

A woman with dark hair and glasses, wearing a black top, is shown in profile from the chest up. She is holding a small, yellow, glittery fairy figurine with translucent wings in her right hand, which is raised towards the camera. The background is a dimly lit room with a dark, textured window or door panel. The overall lighting is warm and indoor.

Missing links in the evolution of massive binaries

Rodolfo “Xeneize” Barbá
Universidad de La Serena (Chile)

Fiesta del Hada de la Montaña
Bariloche – Argentina – November 2018

A woman with dark hair and glasses, wearing a black top, is shown in profile from the chest up. She is holding a small, yellow, winged fairy figurine in her right hand, which is raised towards the camera. The background is a dimly lit room with a window showing a dark, starry night sky. The text is overlaid on the lower half of the image.

Speaker missed linking the evolution of massive binaries

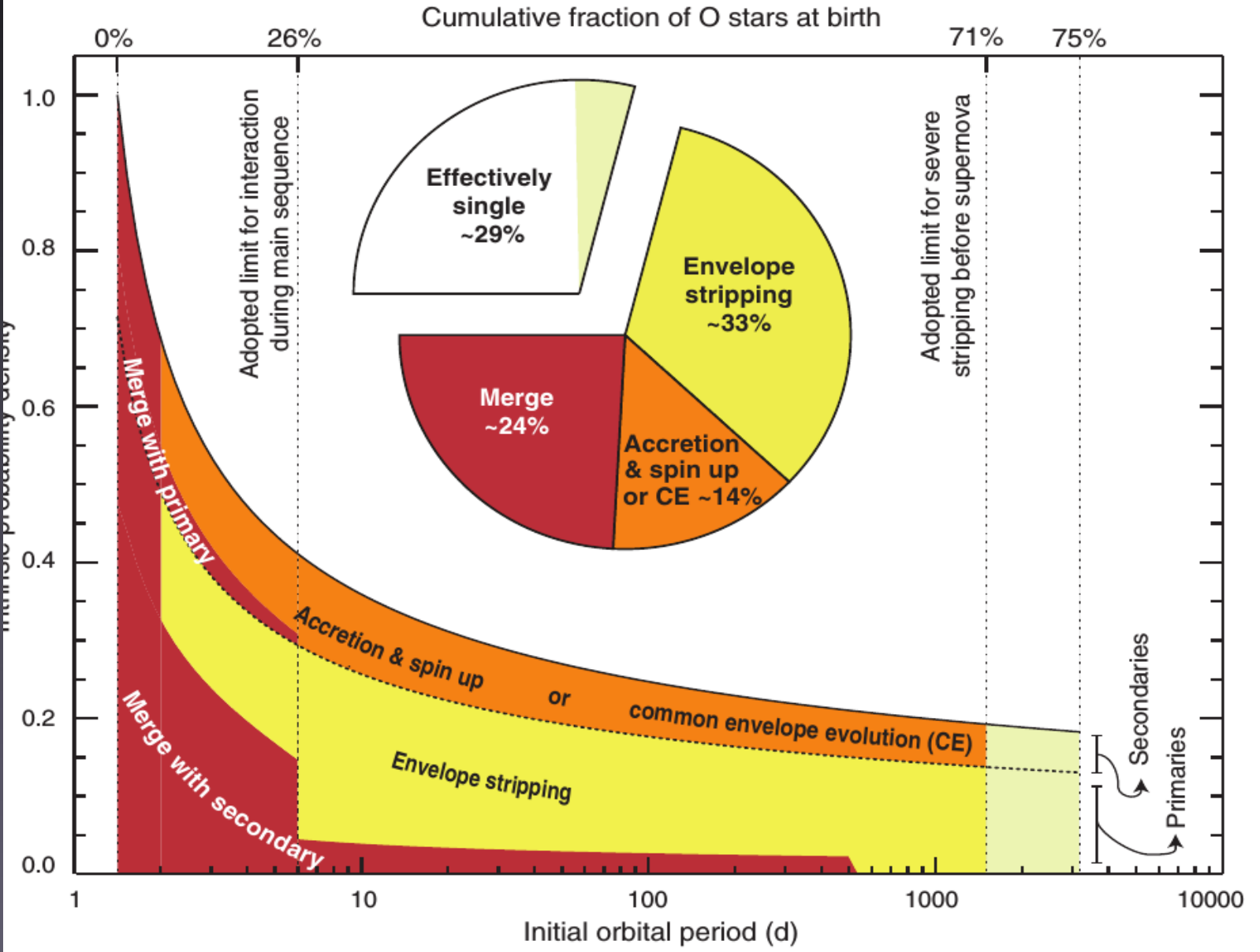
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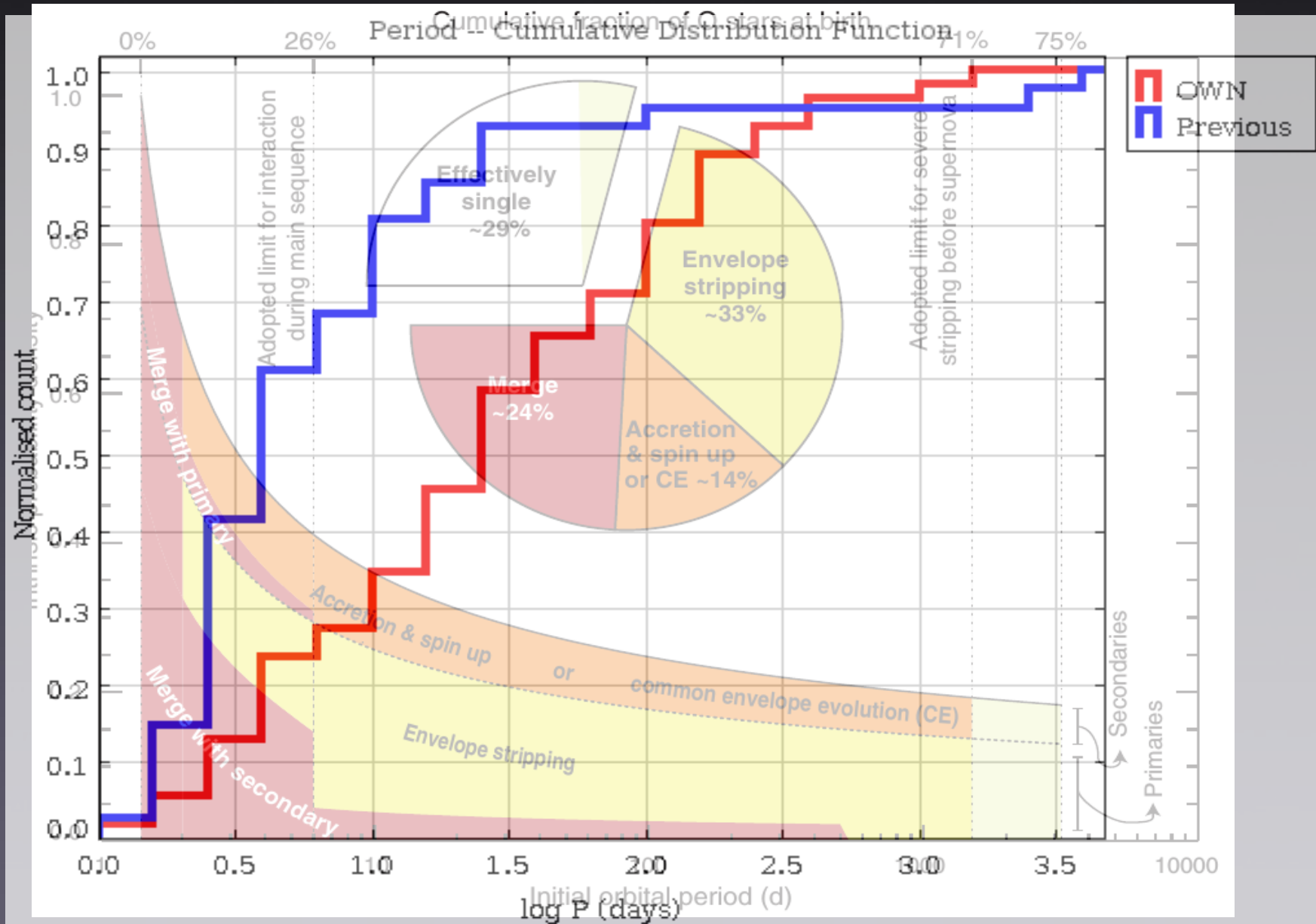
Let's go!!



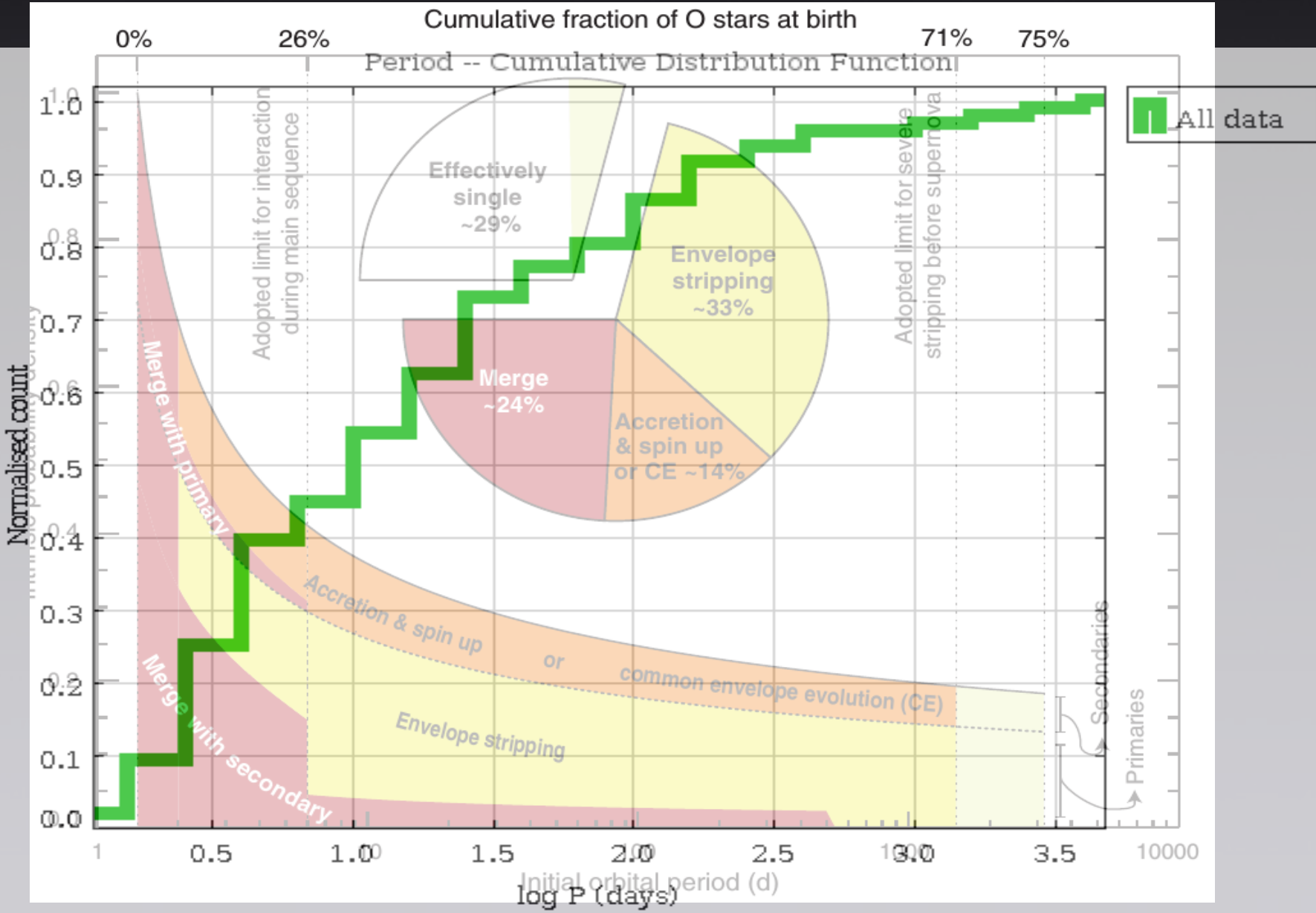
Sana et al. (2012): binary interaction dominates the evolution of massive stars. Sample: 70 stars, 40 SBs.



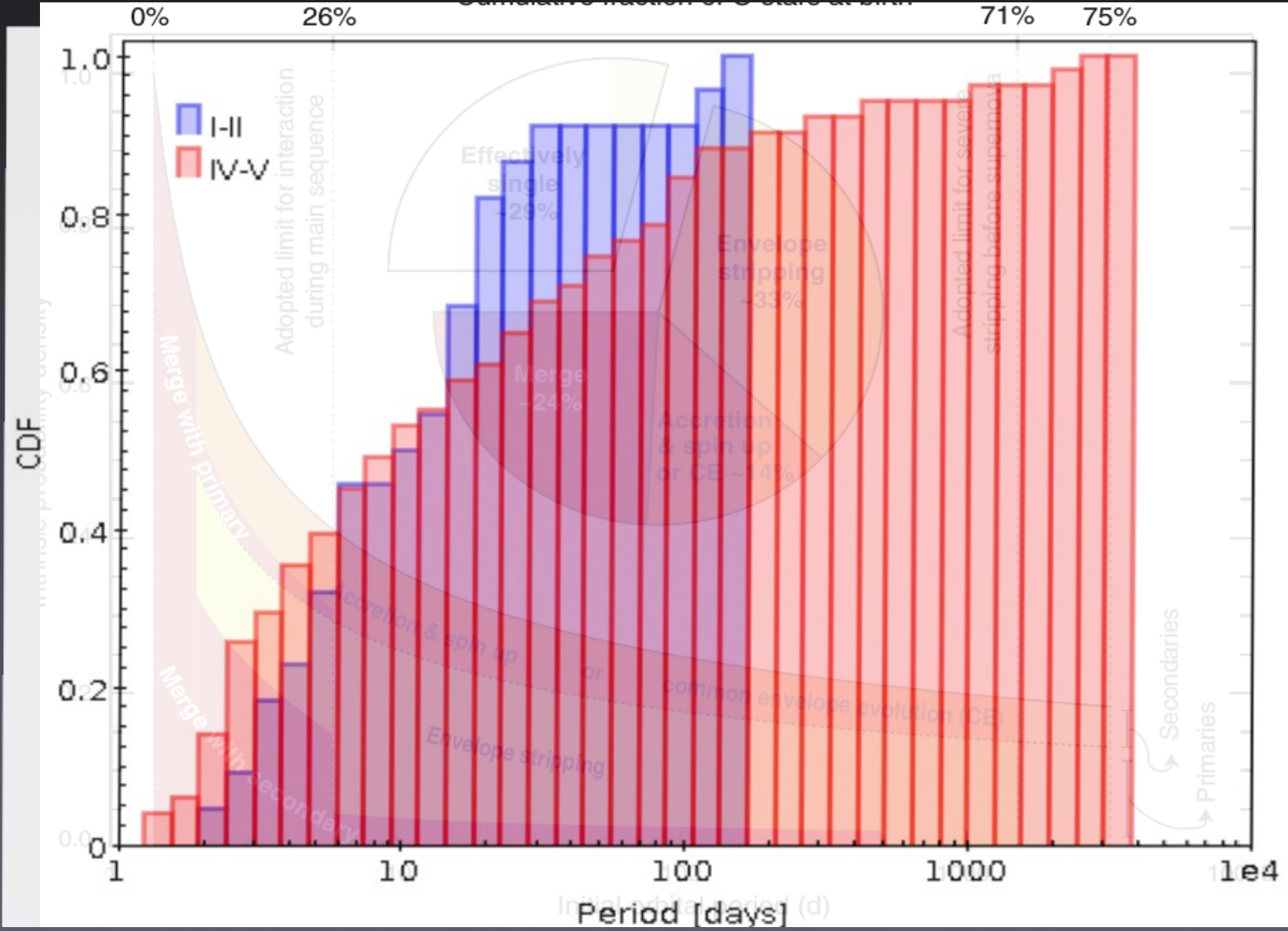
Sample: 70 stars, 40 SBs, compared with OWN (205 stars)



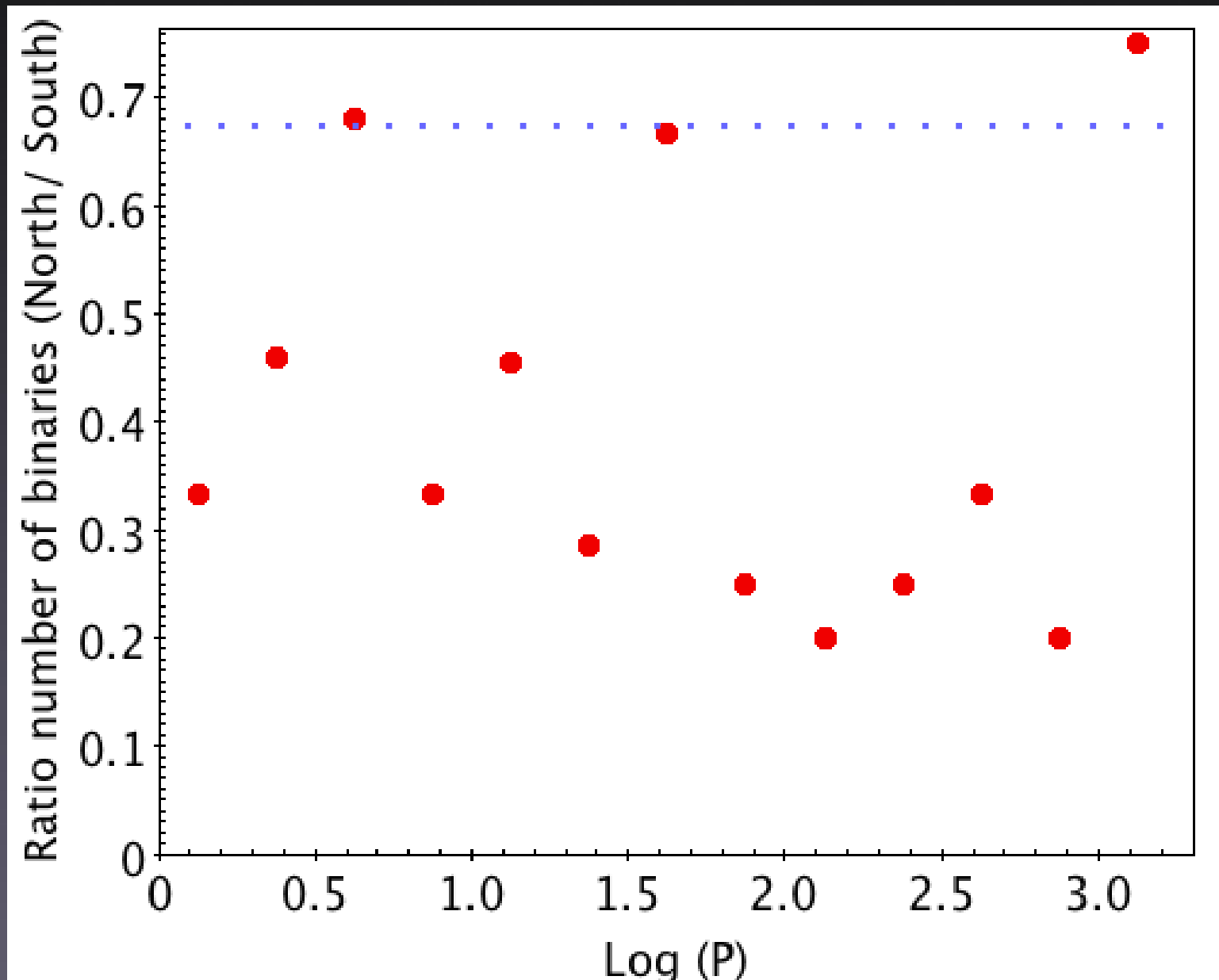
Complete sample OWN + published: 222 SBs



OWN + published: sample of 60 O I-II binaries, and 119 O IV-V binaries



Ratio of number of binaries (North / South)



O stars SB status versus Luminosity

All sky (411 stars, 205 OWN)

• Status	I/Ia/b	II	III	IV-V
• “Single”	57	22	24	73
• SB1	24	6	14	36
• SB2	18	4	29	53
• SB3	5	3	11	20

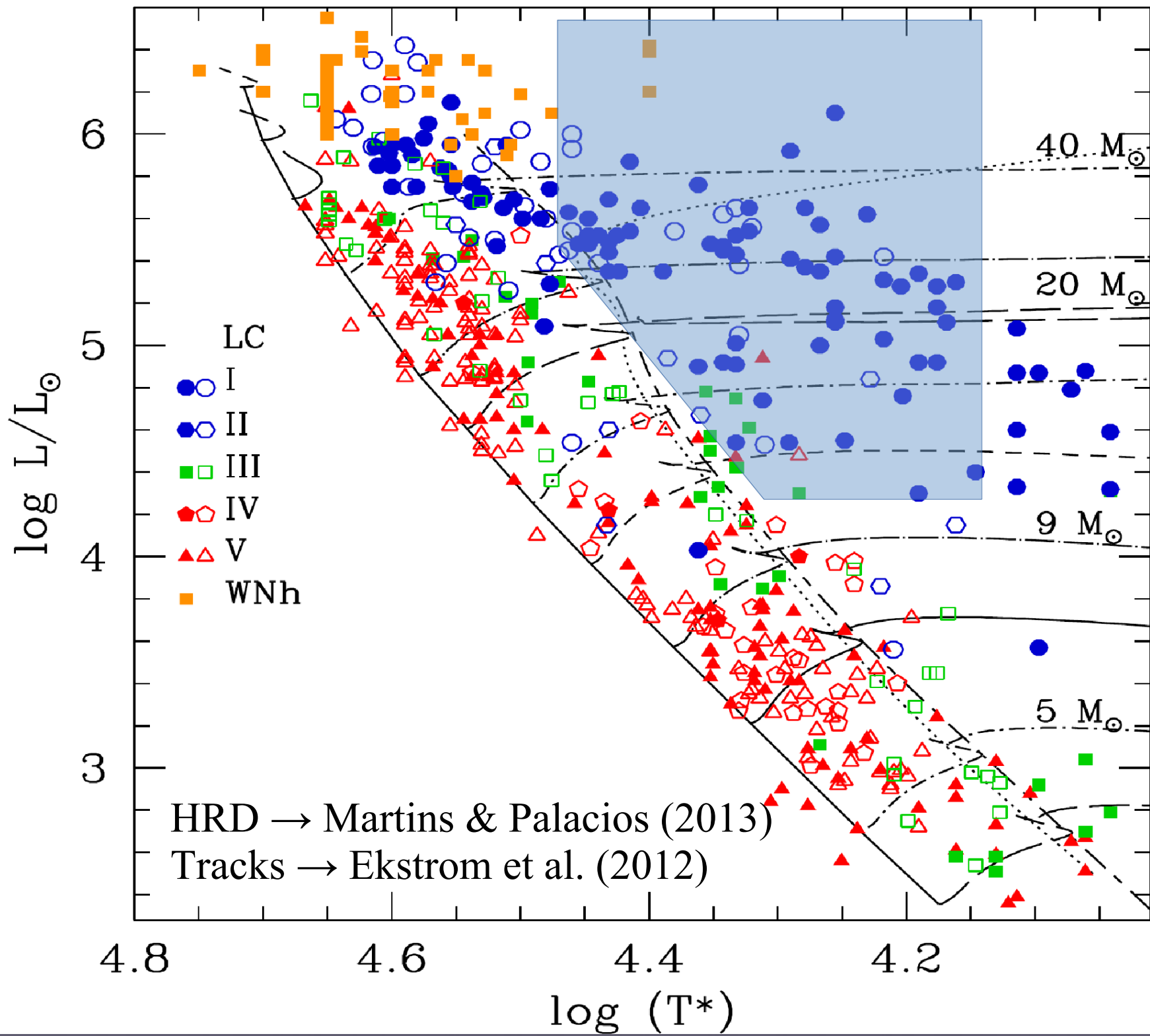
SB status versus Luminosity

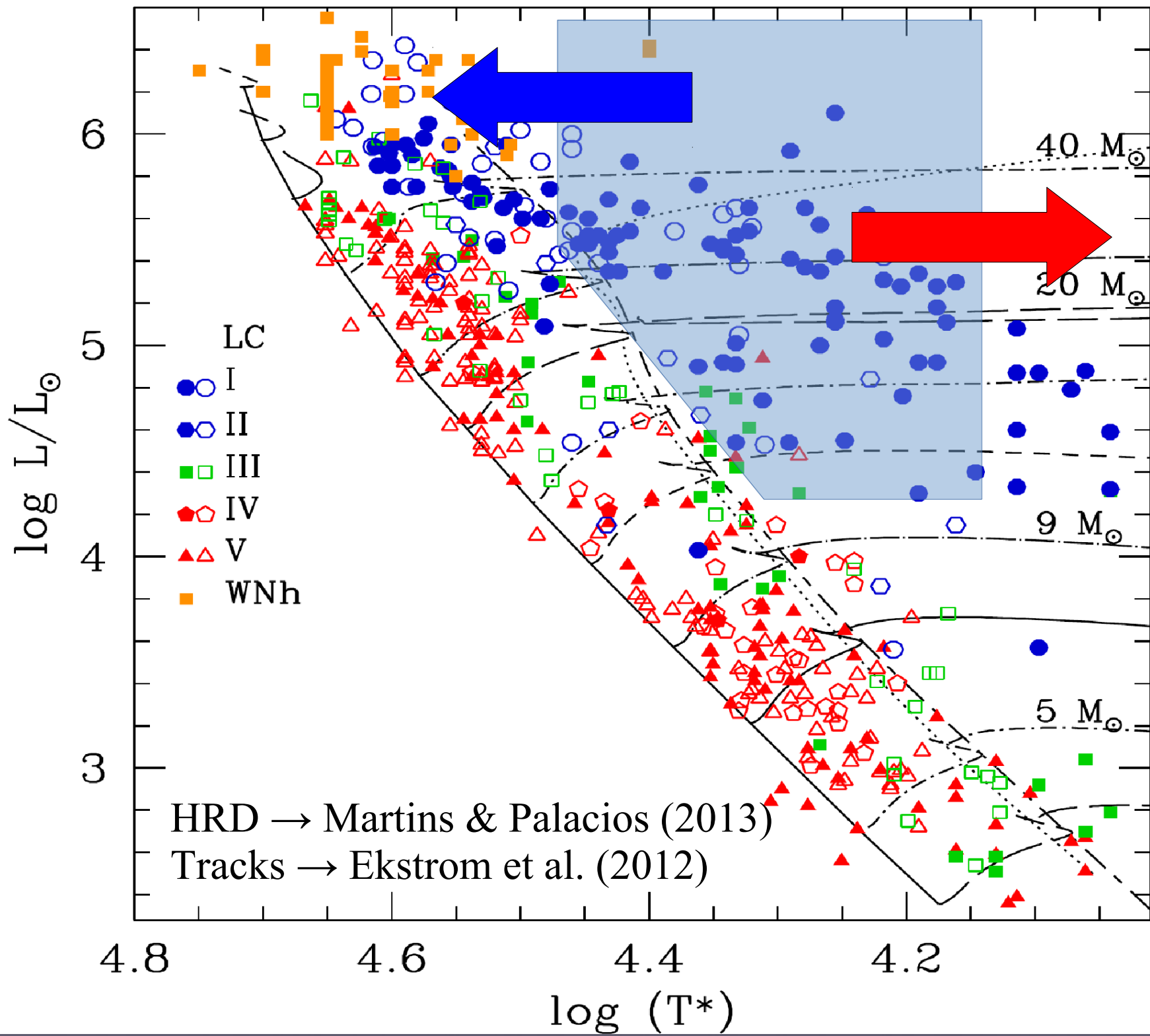
All sky O-stars (411 stars, 205 OWN)

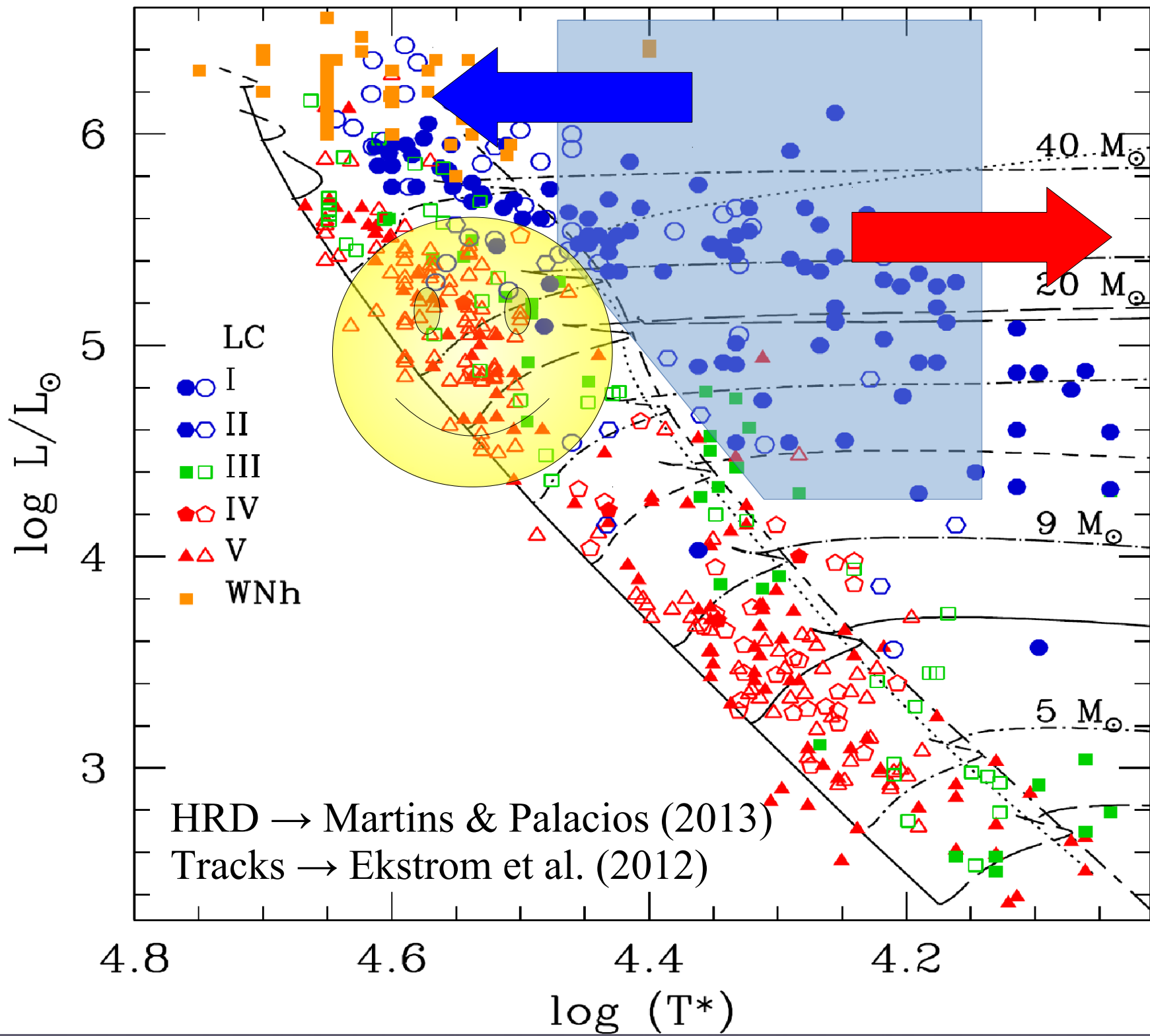
- | • Status | I/la/b | II | III | IV-V |
|------------|--------|------|------|------|
| • “Single” | 0.55 | 0.63 | 0.31 | 0.40 |
| • SB1 | 0.23 | 0.17 | 0.18 | 0.20 |
| • SB2 | 0.17 | 0.11 | 0.37 | 0.29 |
| • SB3 | 0.05 | 0.09 | 0.14 | 0.11 |
- Multiplicity status in early B-type supergiants is unknown: ~1000 stars collected from databases and only 60 SBs!

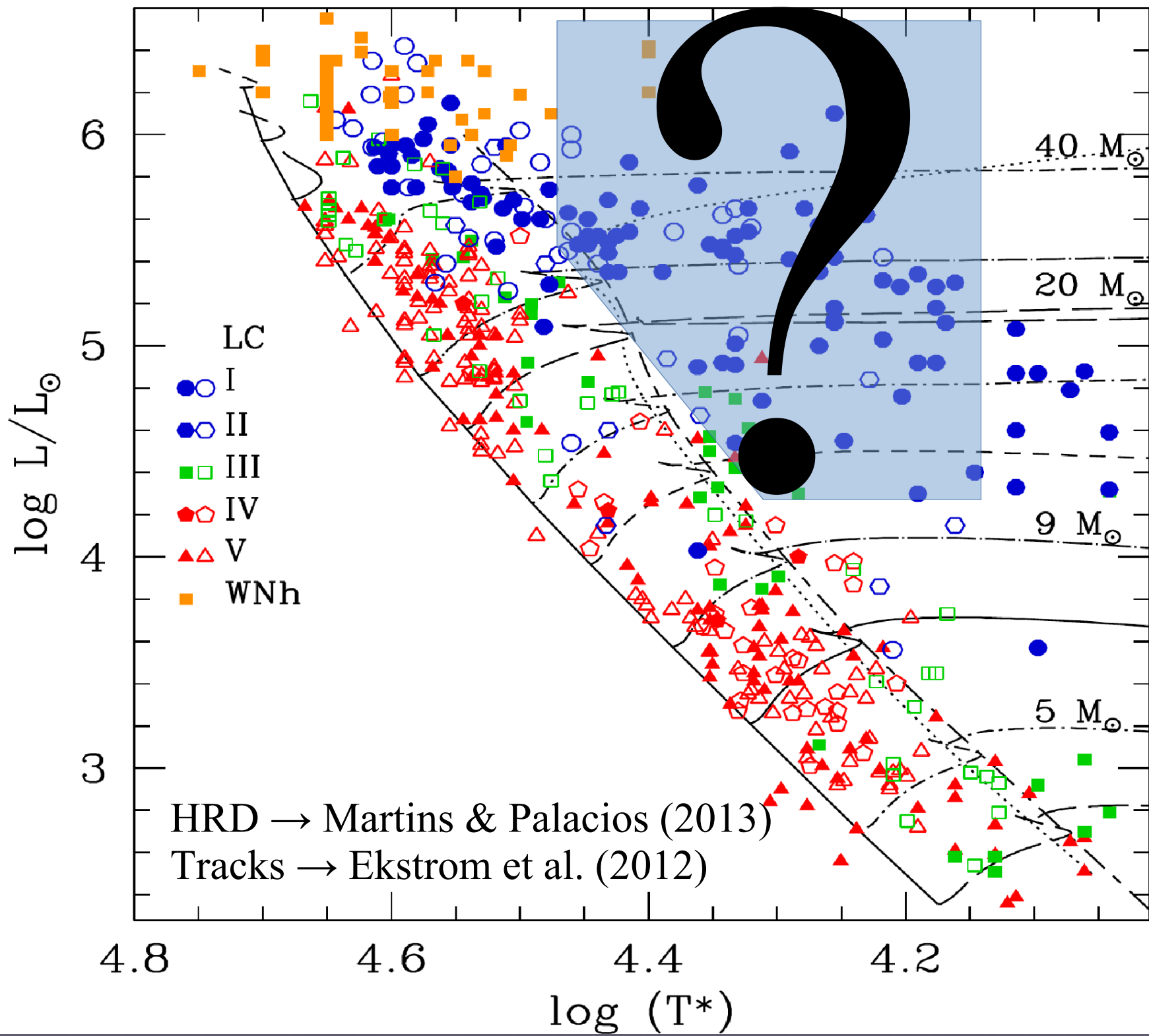
SB status in late O-type and early B-type supergiants

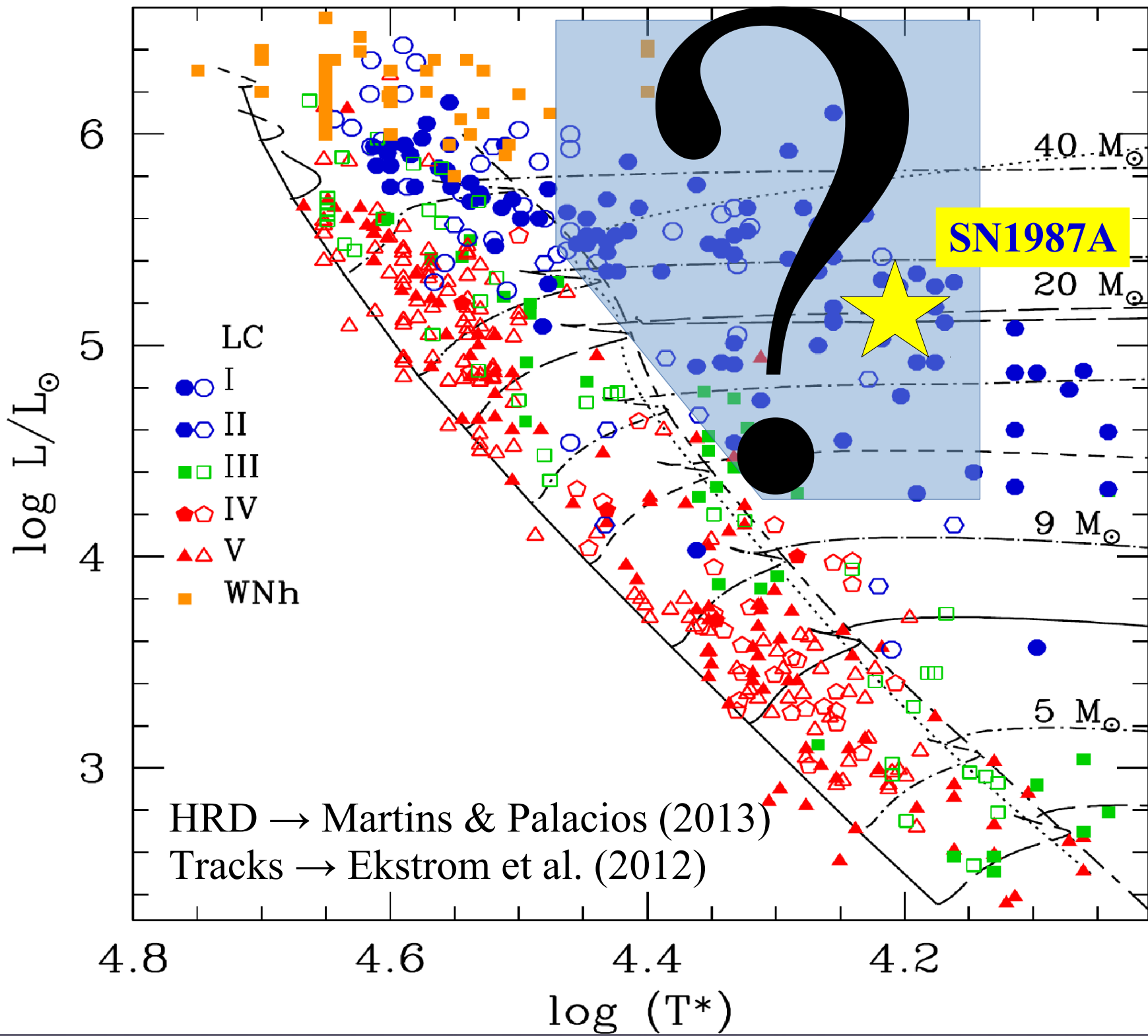
- | | Number | SB Frequency |
|-------------|----------|--------------|
| • O7 | 11 / 20 | 0.57 |
| • O8 | 9 / 19 | 0.52 |
| • O9 | 24 / 63 | 0.38 |
| • B0 | 11 / 260 | 0.04 |
- The low binary numbers of SBs in early-B supergiants:
 - is an observational bias?,
 - Or due to binary mergers, or disrupted binaries?

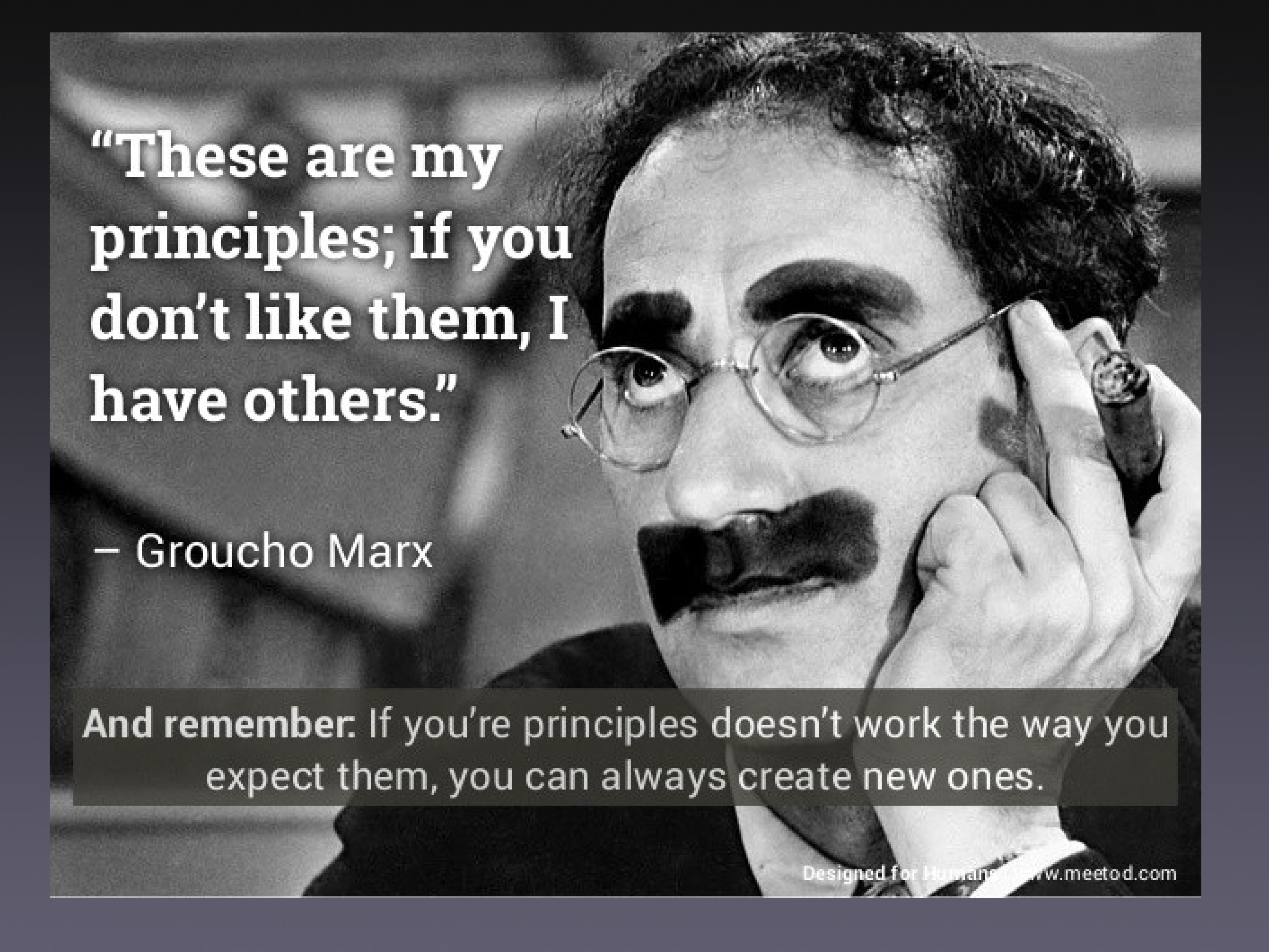












**“These are my
principles; if you
don’t like them, I
have others.”**

– Groucho Marx

And remember: If your principles don't work the way you expect them, you can always create new ones.

A black and white photograph of Groucho Marx. He is wearing his signature round glasses and has a prominent mustache. He is holding a cigar in his right hand, which is raised towards his face. The background is slightly blurred, suggesting an indoor setting.

“These are my
observations if you
don’t like them, I
have others.”

– Groucho Marx

And remember: **If your models** doesn’t work the way you
expect them, you can always create new ones.

Morphology
matters!!!!

Nolan Walborn



You can only confirm that a
massive star *is* a binary,
but never that it is not.

Virpi Niemelä

Yo digo que las estrellas
Le dan gracias a la noche
Porque encima de otro coche
No pueden lucir tan bellas
Y digo que es culpa de ella
De la noche, el universo,
Cual son culpables los versos
De que haya noches y estrellas.

I say that stars
Thank the night
Because on top of another car
They cannot look so beautiful
And, I say it's her fault
of the night, the universe,
what are the guilty verses
that there are nights and stars.

Silvio Rodríguez



That's all folk!!