The Ophichus DIsk Survey Employing ALMA (ODISEA)

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The ALMA Quest for Our Cosmic Origins

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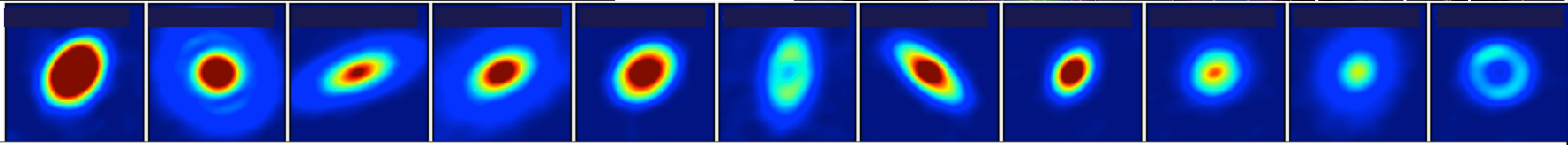
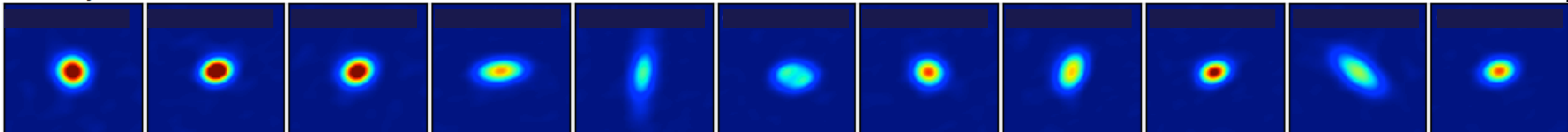
Santiago, Chile

NÚCLEO DE ASTRONOMÍA udp
FACULTAD DE INGENIERÍA

MAD

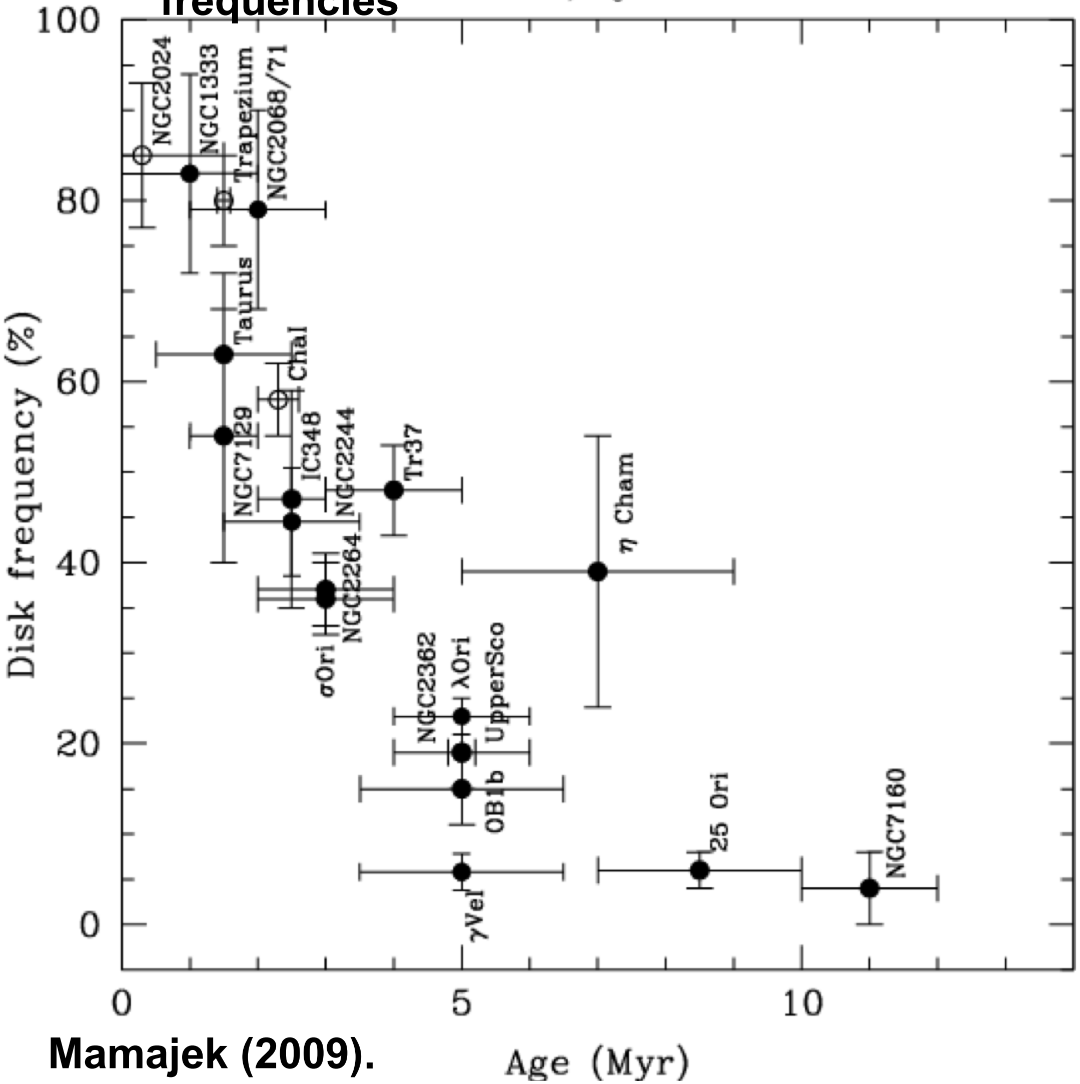


Jonathan Williams; Simon Casassus; Alice Zurlo; David Principe; Matthias Schreiber; Antonio Hales; Sebastian Perez; Gesa Bertrang; Dary Ruíz-Rodríguez; Gerrit van der Plas; Hector Canovas; Valentin Christiaens; Henning Avenhaus; Amelia Bayo; Bill Dent; Johan Olofsson; Karla Peña Ramírez; Santiago Orcajo; Roberto Gamen; Gabriel Ferrero



Disk demographic studies in the IR

IR (optically thick): disk frequencies

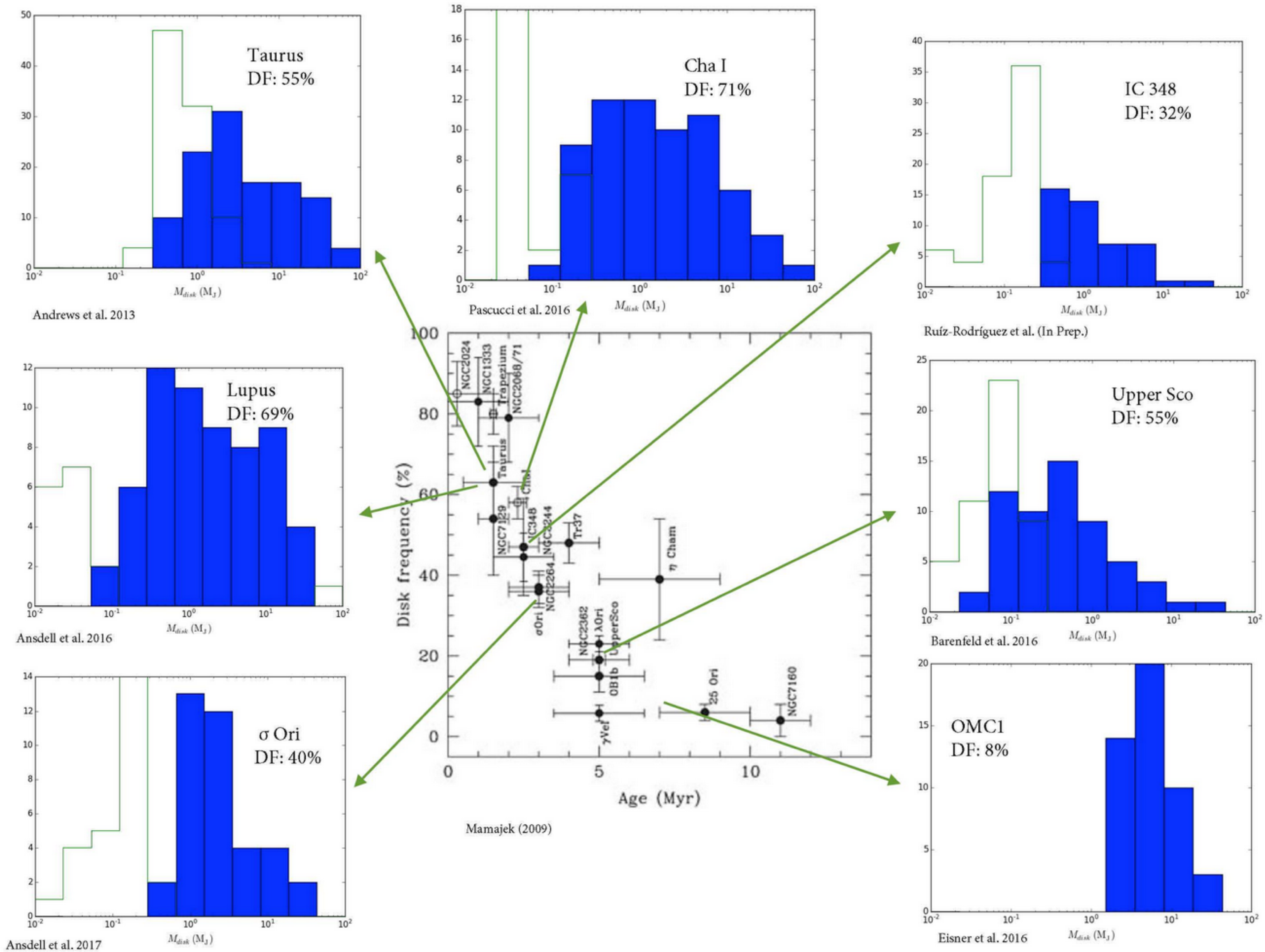


Mamajek (2009).

Disk lifetimes 1-10 Myr

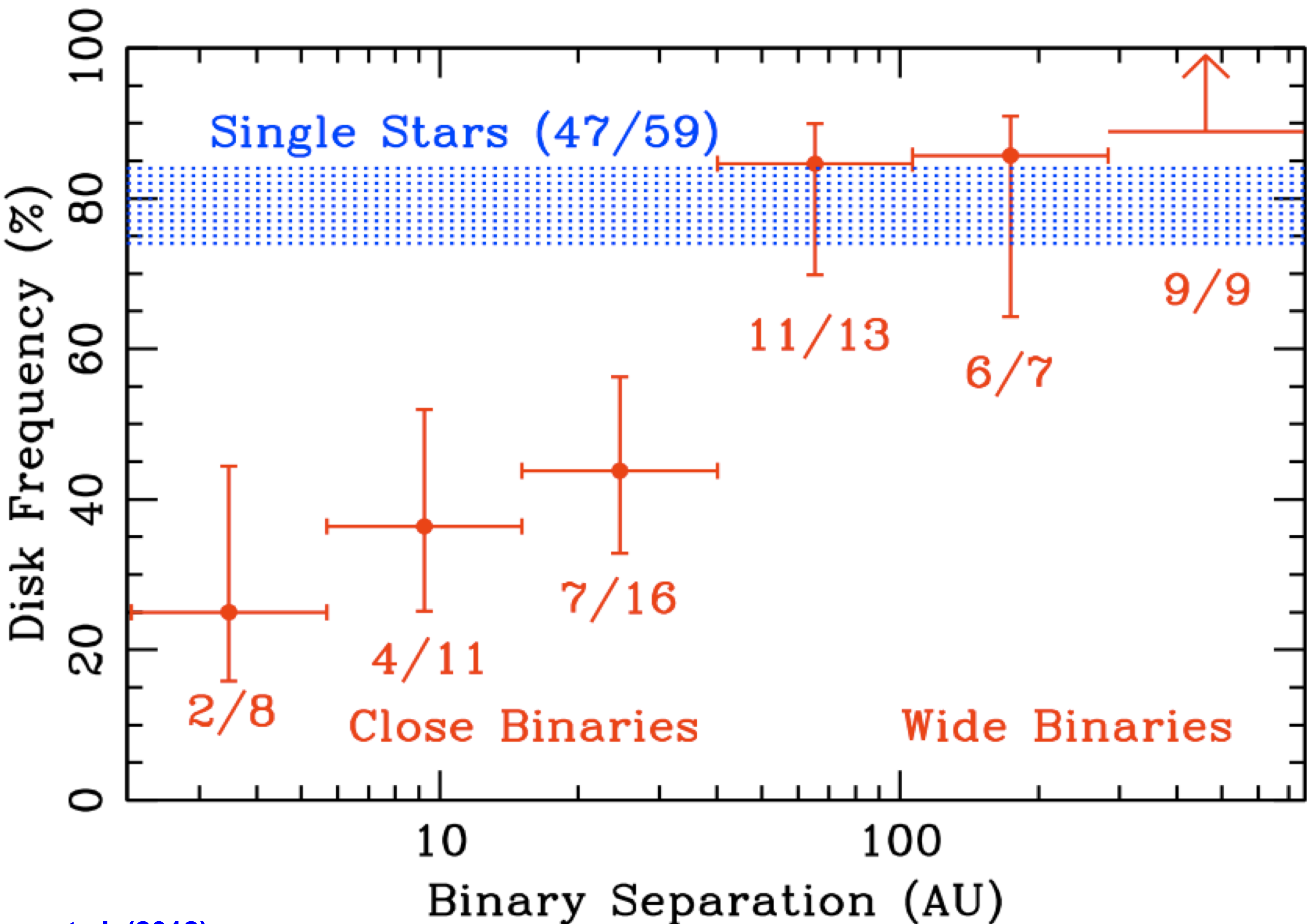
Median lifetime ~3 Myr

Disk demographic studies at mm wavelengths

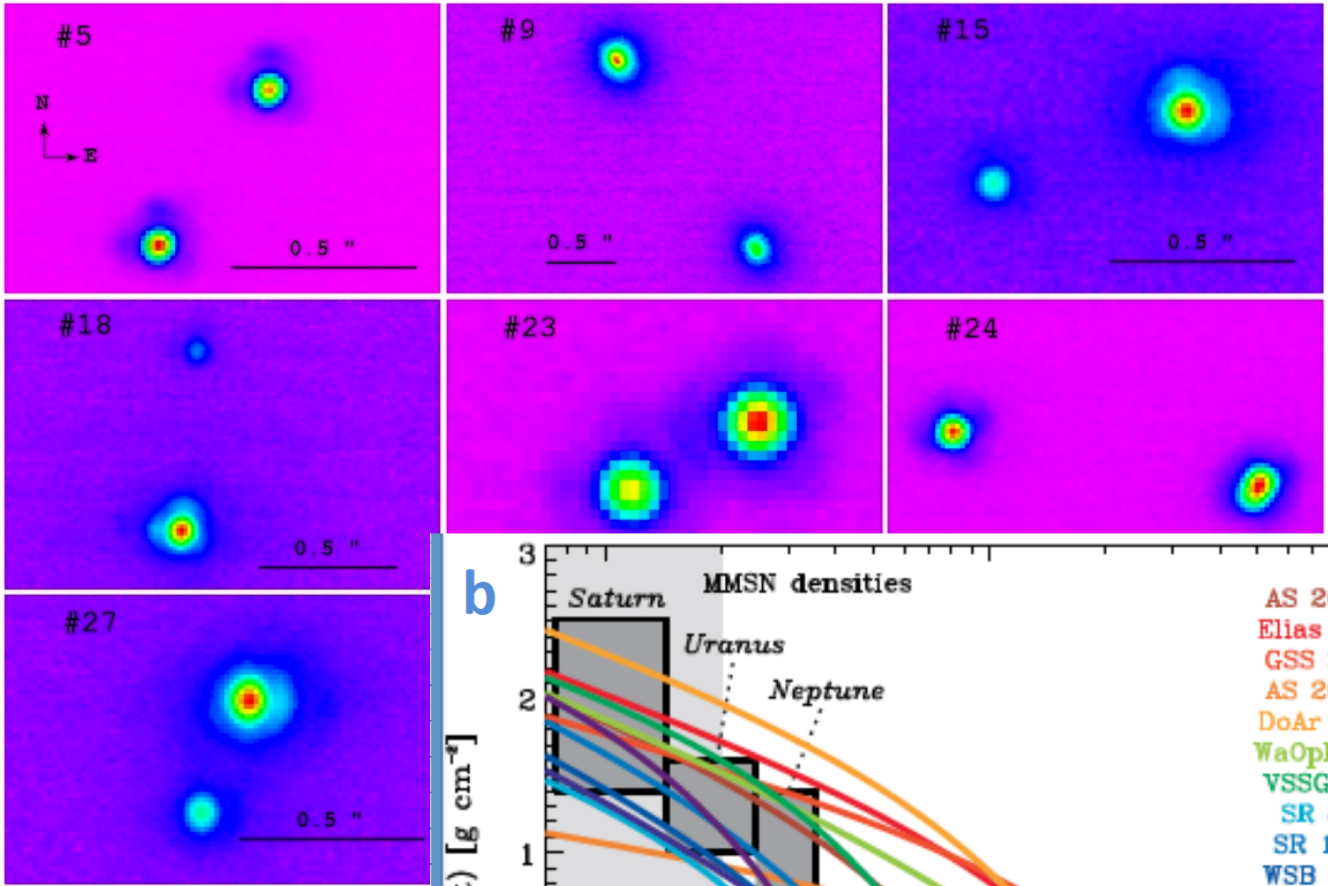


mm (optically thin): disk masses

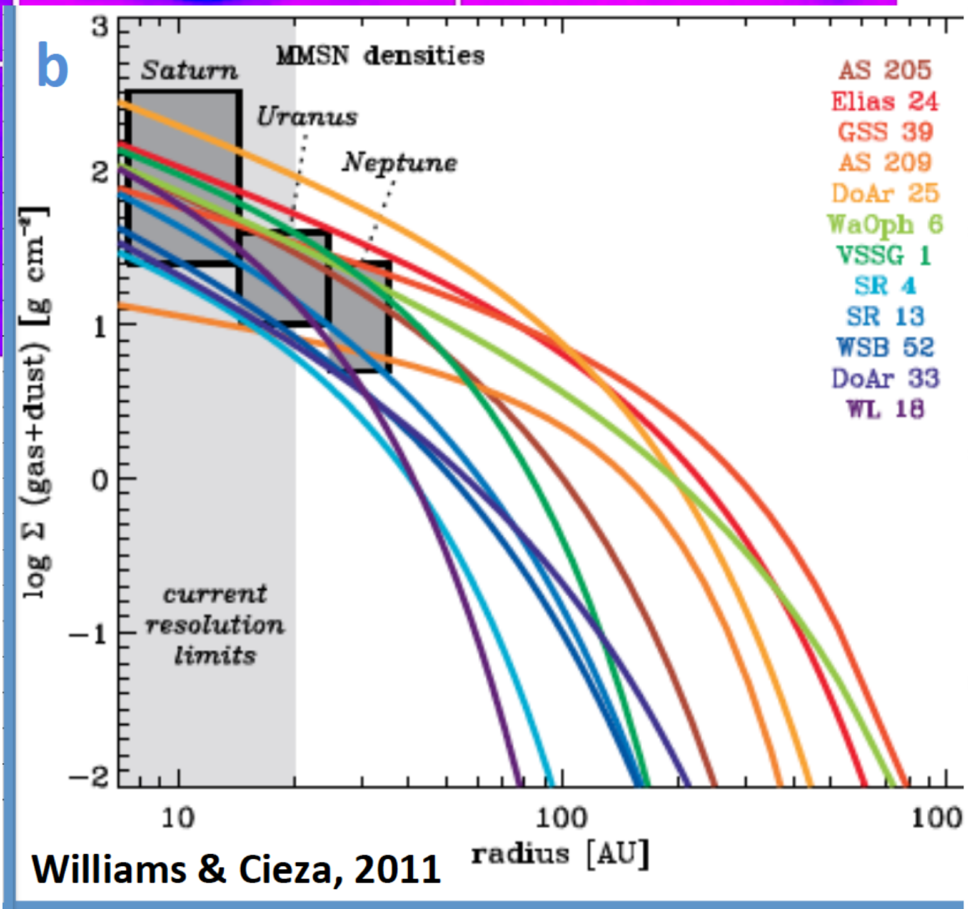
The Effect of Binaries on Circumstellar Disk Lifetimes



Kraus et al. (2012)

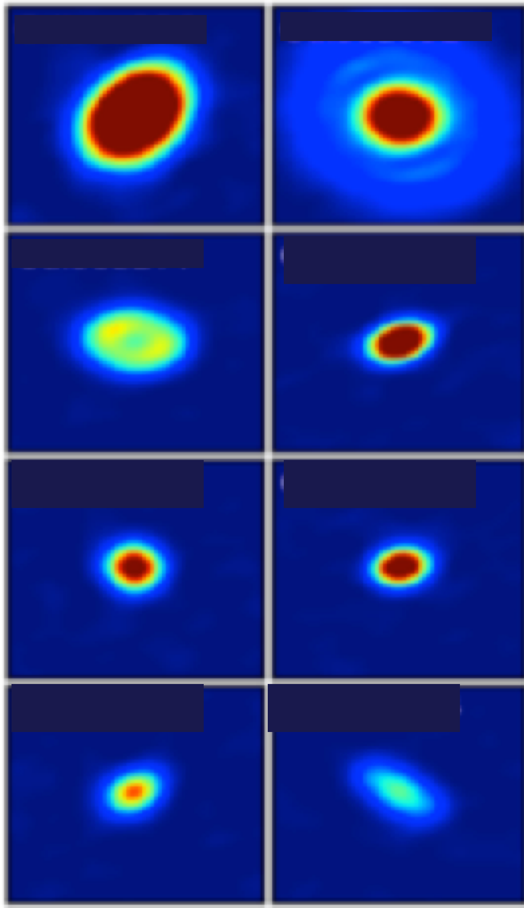


Cieza et al. 2010
Ophiuchus snapshot survey for transition disks

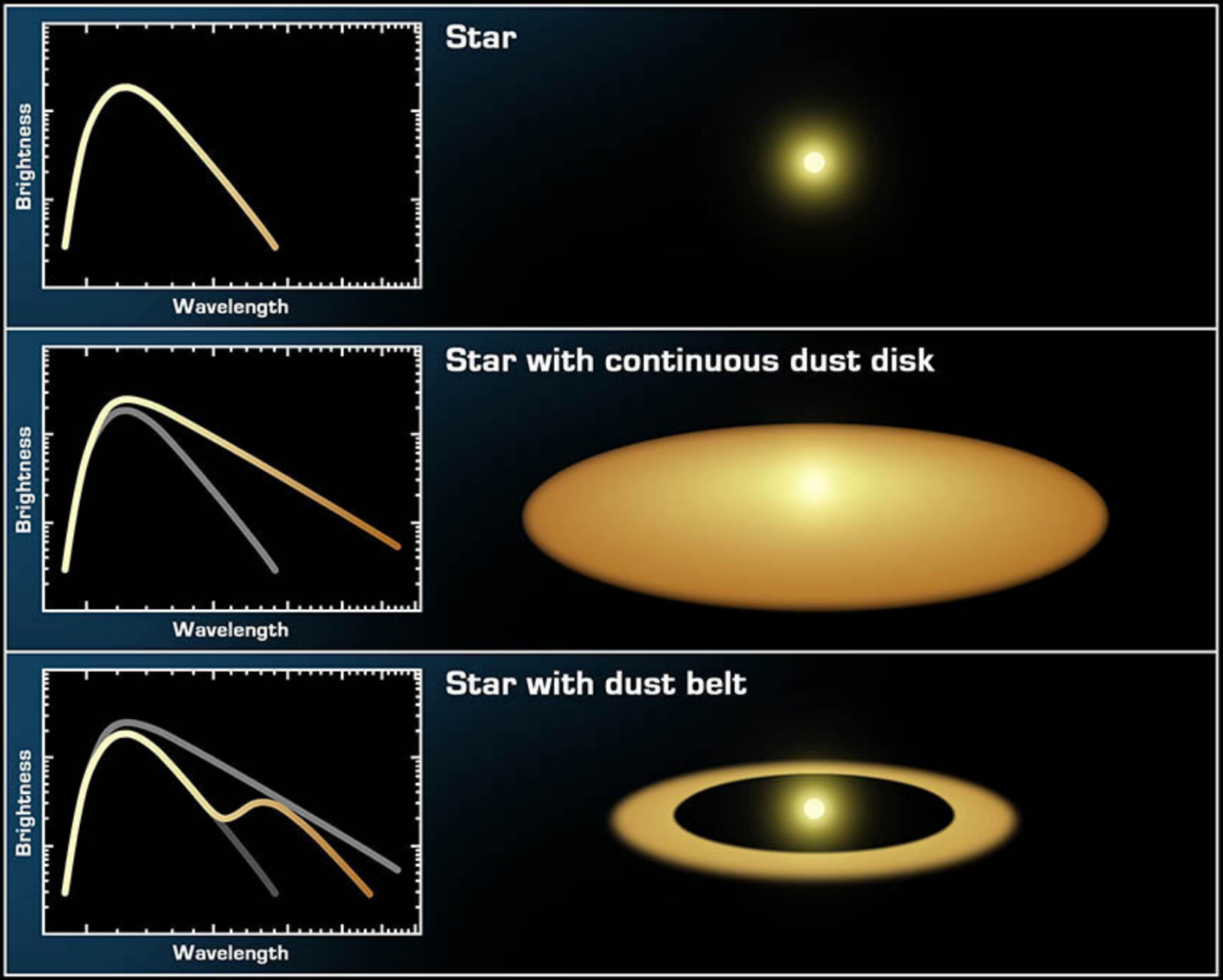


Williams & Cieza, 2011

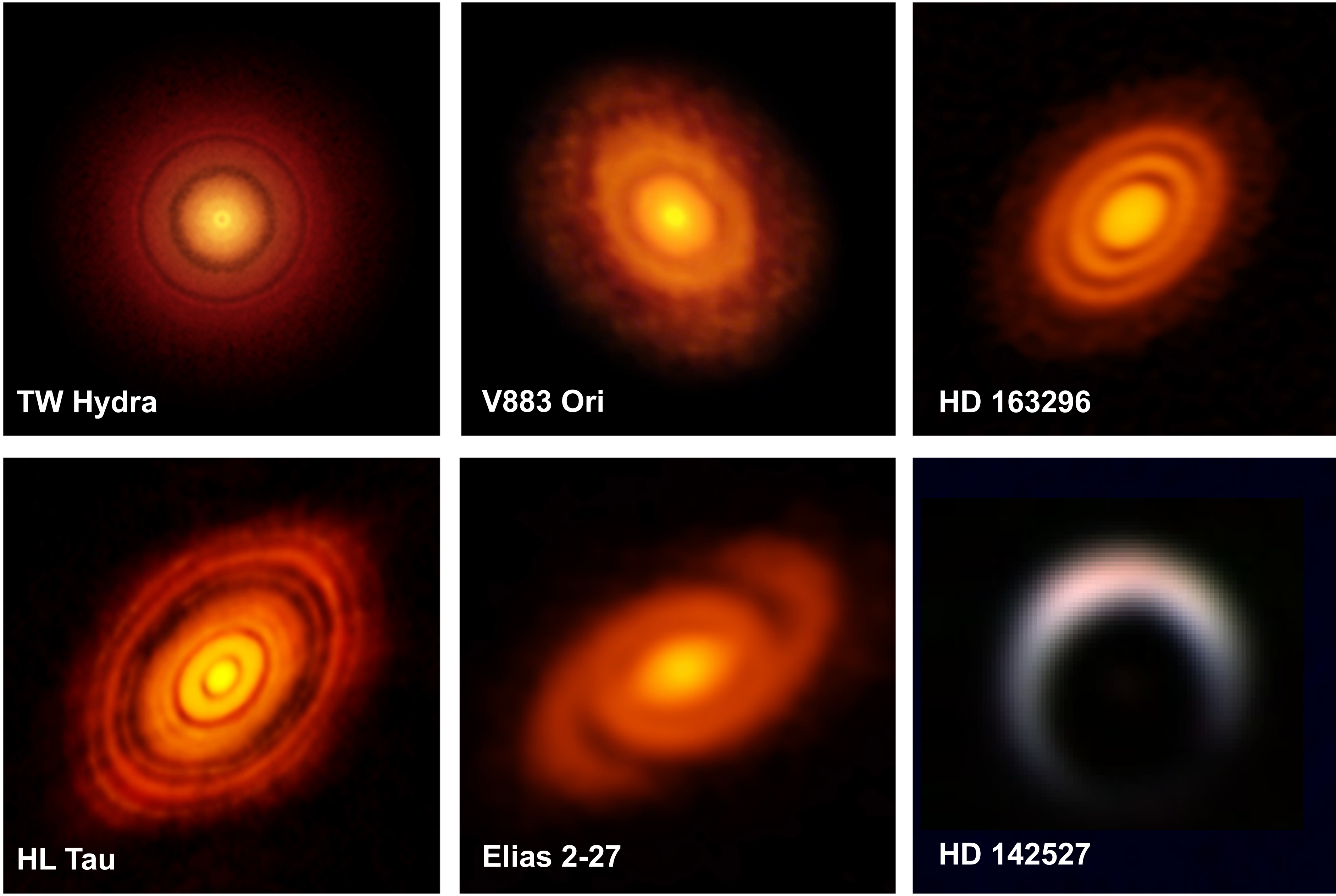
How do companions affect disk properties (sizes and surface density profiles)?



Disk structures from IR observations



Andrews et al. 2016, *ApJ*, 820, L40 Cieza et al. 2016, *Nature*, 535, 258 Isella et al. 2016, *PhysRevLett*, 117, 1101



ALMA Partnership et al. 2015, *ApJ*, 808, L3 Pérez et al. 2016, *Science*, 353,1519 Casassus et al. 2013, *Nature* 493, 191

Cycle-4/5 program:
289 targets in band-6

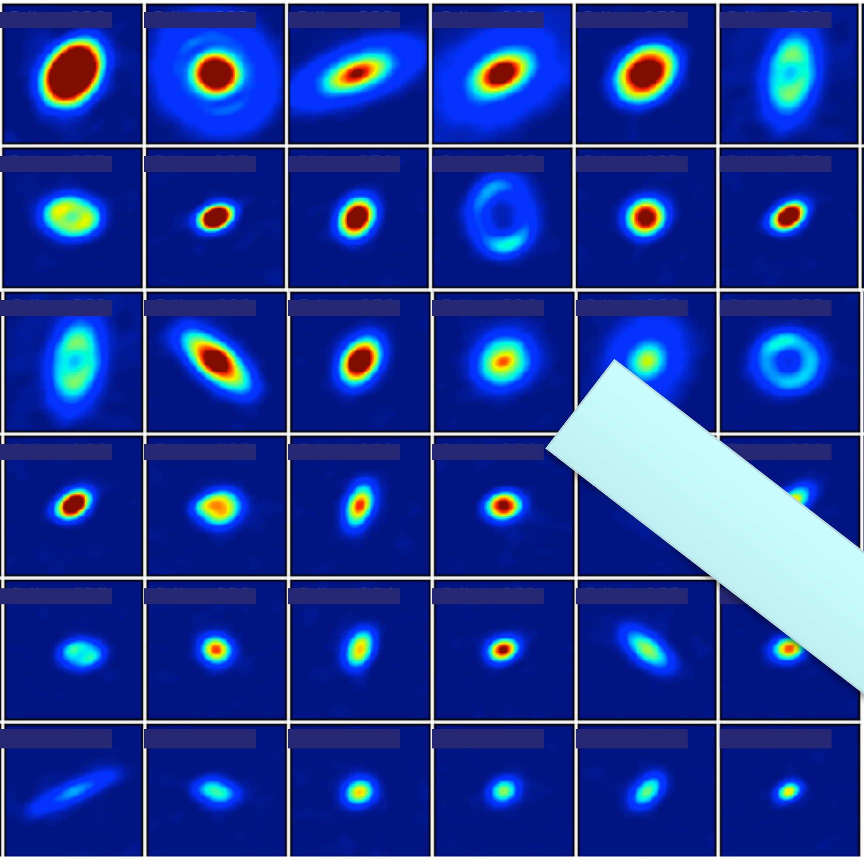
Ophiuchus: closest of region (125 pc) with ~300 disks.

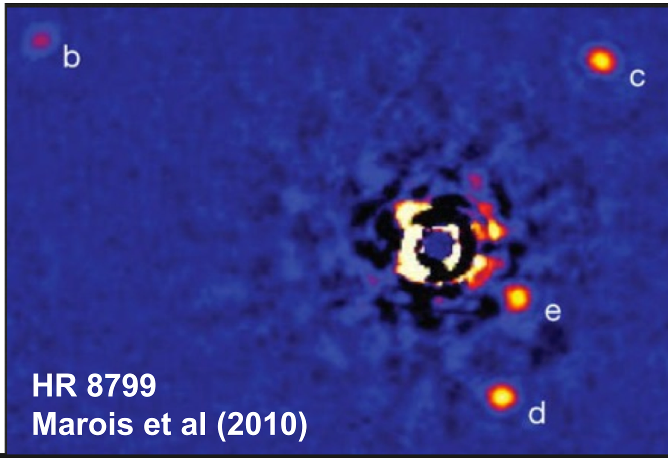
147 targets at 25 AU resolution (Cycle-4)

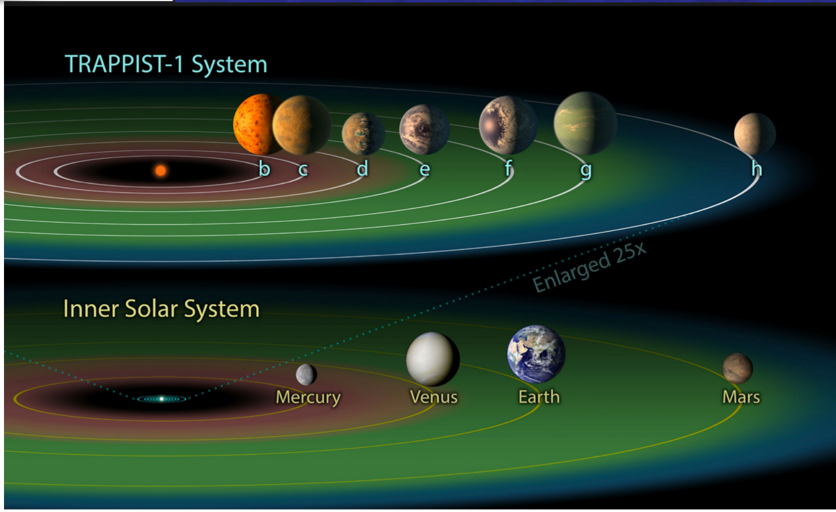
142 targets at 75 AU" resolution (Cycle-5)

1.3 mm continuum +
^{12}CO, ^{13}CO, $C^{18}O$

“From a population of disks to a population of planets”



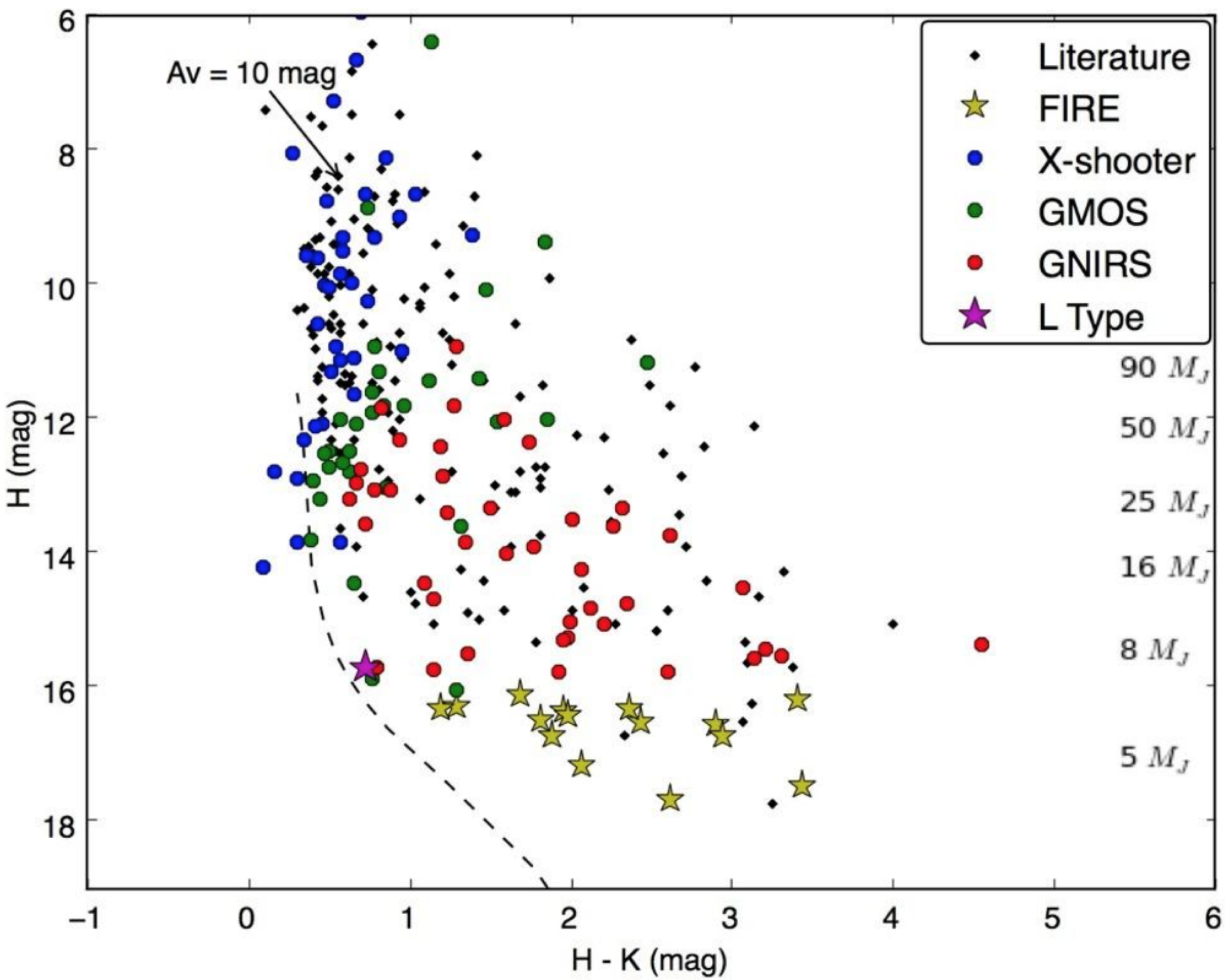


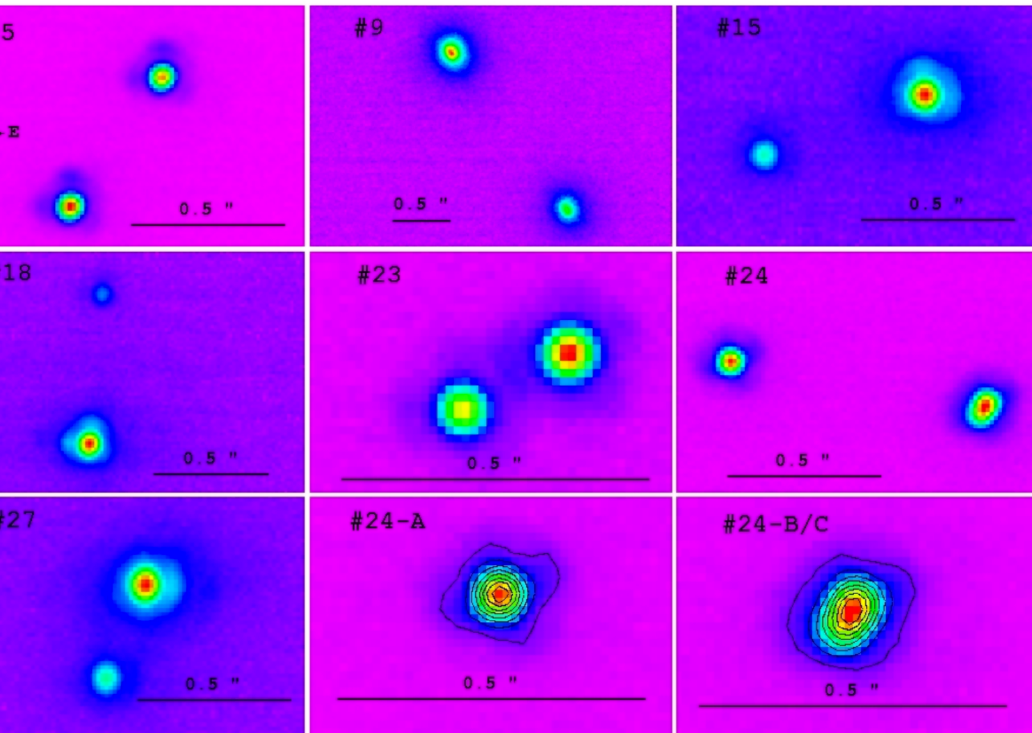


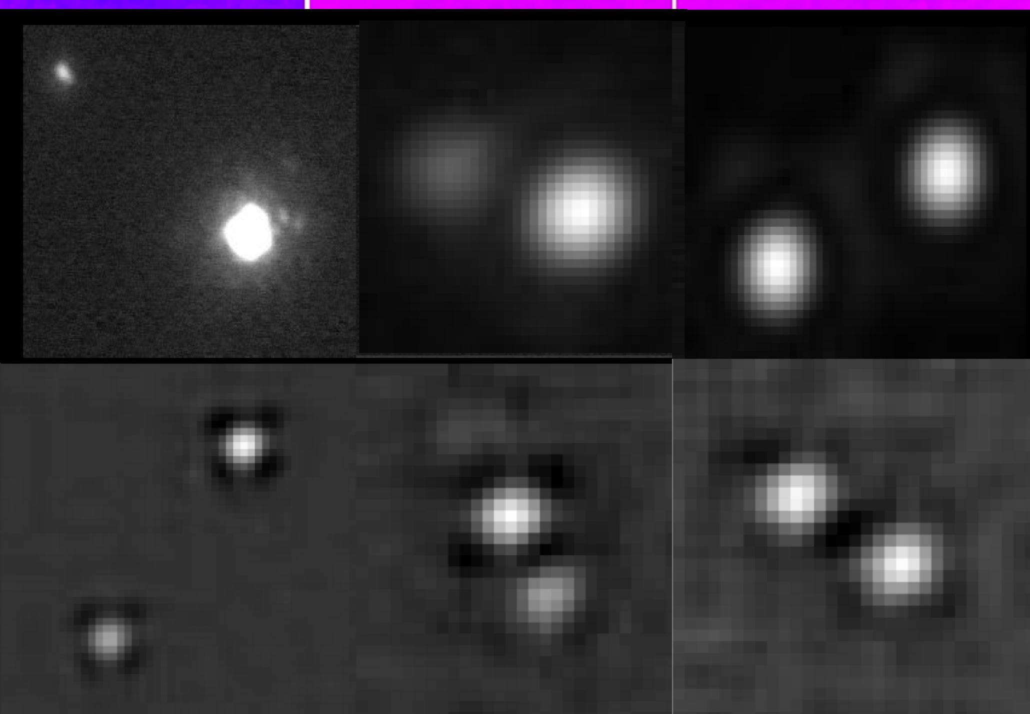
Diverse disks, diverse planetary systems!

Disk properties a function of stellar properties

Complete the stellar characterization: X-shooter (16 hs), Gemini-GMOS (18 hs), Gemini-GNIRS (21 hs), Magellan-FIRE (3.0 nights).





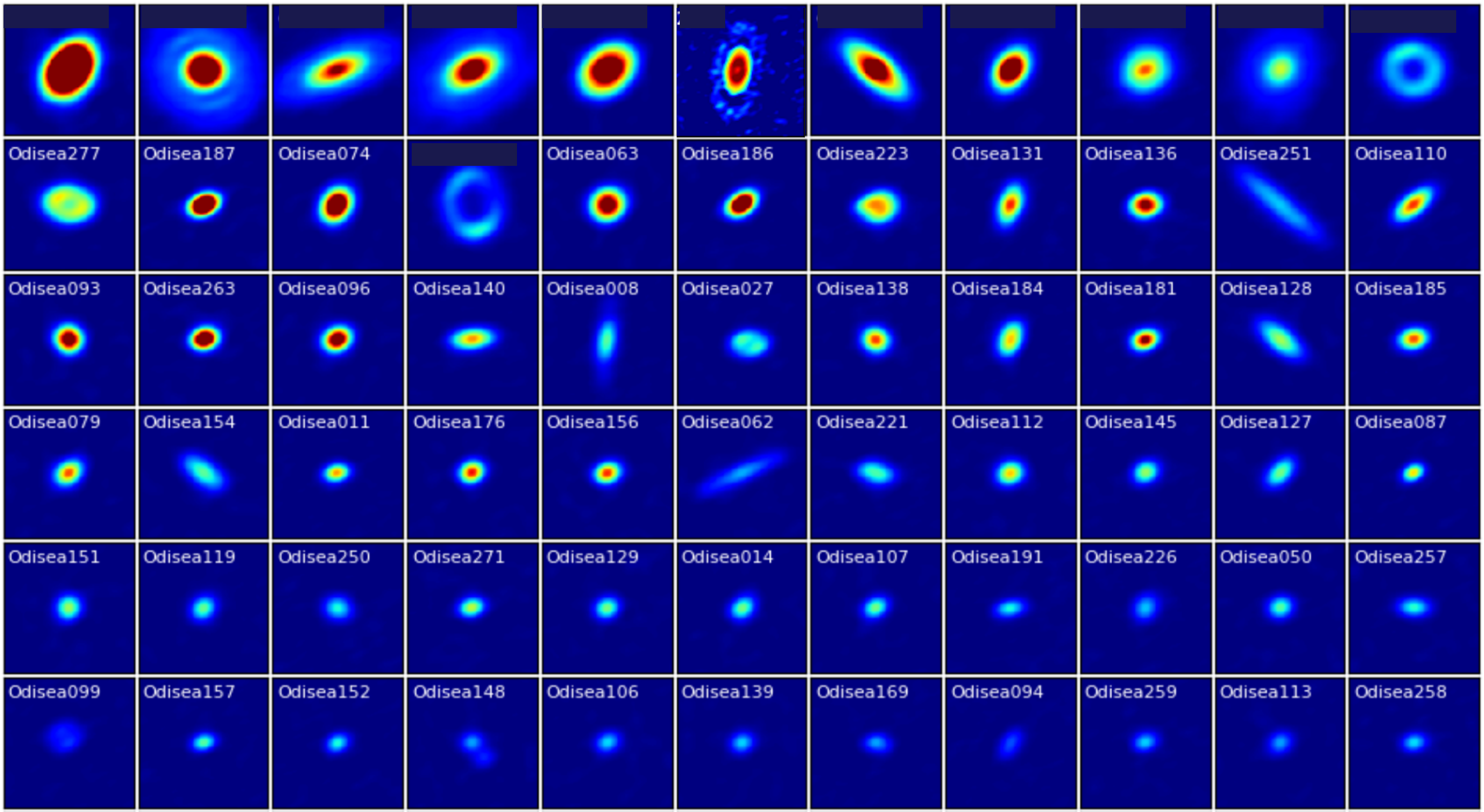


Completing Multiplicity characterization:

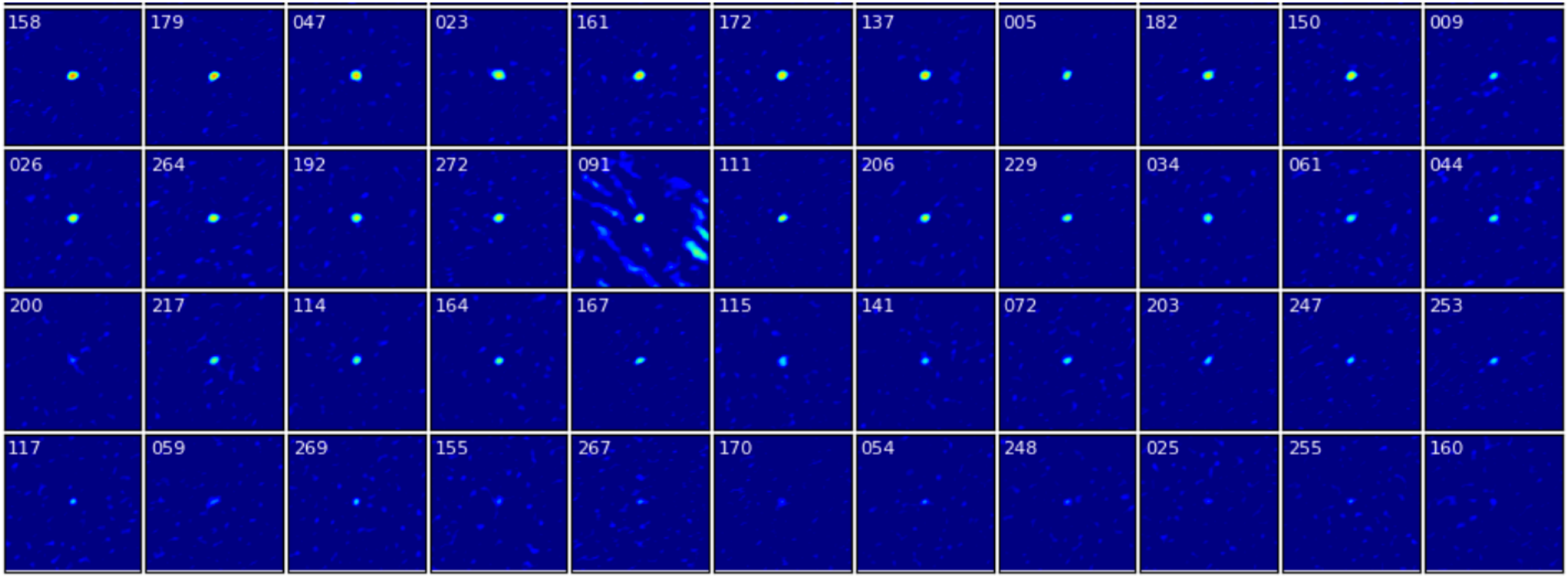
1.5 nights with VLT-NACO
1.5 nights with Keck.

21 new multiple systems (Zurlo et al. in prep)

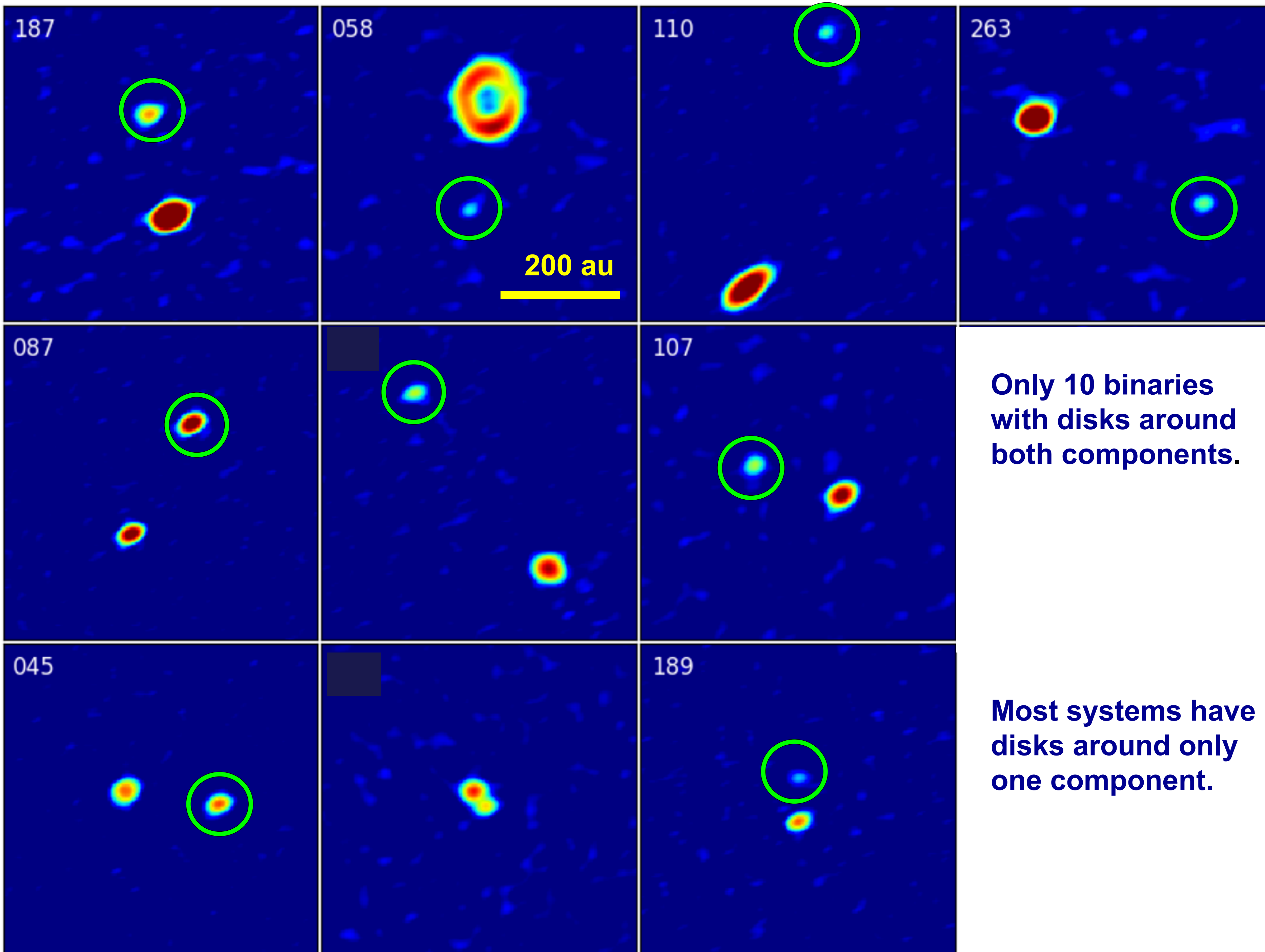
Cycle-4: 66 resolved disks: fluxes, sizes, inclinations and structures.



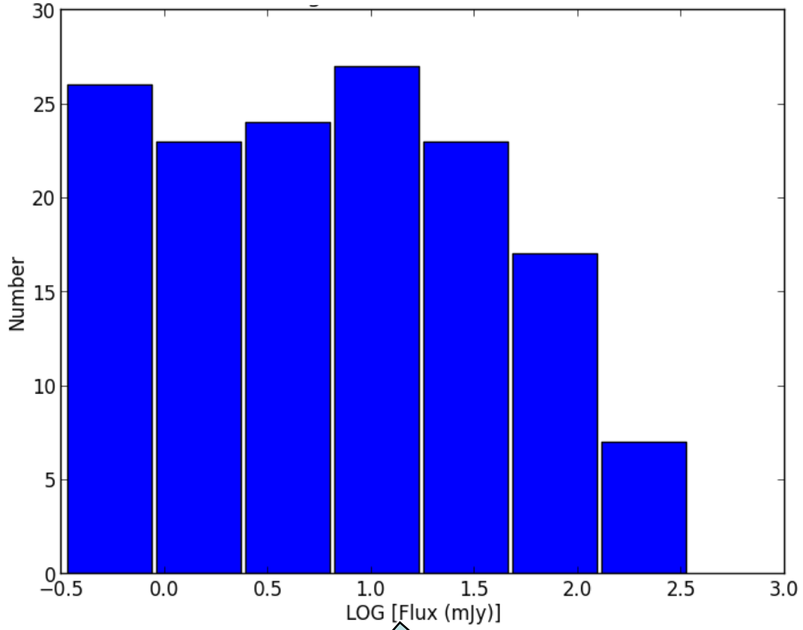
Cycle-4: 44 unresolved disks: fluxes, sizes (< 15 au radius)

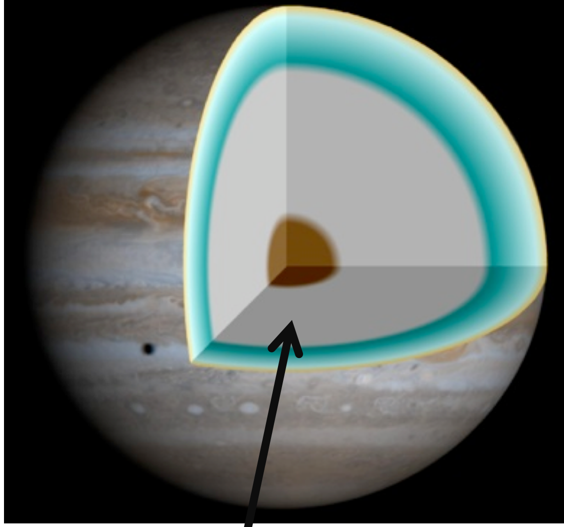


37 non-detections: 1.3 mm flux < 1 mJy (5-sigma)

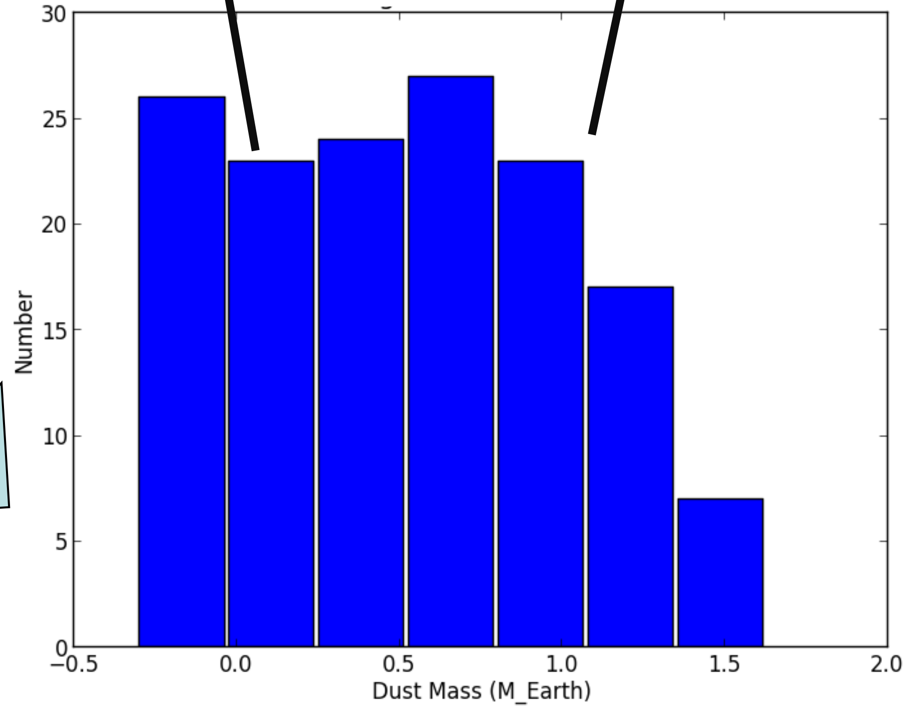

187
058
110
263
087
107
045
189
200 au
Only 10 binaries with disks around both components.
Most systems have disks around only one component.

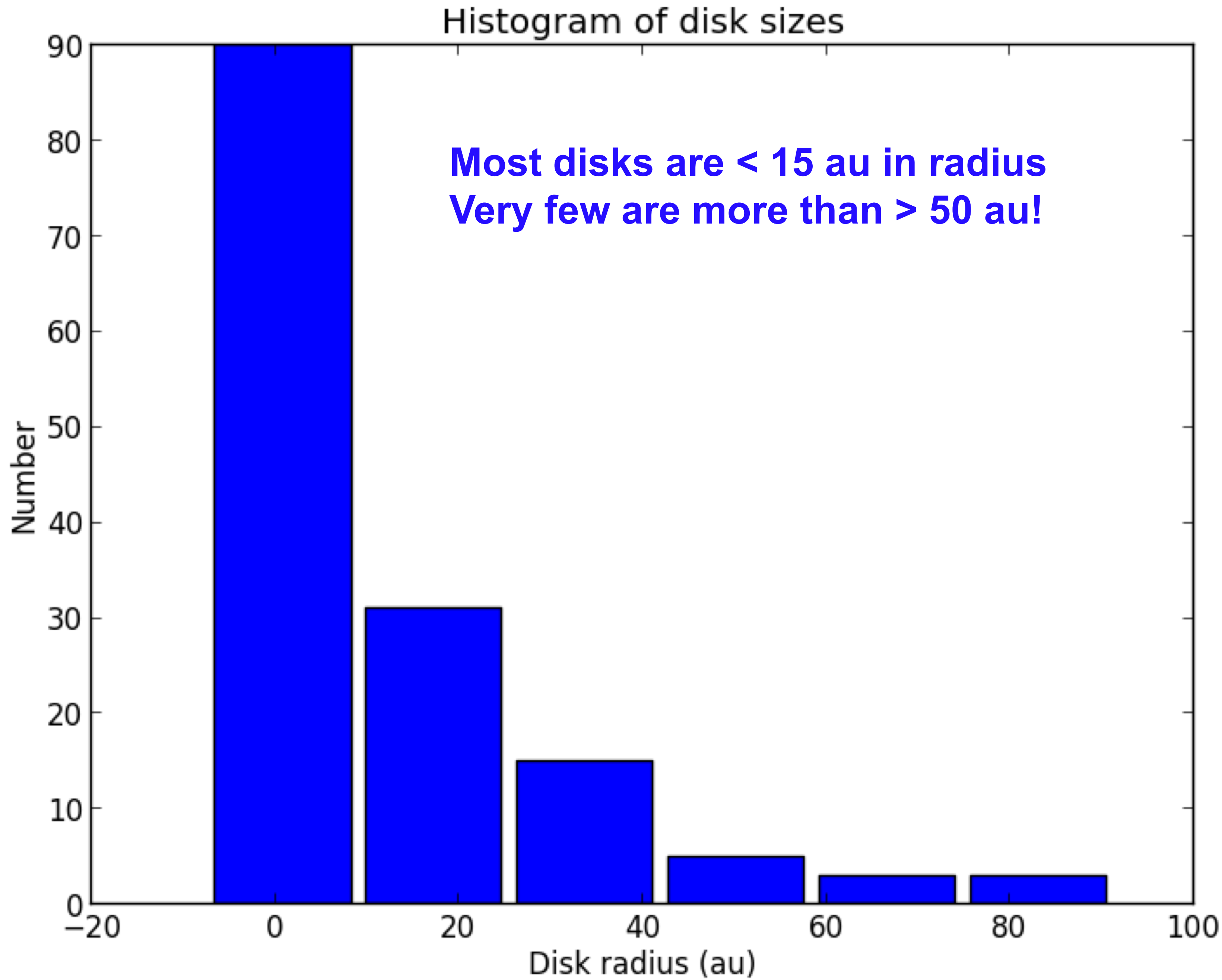
1.3 mm fluxes



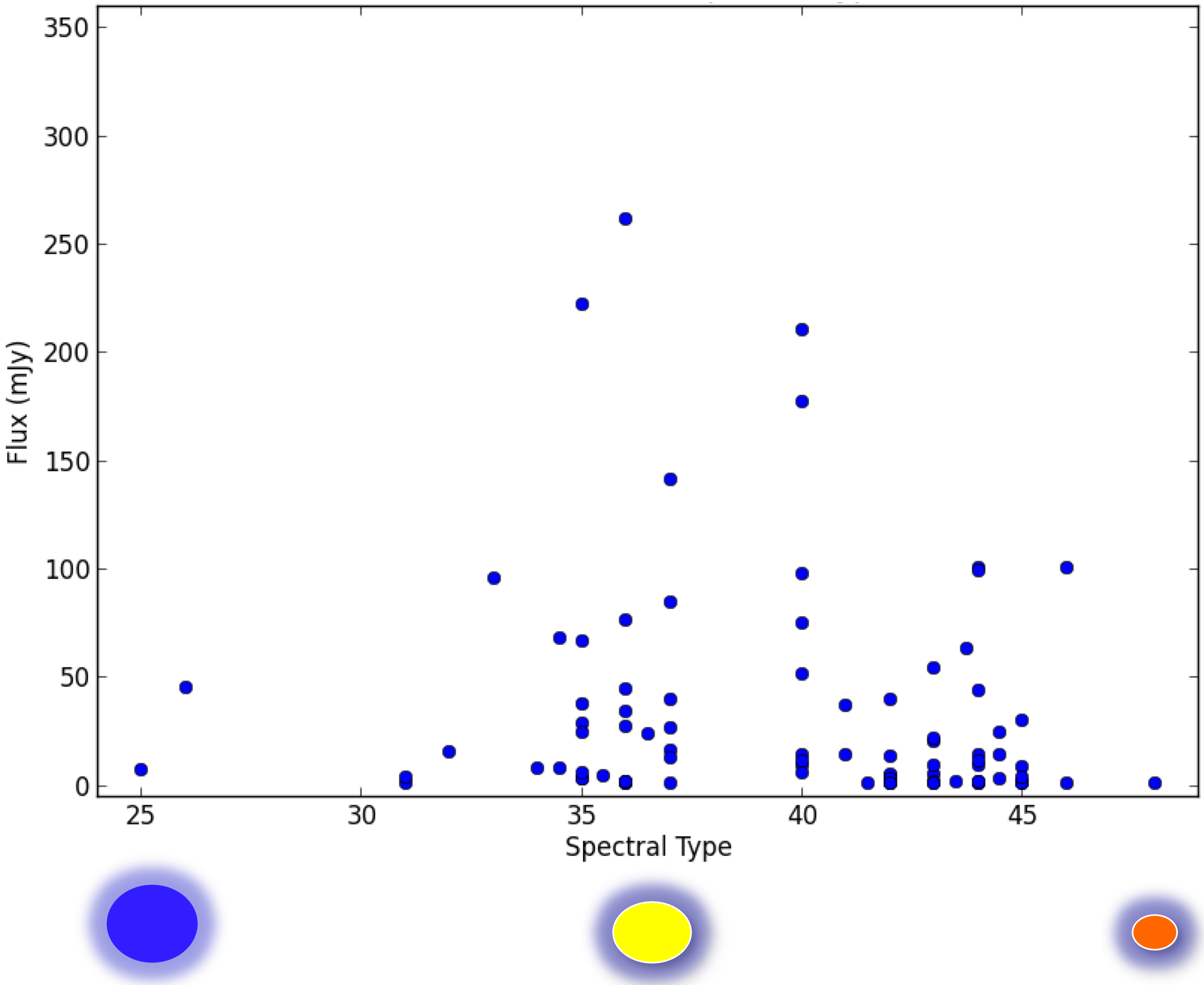


Dust masses




Histogram of disk sizes
Most disks are < 15 au in radius
Very few are more than > 50 au!
Number
Disk radius (au)
0
10
20
30
40
50
60
70
80
90
−20
0
20
40
60
80
100

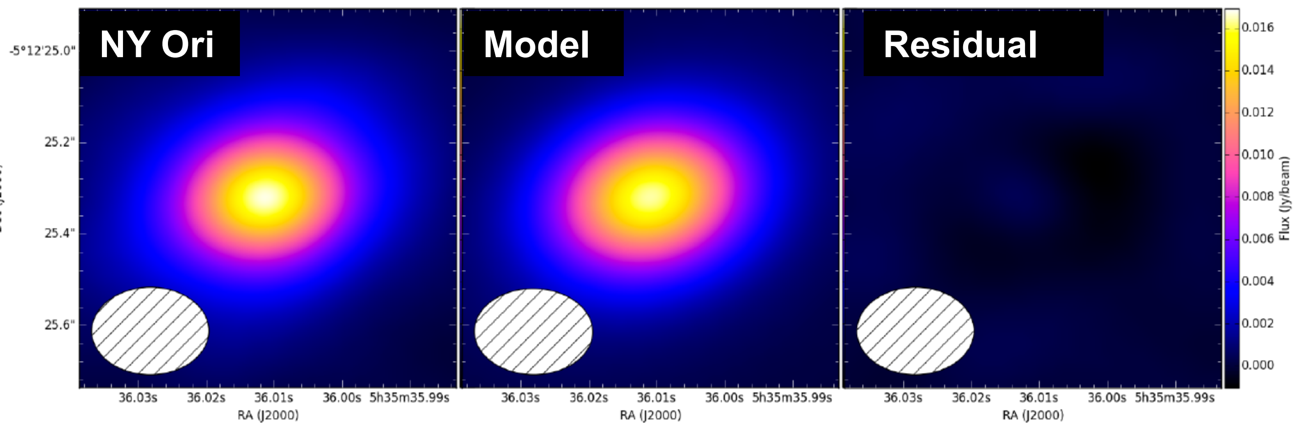
mm fluxes vs spectral type

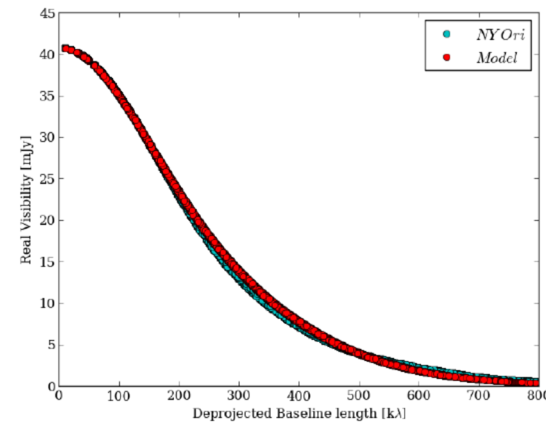


Monte Carlo Radiative transfer modeling for all resolved disks: (Perez et al. in prep).

Prescription from viscous evolution Characteristic radius + exponential tapper:

$$\Sigma = (2-\gamma)\frac{M_d}{2\pi R_c^2}\left(\frac{R}{R_c}\right)^{-\gamma}\exp\left[-\left(\frac{R}{R_c}\right)^{2-\gamma}\right], \quad H \propto R^{1+\psi}$$





Name	R_c (au)	M_{disk} ($M_\odot$)	H_{100} (au)	γ	Ψ
NY Ori	38	0.07	0.04	1.45	1.00
V883 Ori	65	0.66	0.60	0.90	0.03
V1647 Ori	35	0.11	0.14	1.80	1.75
V2775 Ori	35	0.16	0.13	1.82	1.60
HBC 494	10	0.18	0.15	1.80	1.50

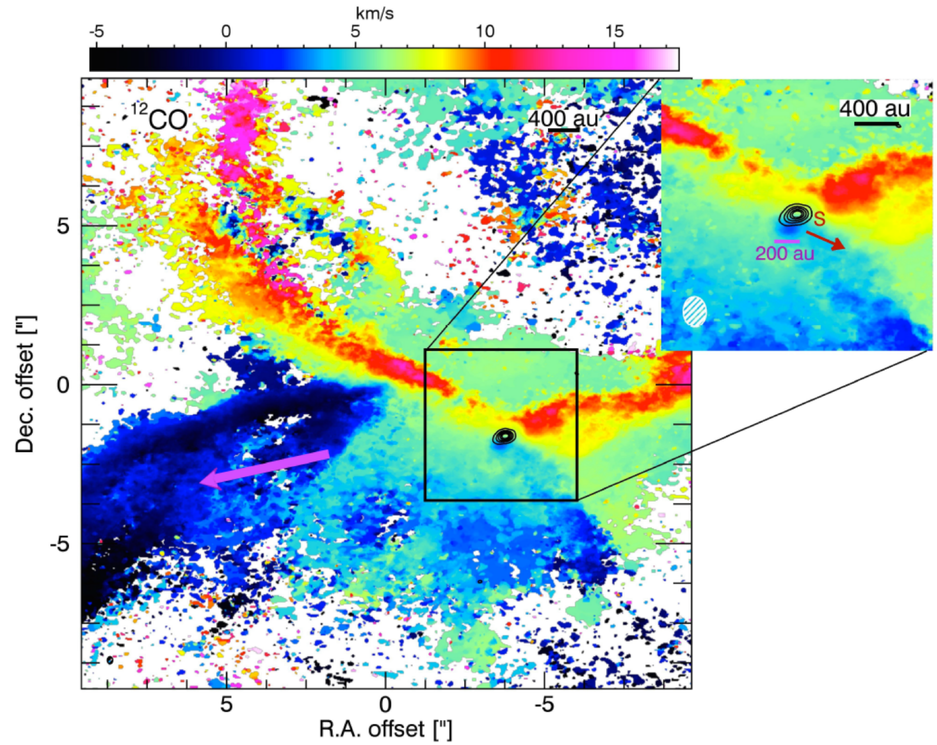
Cieza et al. (2018)

Line data / Gas:

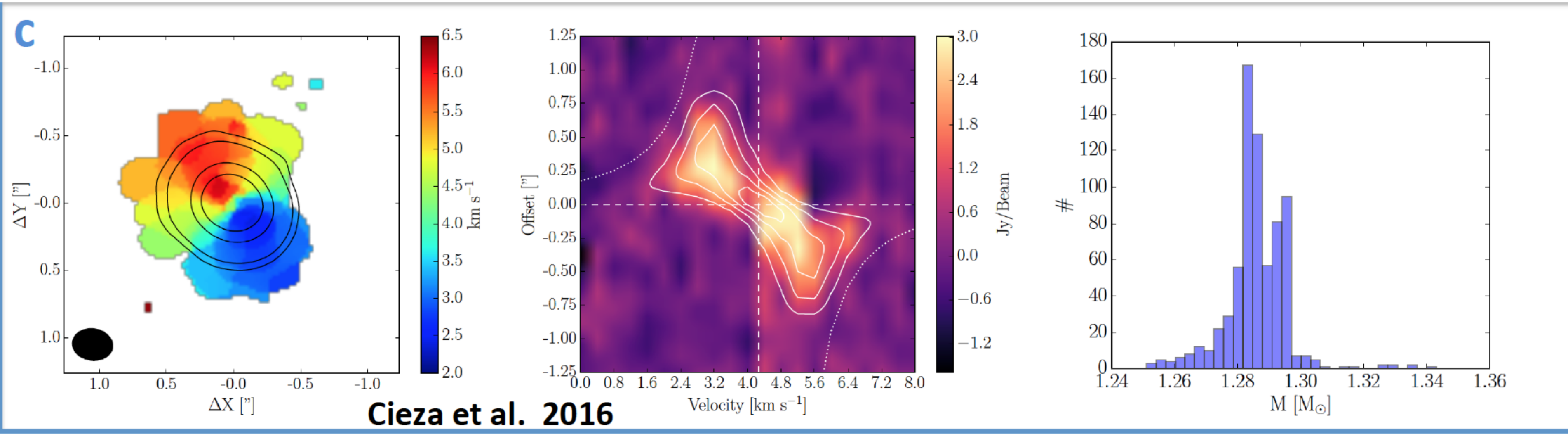
Study outflows (Class I and Class II)

Investigate gas to dust mass ratios (very hard!)

Derive stellar dynamical masses (test evolutionary track)



HBC 494, Ruiz-Rodriguez et al. 2017



Cieza et al. 2016

List of ODISEA papers:

1. **Survey description and continuum results (Cieza et al. in prep)**

2. **Modeling of all resolved sources (Perez et al. in prep)**

2. **Spectroscopic characterization and disk properties vs stellar properties (Ruiz-Rodriguez et al. in prep)**

4. **Multiplicity paper and disk properties in binary systems (Zurlo et al. in prep).**

5. **Molecular line paper: outflows, gas masses, stellar dynamical masses (Williams et al in prep)**

Thanks!

Questions?