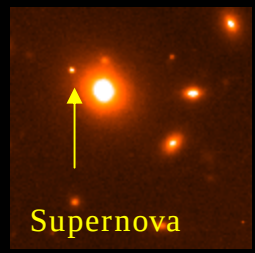
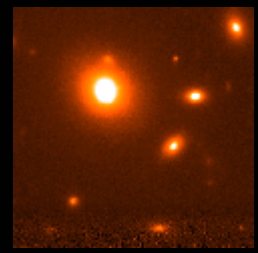
HST Early Release Observations of Abell 2218, Fruchter et al. 2000

Probing SN Ia Progenitors using SN Ia Rates in clusters (and in the field)

Avishay Gal-Yam (Caltech)



March 1999



January 2000

Highlights

1. SN Ia progenitors and the origin of ICM metals from cluster SN rates
2. A little bit about field rates
3. Puzzles

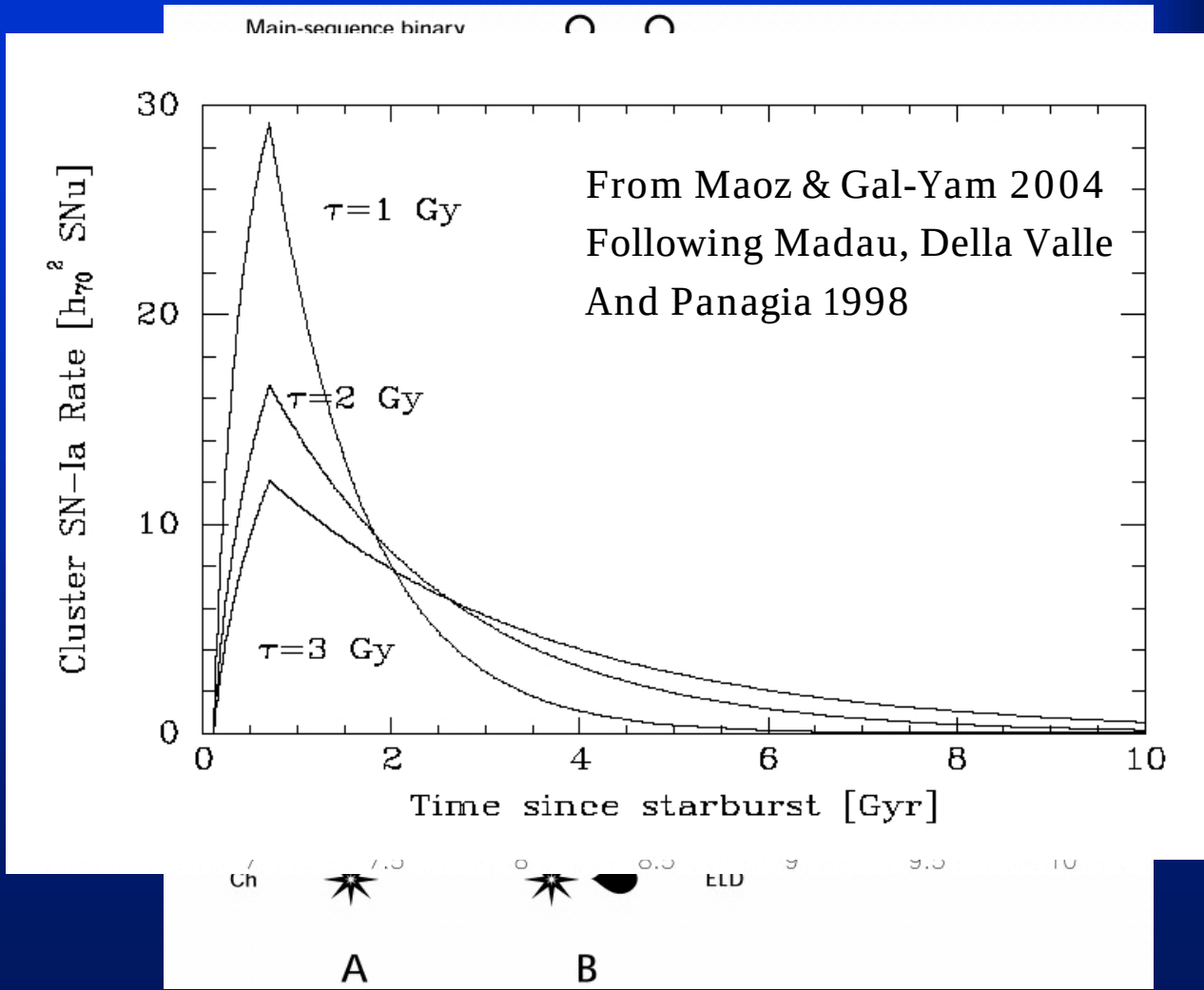
The ICM Iron Problem

- Problem: the observed iron content (0.3 solar) of the intra-cluster medium (ICM) cannot be produced by core-collapse SNe associated with a stellar population with a normal IMF

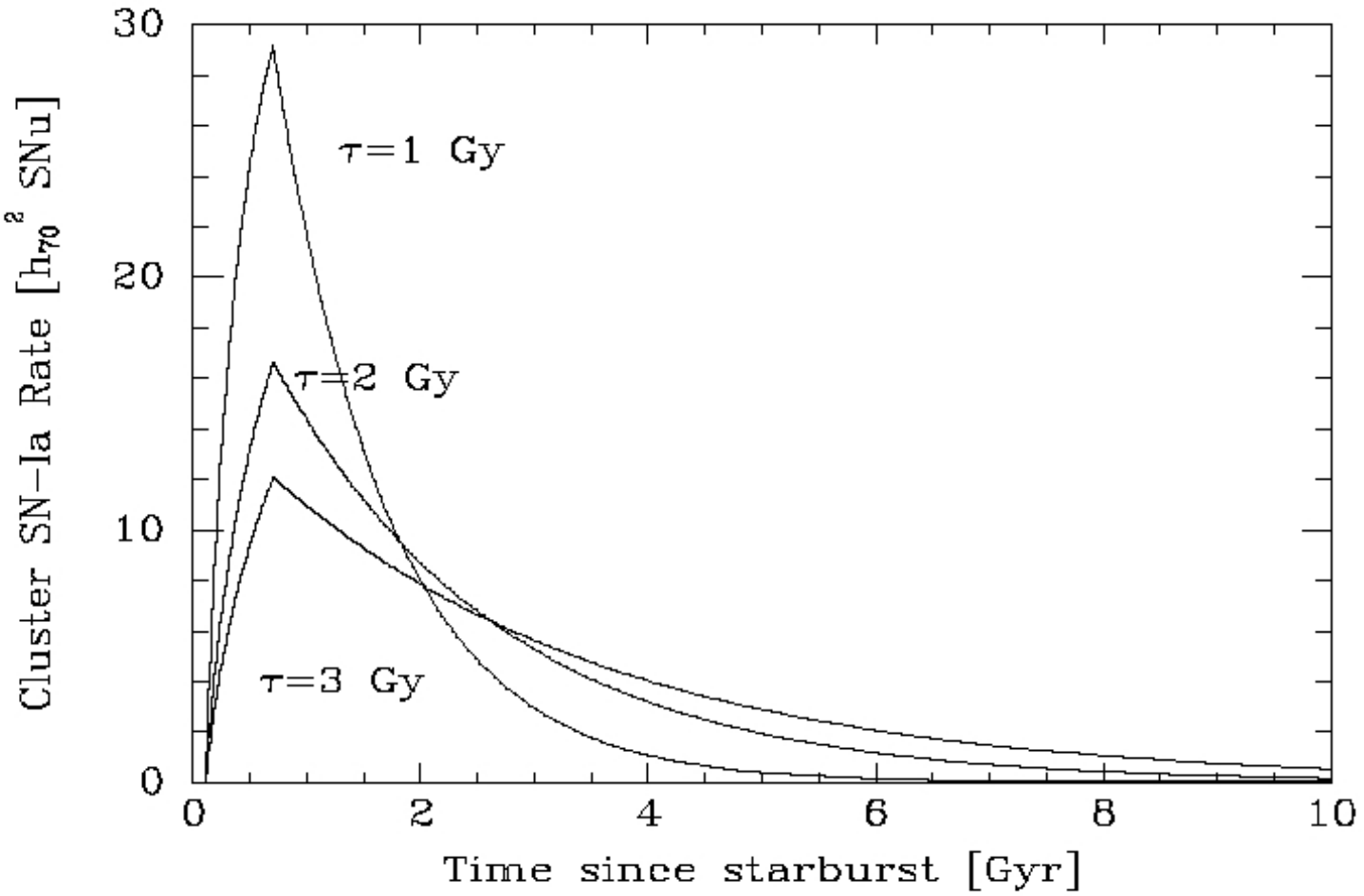
- Top-heavy IMF ?
- A dominant role for SNe Ia ?

Progenitors of SNe Ia and the time delay

Different progenitor models predict widely differing typical delay times from star formation to SN Ia explosion (~10^8 - ~10^9 y)

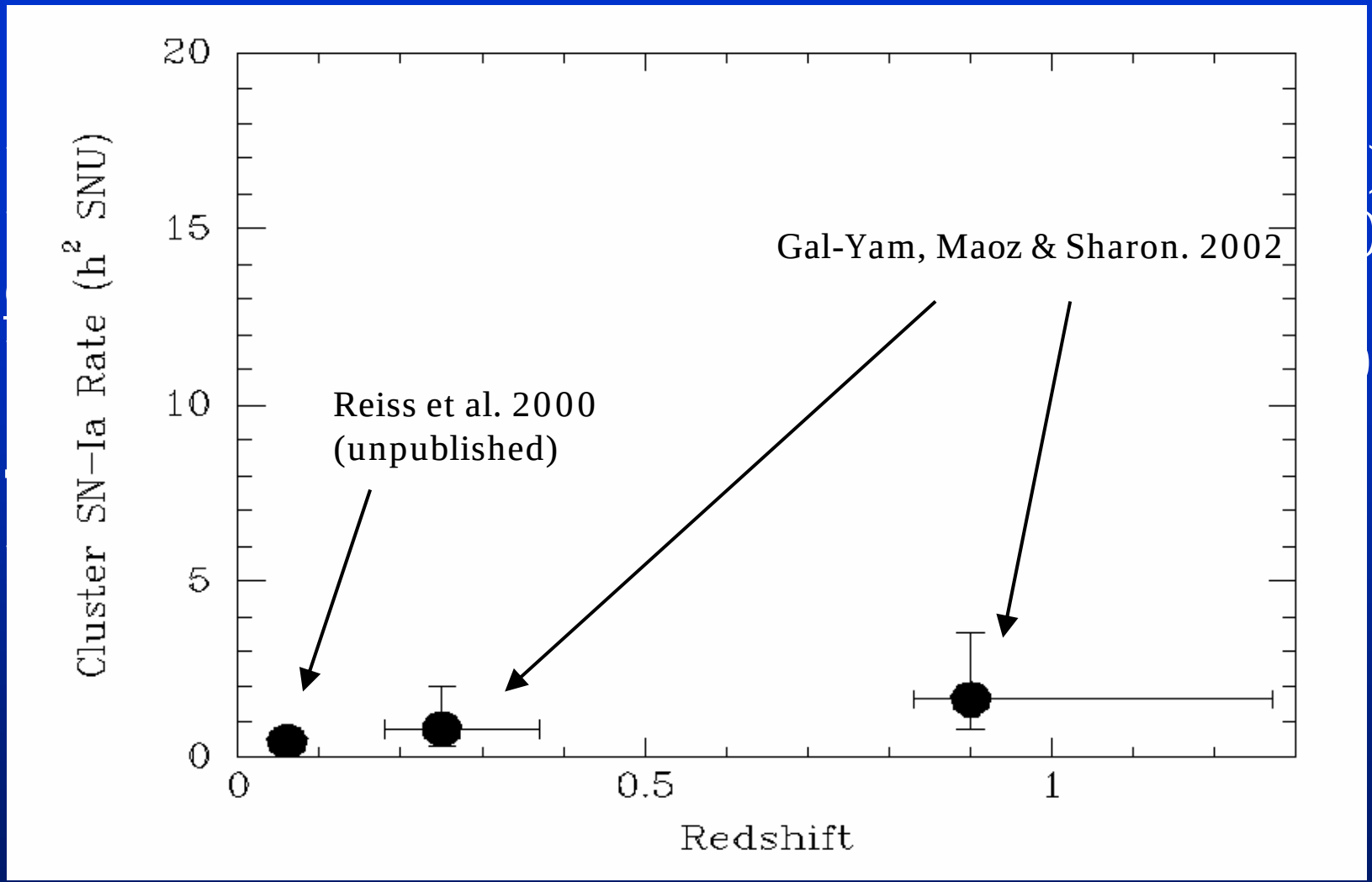


Testing progenitor models with cluster SN rates (Maoz & Gal-Yam 2004, MNRAS, 347, 951)



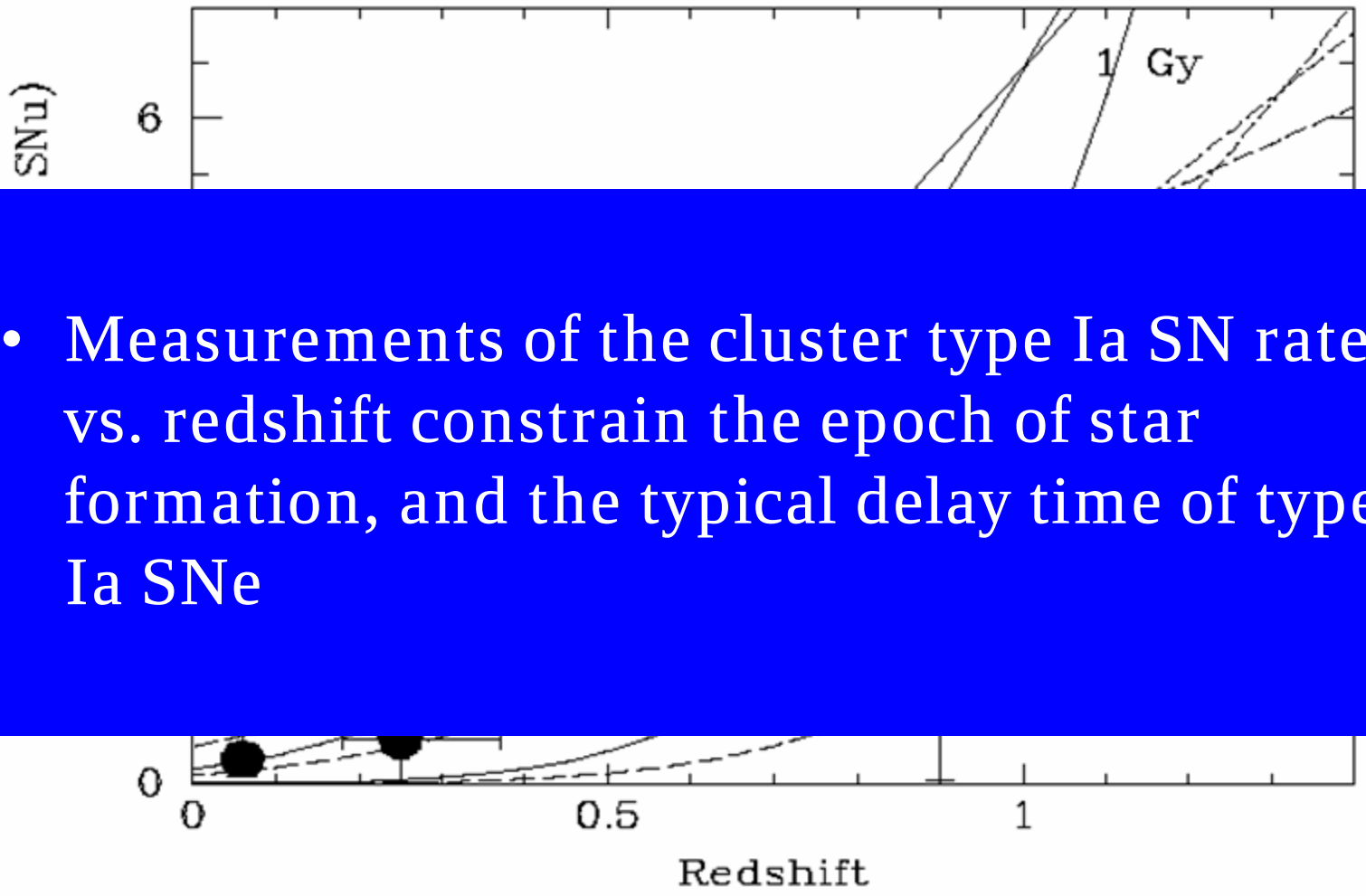
High-z Cluster SN Rates

(Gal-Yam, Maoz & Sharon 2002, MNRAS, 332, 37)



A first measurement of cluster SN rates at high-z

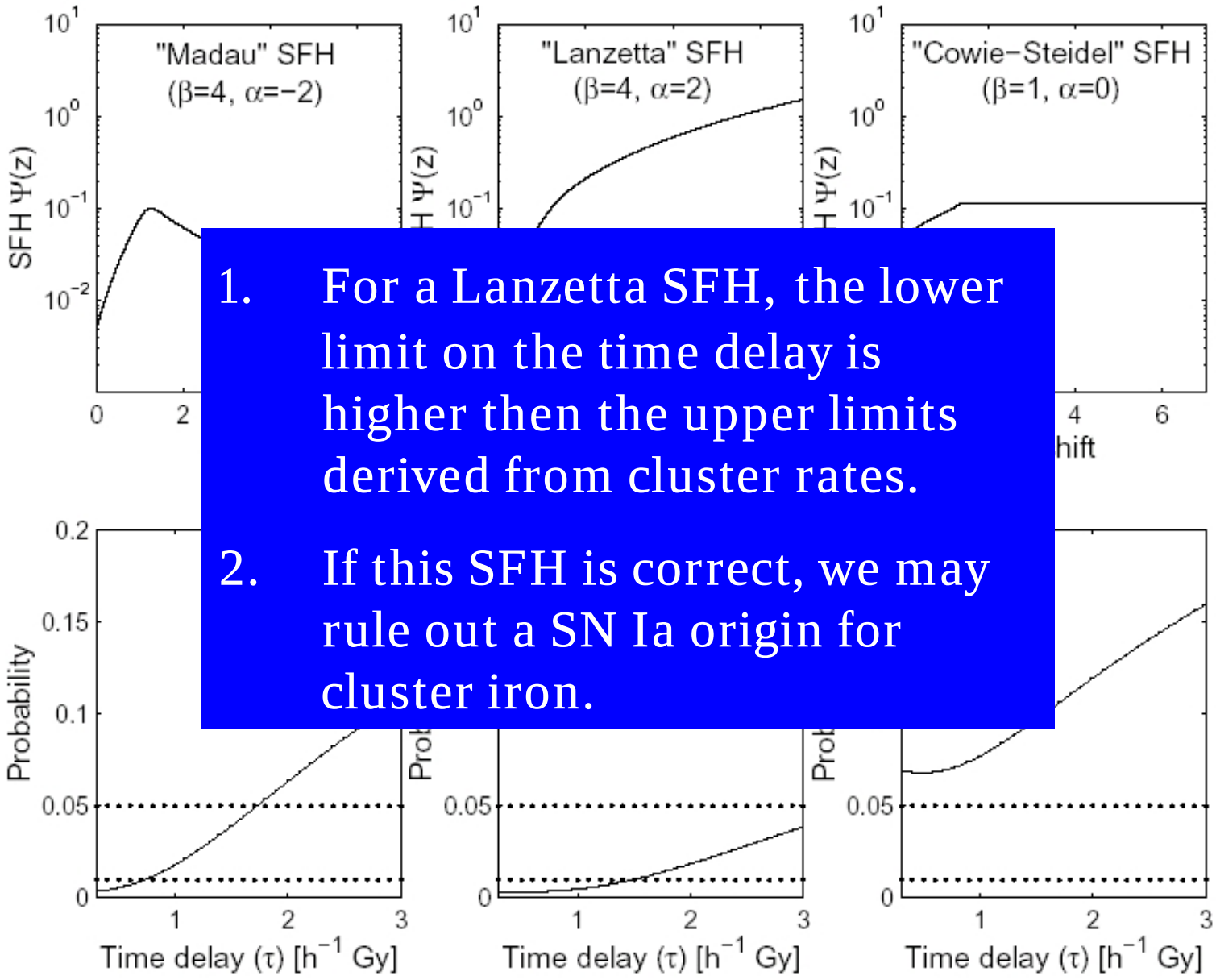
Comparison with observations



- Measurements of the cluster type Ia SN rate vs. redshift constrain the epoch of star formation, and the typical delay time of type Ia SNe

Upper limit on the typical SNe Ia delay time

Additional constraints (1)



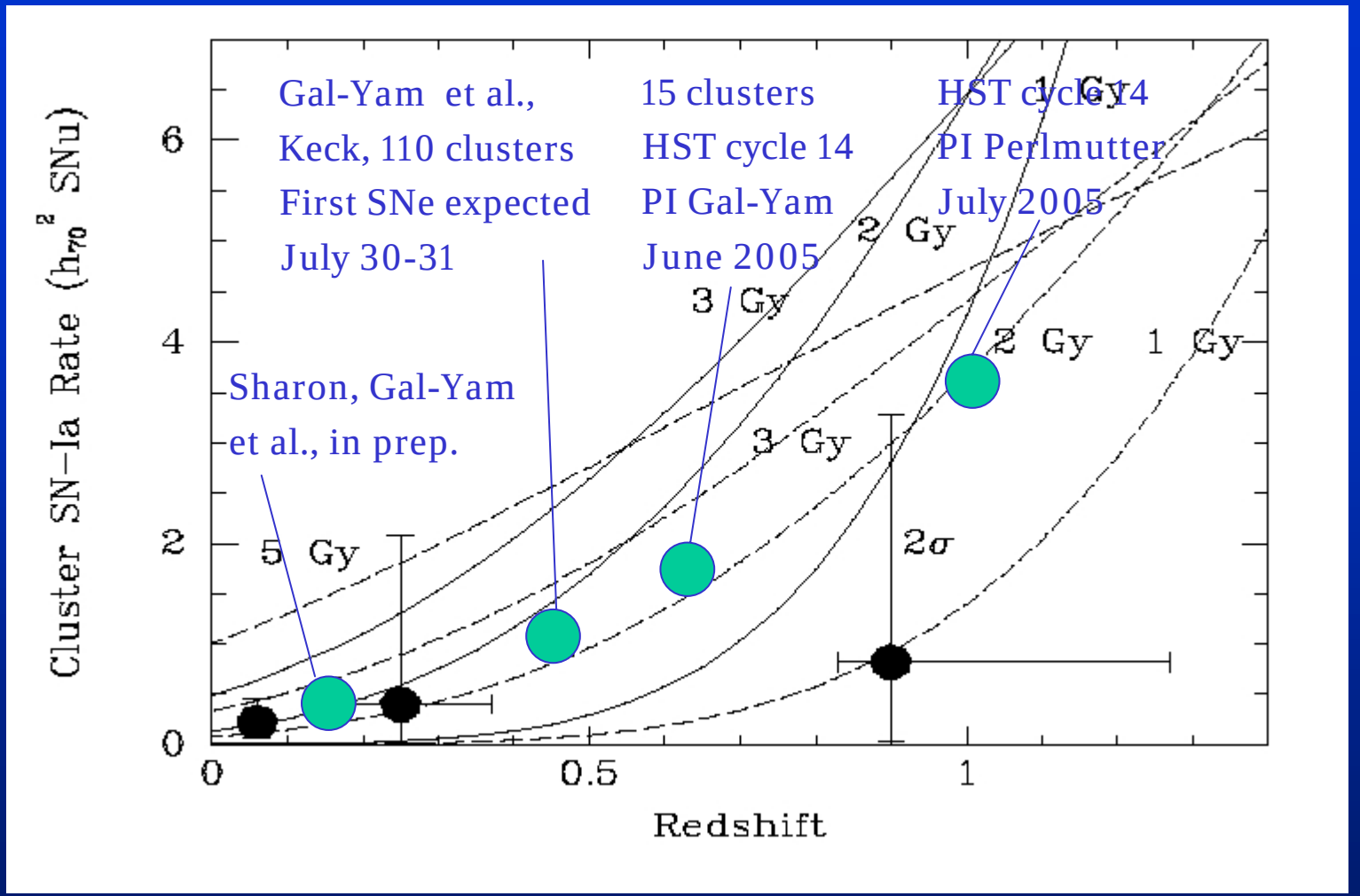
1. For a Lanzetta SFH, the lower limit on the time delay is higher then the upper limits derived from cluster rates.
2. If this SFH is correct, we may rule out a SN Ia origin for cluster iron.

Additional constraints (2)

- If the SN Ia contribution to cluster iron is determined by other means (e.g. relative abundances of other elements fron X-ray spectroscopy) we can constrain the SN Ia delay time and progenitor models.

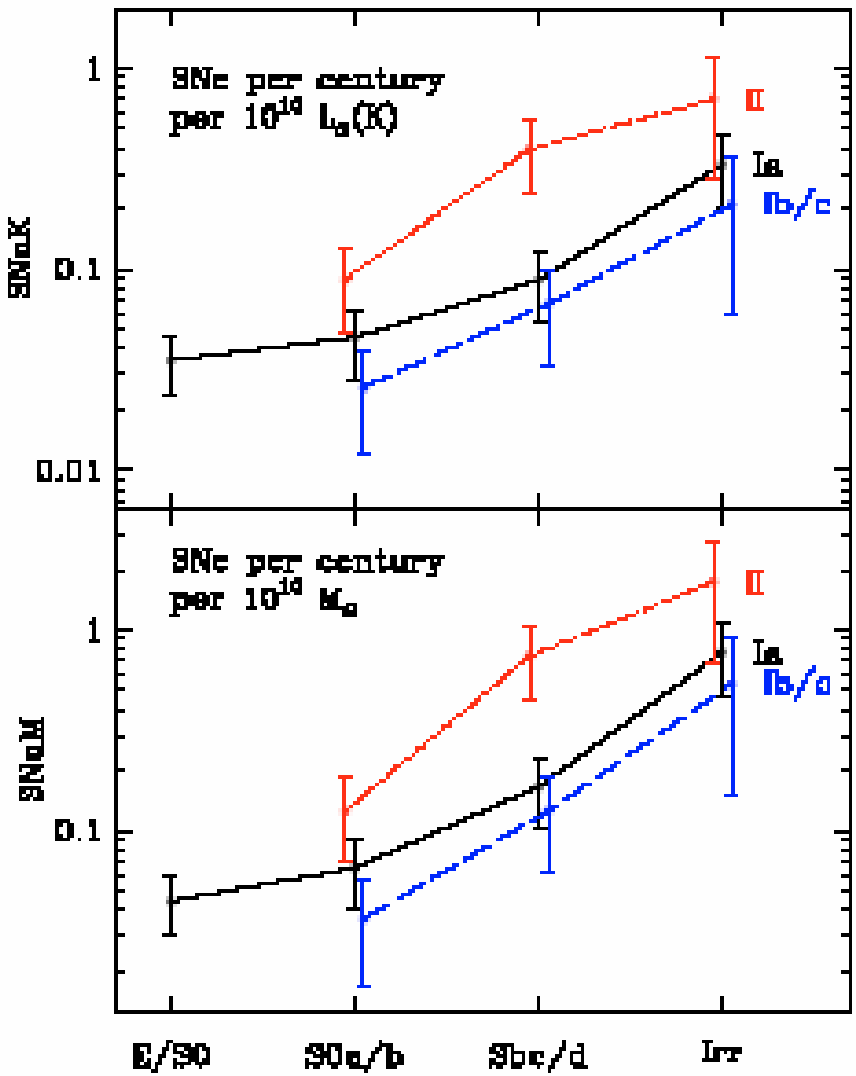
- Using redshift distributions of field SNe Ia we can also constrain the SFH.

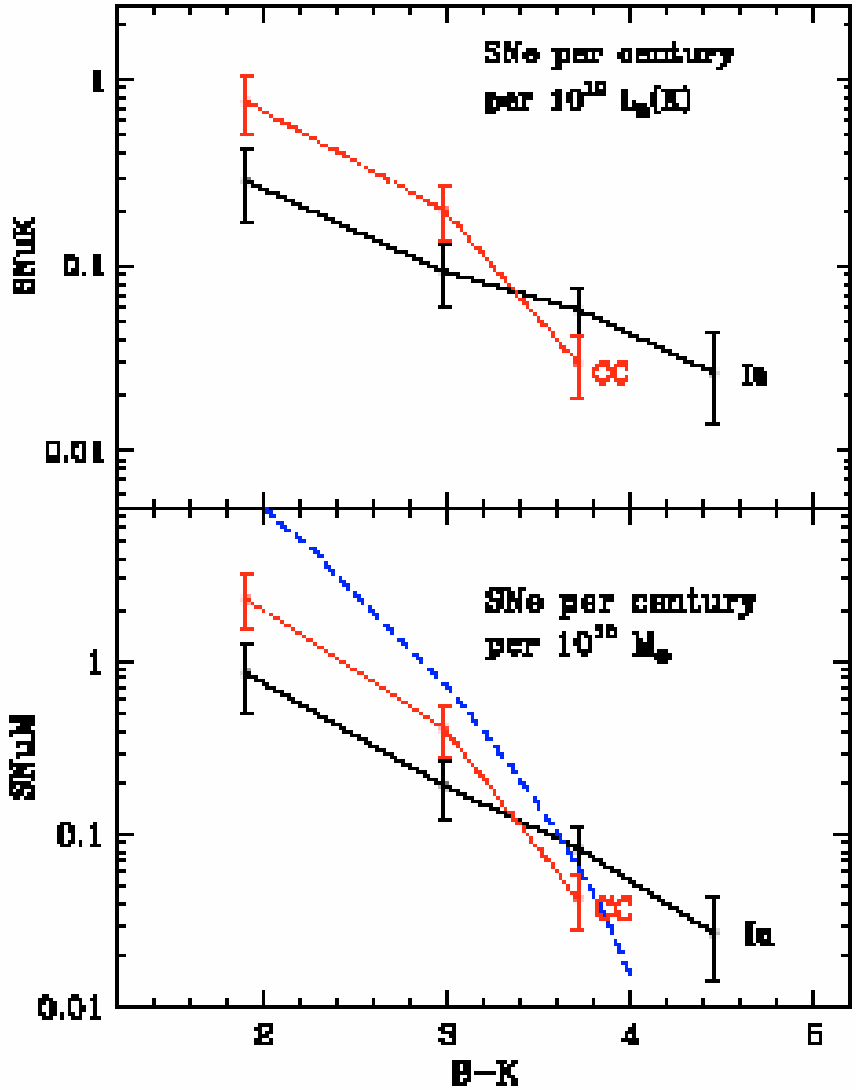
What next ?



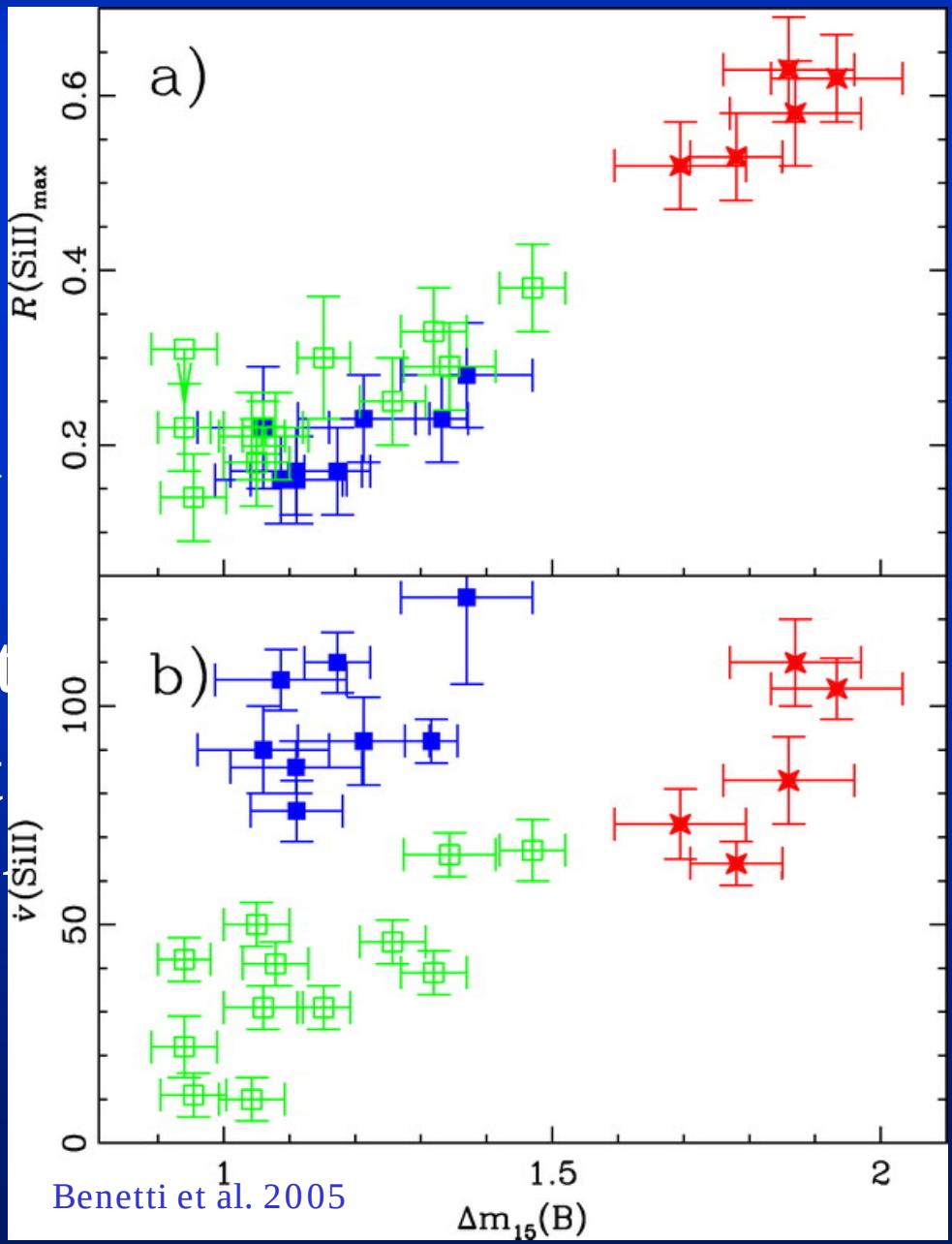
Need more cluster SNe !

More about field rates





1. How is both long and short
2. Mult
3. Wha



Benetti et al. 2005

Thanks