Can habitable planets form in clustered environments?

NGC 3603 Credit: HST archive

Planet Formation and Evolution
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Introduction

Can habitable planets form in clustered environments?

1. Environmental effects on protoplanetary discs?

➡ external photoevaporation and dynamical interactions

2. Observational evidence?

➡ not conclusive

3. Effect on the habitable zone?

➡ ?

The study

de Juan Ovelar et al. 2012

(~~submitted~~)

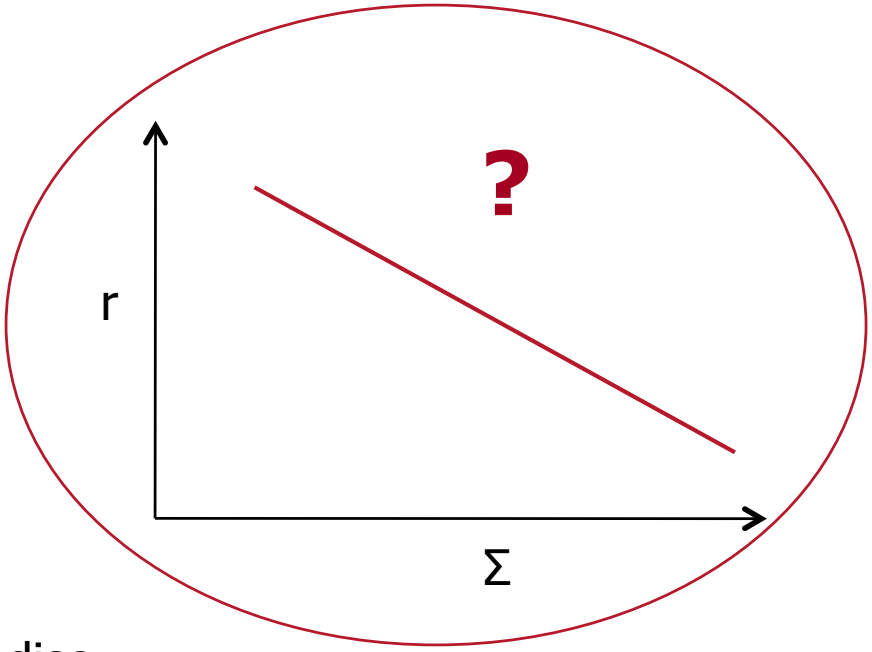
(accepted)

The study

2. Observational evidence?

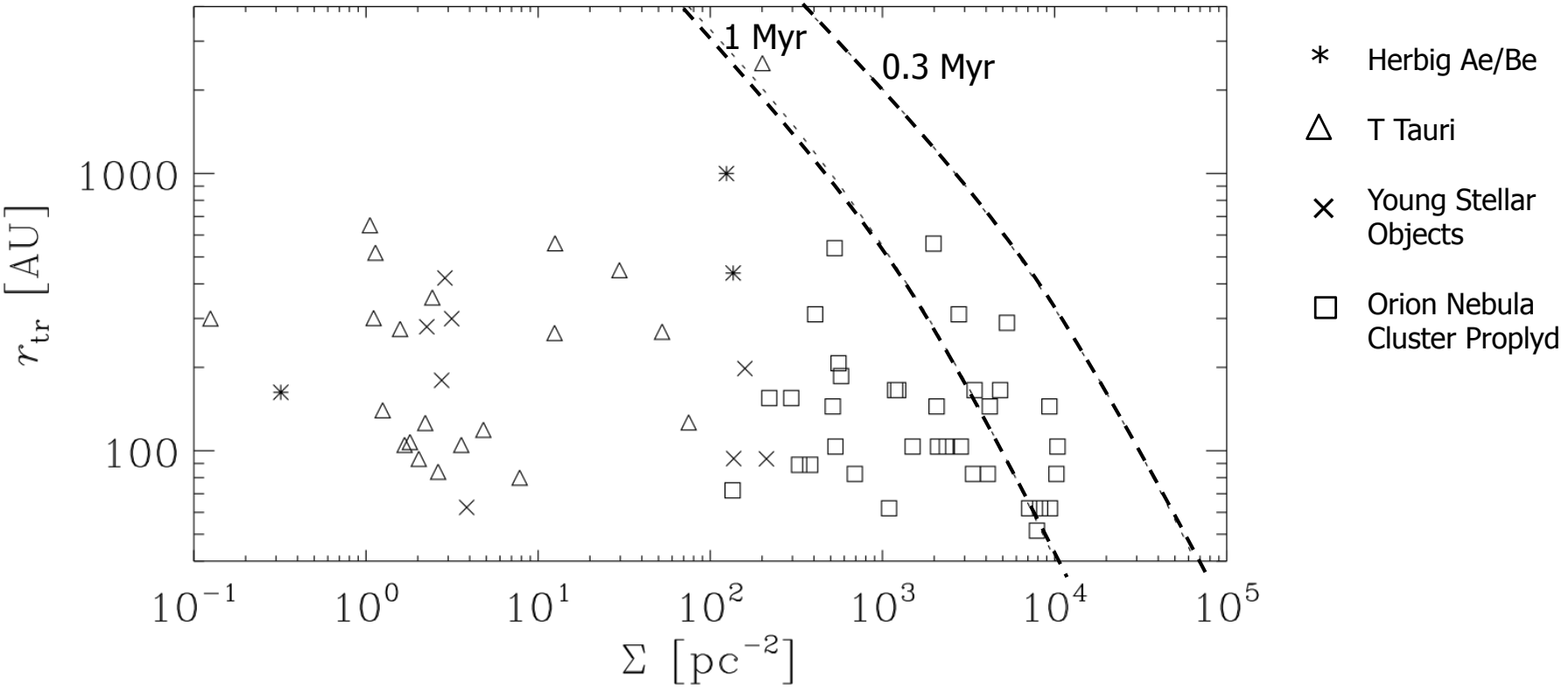
Catalog of resolved Protoplanetary Discs **(PPDs)** → disc radius r

Catalog of Young Stellar Objects **(YSOs)** → ambient stellar density around disc (Nr stars/unit area) Σ

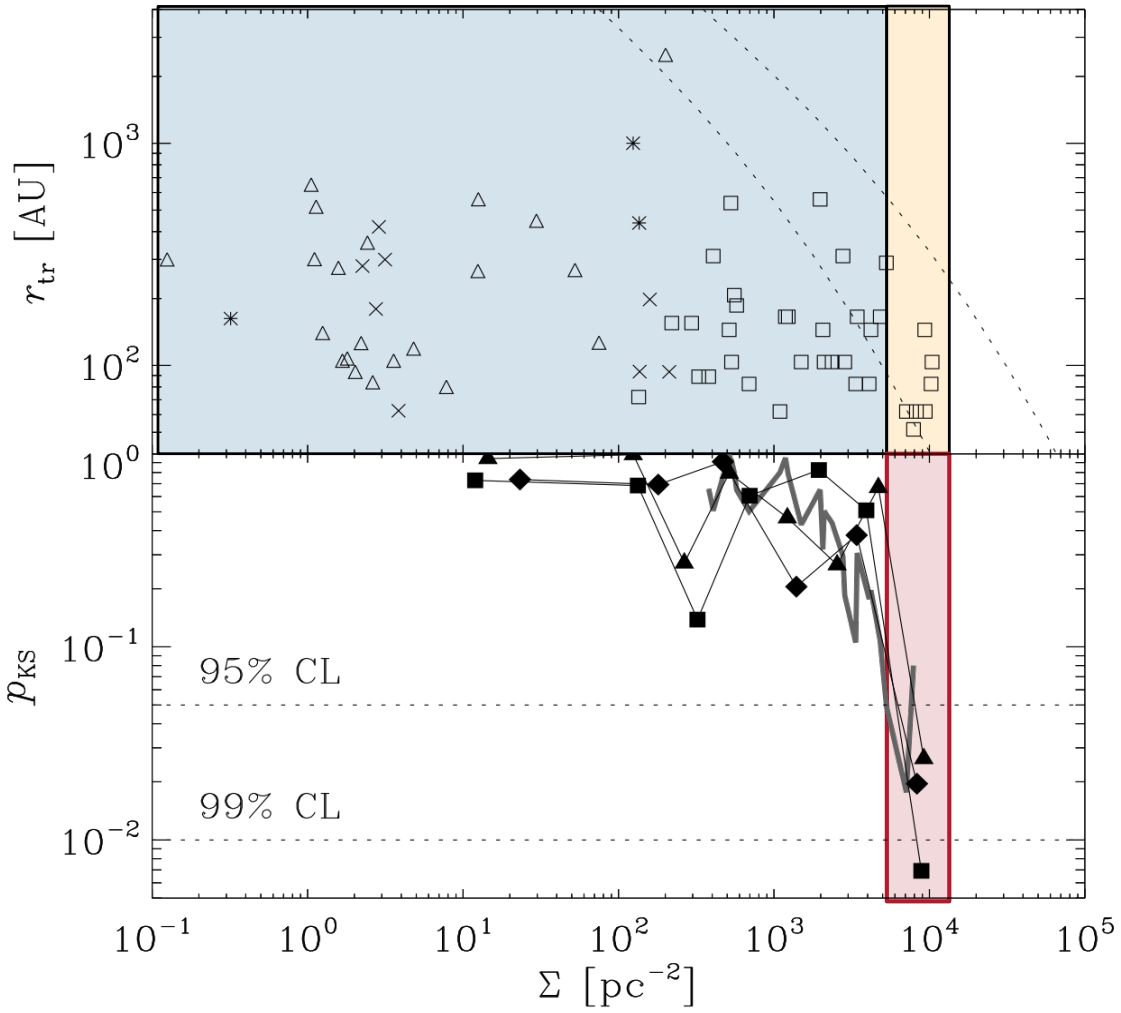


The study

Disc radius vs. ambient surface density

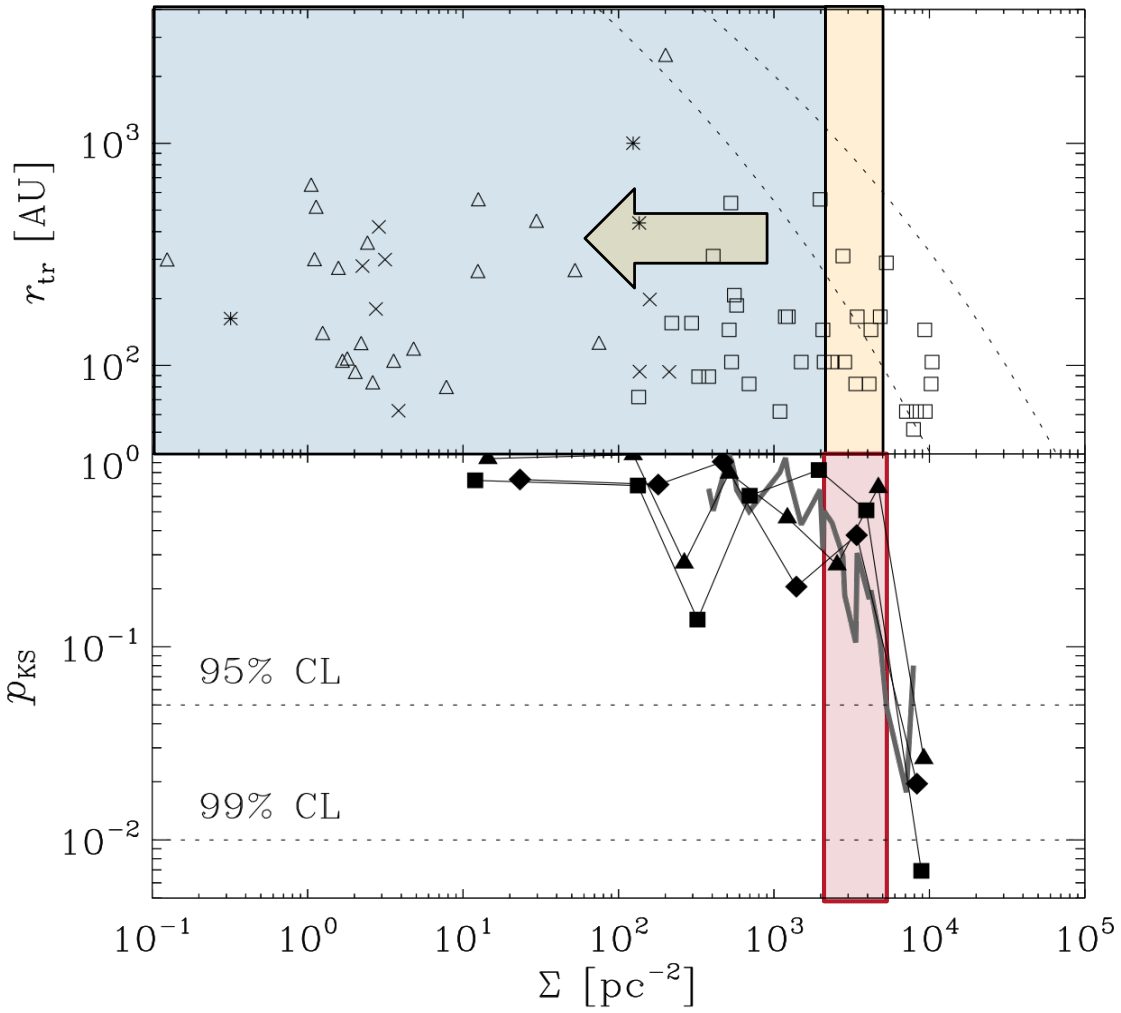


The study



- KS-test to **detect a change** in the radius distribution
- 6, 7 and 8 objects per bin
- **> 97% confidence level detection @ $\Sigma \geq 10^{3.5}$**

The study



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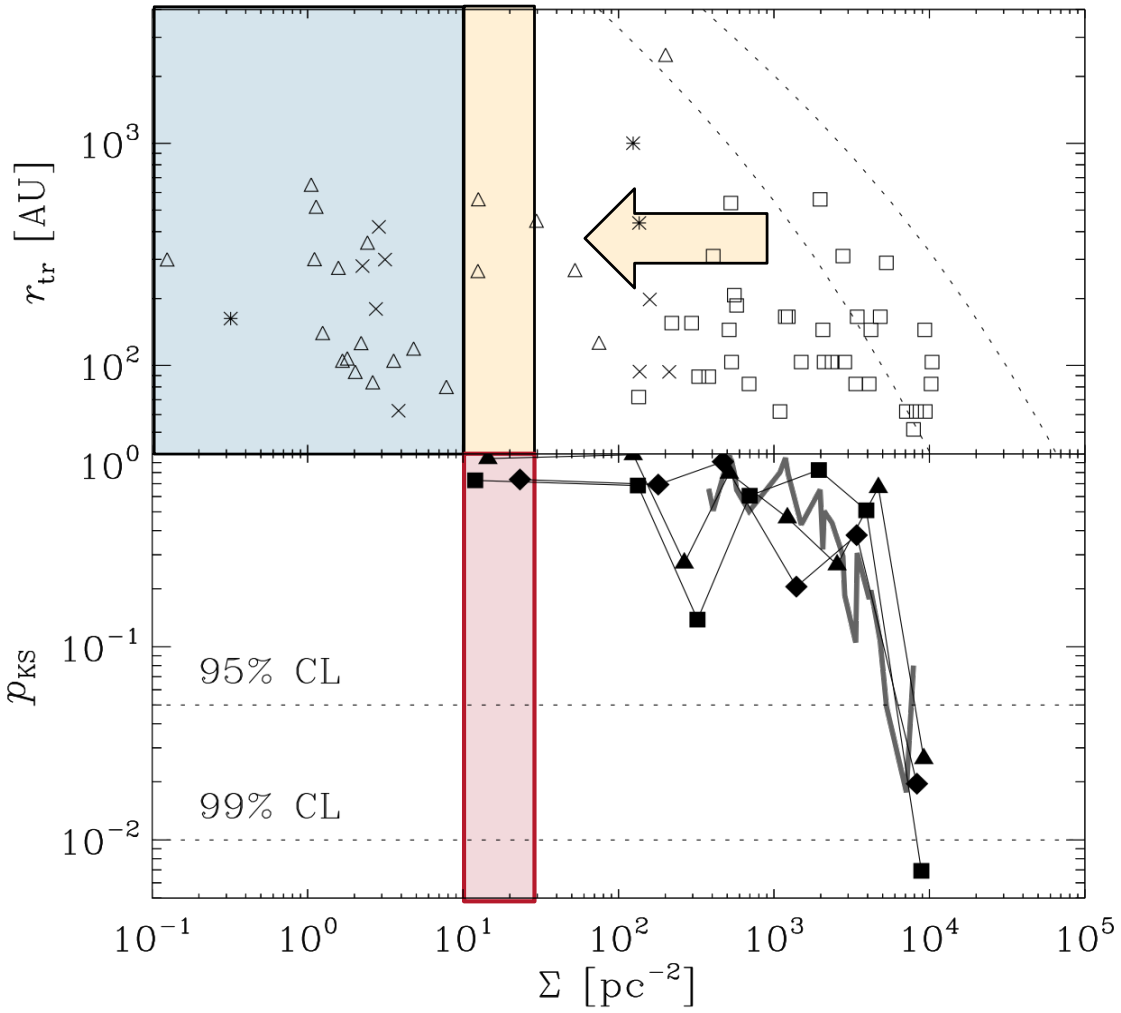

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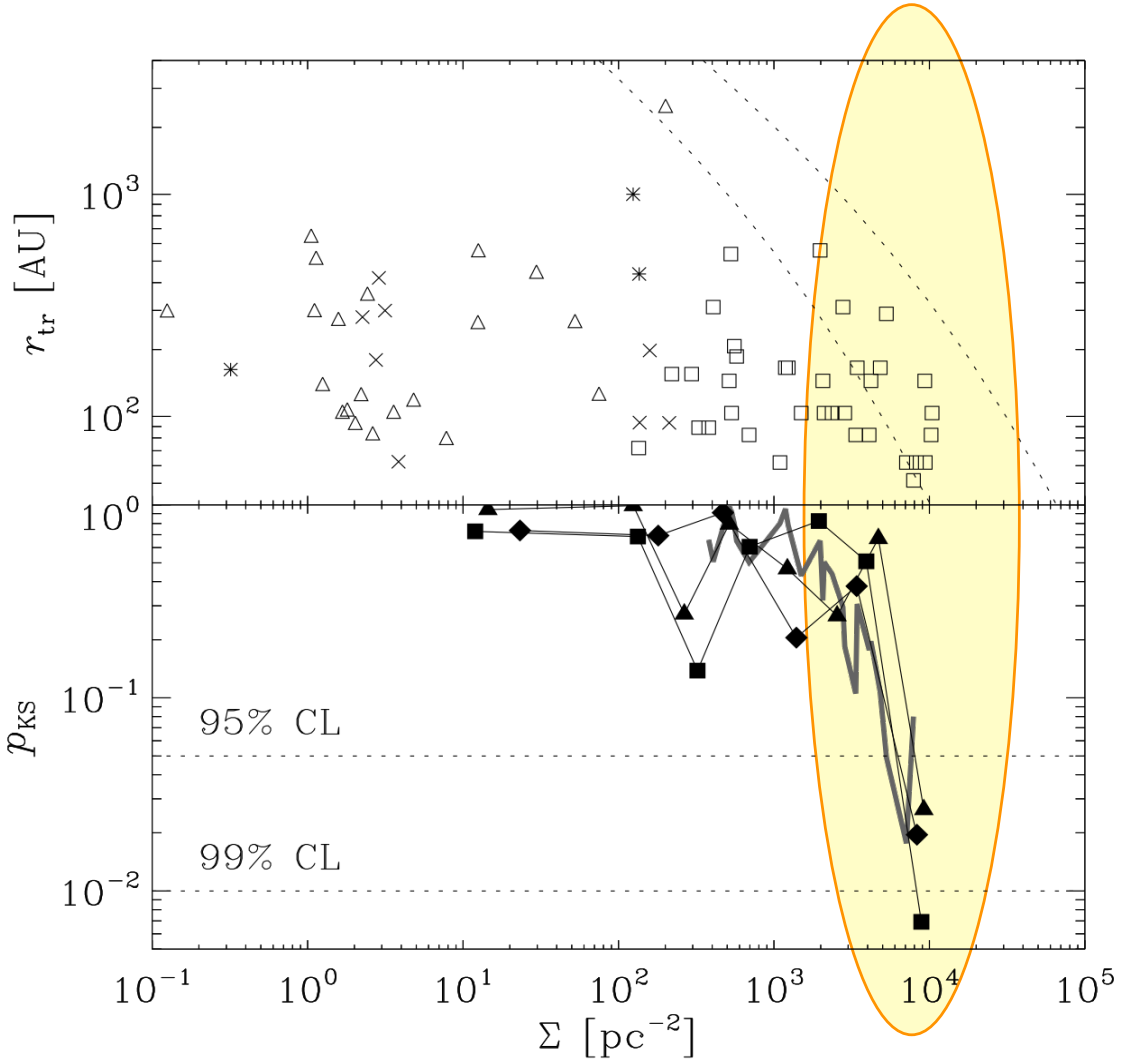

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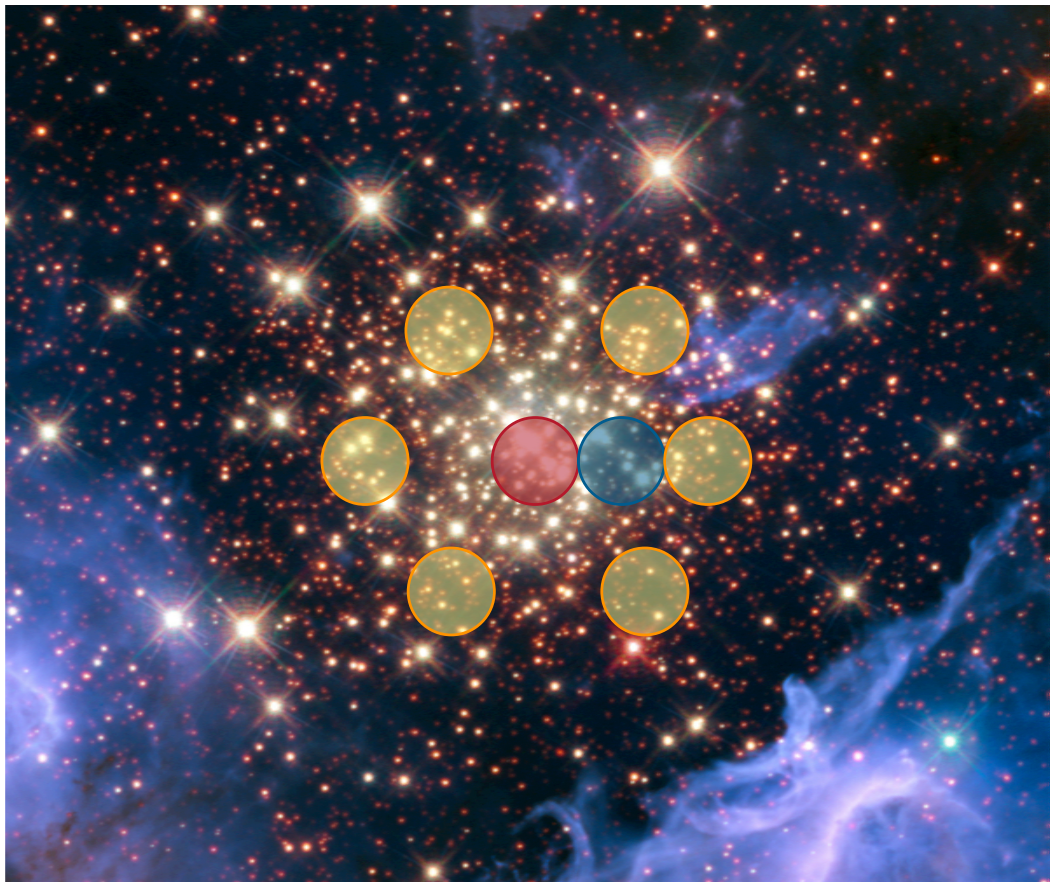
- 6, 7 and 8 objects per bin
- **> 97% confidence level detection @ $\Sigma \geq 10^{3.5}$**

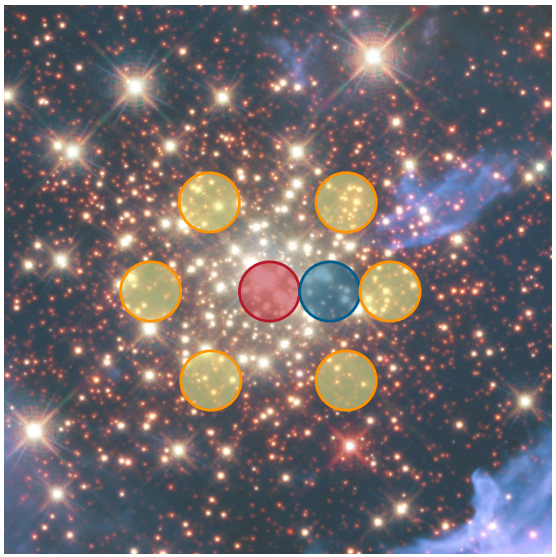
The test

Although results are highly suggestive we need to probe higher density environments:

ALMA Cycle 1 proposal for studying disc mass function in **NGC3603** (~3 Myr) with $\Sigma_{max} > 10^4$



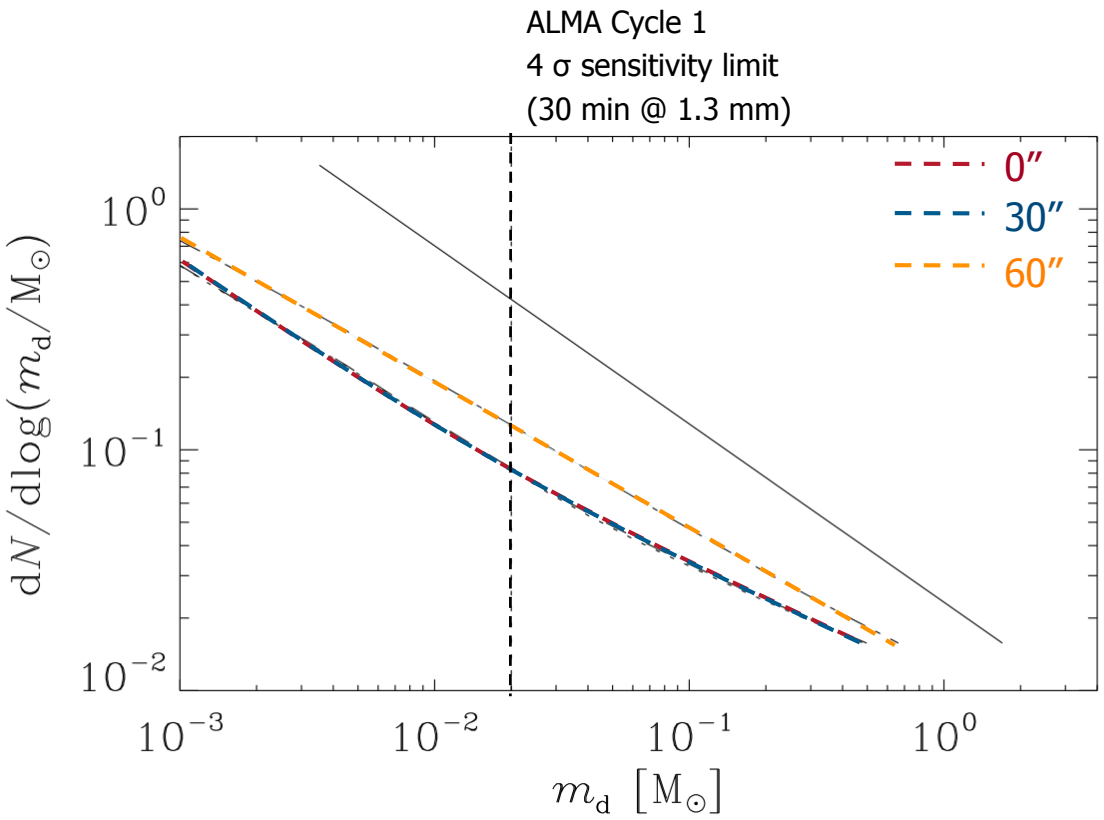
The test



$\Sigma_{0''} \sim 2 \times 10^4$

$\Sigma_{30''} \sim 2 \times 10^3$

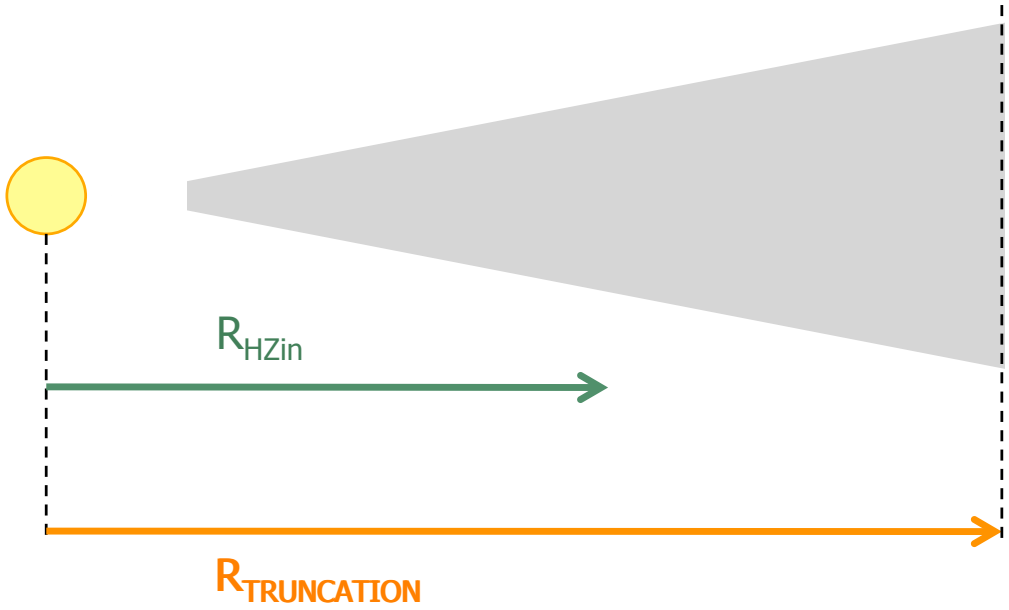
$\Sigma_{60''} \sim 5 \times 10^2$



The habitable zone

3. Effect on the habitable zone?

but while we wait…



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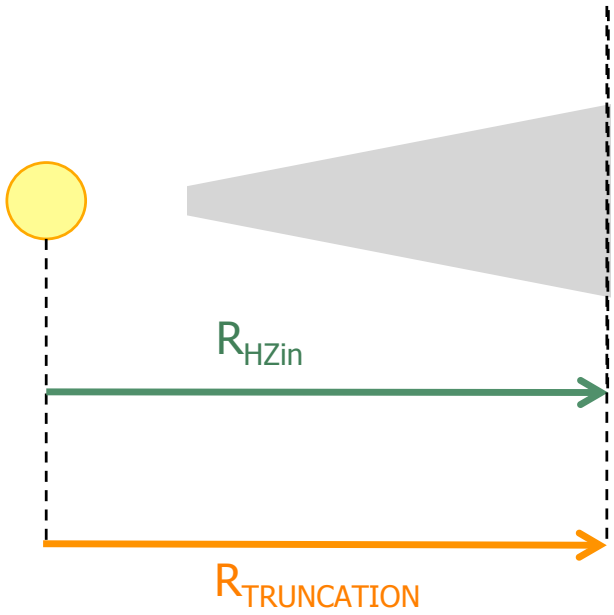
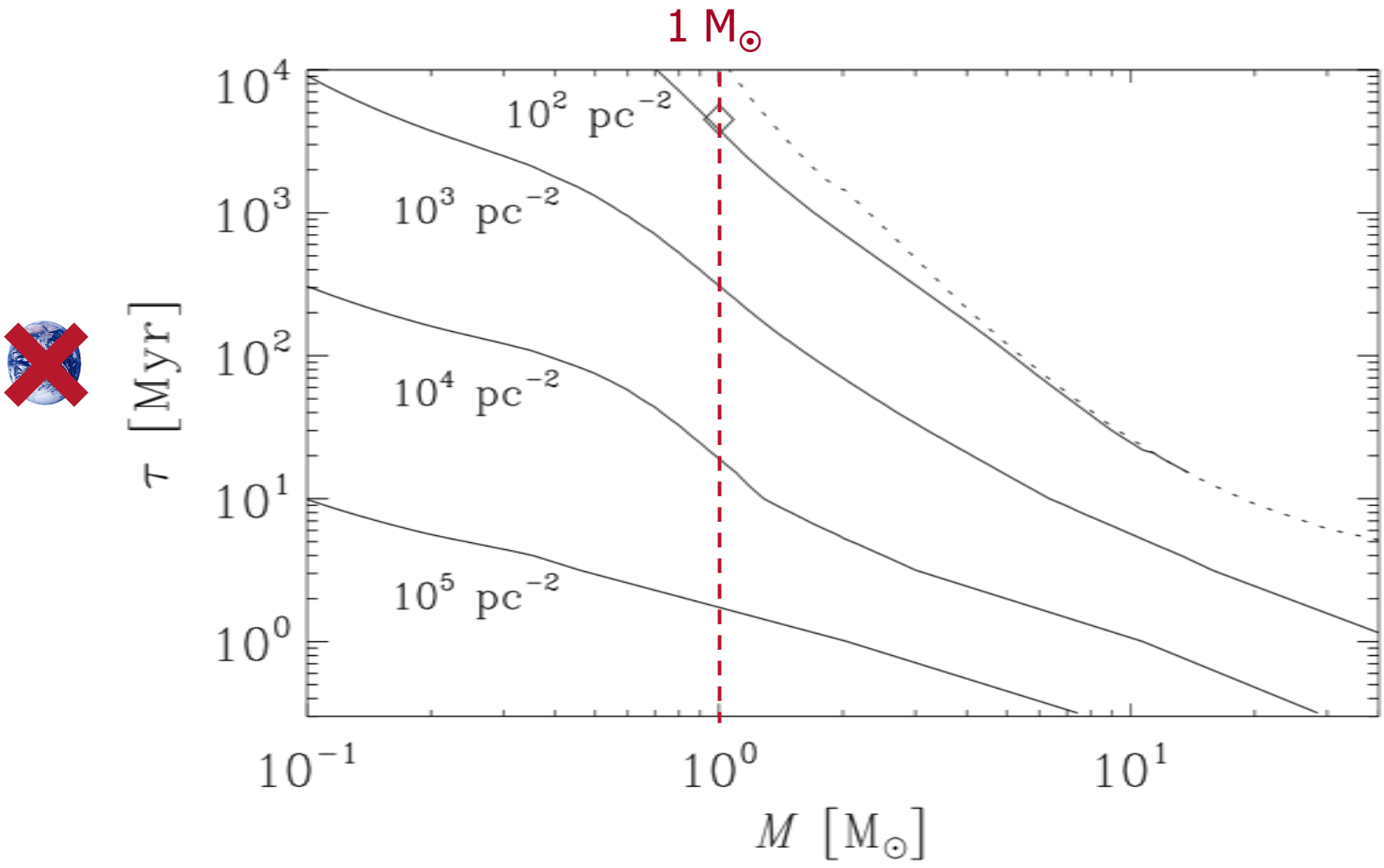


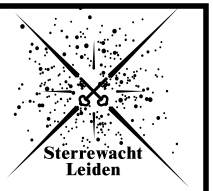
$$HZ_{LIFETIME} = T\ (R_{TR.} = R_{HZ})$$

The habitable zone

HZ lifetime



Conclusions



Can habitable planets form in clustered environments?

1. Environmental effects on protoplanetary discs?

➡ photoevaporation and dynamical interactions

2. Observational evidence?

➡ not conclusive ➡ **> 97% confidence level that environment matters**
+ ALMA Cycle 1 prop.

3. Effect on the habitable zone?

➡ **?** ➡ **rough prediction of $HZ_{LIFETIME}$**
NO photoevaporation taken into account

Outline

Bottom line:
there's a universe outside the disc…watch out!!

Thank you!!