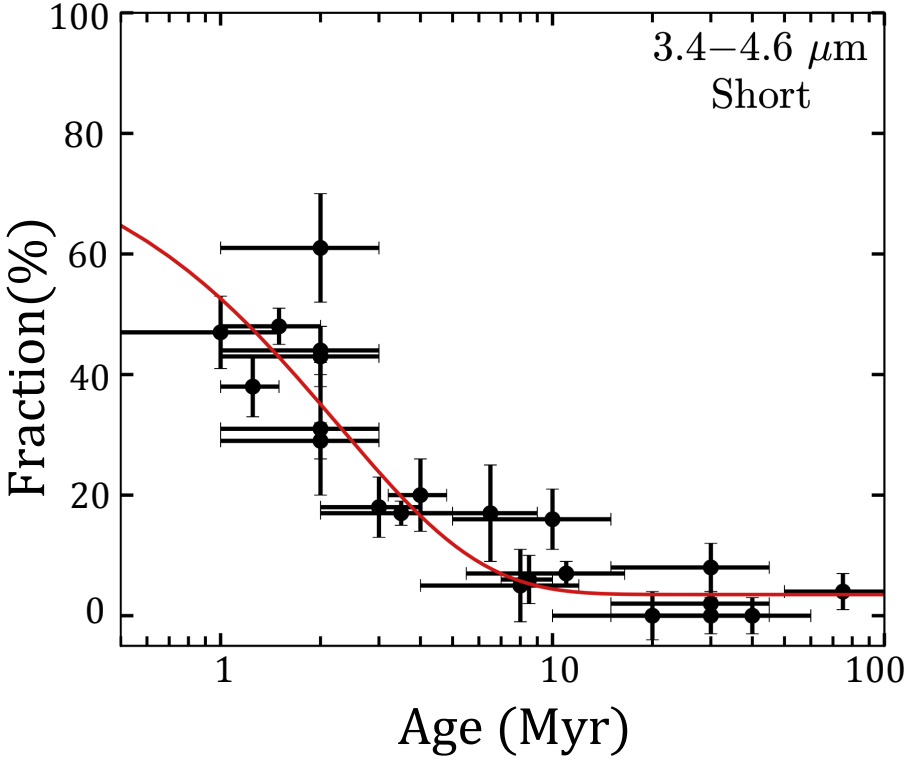
…that can be used to study the evolution of the disk at different radii

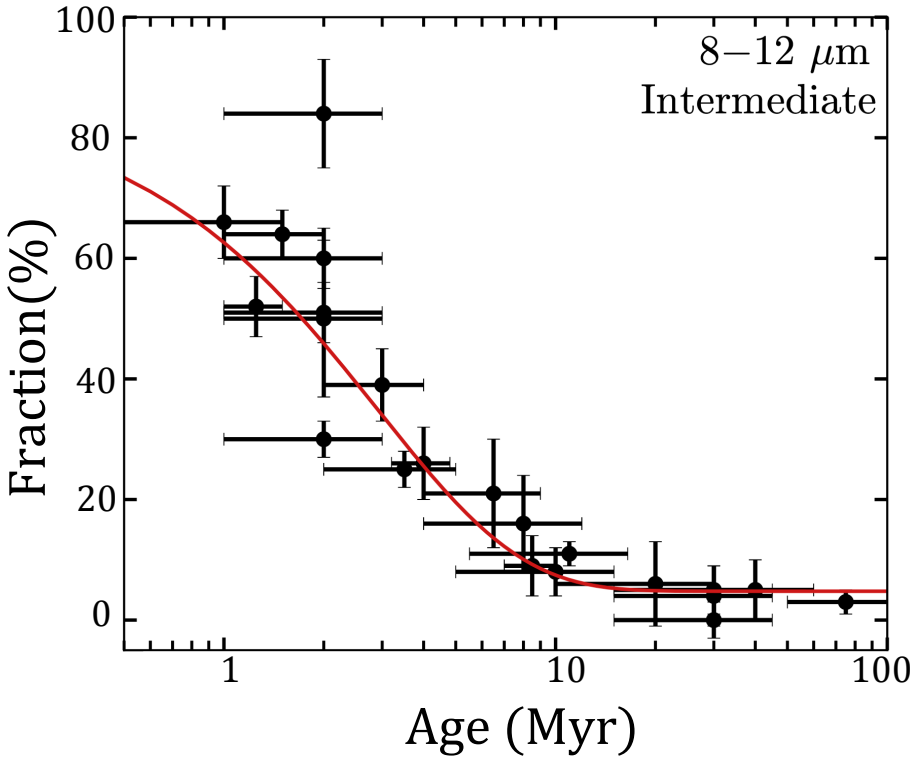


Evidence of inside-out disk dispersal



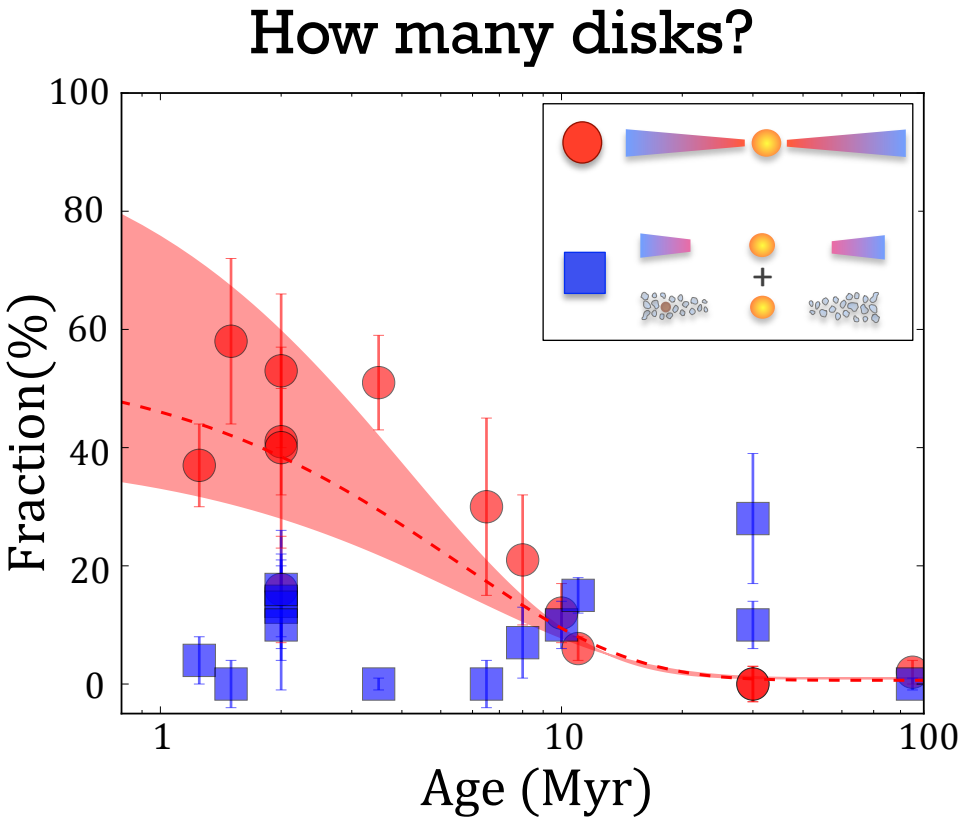






Ribas et al. 2013b, in press

Protoplanetary disks disappear at 10 Myr, and only debris disks are found after that



Ribas et al. 2013b, in press

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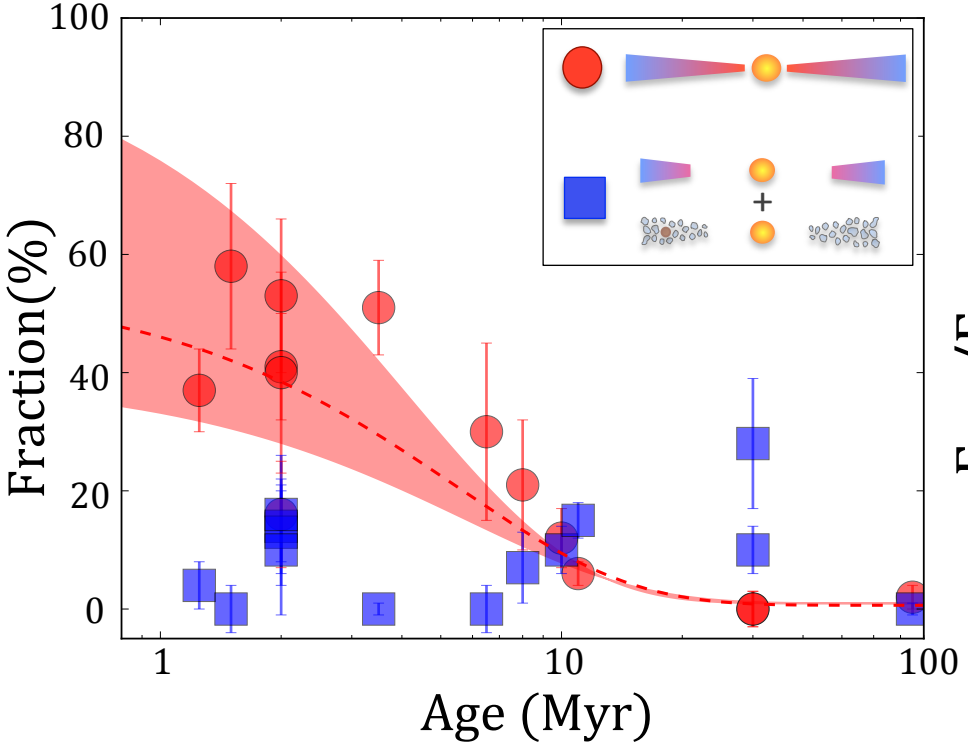
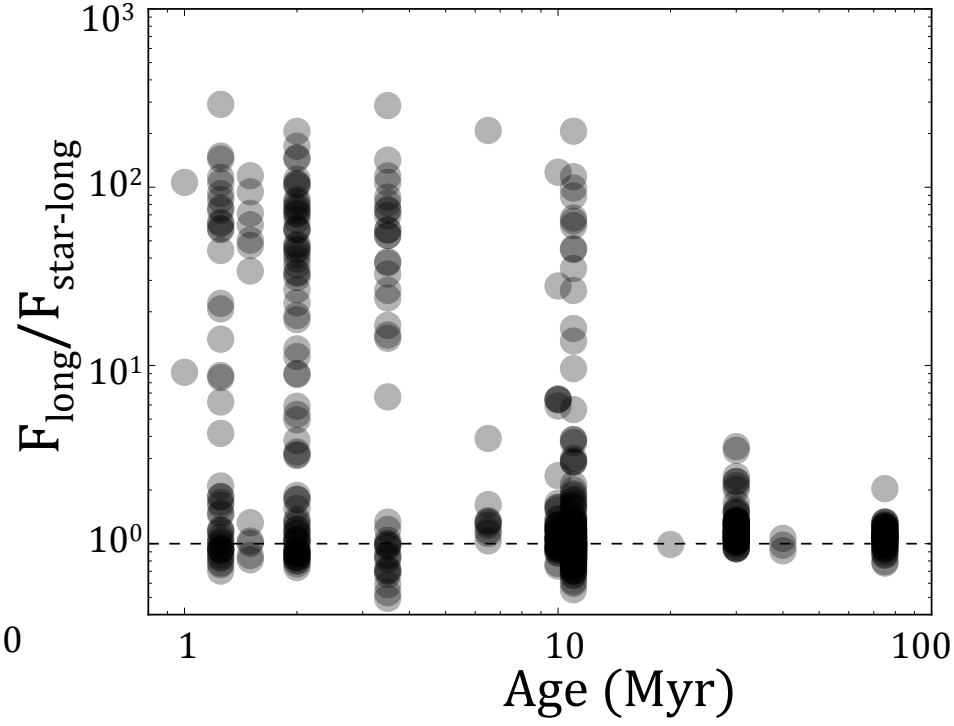
How many disks?



How much excess?



Ribas et al. 2013b, in press

We will continue exploiting the database in the future

Other dependencies?

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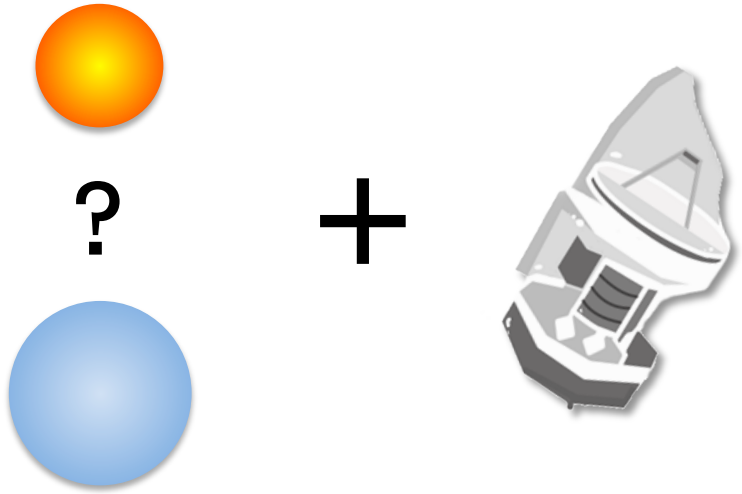


Other dependencies?

Herschel data

We will continue exploiting the database in the future

?

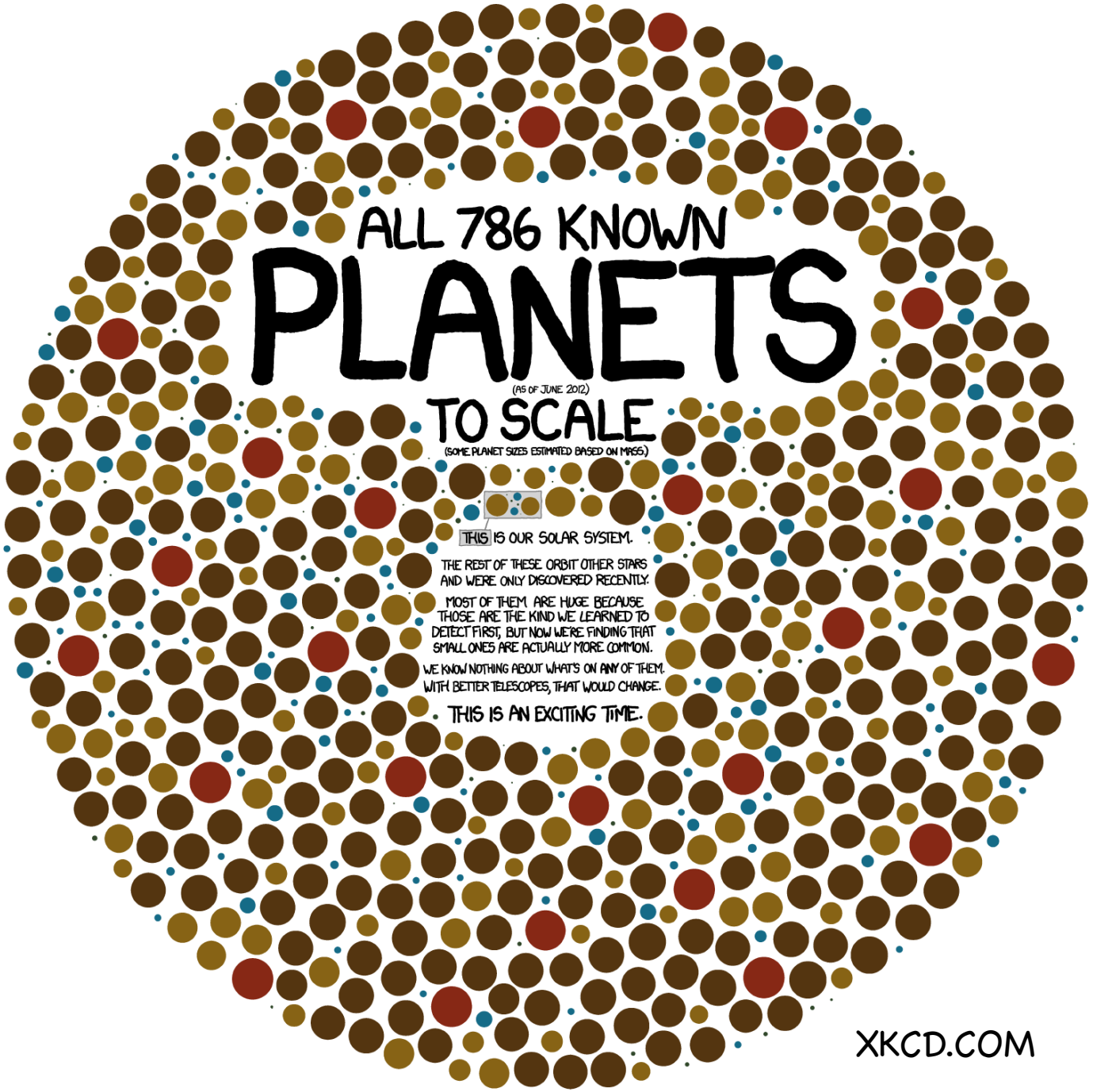
+

+

Other dependencies?

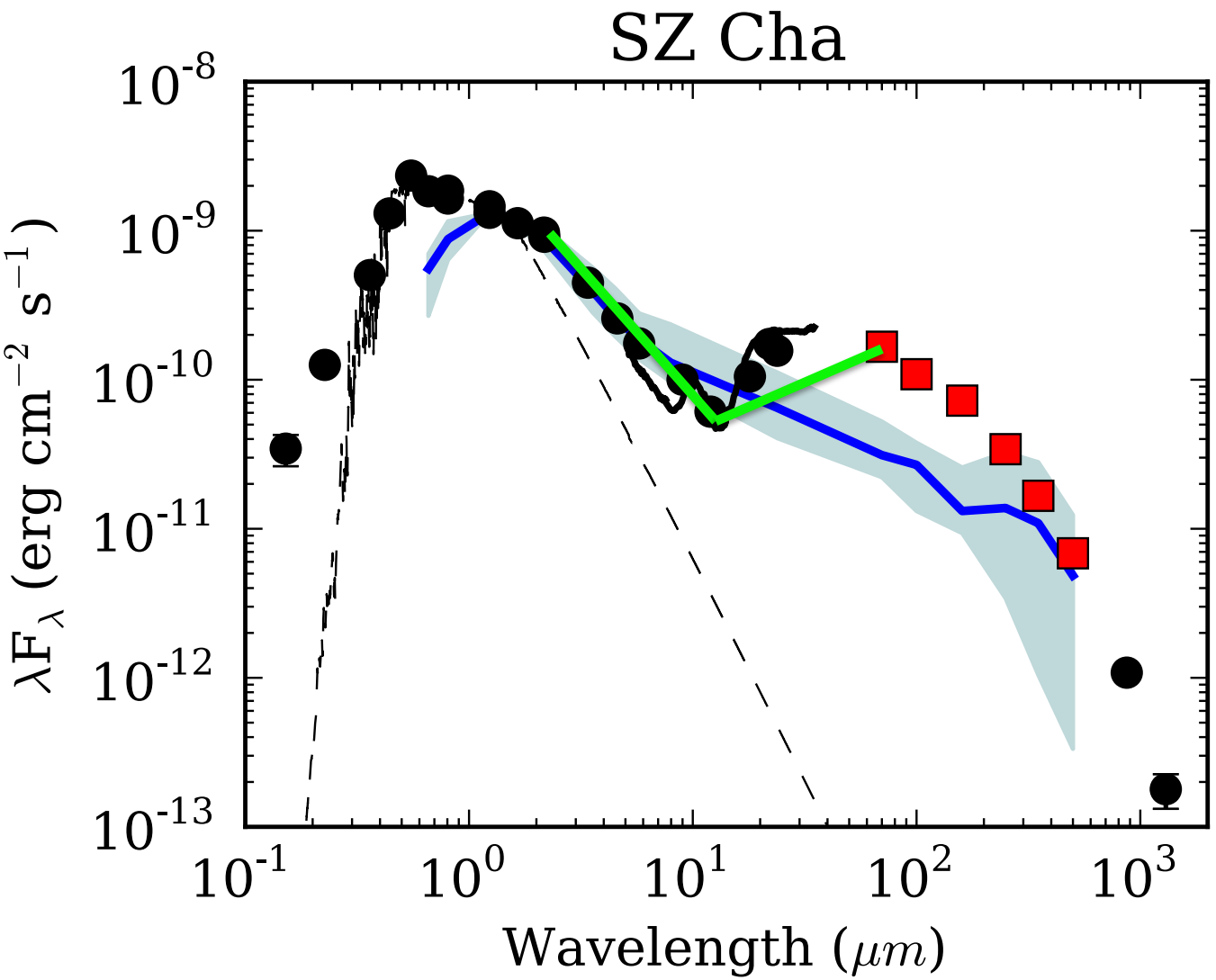
Herschel data

Modeling

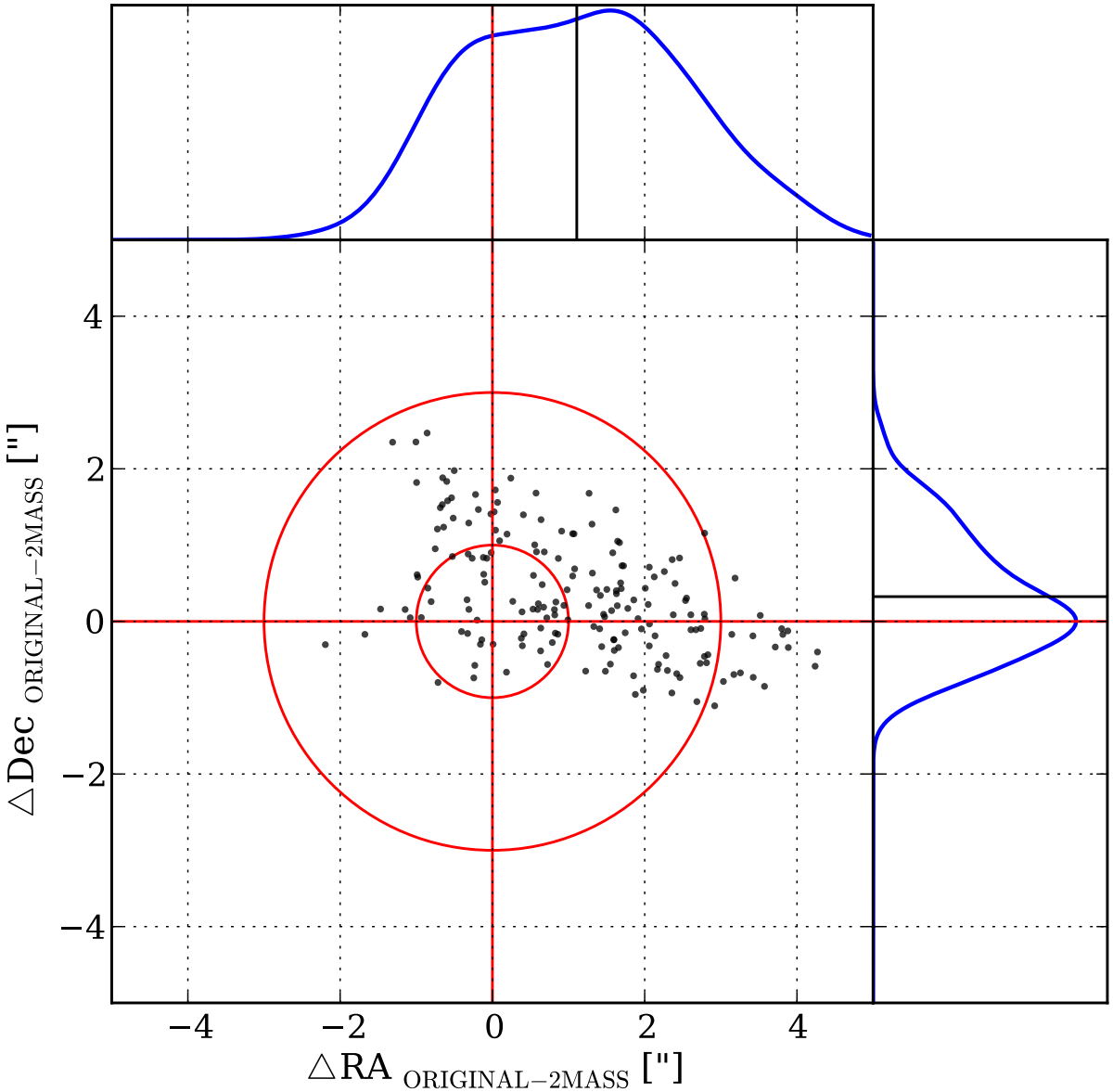

ALL 786 KNOWN
PLANETS
(AS OF JUNE 2012)
TO SCALE
(SOME PLANET SIZES ESTIMATED BASED ON MASS)
THIS IS OUR SOLAR SYSTEM.
THE REST OF THESE ORBIT OTHER STARS AND WERE ONLY DISCOVERED RECENTLY.
MOST OF THEM ARE HUGE BECAUSE THOSE ARE THE KIND WE LEARNED TO DETECT FIRST, BUT NOW WE'RE FINDING THAT SMALL ONES ARE ACTUALLY MORE COMMON.
WE KNOW NOTHING ABOUT WHAT'S ON ANY OF THEM. WITH BETTER TELESCOPES, THAT WOULD CHANGE.
THIS IS AN EXCITING TIME.
XKCD.COM

Extra slides

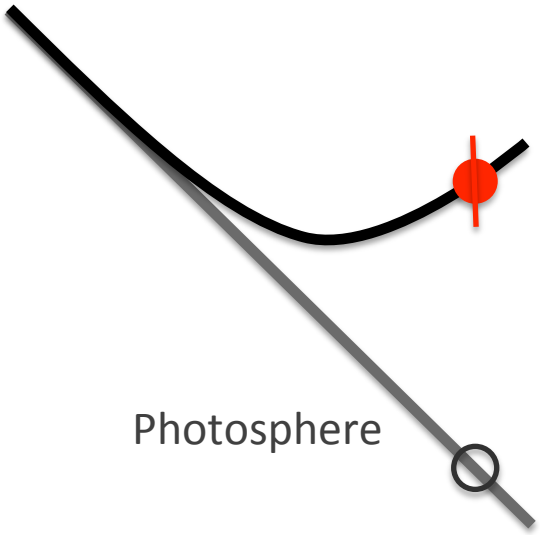
Transitional disk identification



Astrometic curation process



Excess definition



$$\chi_\lambda = \frac{F_{observed} - F_{photosphere}}{\sigma_{Total}}$$

$$\sigma_{Total} = \sqrt{(\sigma_{Observed}^2 + \sigma_{Calibration}^2)}$$

If $\chi_\lambda > 5 \longrightarrow$ **excess!**