Modeling the ionizing spectra of HII regions.

individual stars vs. stellar ensembles.

(Villaverde, Cerviño & Luridiana, 2010, A&A submitted)

Marcos Villaverde(1), Miguel Cerviño(1), Valentina Luridiana(1,2)

(1) Instituto de Astrofísica de Andalucía
(2) Instituto de Astrofísica de Canarias

Credit & Copyright Tony Hallas

VII ESTALLIDOS WORKSHOP. March 8-10 2010, Salobreña

Credit: N. Scoville (Caltech), T. Rector (U. Alaska, NOAO) et al., Hubble Heritage Team, NASA.

-We centered our study on low-mass clusters.

WHY?

- They are the most abundant.

(Lada & Lada, 2003)

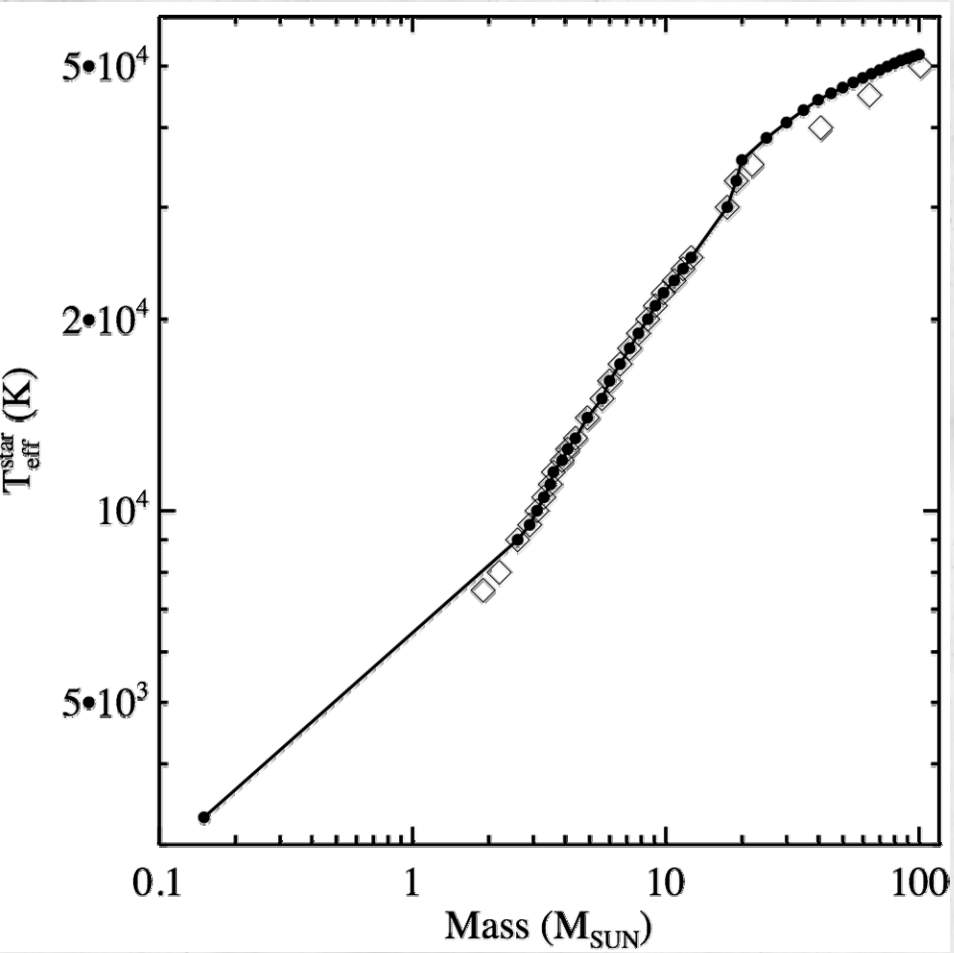
- They are not well-represented with a completely sampled IMF.

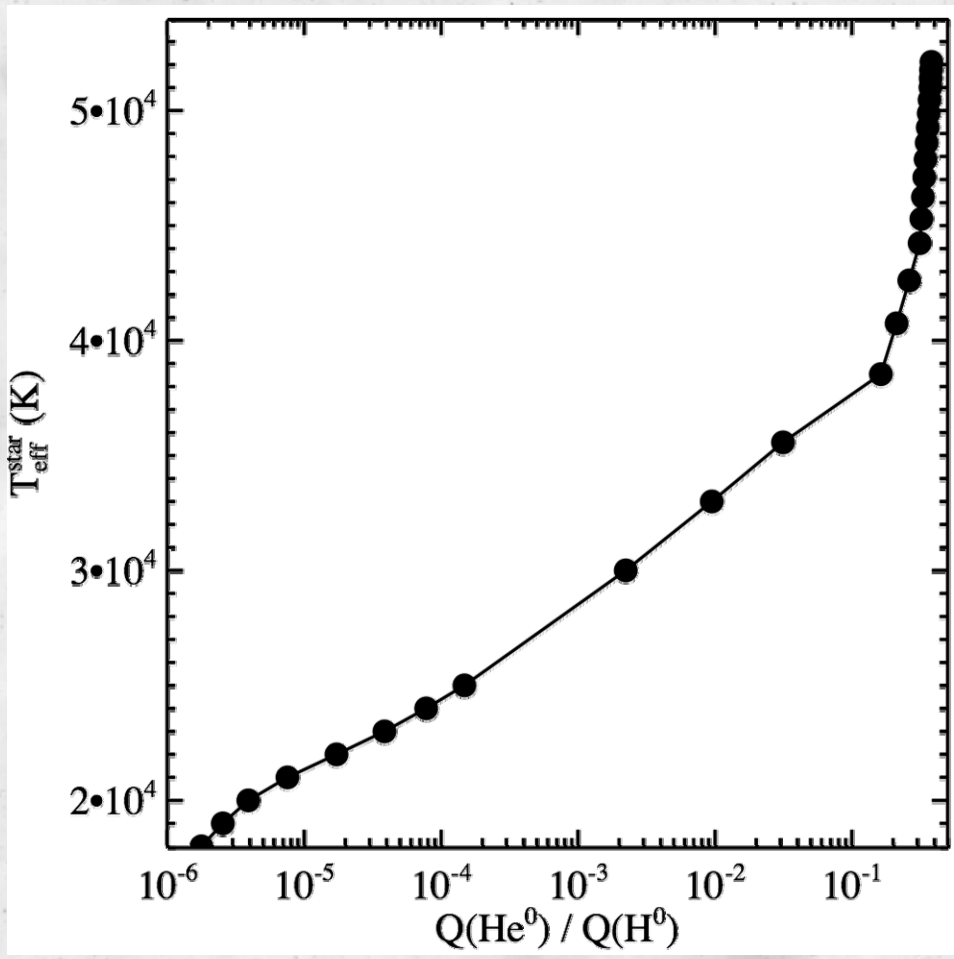
(Cerviño & Valls-Gabaud, 2003)

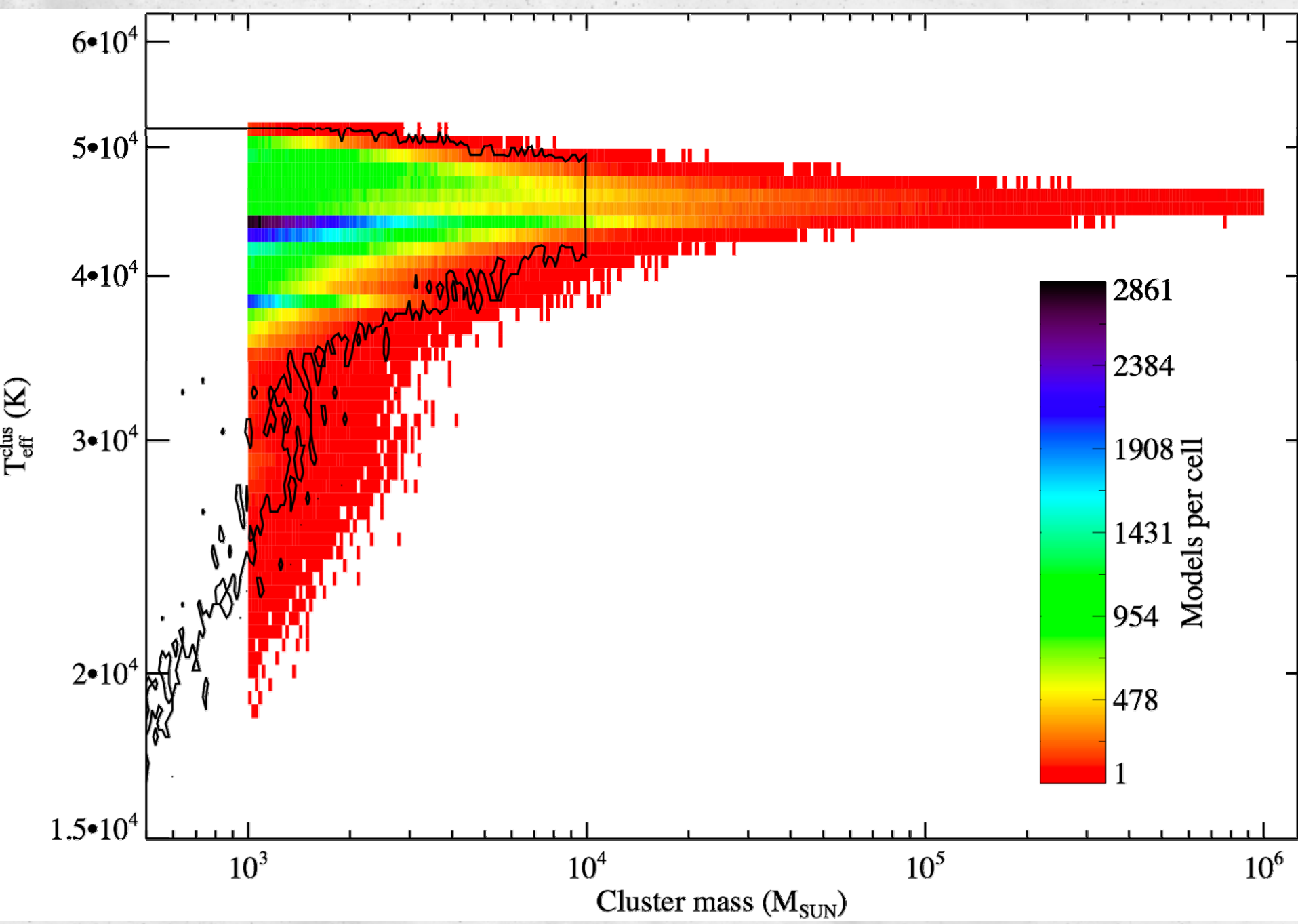
Monte Carlo simulations

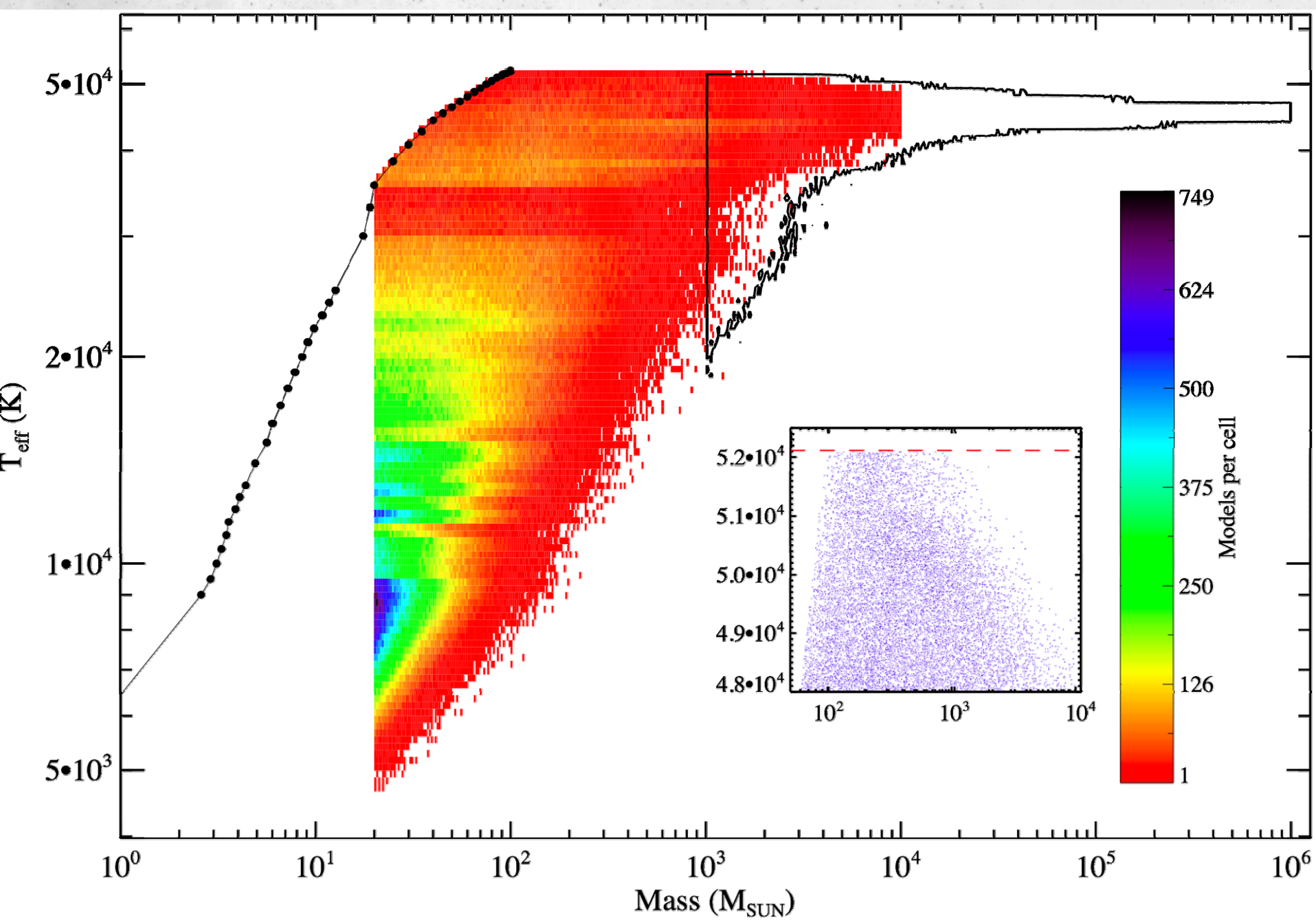
- 2 million simulations:
  - Solar metallicity and ZAMS
  - Cluster masses between 20-10^4 $M_\odot$ (low mass set)
  - Cluster masses between 10^3-10^6 $M_\odot$ (high mass set)
- ICMF $\propto M^{-2}$ (Lada & Lada, 2003; Zhang & Fall, 1999; Hunter et al., 2003)
- IMF $\propto M^{-2.35}$ (Salpeter, 1955)
- Distributions of:
  - Number of stars
  - Cluster masses
  - Q(Ho)
  - Cluster Teff as a function of cluster Q(He)/Q(H)

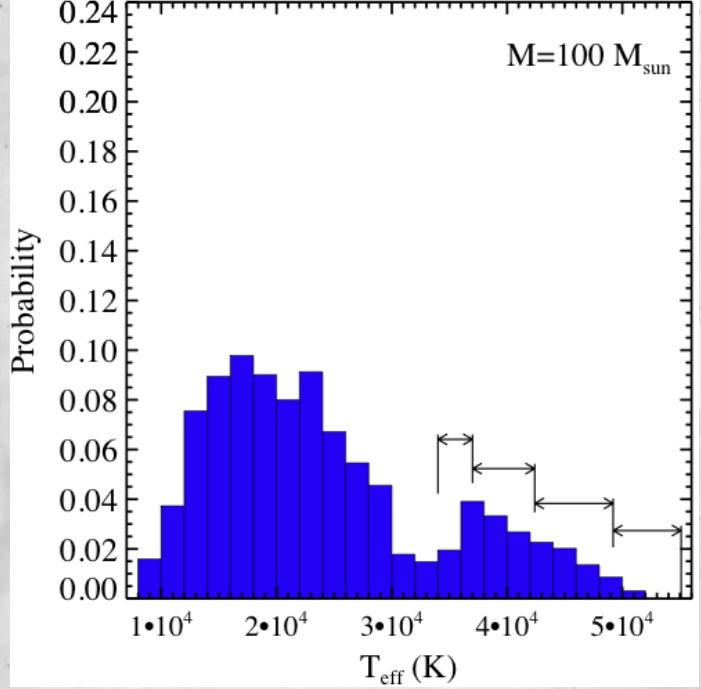
T_{eff} calibration

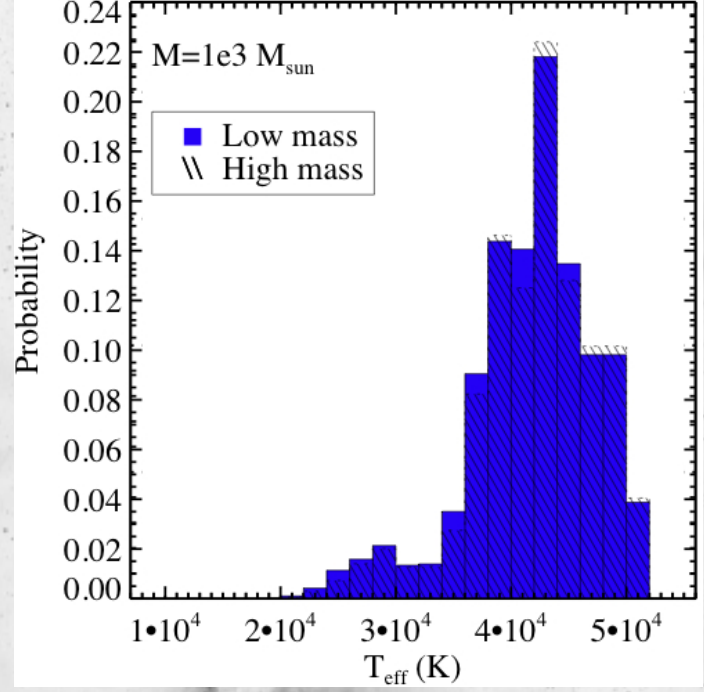


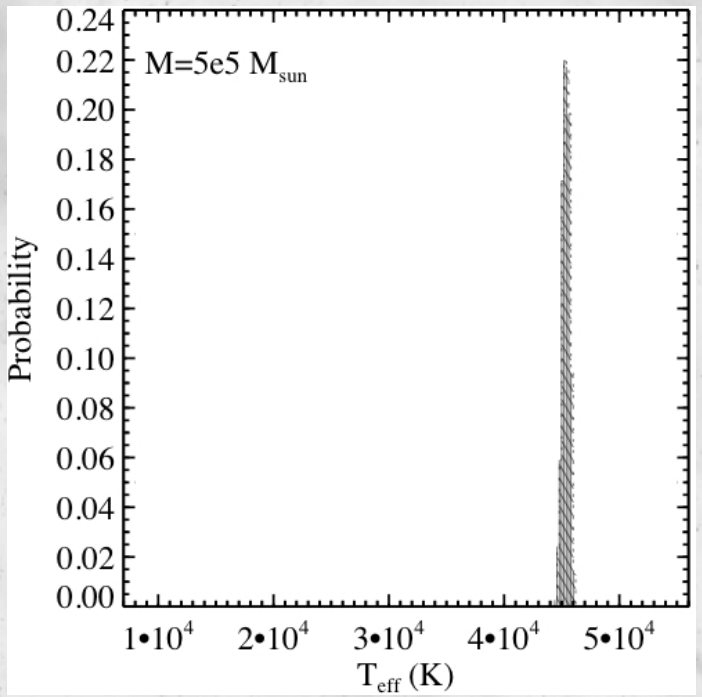



6•10^4
5•10^4
4•10^4
3•10^4
2•10^4
1.5•10^4
T_eff^clus (K)
10^3
10^4
10^5
10^6
Cluster mass (M_SUN)
2861
2384
1908
1431
954
478
1
Models per cell

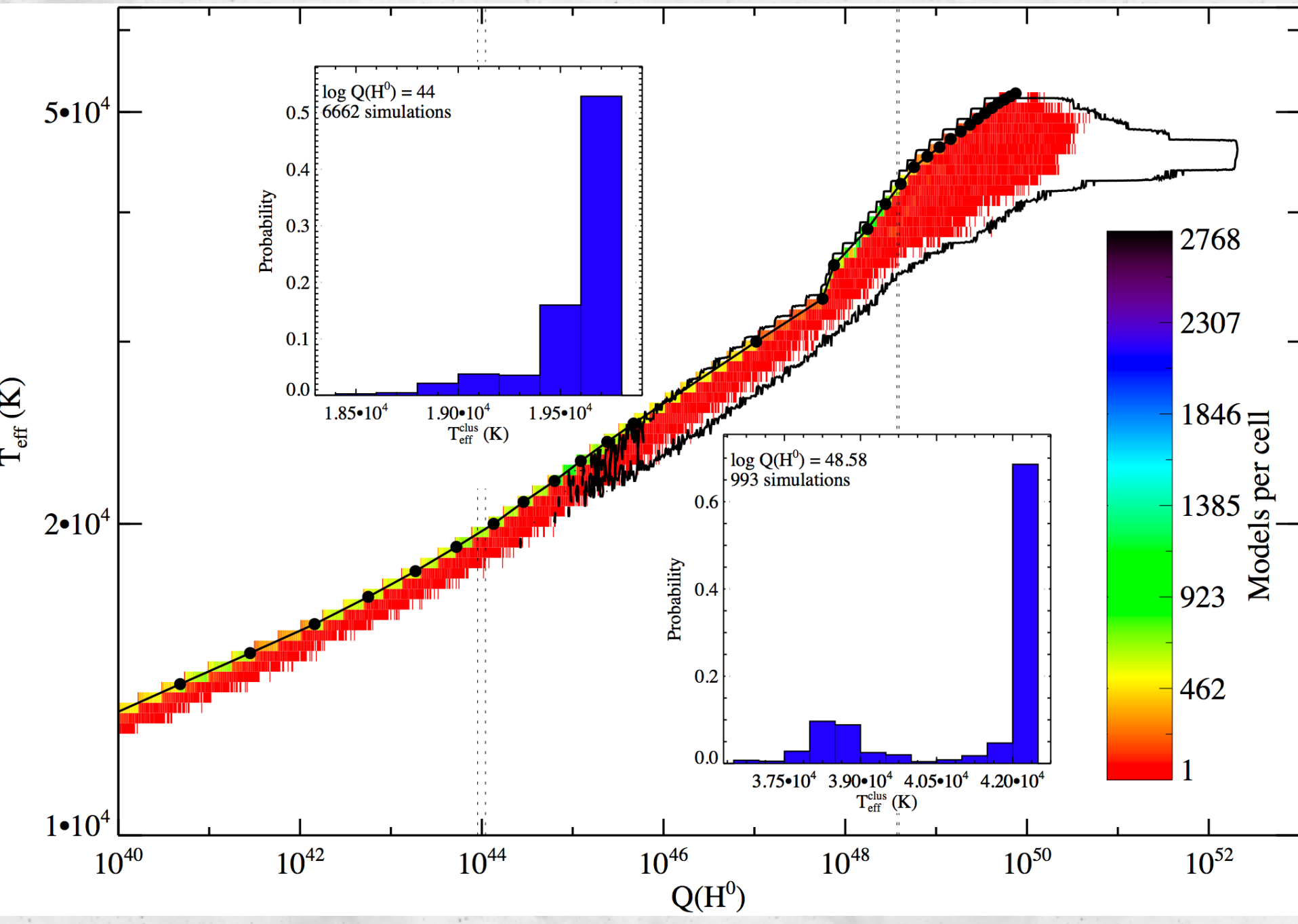

5•10^4
2•10^4
1•10^4
5•10^3
T_eff (K)
10^0
10^1
10^2
10^3
10^4
10^5
10^6
Mass (M_SUN)
5.2•10^4
5.1•10^4
5.0•10^4
4.9•10^4
4.8•10^4
10^2
10^3
10^4
749
624
500
375
250
126
1
Models per cell







80 % of 100 $M_\odot$ clusters do not generate HII regions.


log Q(H0) = 44
6662 simulations
Probability
Tclus eff (K)
log Q(H0) = 48.58
993 simulations
Probability
Tclus eff (K)
Teff (K)
Q(H0)
Models per cell
2768
2307
1846
1385
923
462
1

Conclusions

- 2 million Monte Carlo Simulations
- Only 20% of clusters with M~100 $M_{\odot}$ can generate an HII region.
- Strong correlation between $Q(H^0)$ and T_{eff} for $M < 10^4$
- $M < 10^4$ better represented by a single star
- Low Mass clusters are suitable for hot-star atmospheres studies.


THANK YOU