M17: Hints on the origin of close massive binaries?

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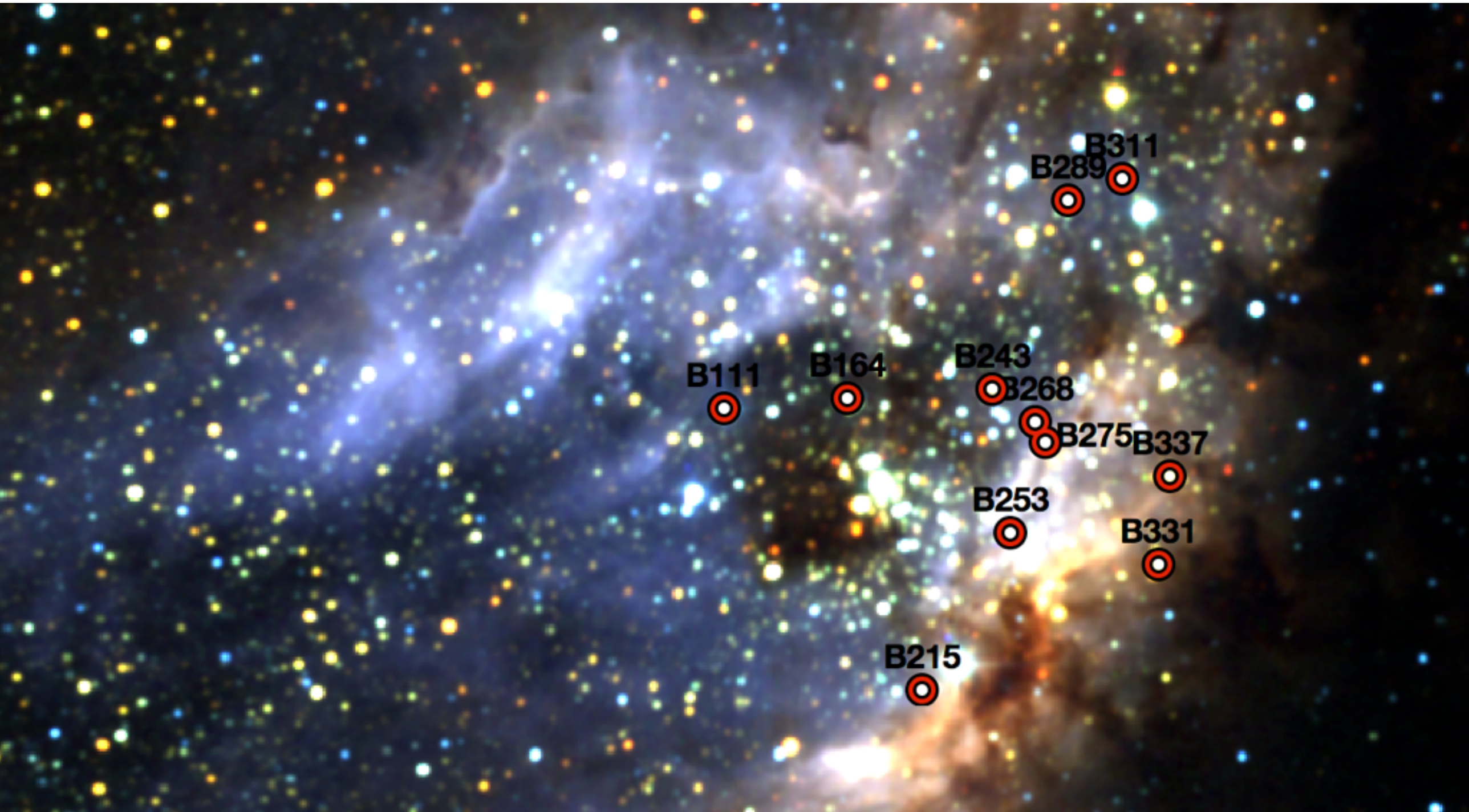
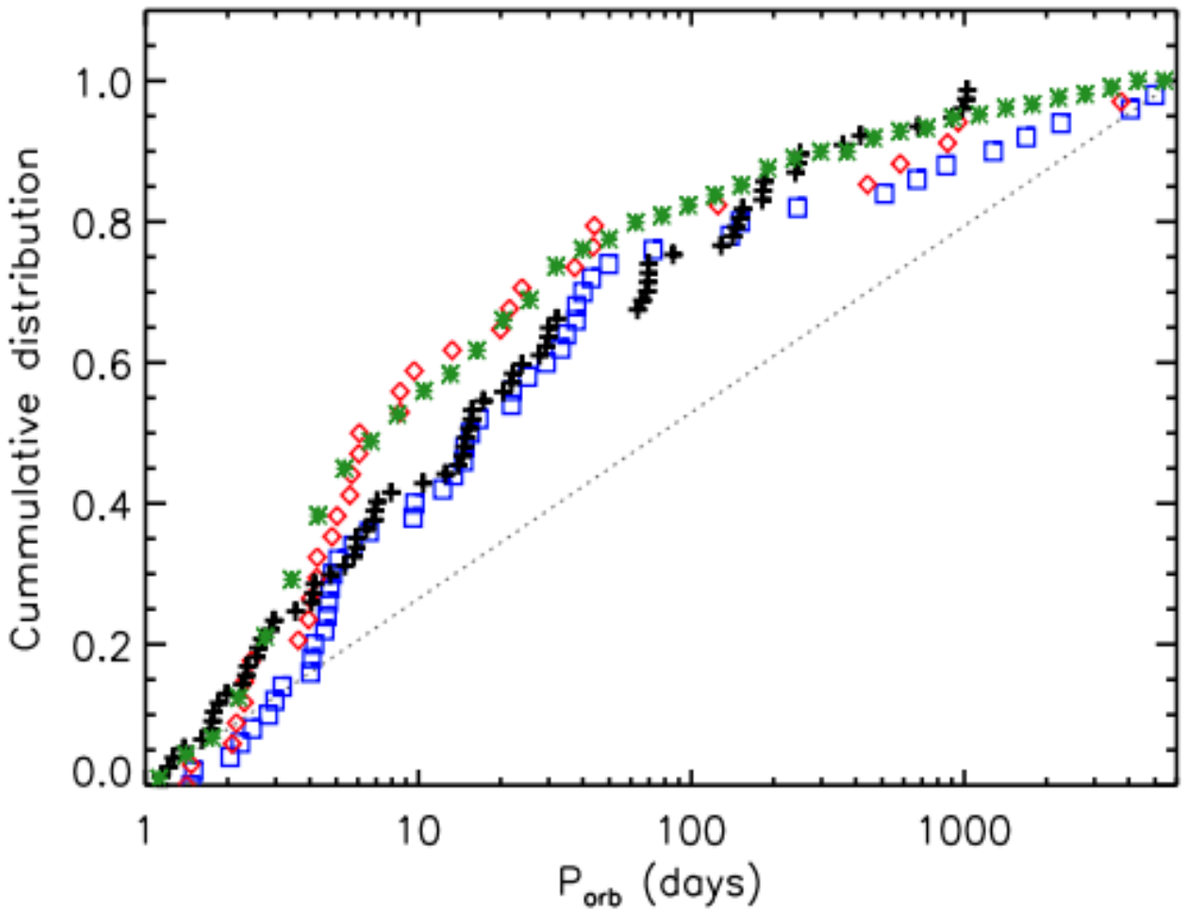


Period distributions in 2016

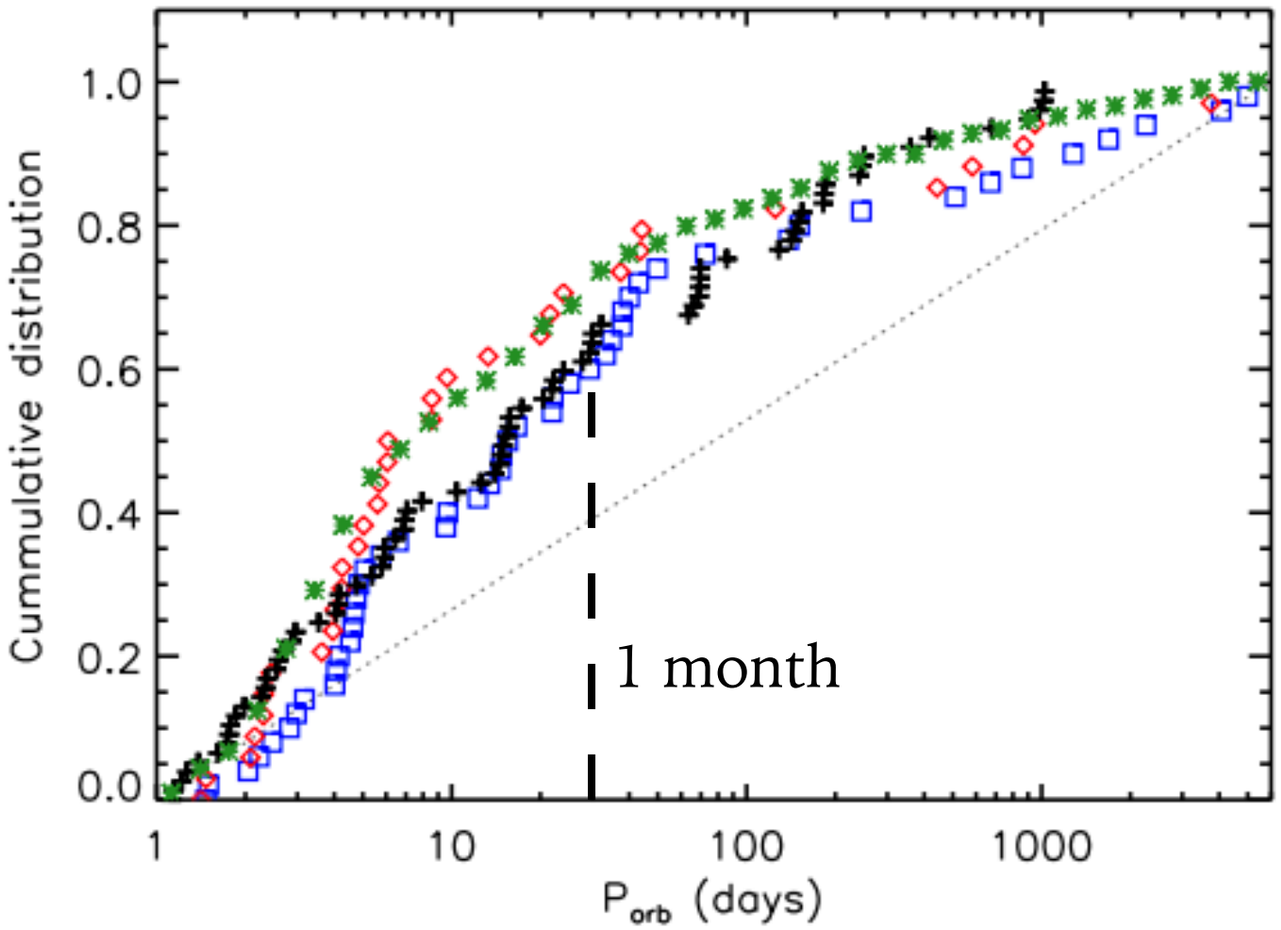


From Sana+17; Red: Sana+12, Blue: Kobulnicky+14, Black: Almeida+17, Green: OWN, Barba+17

Spectroscopic surveys:

- Sana+12: Science **1-4 Myr**
- Barbá+17: OWN (**1-10 Myr**)
- Almeida+17: 30Dor/TMBM (1-**8 Myr**)
- Kolbunick+14: Cyg OB2 (**3.5-5 Myr,** Wright+15)

Period distributions in 2016



About half of massive stars belong to systems with periods < 1 month (separations < 1 AU).

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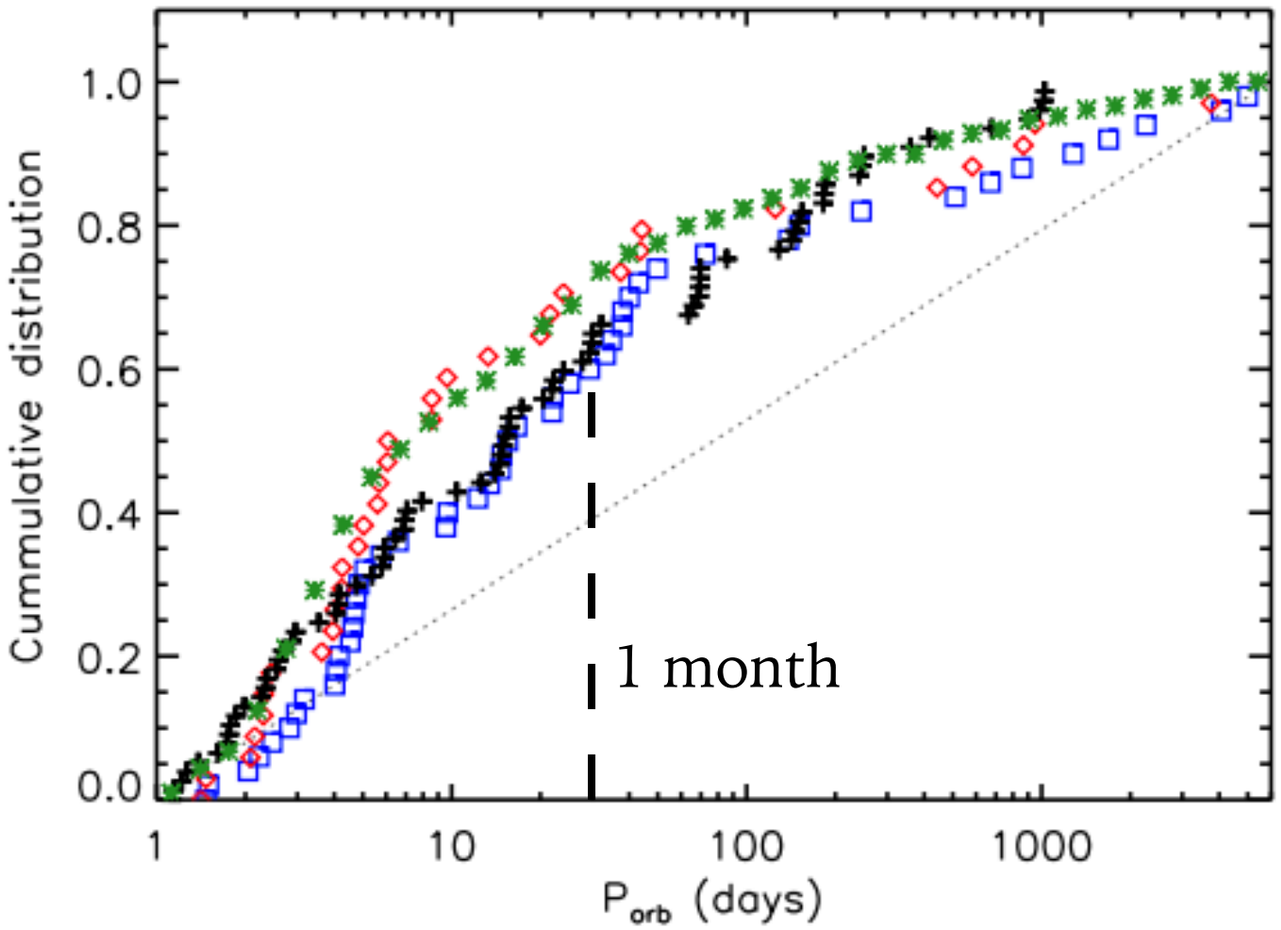
Period distributions in 2016



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How do they form??

From Sana+17; Red: Sana+12, Blue: Kobulnicky+
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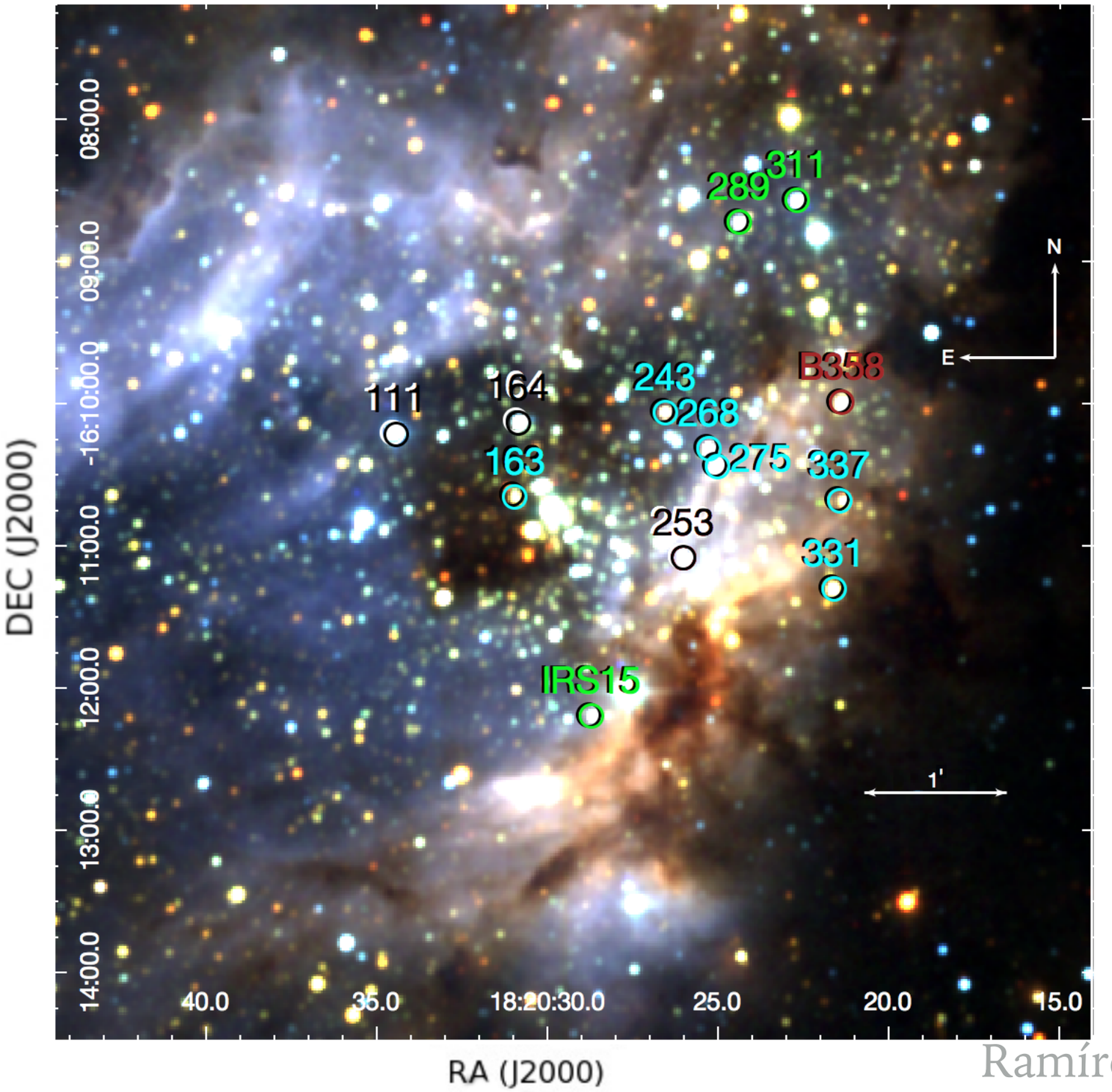
M17 - The Omega nebula



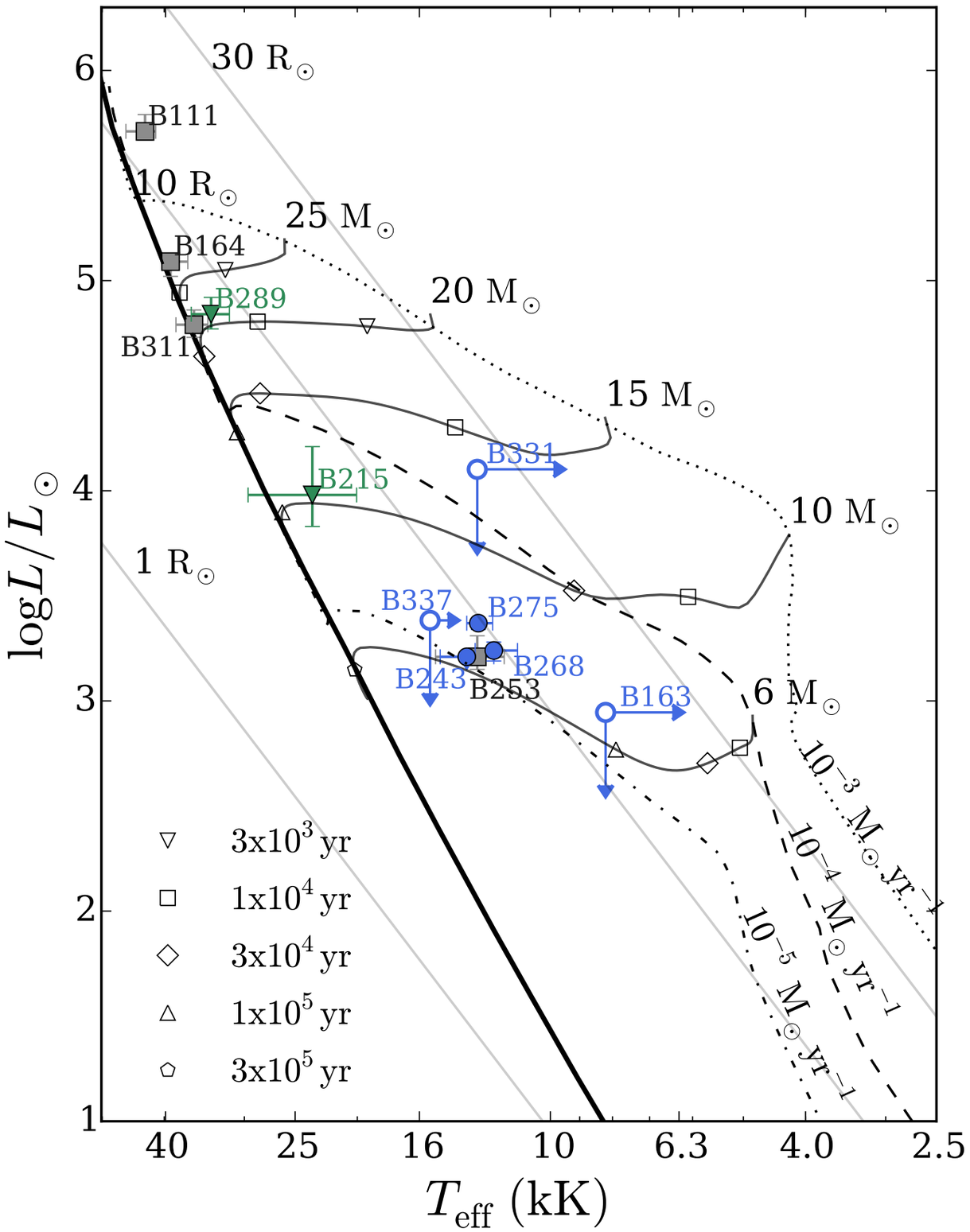
Giant HII region M17:

- d = 1980 pc (Xu+11)
- L = 3.6x10^6 (Povich+07)
- Hosts NGC 6618
- 16 O stars
- > 100 B stars

Chini+11, Hoffmeister+08

We observed 11 mYSO candidates by Hanson+97

Ramírez-Tannus et al, A&A, in press 2017



We have studied the properties of a **sample** of massive young stellar objects (YSOs).

$(6 \lesssim M_\odot \lesssim 20)$

PMS tracks: Hosokawa & Omukai 09, Davies+11

Ramírez-Tannus et al, A&A, in press 2017

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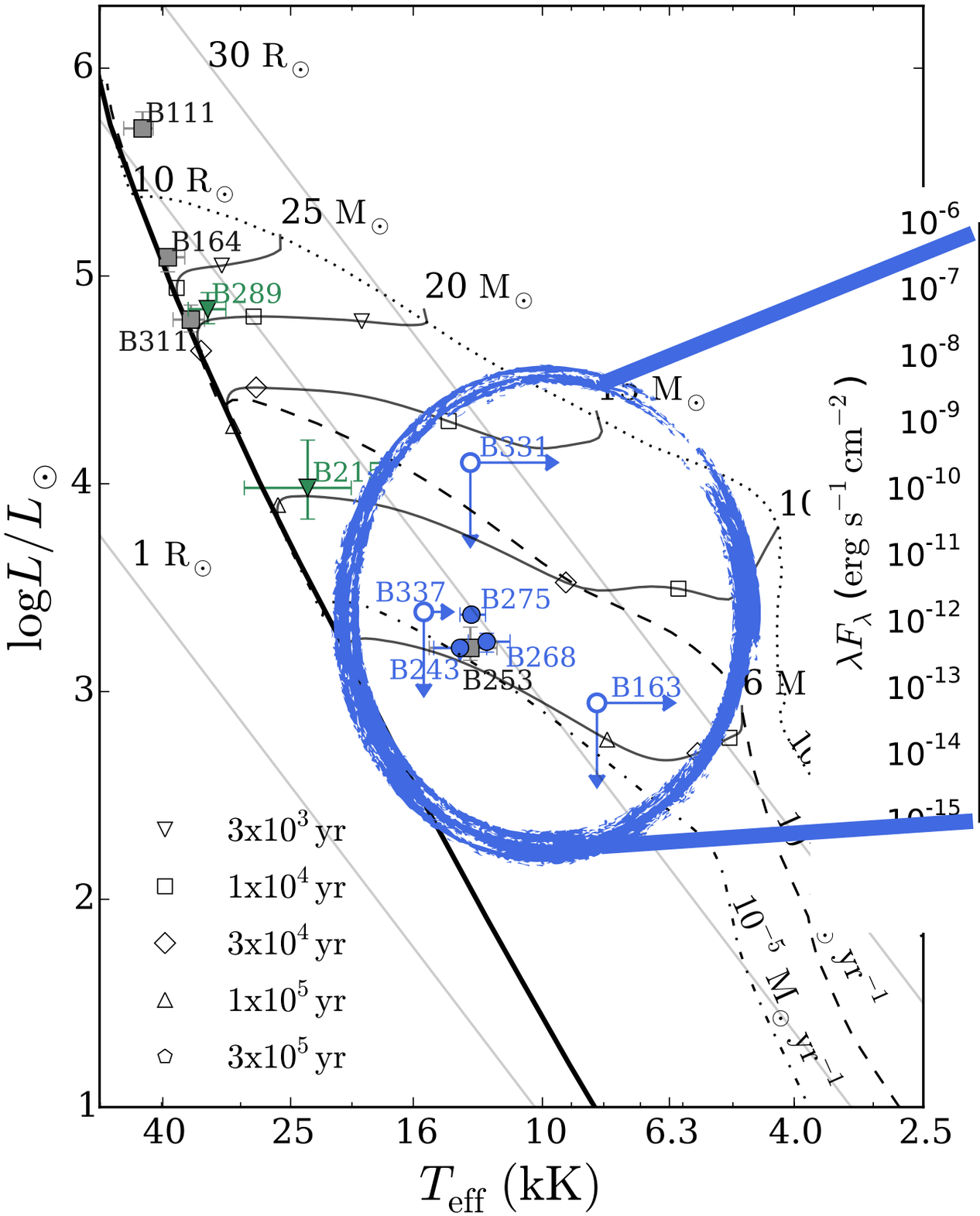

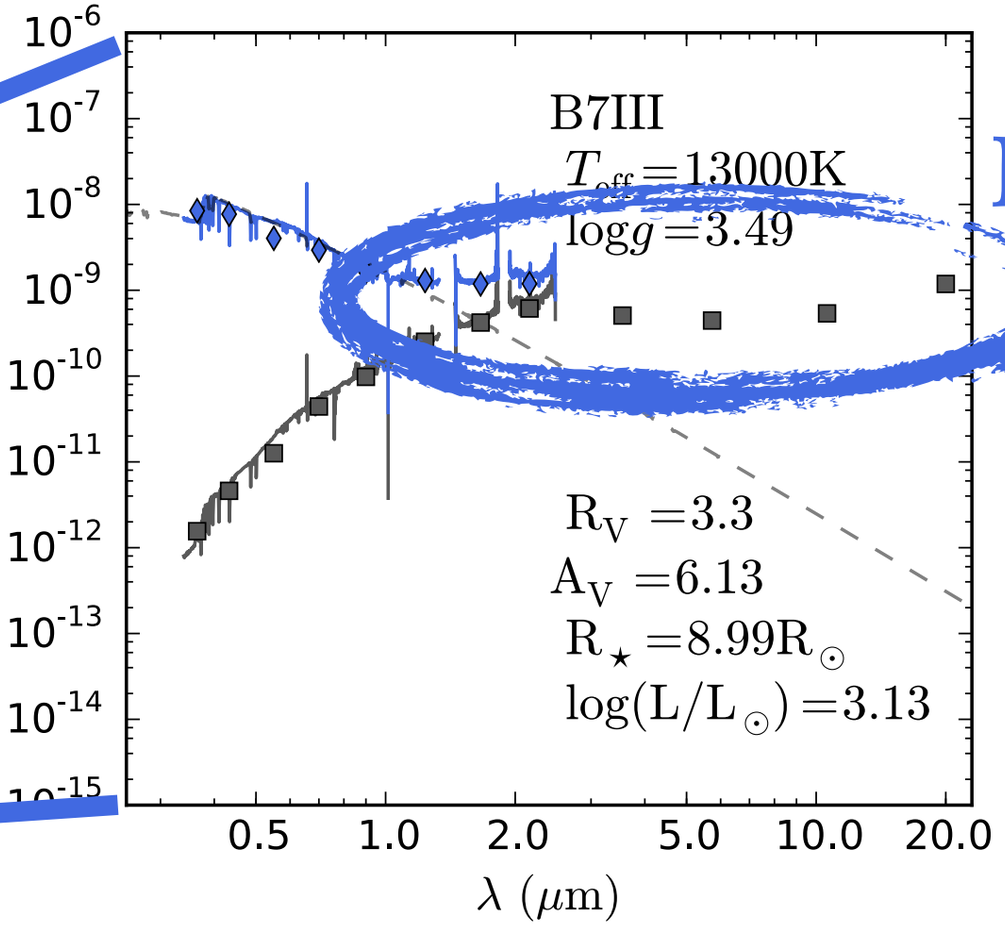

Disk

PMS tracks: Hosokawa & Omukai 09, Davies+11.

SED: Kurucz+03

Ramírez-Tannus et al, A&A, in press 2017

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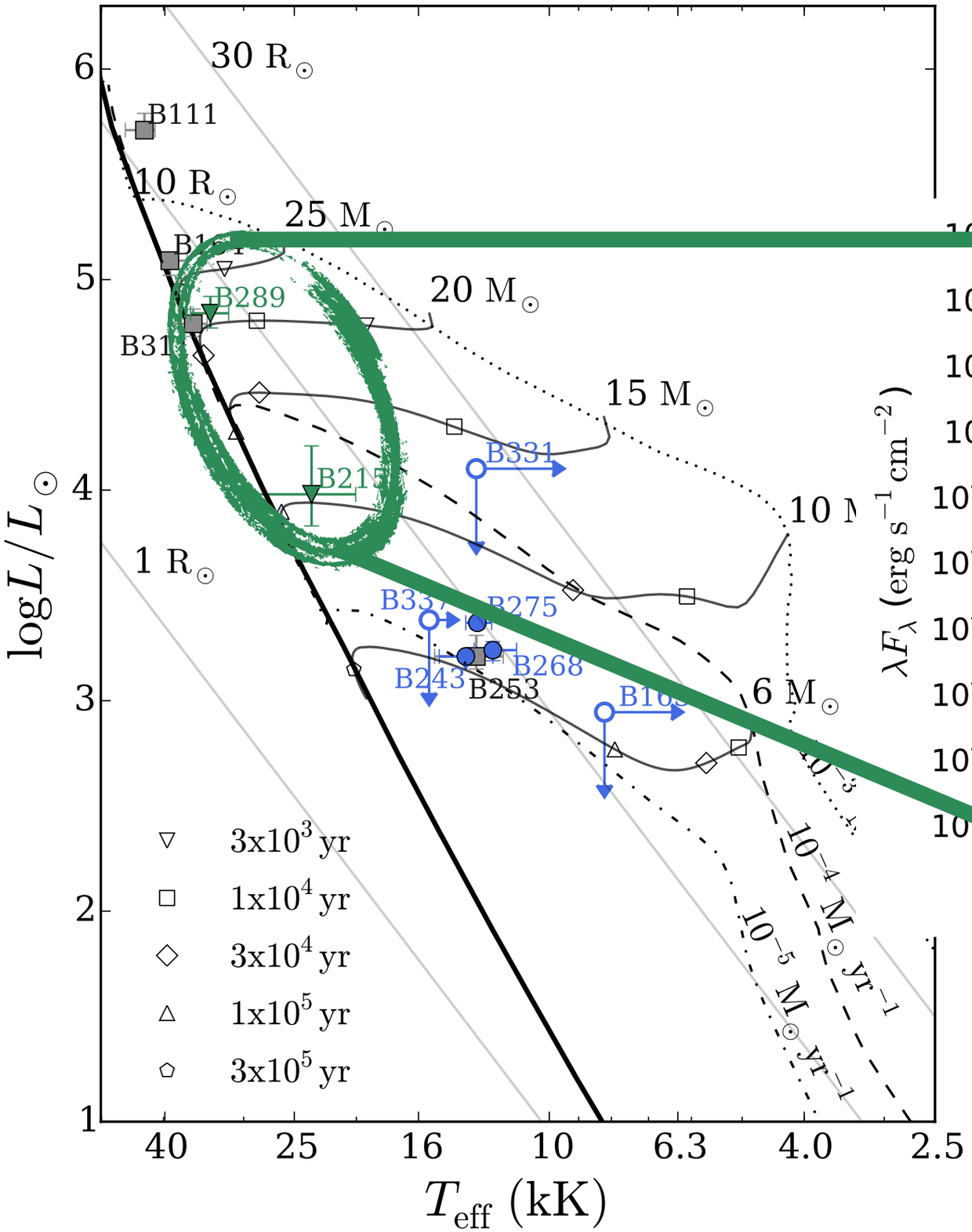
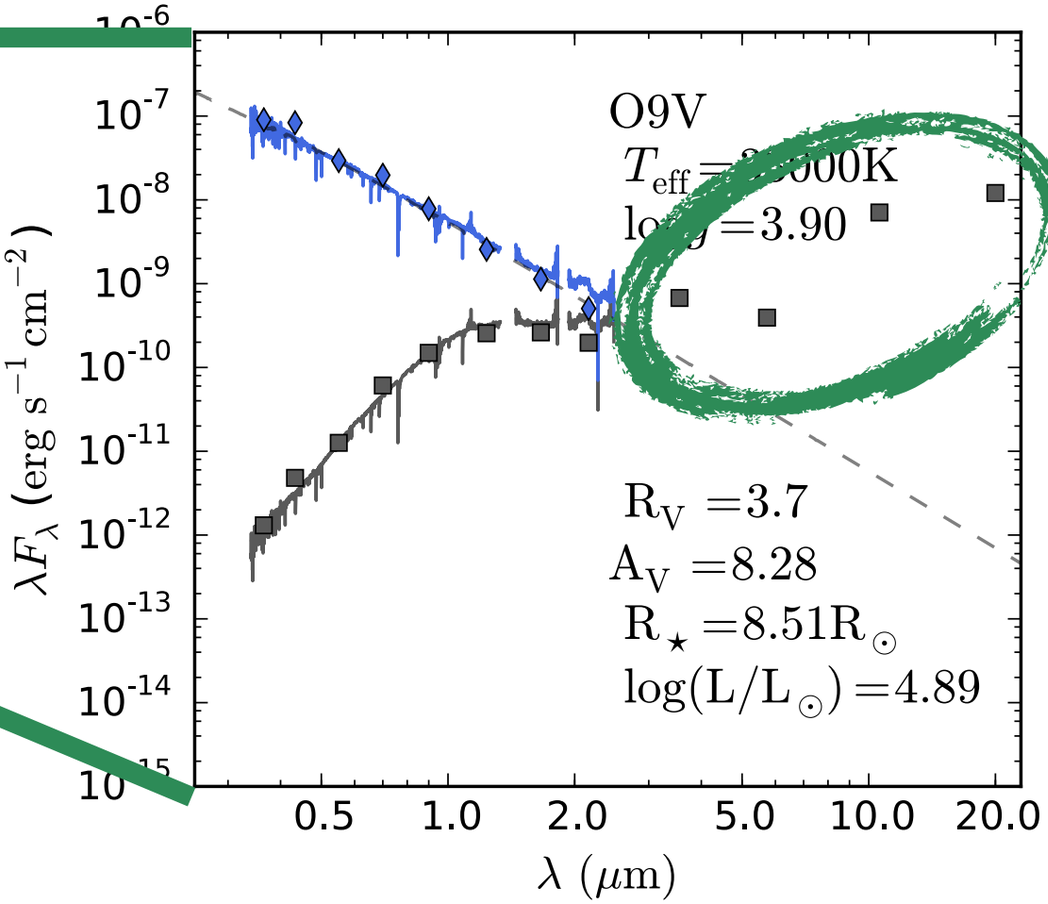
Dusty Disk





PMS tracks: Hosokawa & Omukai 09, Davies+11.

SED: Kurucz+03

Ramírez-Tannus et al, A&A, in press 2017

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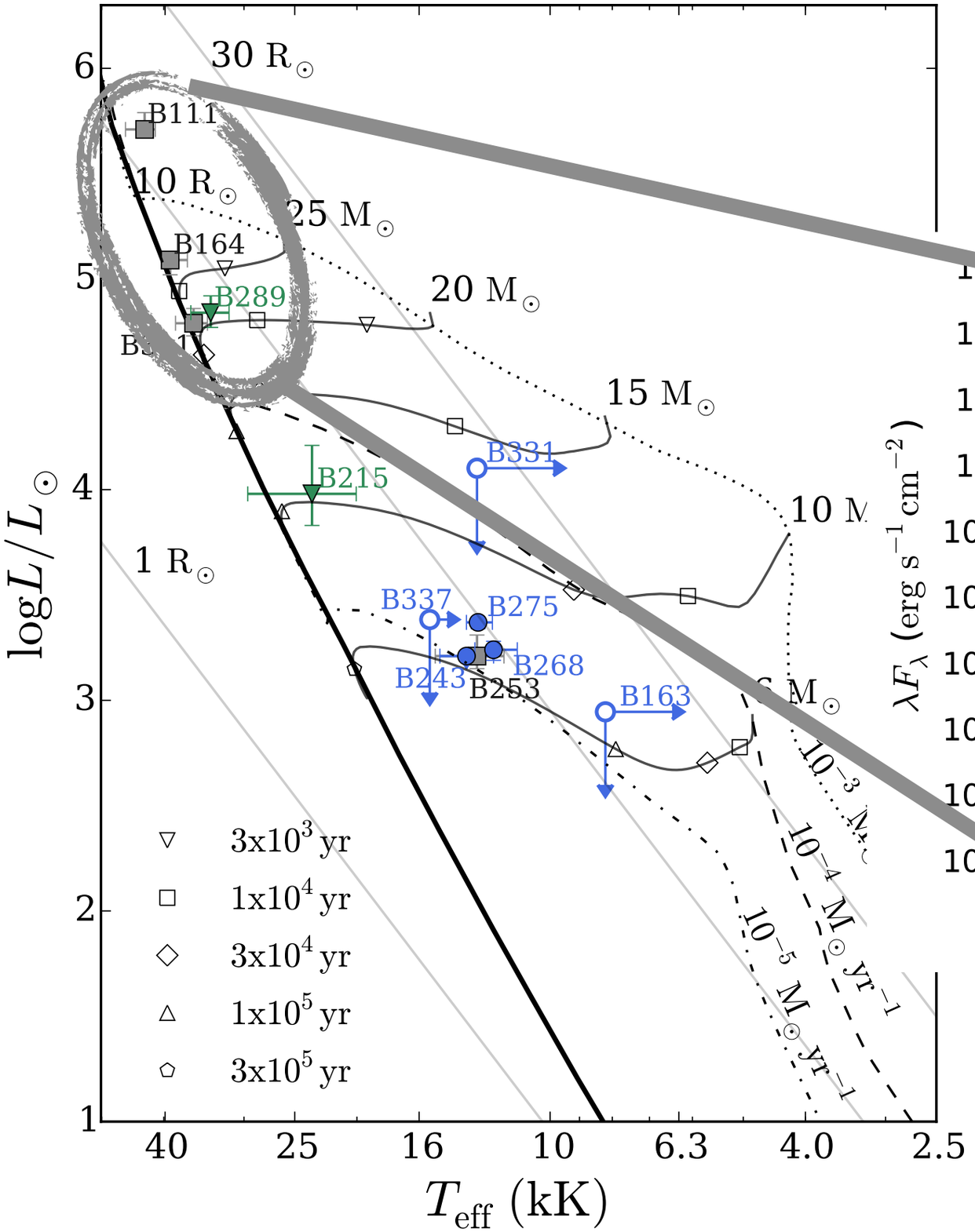
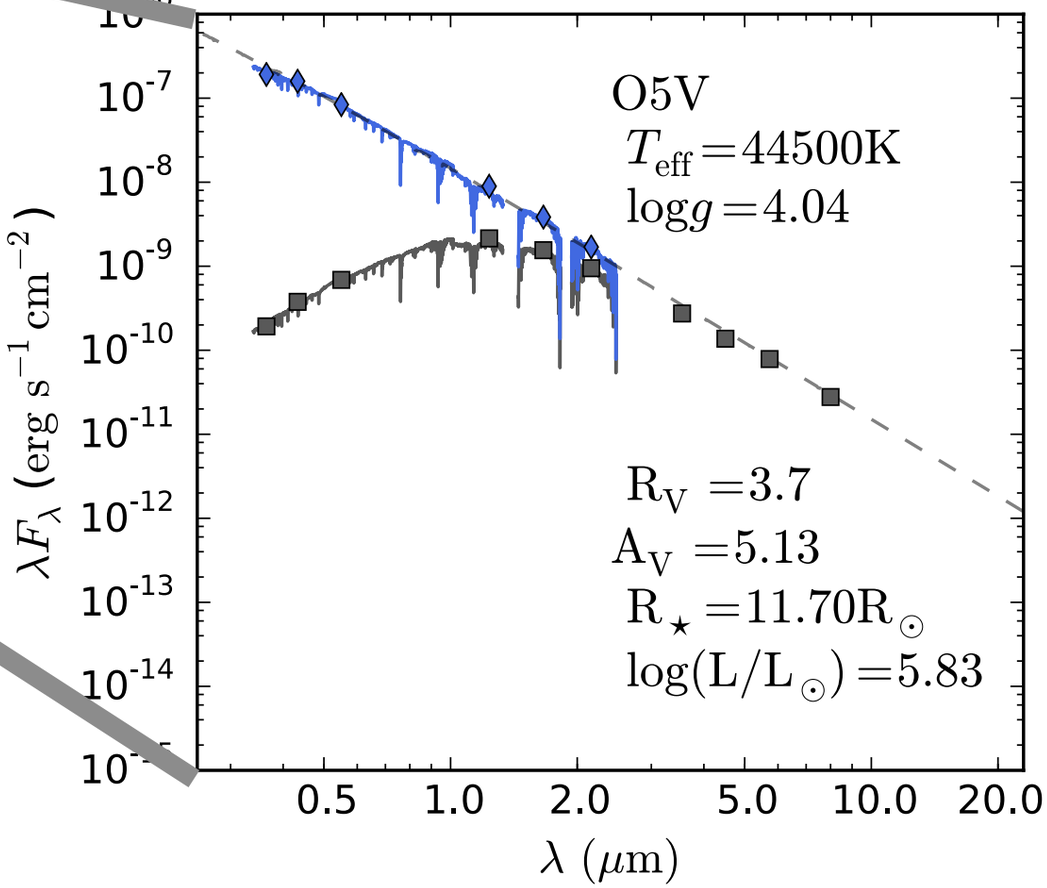
"Normal" O stars





PMS tracks: Hosokawa & Omukai 09, Davies+11.

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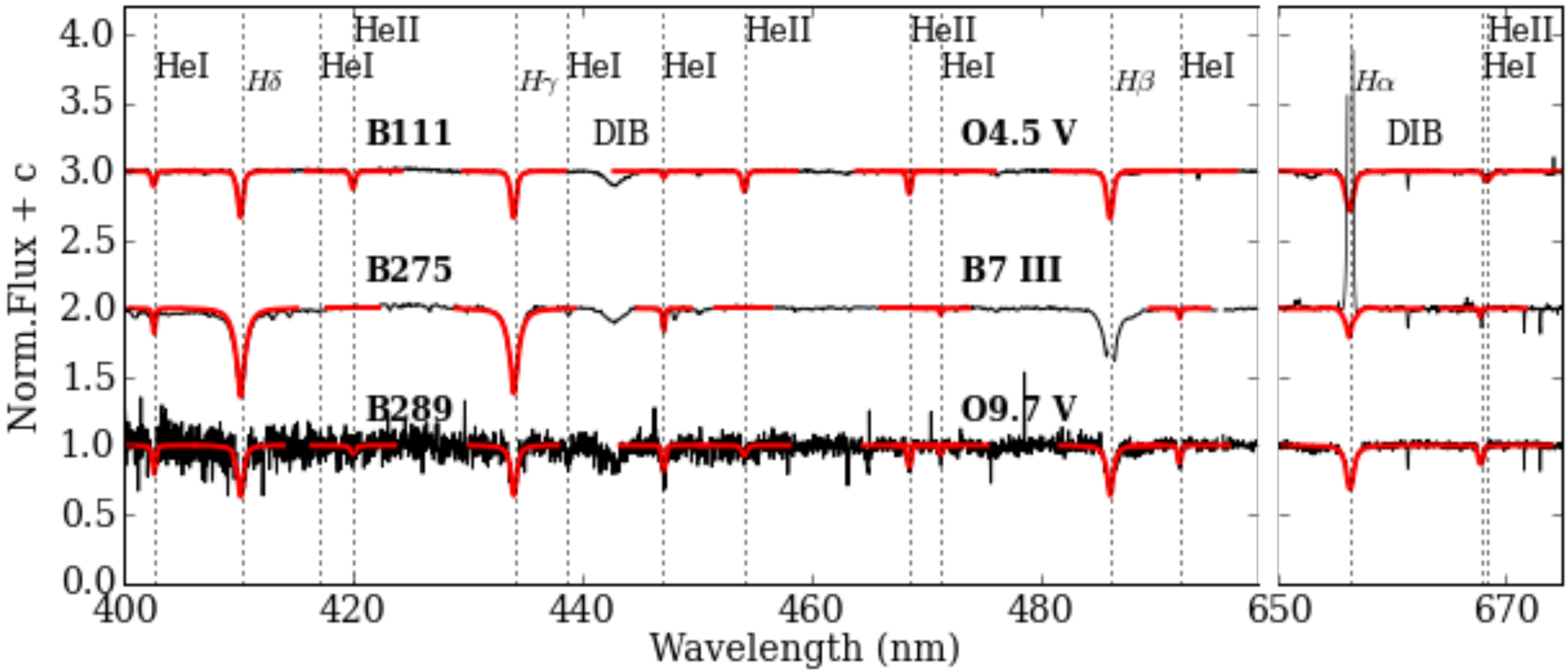
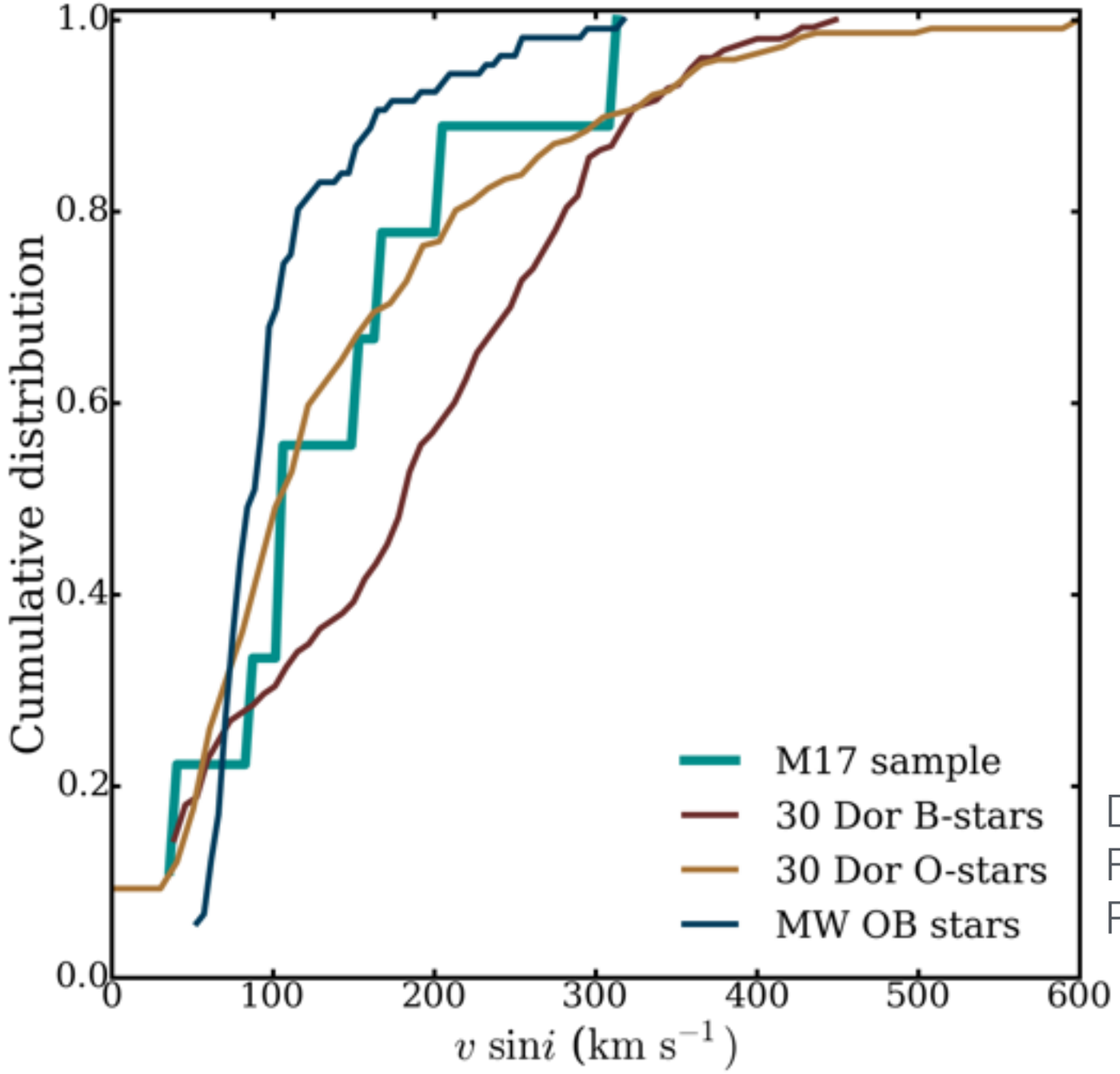
Ramírez-Tannus et al, A&A, in press 2017

Spectral modelling

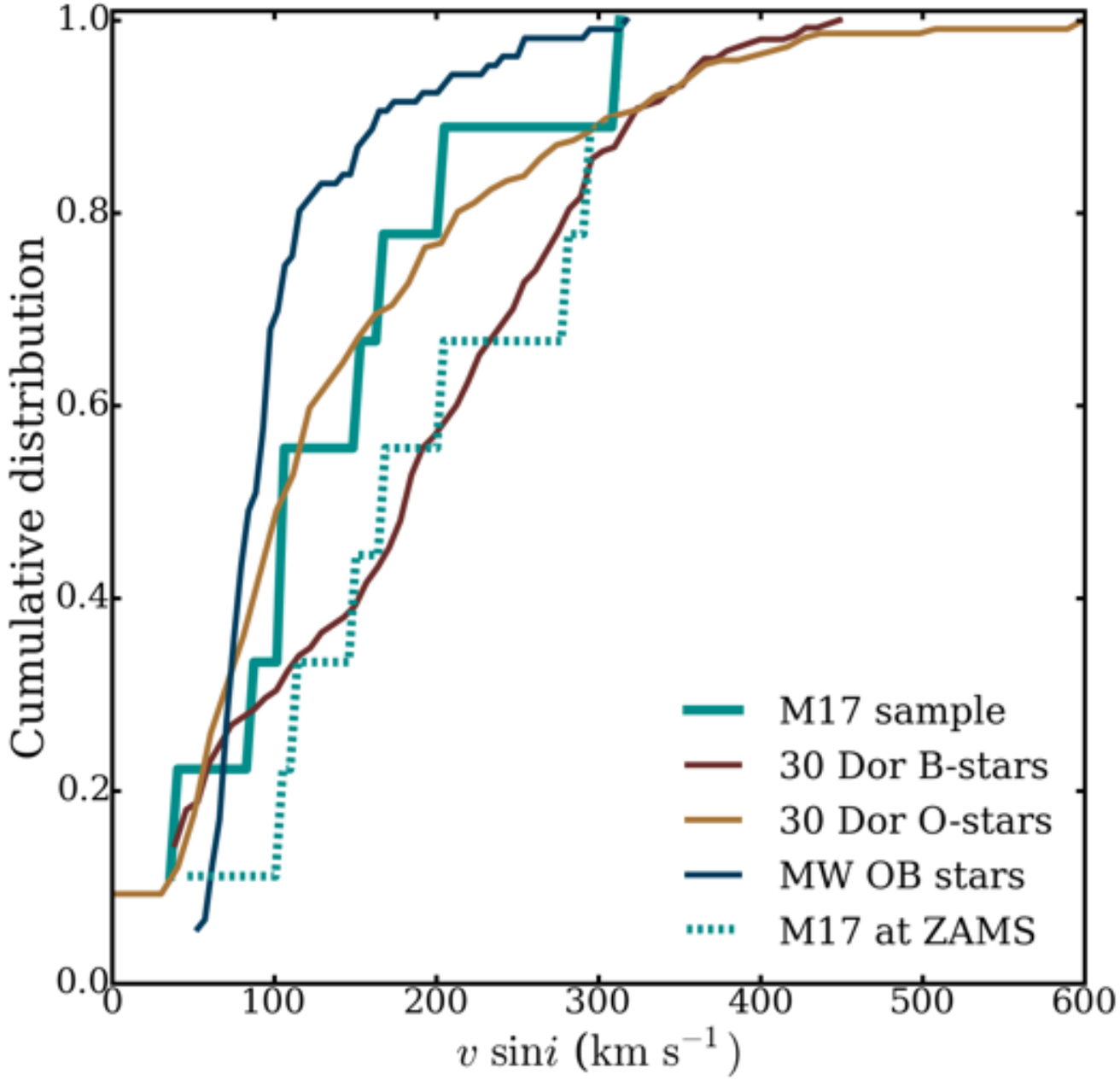


$v \sin i$ distribution

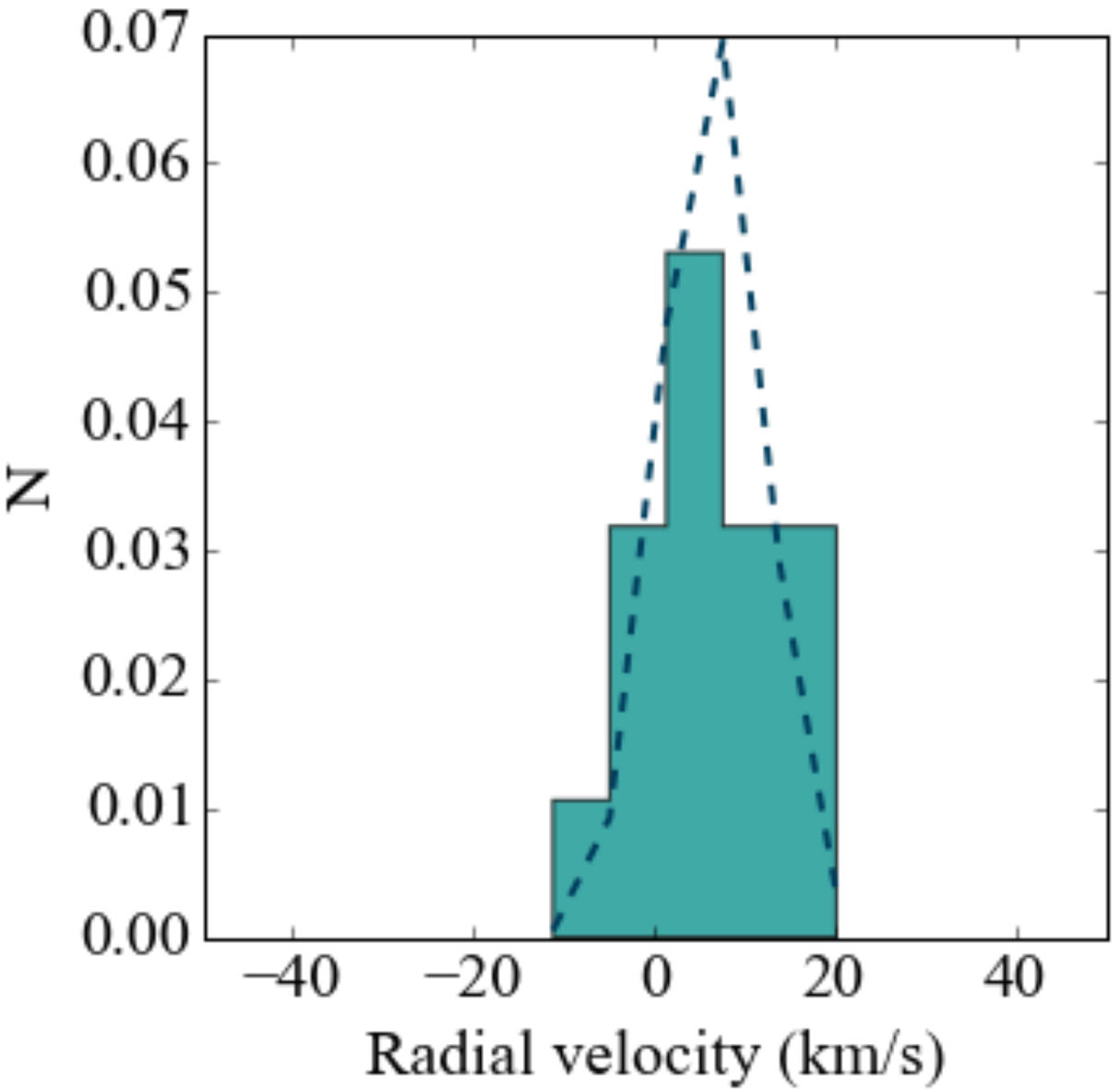


Dufton 2013
Ramírez-Agudelo 2013
Peny & Gies 2009

$v \sin i$ distribution



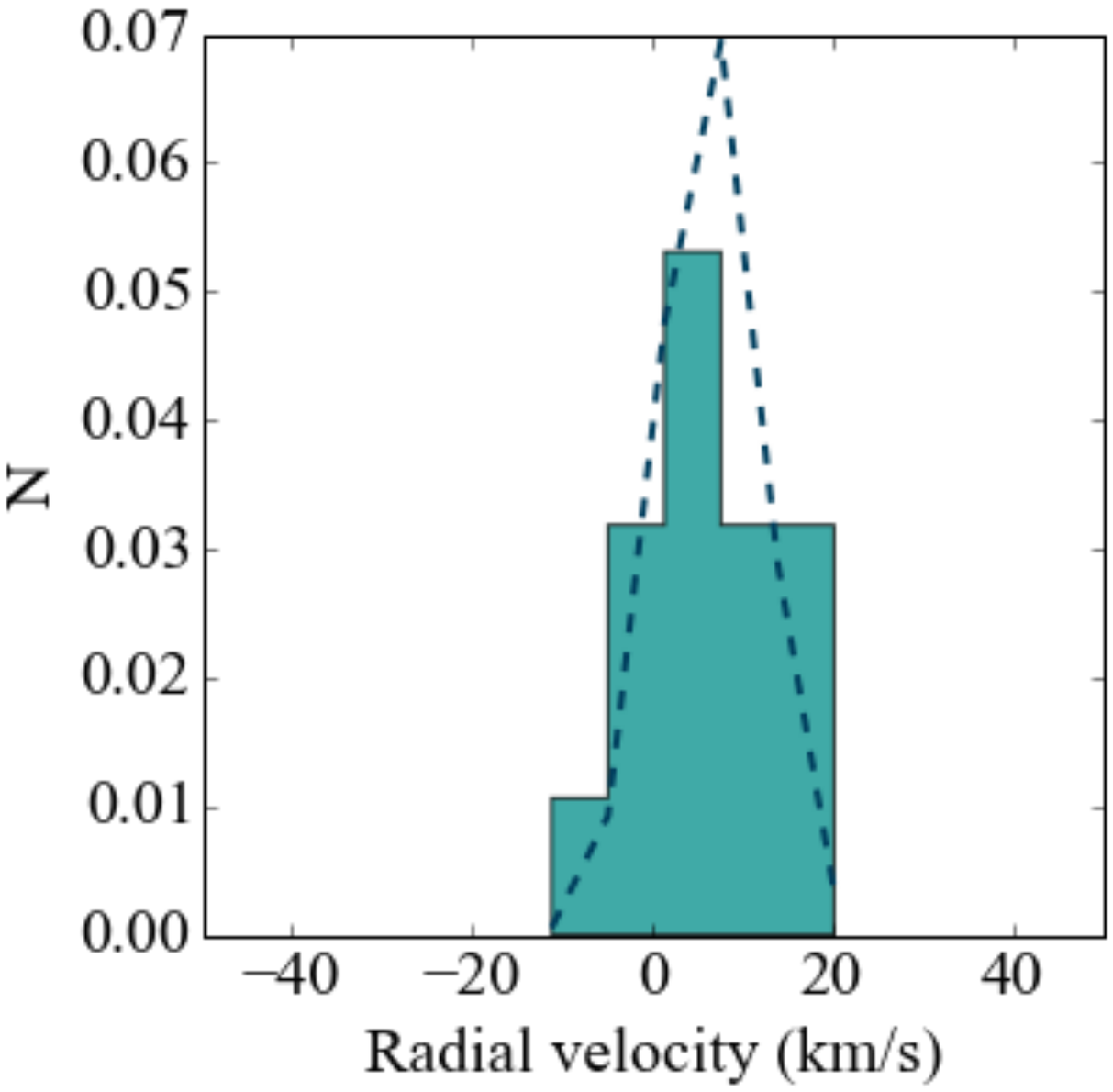
Radial velocity dispersion



For M17:

$$\sigma_{1D} = 5.5\,\mathrm{km\,s^{-1}}$$

Radial velocity dispersion



For M17:

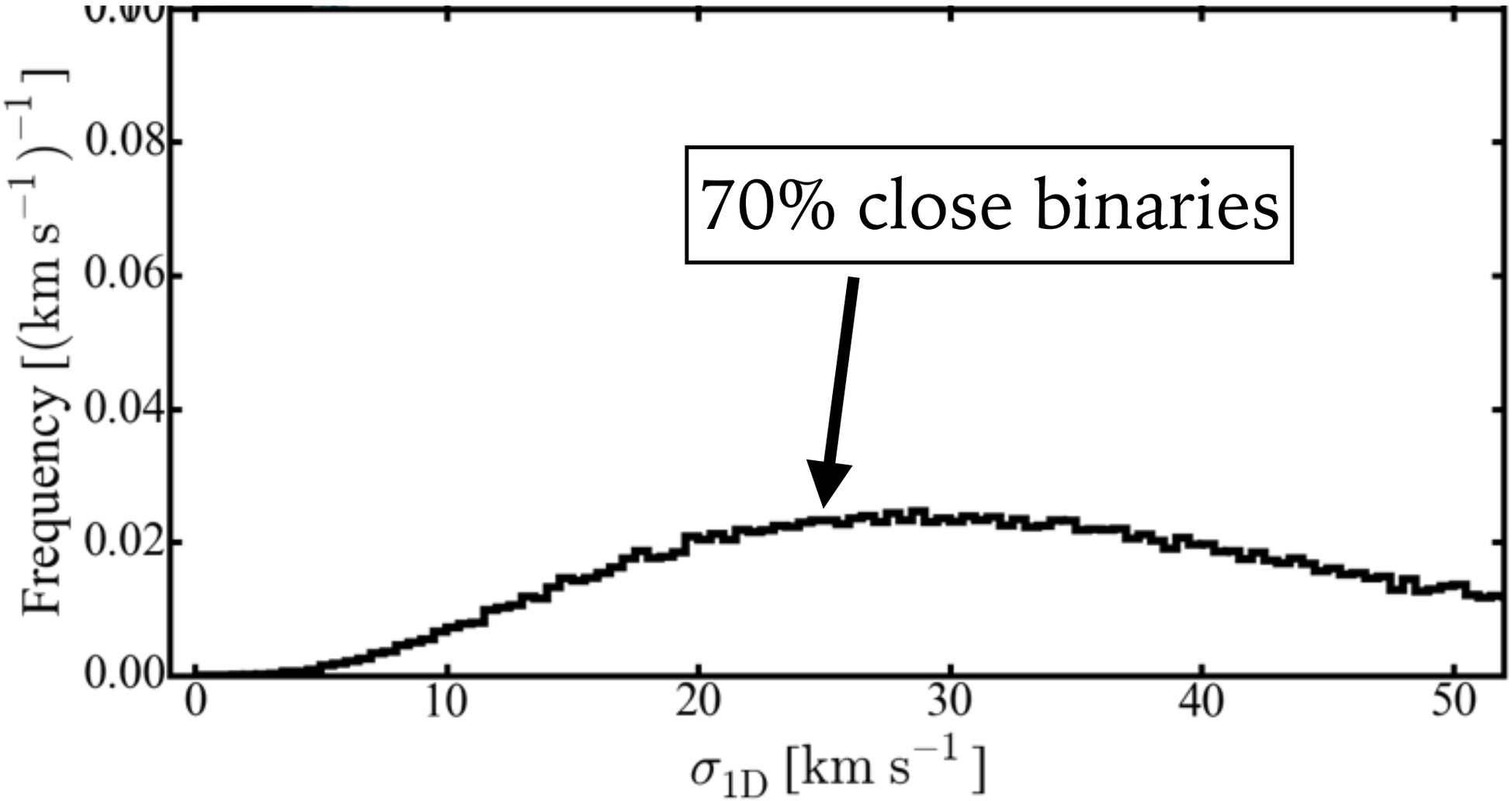
$\sigma_{1D} = 5.5\,\mathrm{km\,s^{-1}}$

Expected:

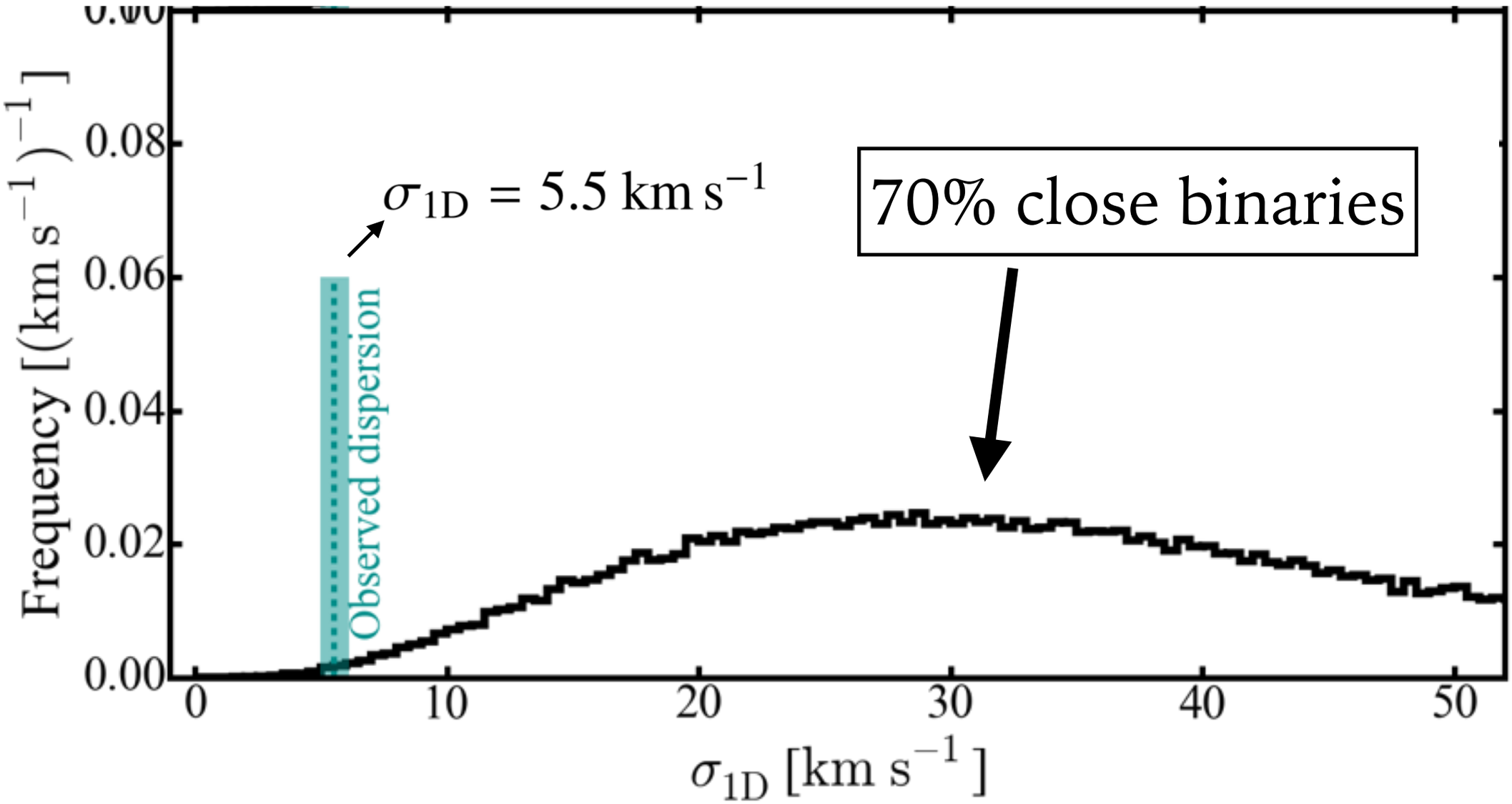
$\sigma_{1D} \sim 30\ \mathrm{km\,s^{-1}}$

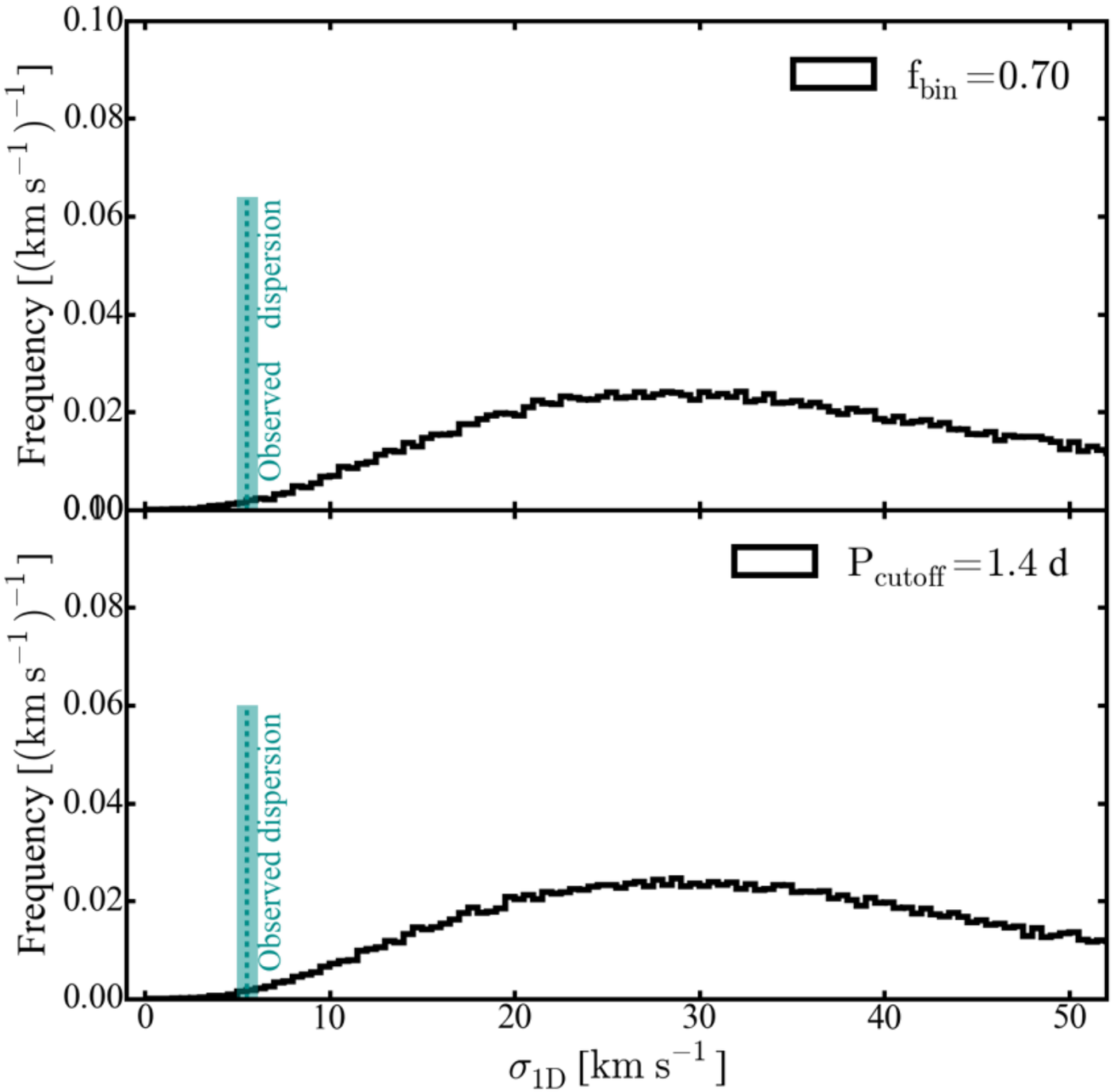
Simulating stellar populations

For OB stars in older 2-4 Myr clusters:

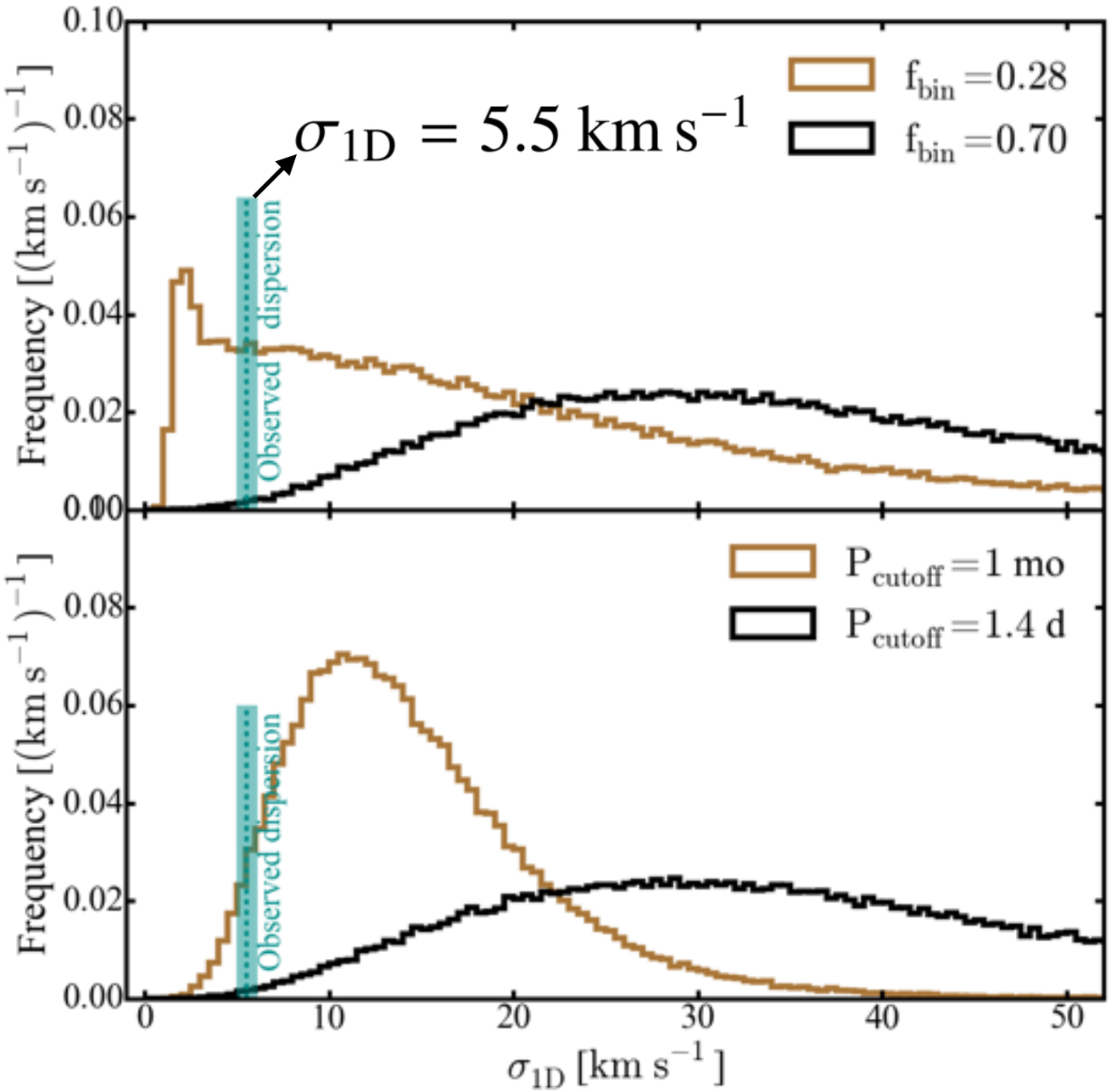


Simulating stellar populations

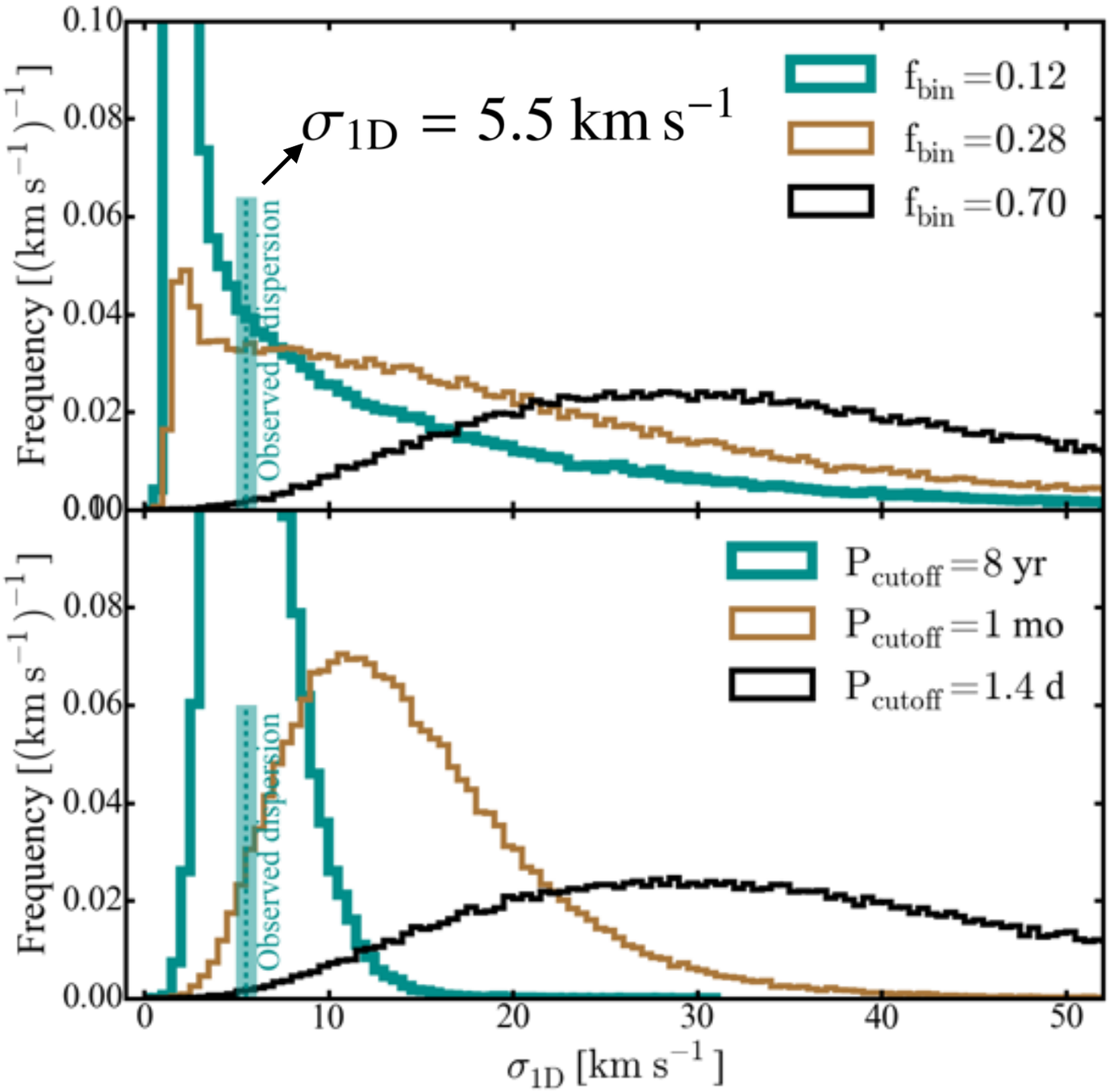



$f_{bin} = 0.70$
Observed dispersion
$P_{cutoff} = 1.4$ d
Observed dispersion
Frequency $[(\mathrm{km\ s^{-1}})^{-1}]$
σ_{1D} [km s^{-1}]
0.00
0.02
0.04
0.06
0.08
0.10
0
10
20
30
40
50

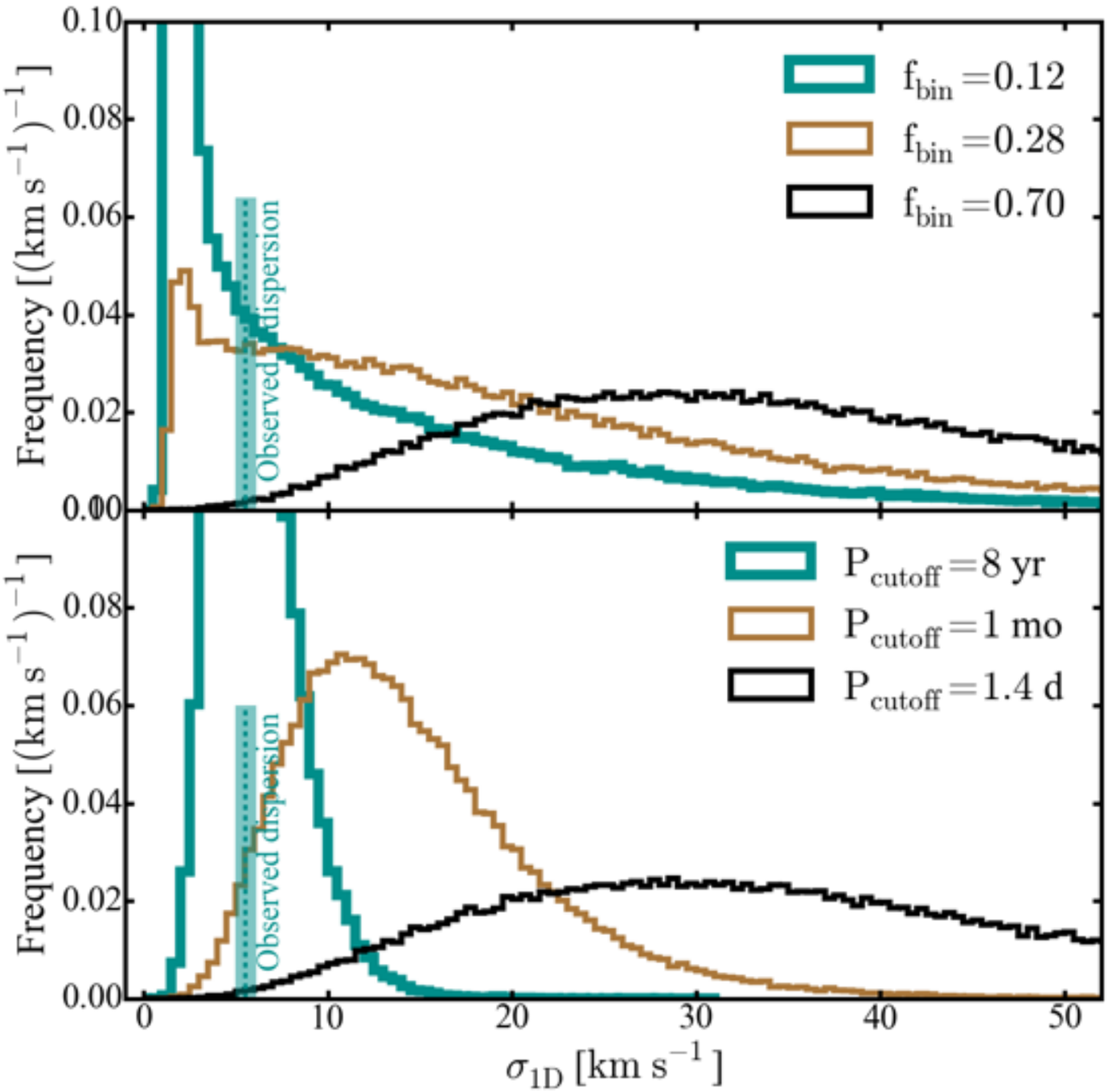
Simulating stellar populations



Simulating stellar populations



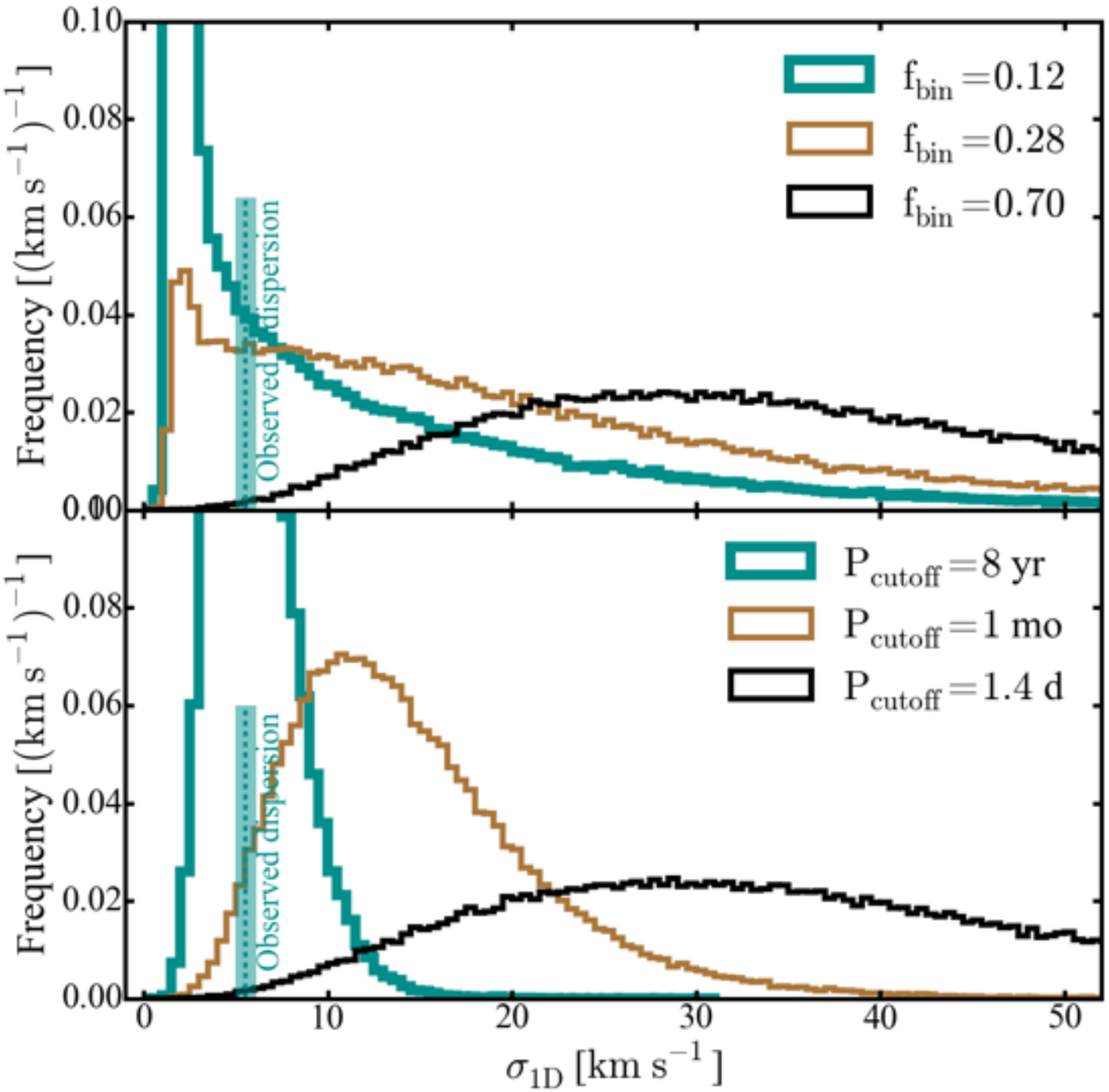
Are the observed mYSOs single?



1. No binaries between massive YSOs:

- Formation conditions are different in M17

Are mYSOs born in wide orbits?



1. No binaries between massive YSOs:

- Formation conditions are different in M17

2. Massive YSOs are in wide binaries:

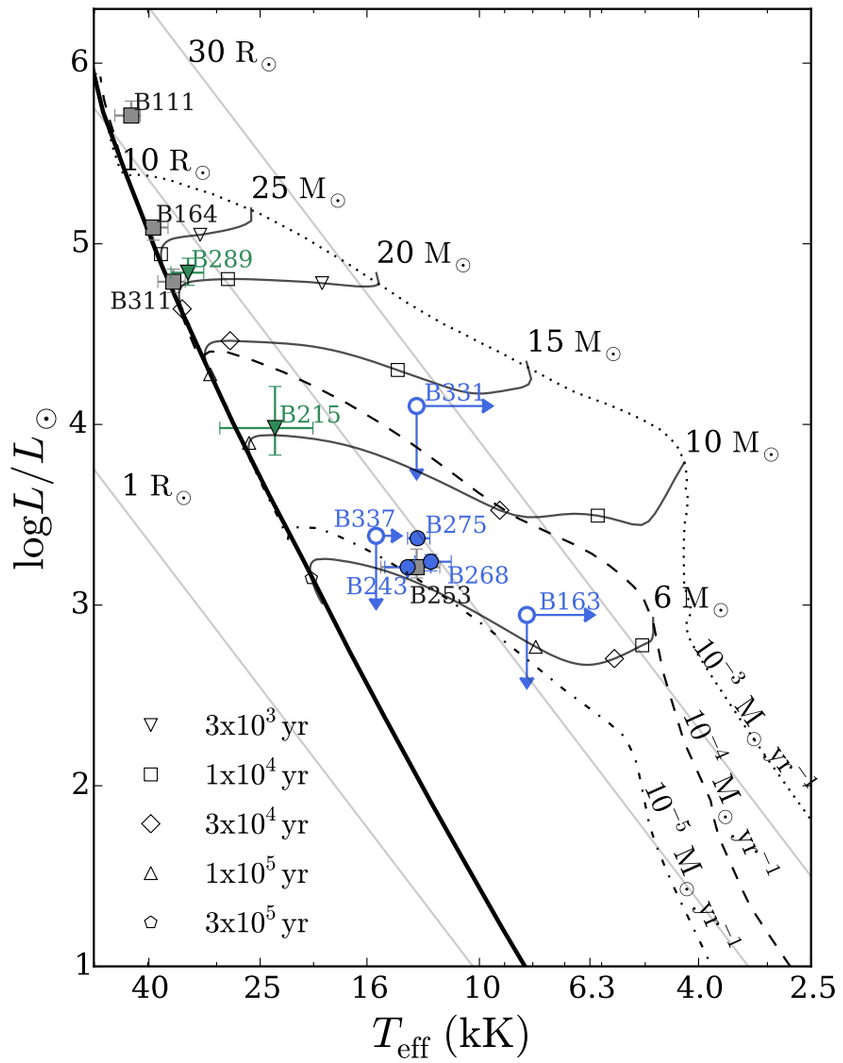
- Binaries tighten later (via interaction with disks or companions)

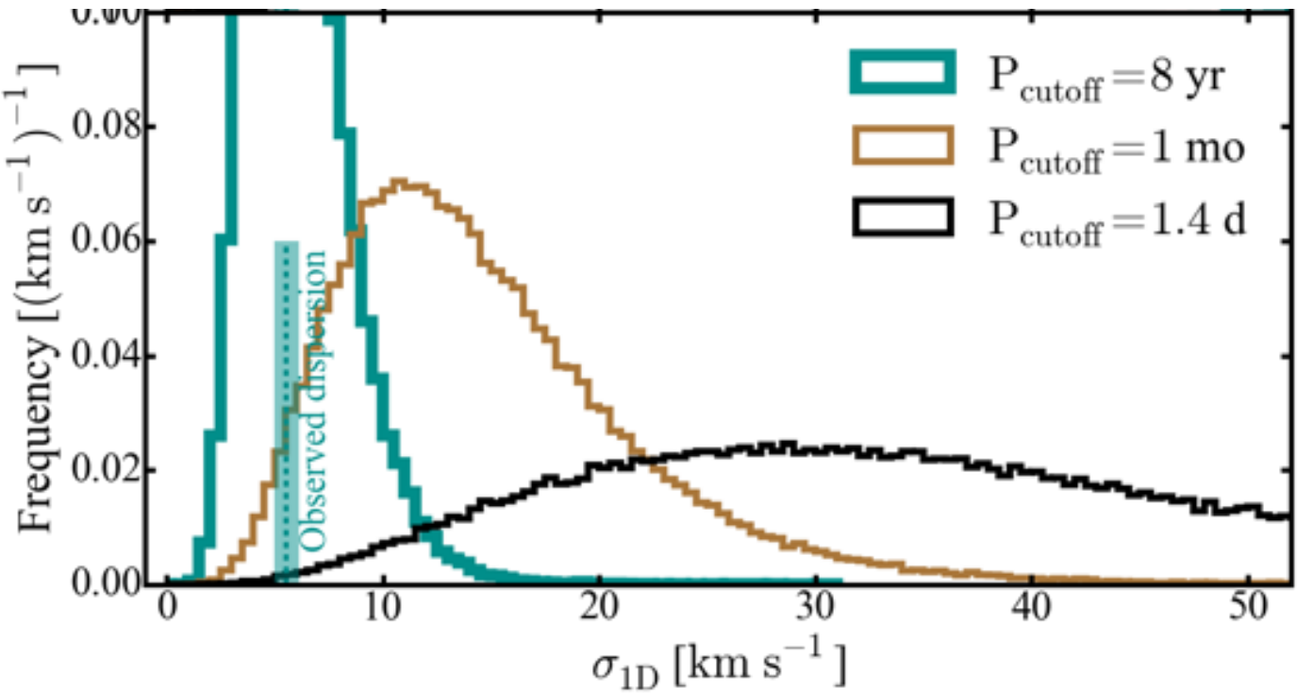
Summary:

1.

We analysed a sample of massive young stellar objects in M17.

(Ramírez-Tannus et al., A&A, 2017)



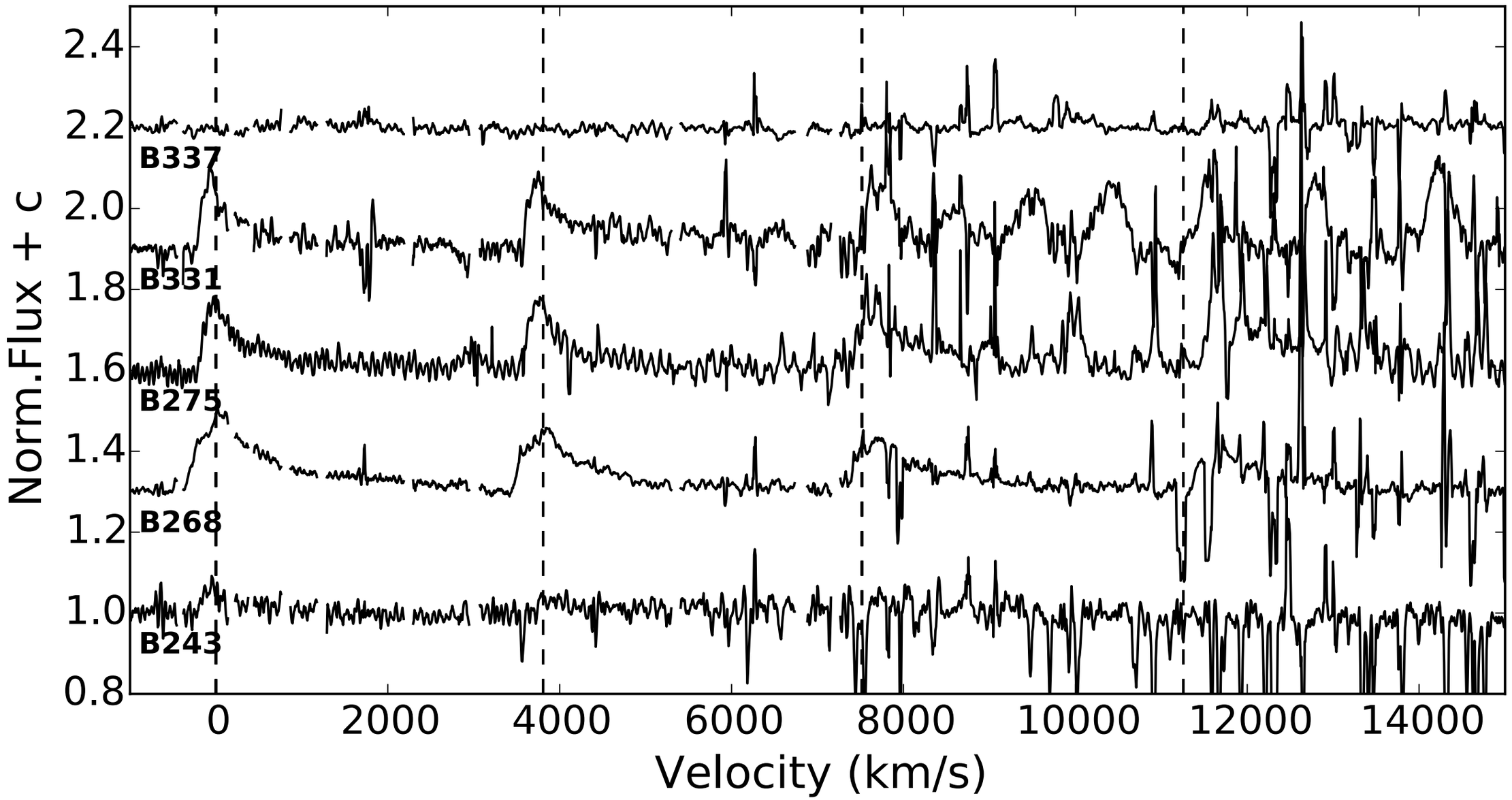


2.

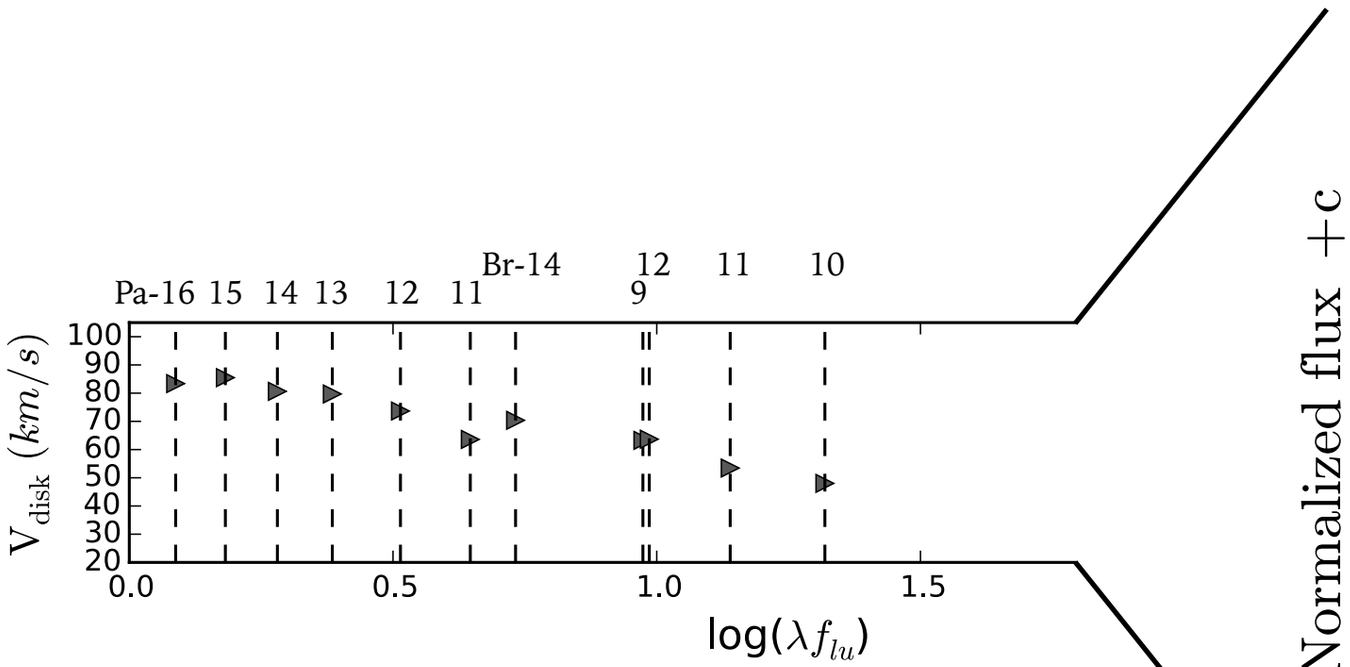
They seem to be born in wide orbits and come closer in ~2 Myrs.

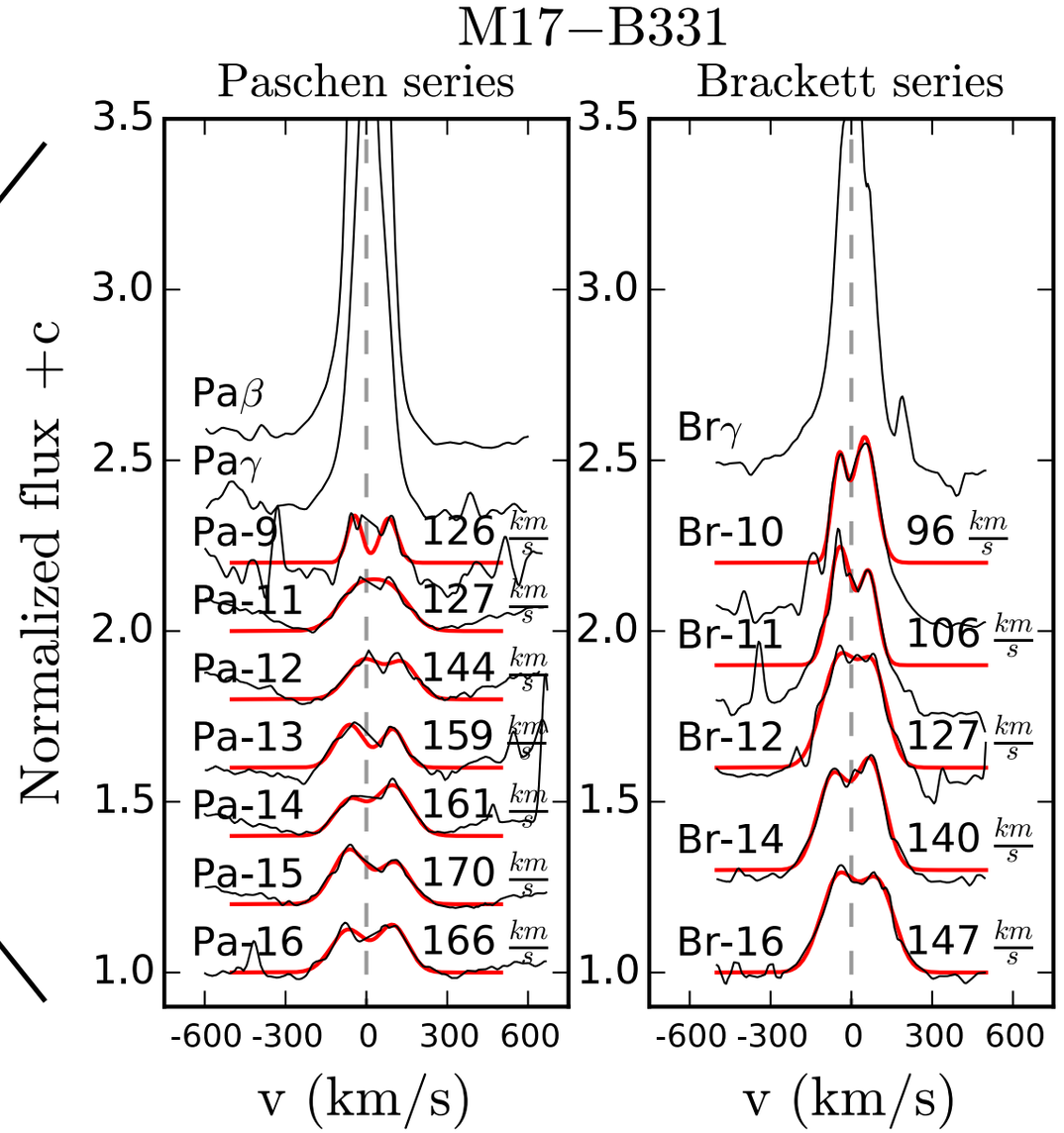
(Sana et al., A&AL, 599, 9, 2017)

Circumstellar disks



Velocity structure in disks





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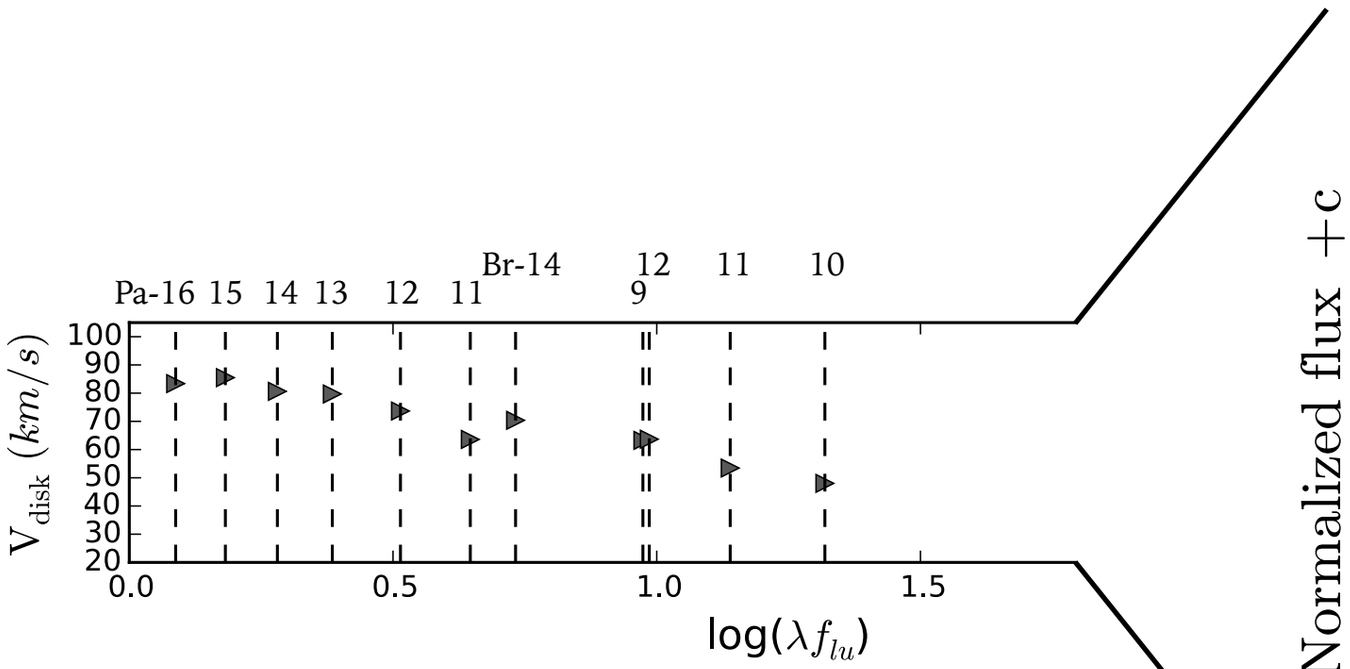

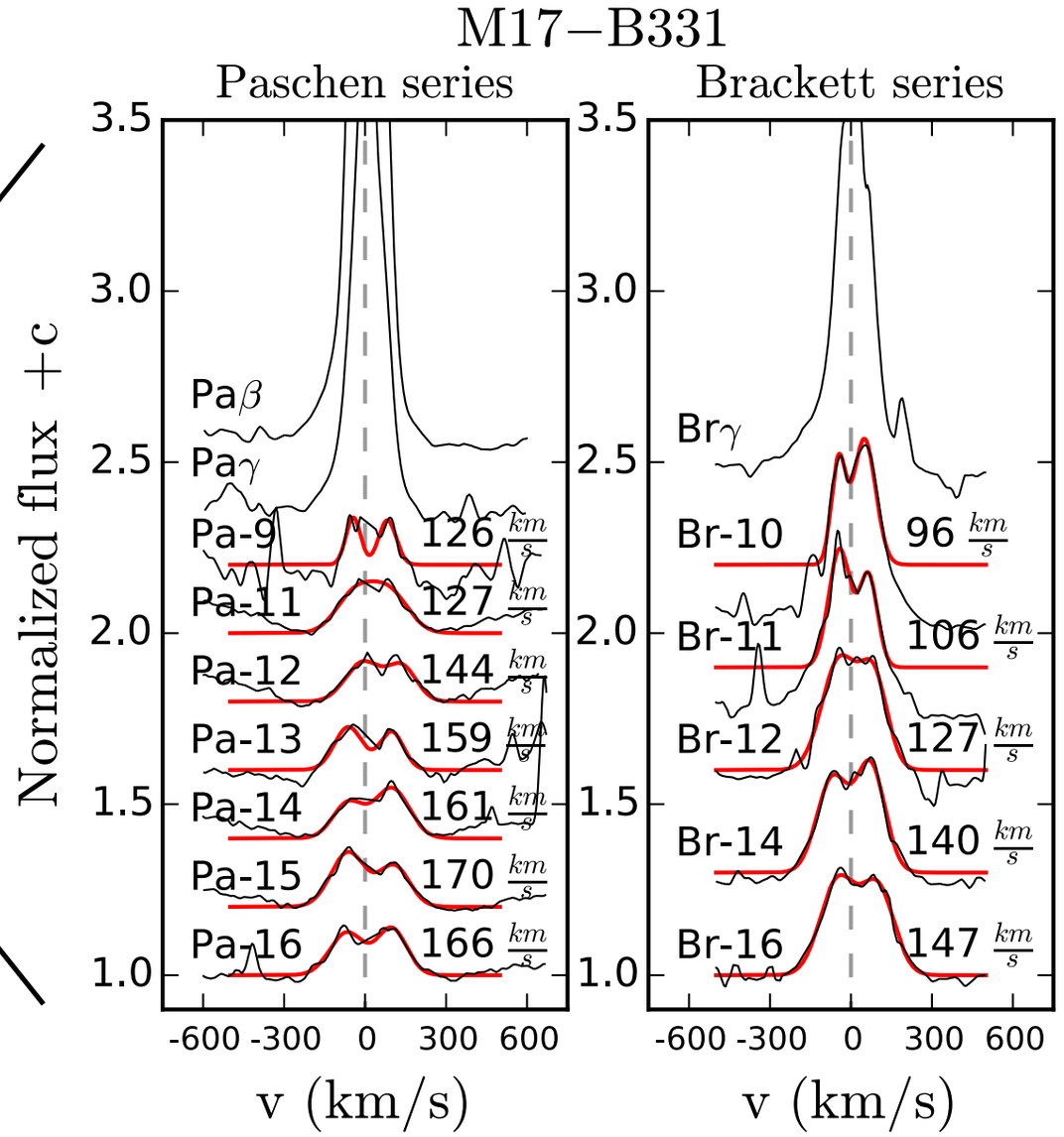

Hanneke Poorta

Modelling emission lines with LIME