Planet formation by nucleated-instability: predictions for CoRoT

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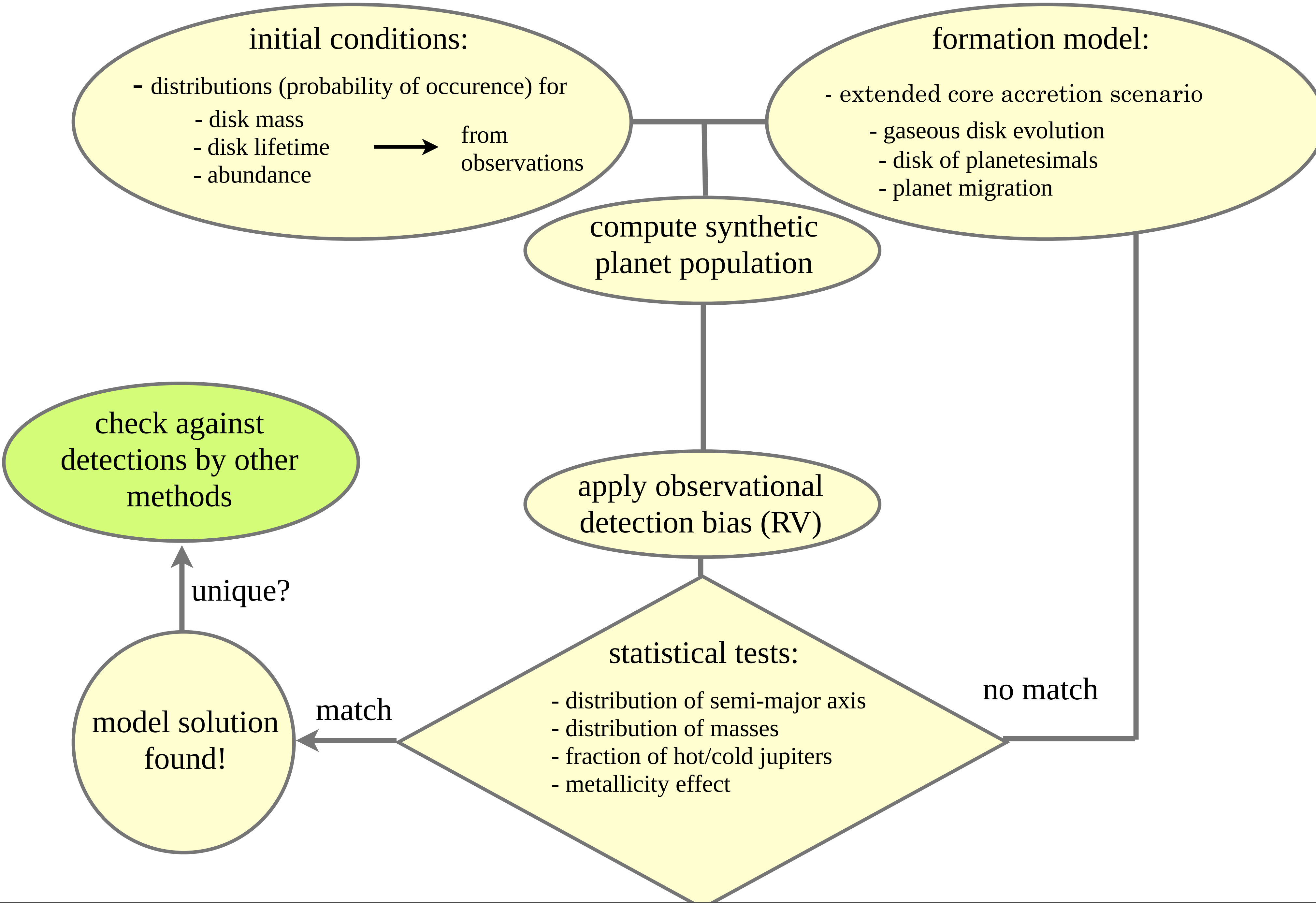
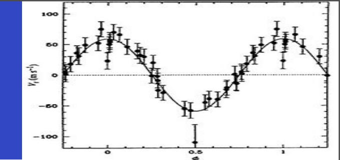
Extra-solar planet population synthesis

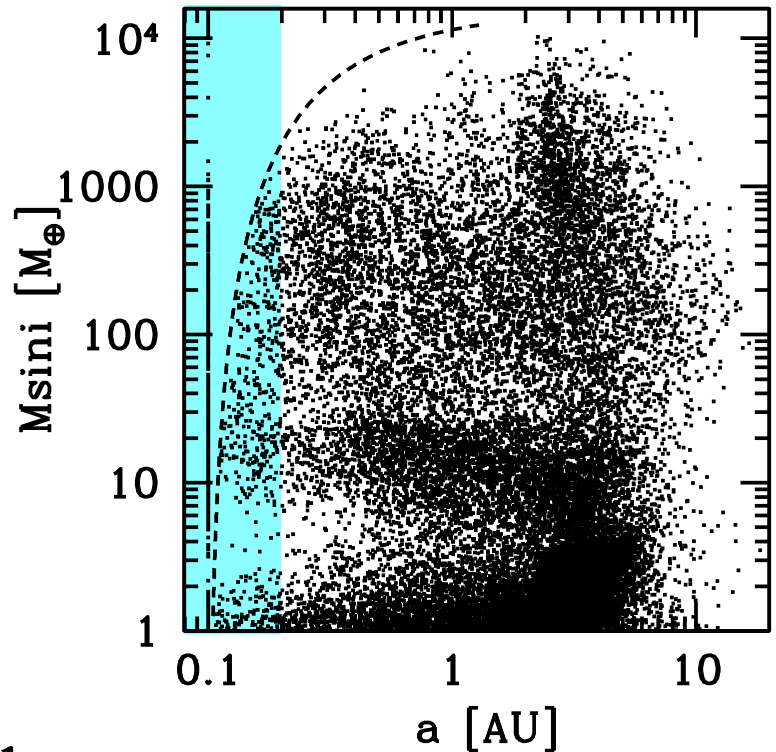


M sin(i) *vs* a

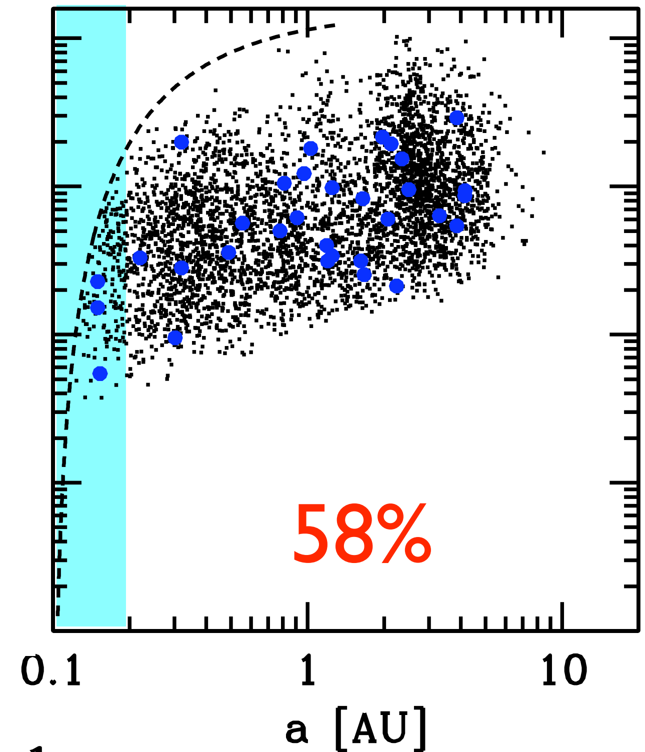


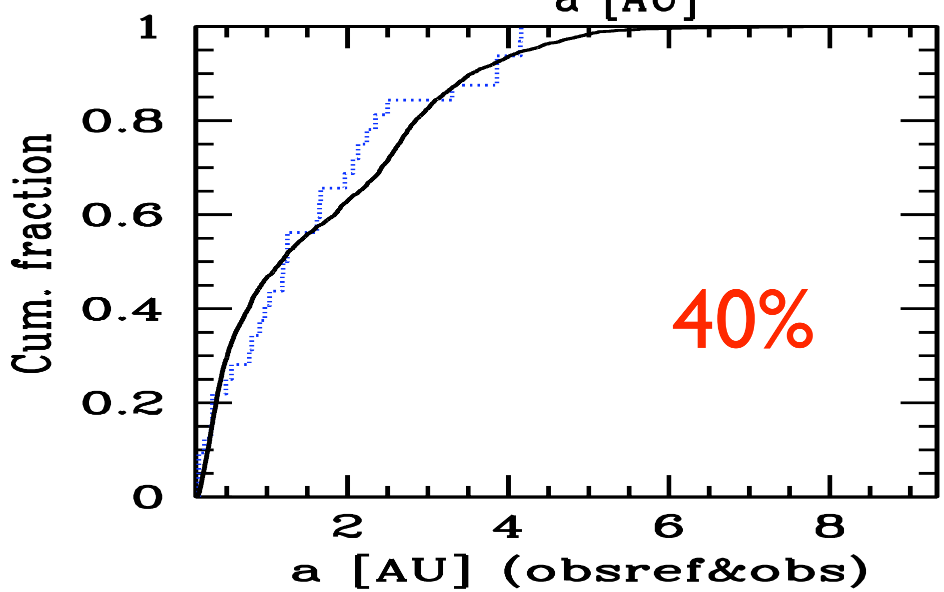
(partial) evaporation

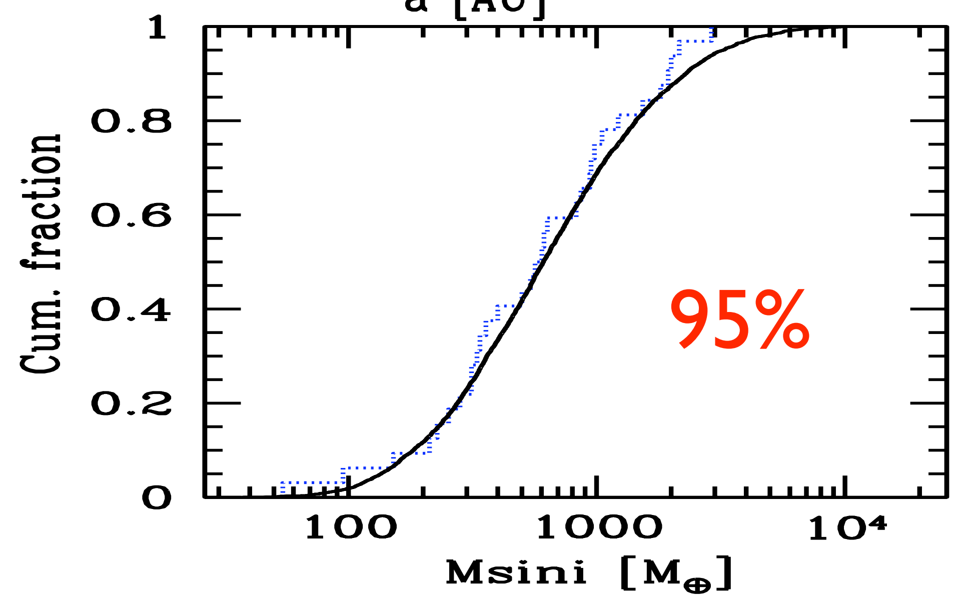
all



10 m/s







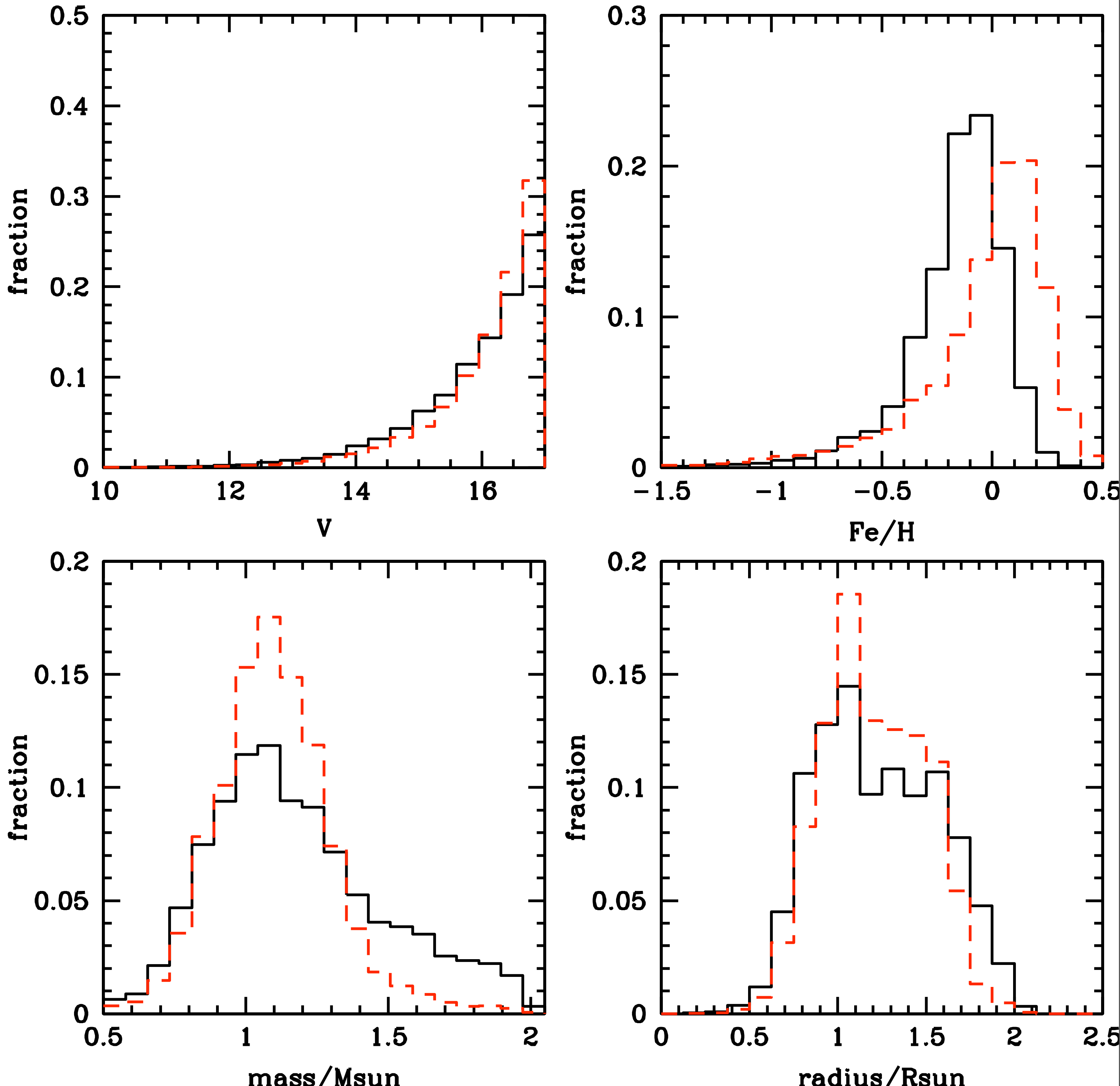
Galactic model

Robin et al. (2003)

4 populations:
- spheroïd
- thick and thin disks
- bulge

Luminosity from
- SFR
- IMF
- evolution tracks

No spiral arms



Detection probability

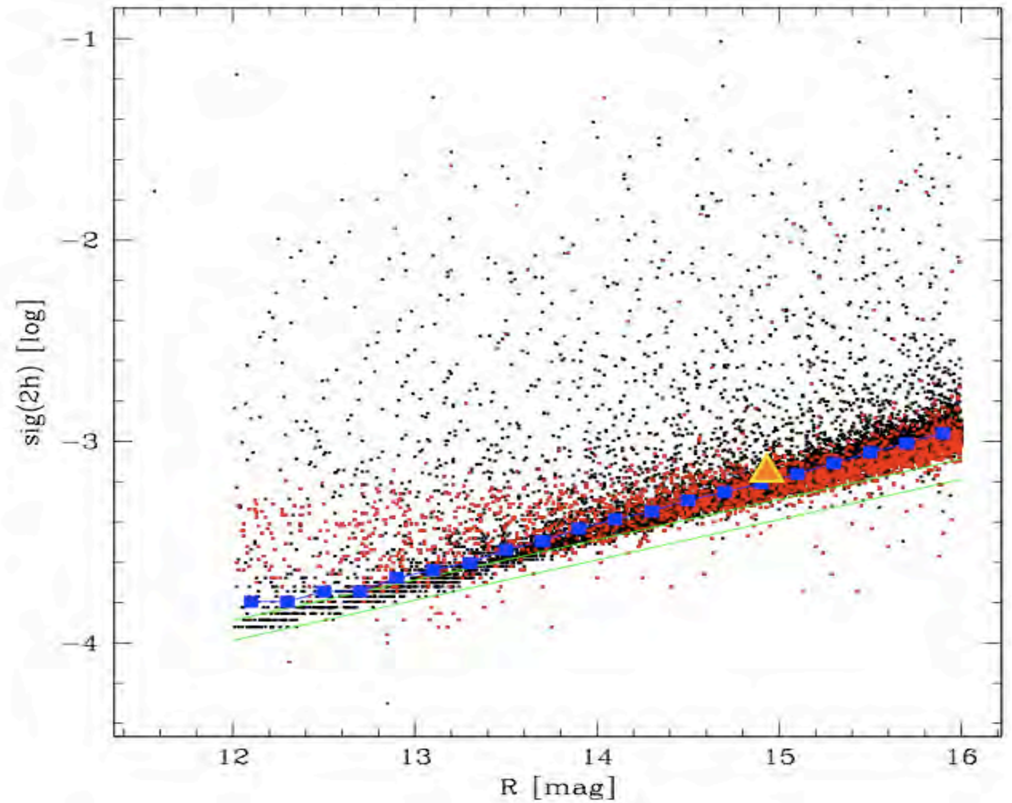
Photometric detection

$$S/N = \sqrt{DT/P}(R_{\mathrm{planet}}/R_{\mathrm{star}})^2/\sigma_{\mathrm{tot}} > ST$$

σ_{tot} : noise

$$\log \sigma_{\mathrm{tot}} = 0.216(V - 12.5) - 3.8$$

$$ST = 12$$



Spectroscopic detection

V	12.5 - 13.5	13.5 - 14.5	14.5 - 15.5	> 15.5
$\varepsilon_{\mathrm{RV}}$	5	8	12	20

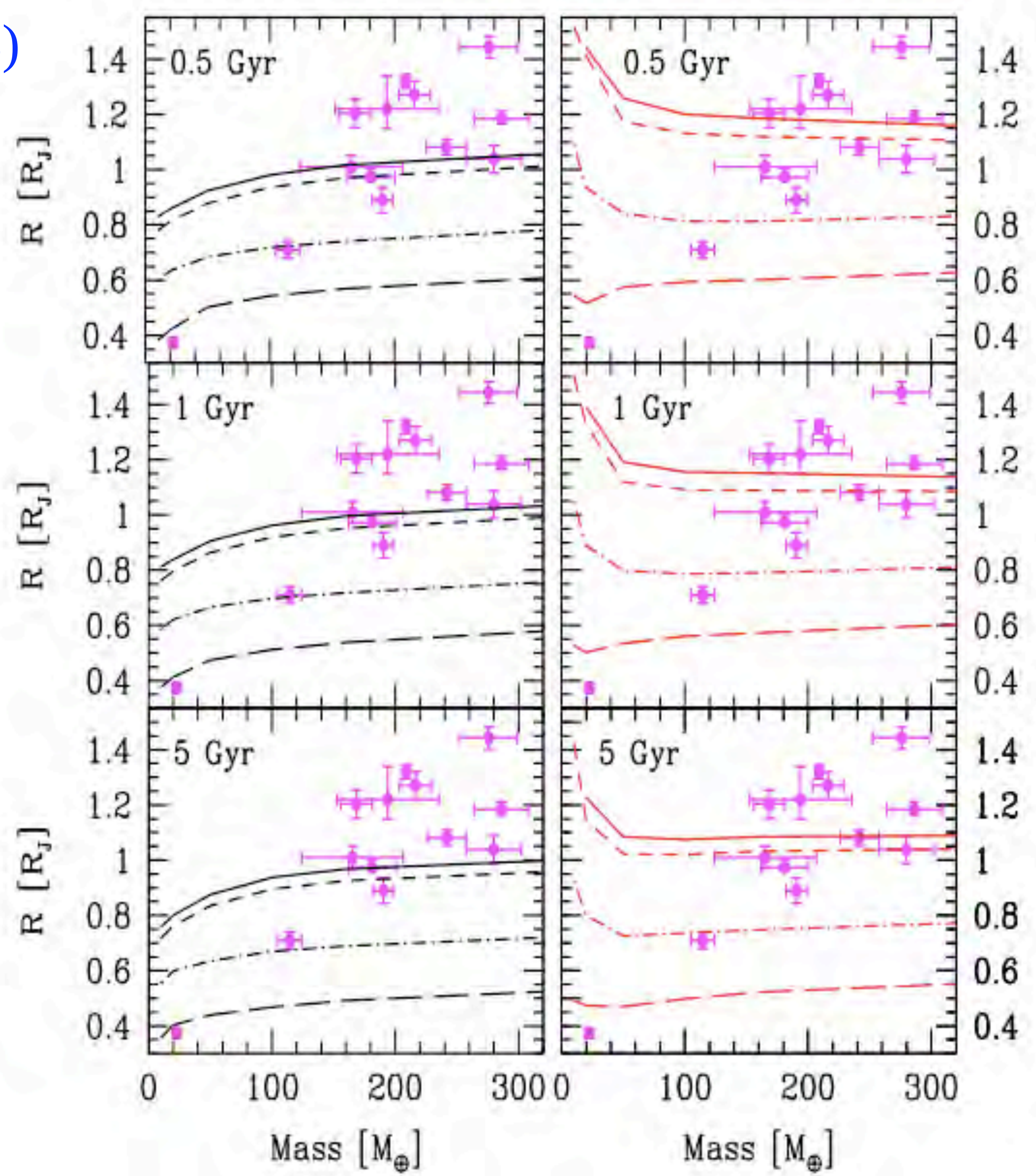
Planet evolution models

Models from Baraffe et al. (2008)

⇒ mass and heavy elements from formation model

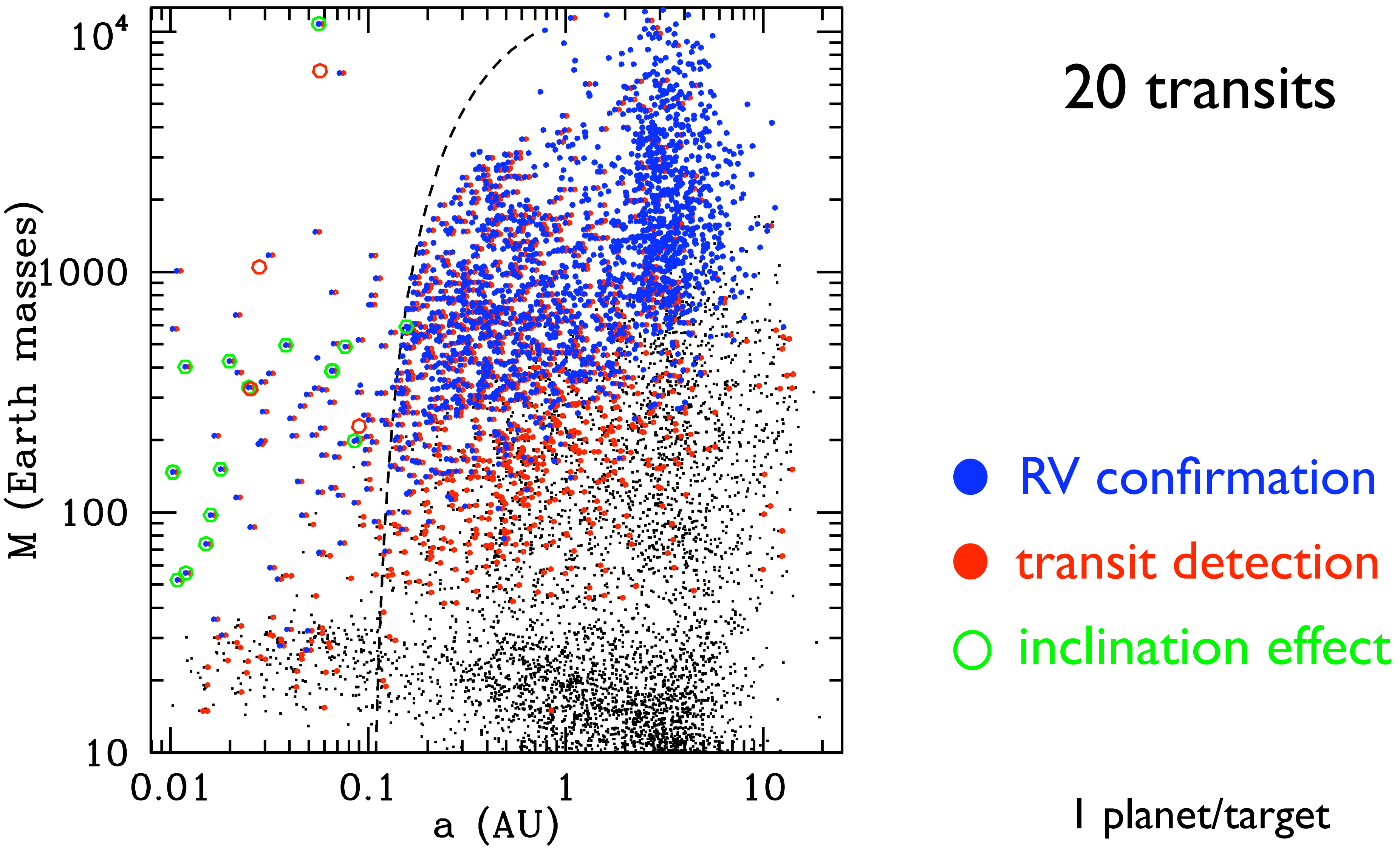
⇒ irradiation from a Sun at 0.045 AU

⇒ radius at 2 or 5 Gyr



IRa01 and LRc01

	RA	DEC	l	b	length	#LC	Giant fraction
IRa01	6h44	-1m12	212.1	-1.64	45	9900	0%
LRc01	19h23	0m27	36.6	-7.01	152	11300	0%



20 transits

1 planet/target

Detection probability

1) Formation model: only one planet per 5-star ?

   ⇒ detection probability OK for RV surveys

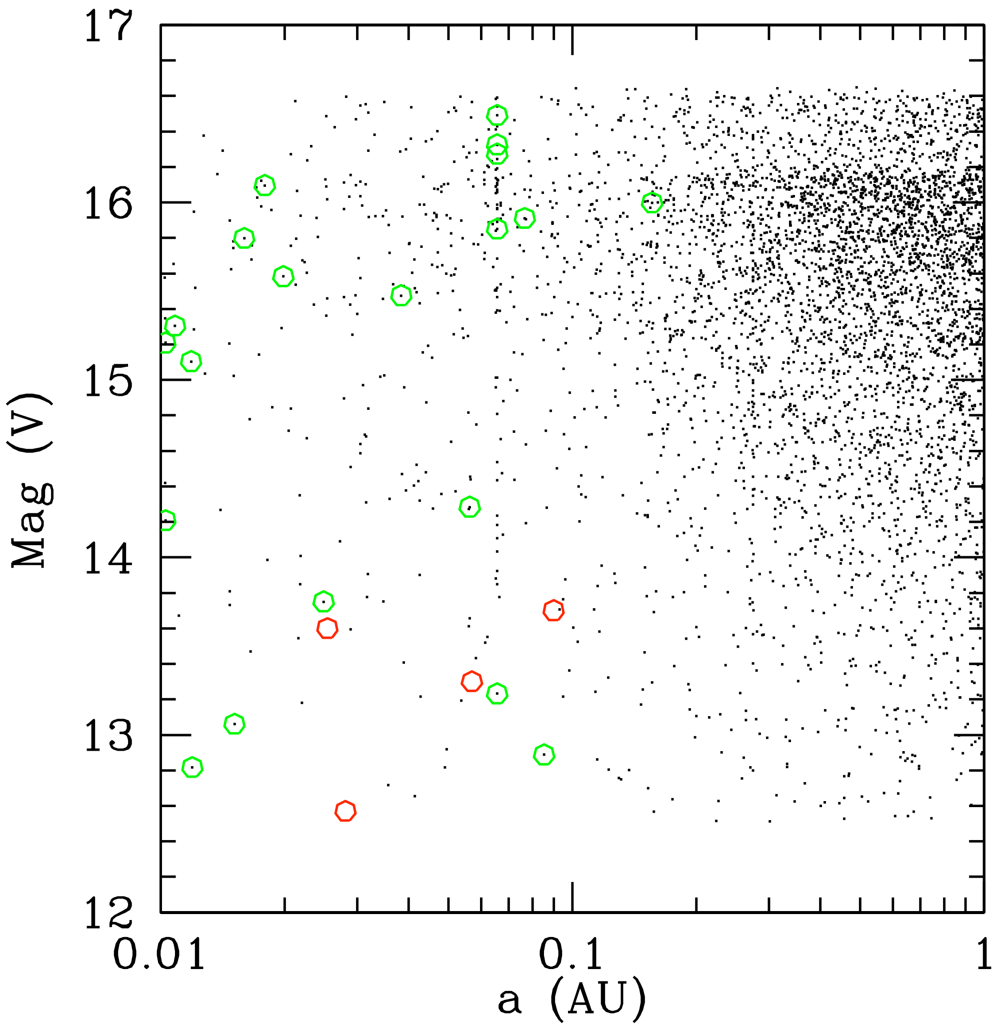
2) Target selection

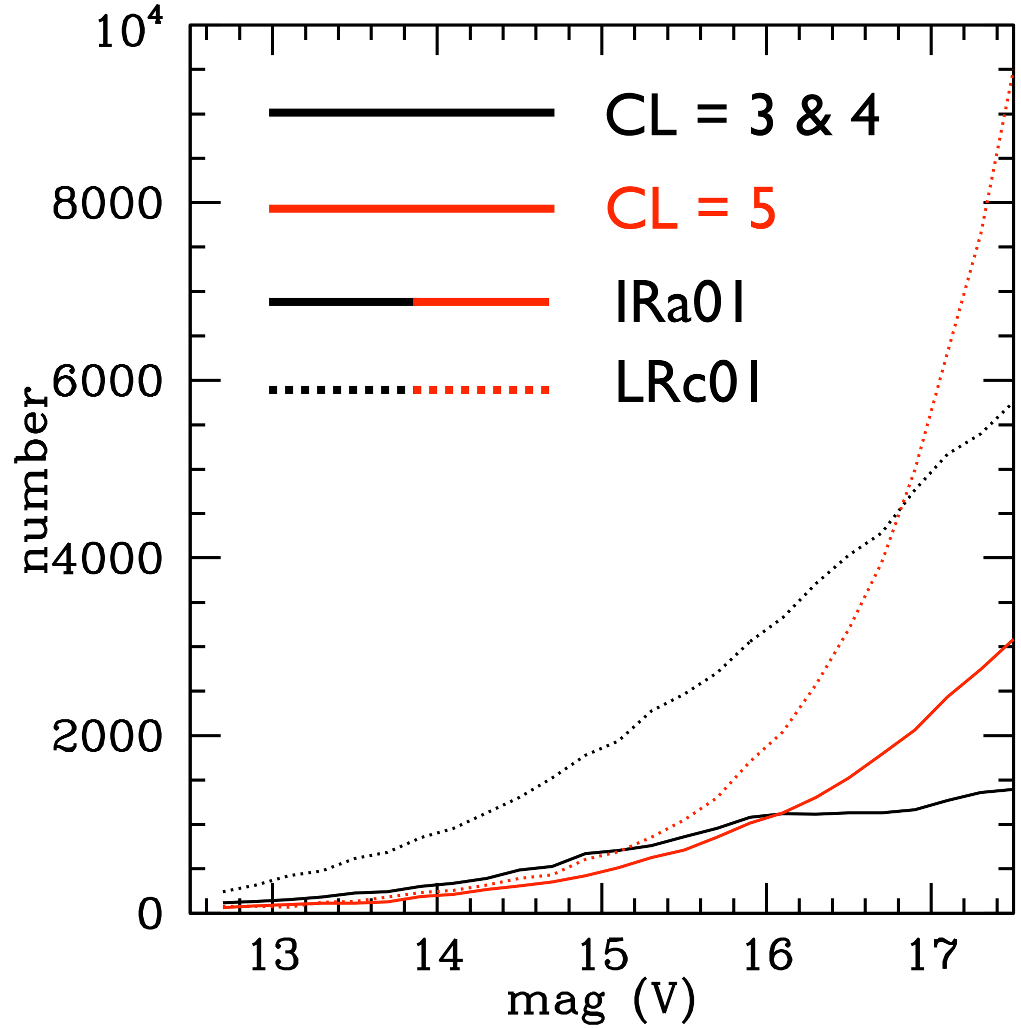
2) Noise

3) Follow-up

Target selection

"ideal" target selection: brightest MS stars

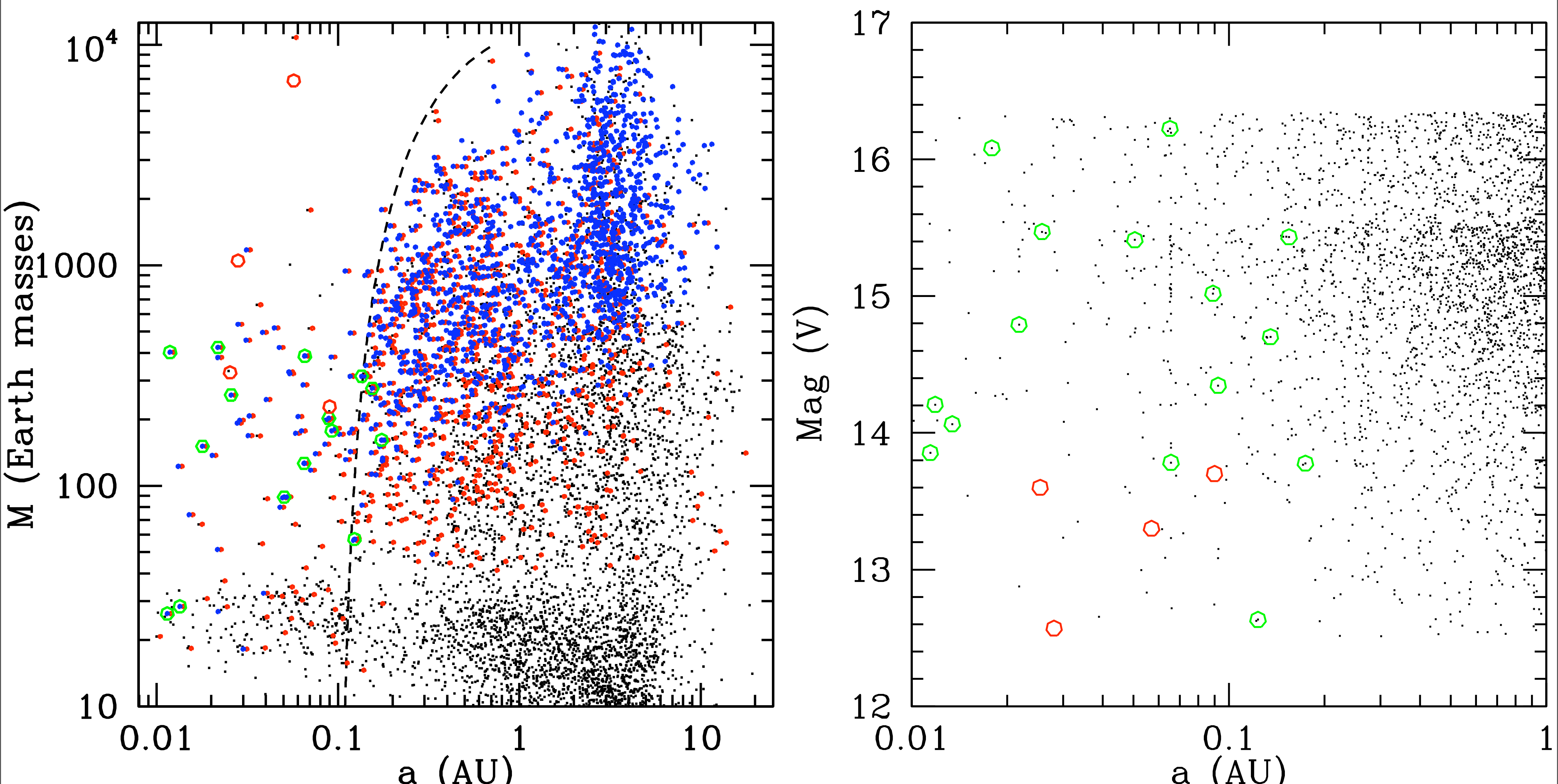




Target selection

"non-ideal" target selection: contamination by giants (50% LRc01, 20% IRa01)

15 transits



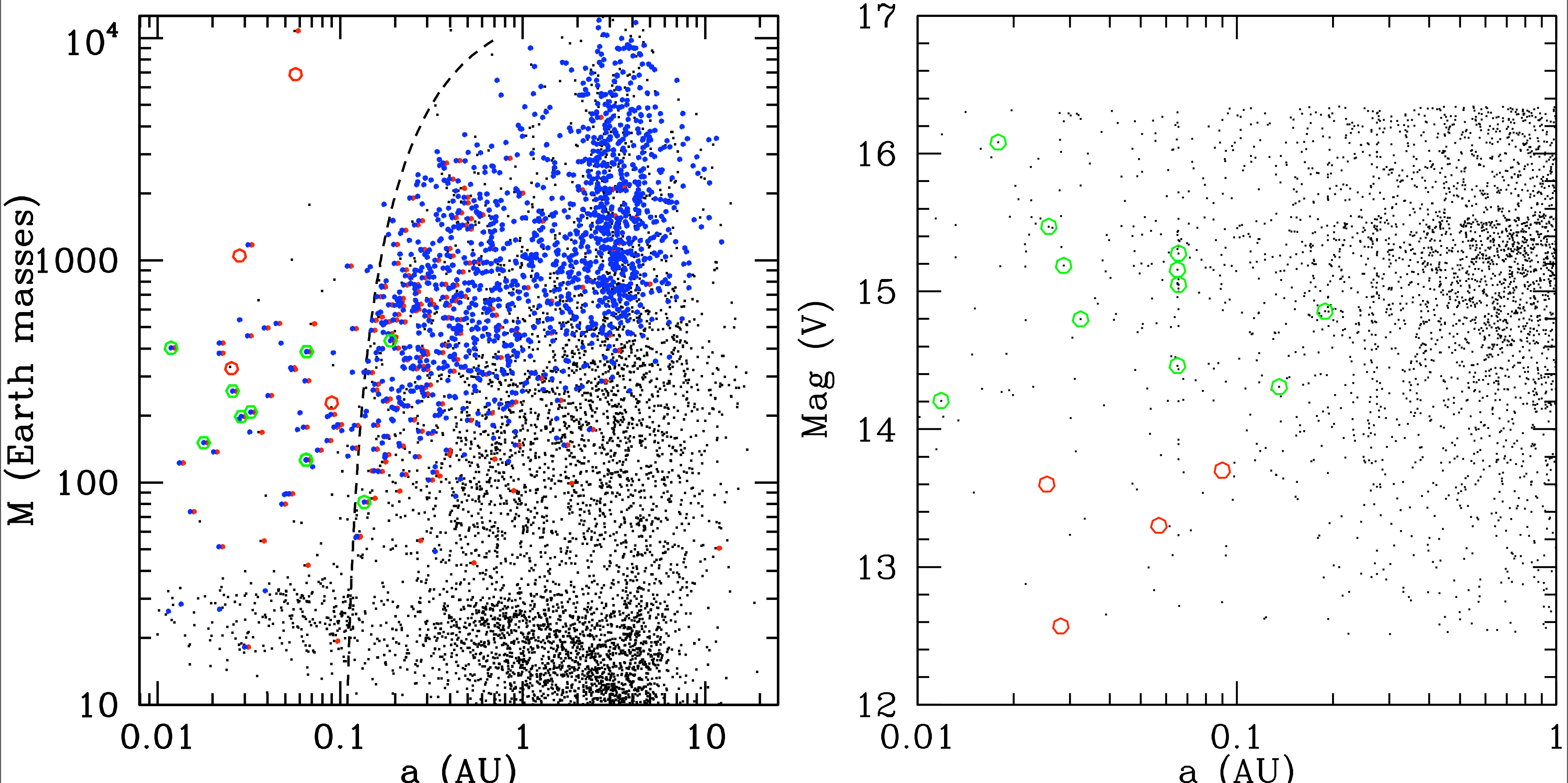
⇒ need huge contamination to prevent faint transits

⇒ how to explain the V dependance ?

Noise

Noise increased by factor 3

11 transits

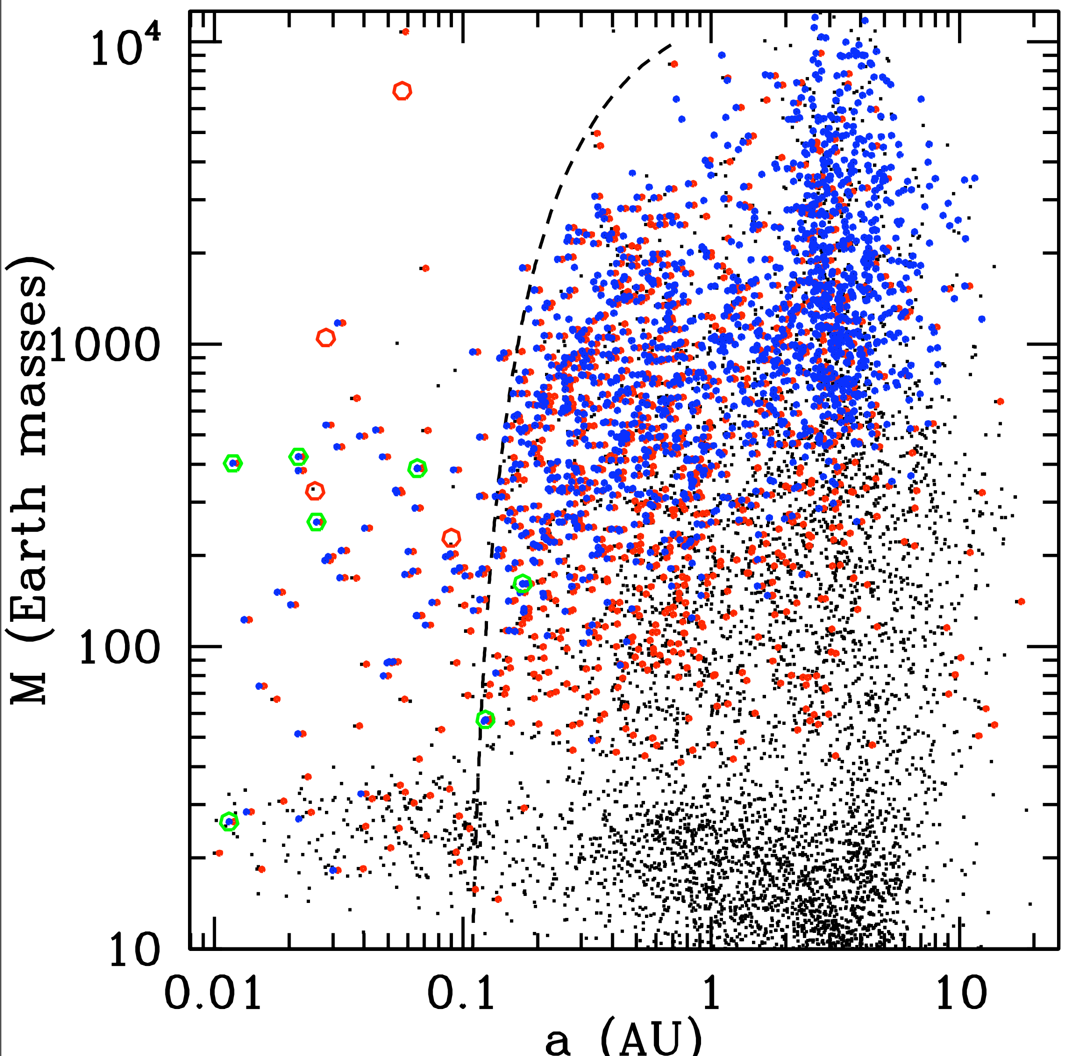


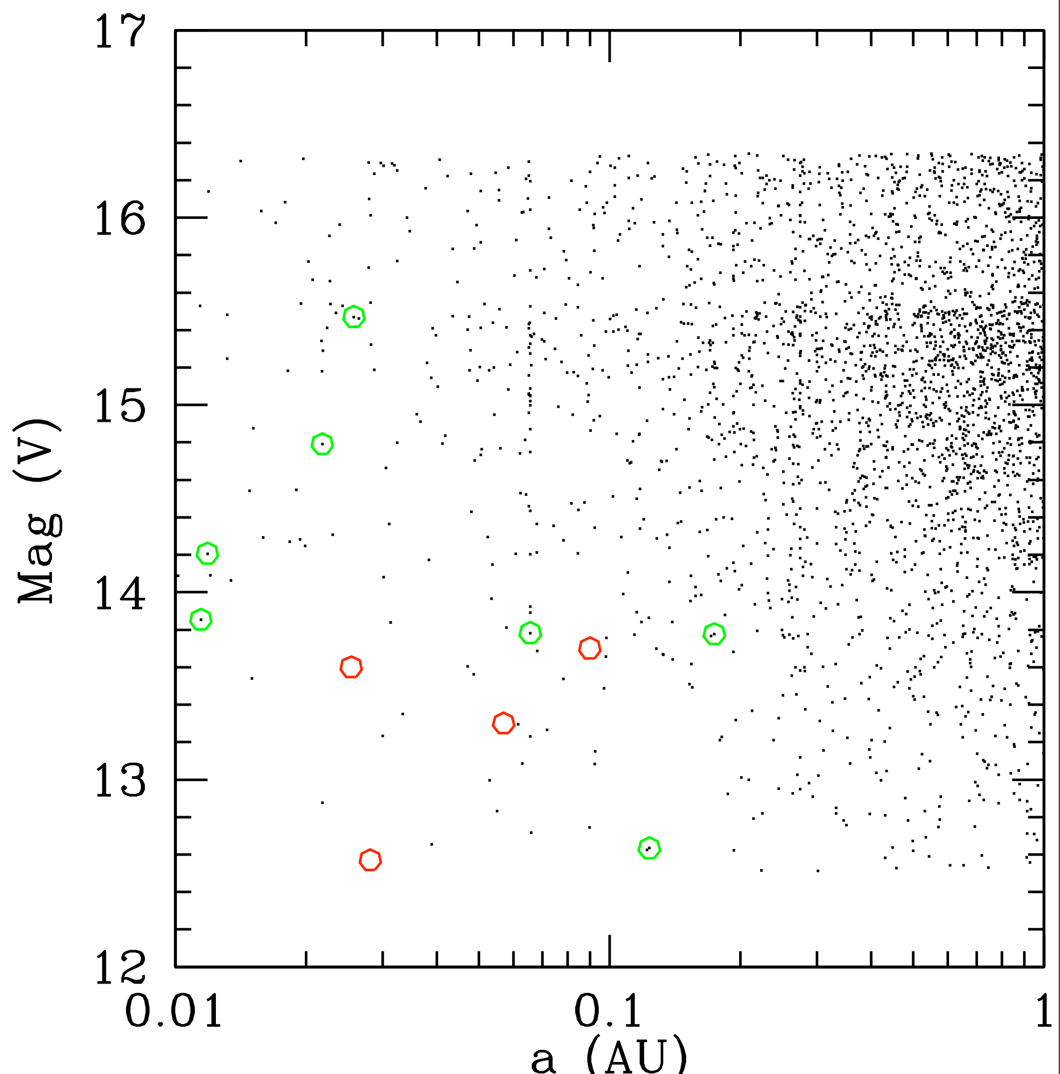
⇒ increase noise by factor 5 to have similar numbers ?

⇒ how to explain the V dependance ?

Follow-up

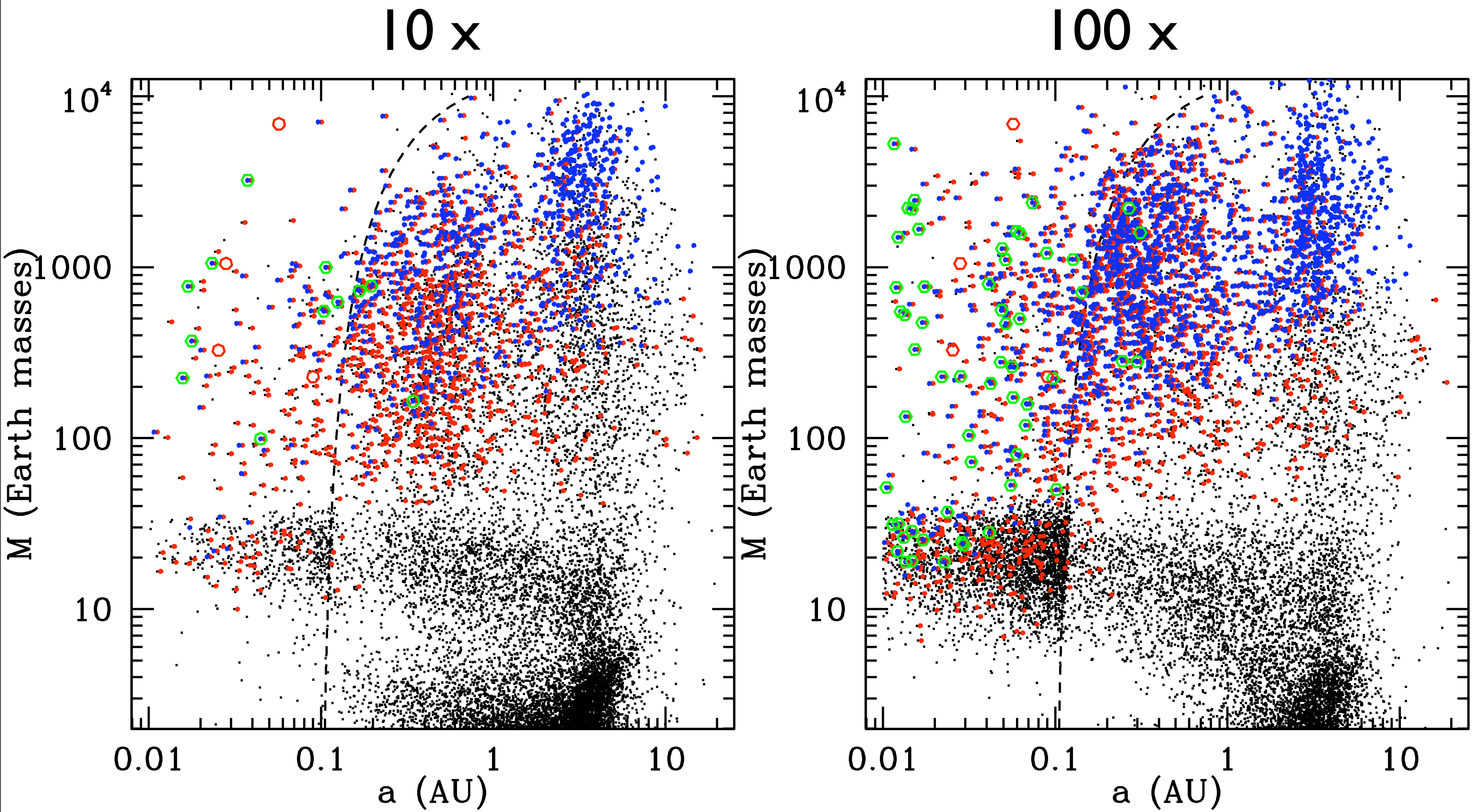
V	12.5 - 13.5	13.5 - 14.5	14.5 - 15.5	> 15.5
$\varepsilon_{\mathrm{RV}}$	10 (5)	24 (8)	100 (12)	100 (20)





⇒ origin of $\varepsilon_{\mathrm{RV}}$ (V) dependance ?

Effect of migration



⇒ constraint on migration process

Conclusions

- planet formation models begin to allow quantitative comparisons with observation
  - core accretion models can reproduce the diversity of the exoplanets
  - compatible with RV data for G stars, with high KS values
  - compatible with detection probability by RV (Hot Jupiters)

- comparing with IRa01 and LRc01 observations
  - too many detections predicted (factor 3-4)
  - lower mass planets are rare
  - origin of the difference ????

- detection of transiting super-earth will constrain formation and migration