Delay times for SNe Ia

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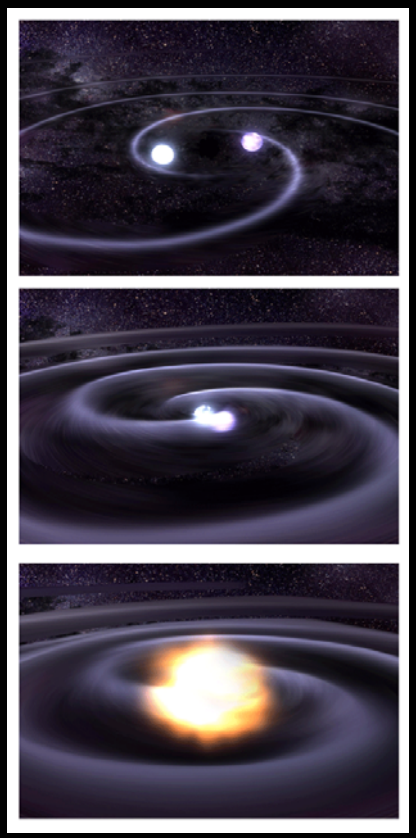
and the Supernova Legacy Survey (SNLS)

Progenitors: need a clock!

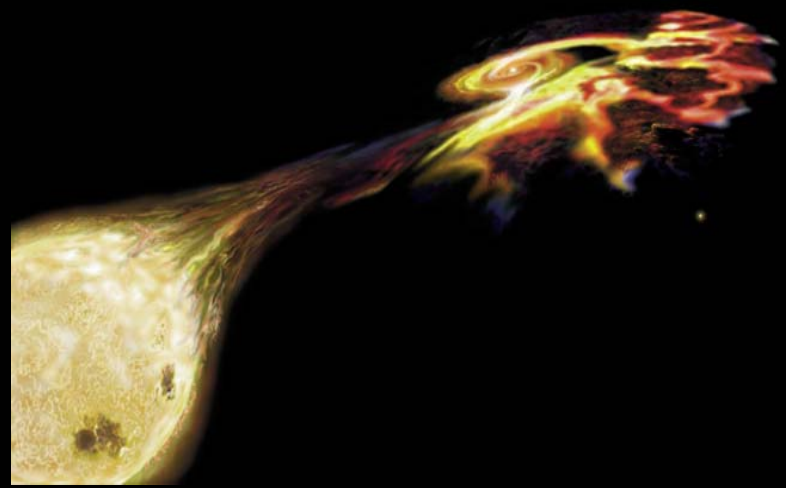


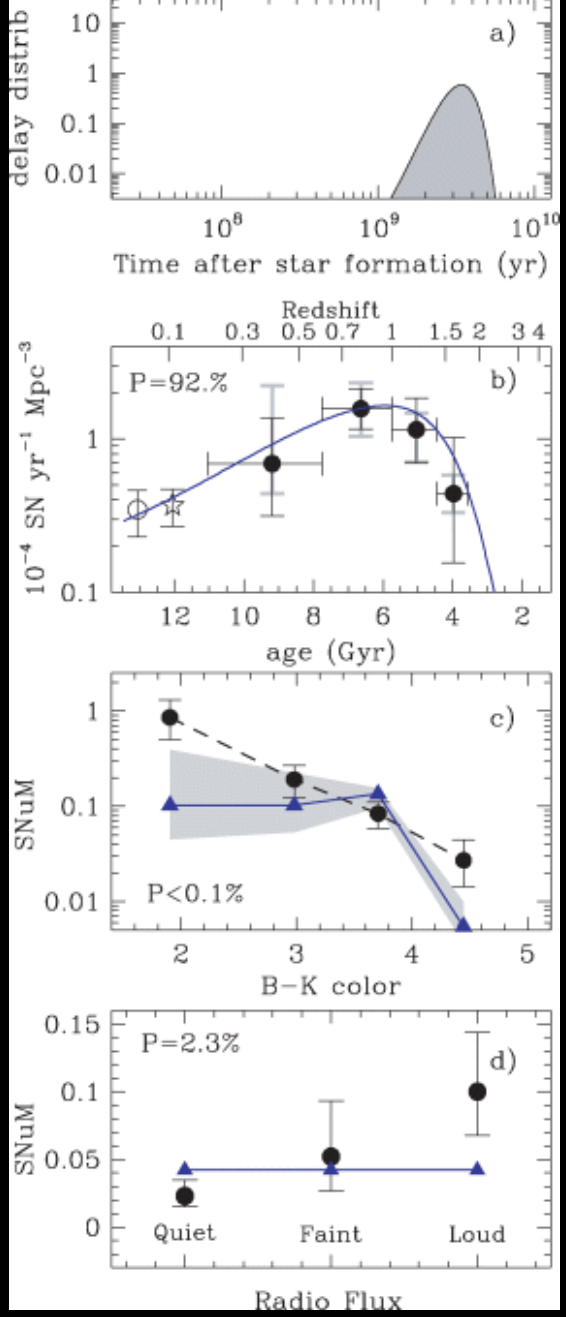
Different progenitor scenarios predict different time delays for SNe Ia after star formation

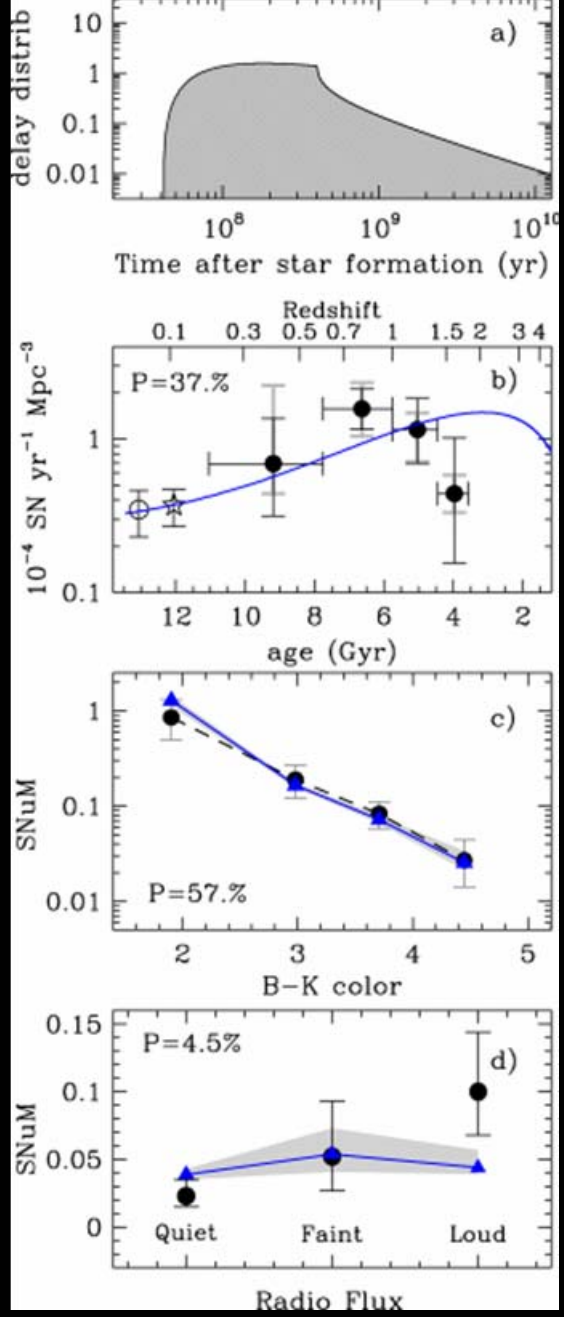
Measure Ia rate as function of z, compare to cosmic SFR vs. z, work out delay time

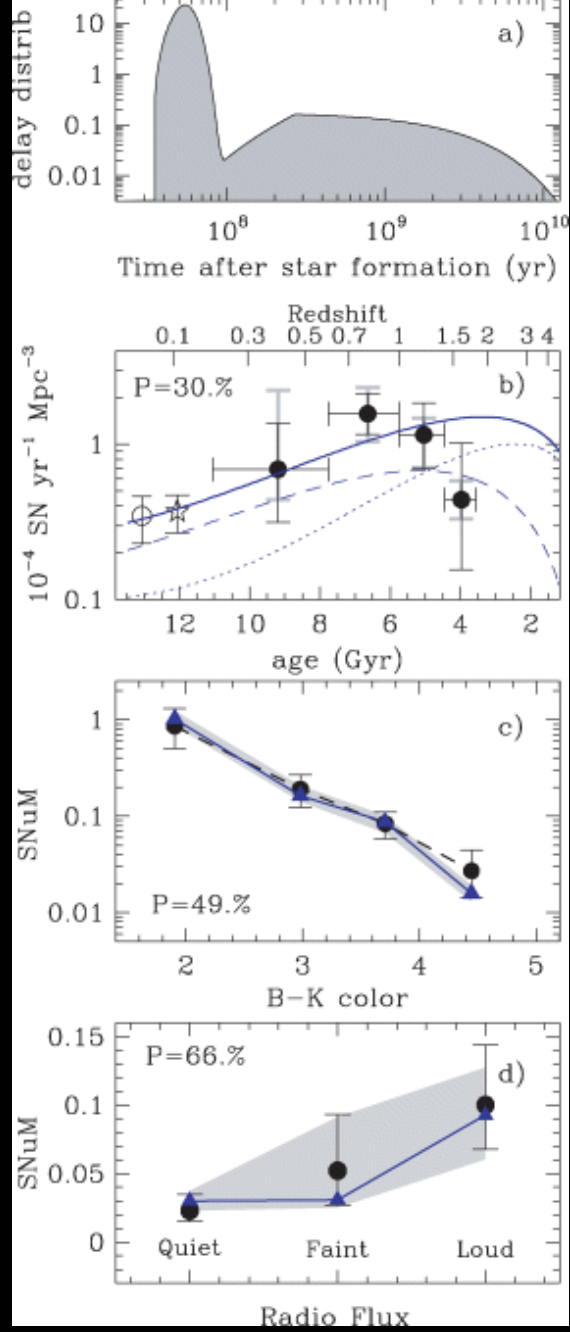
or

Measure Ia rate as function of galaxy type





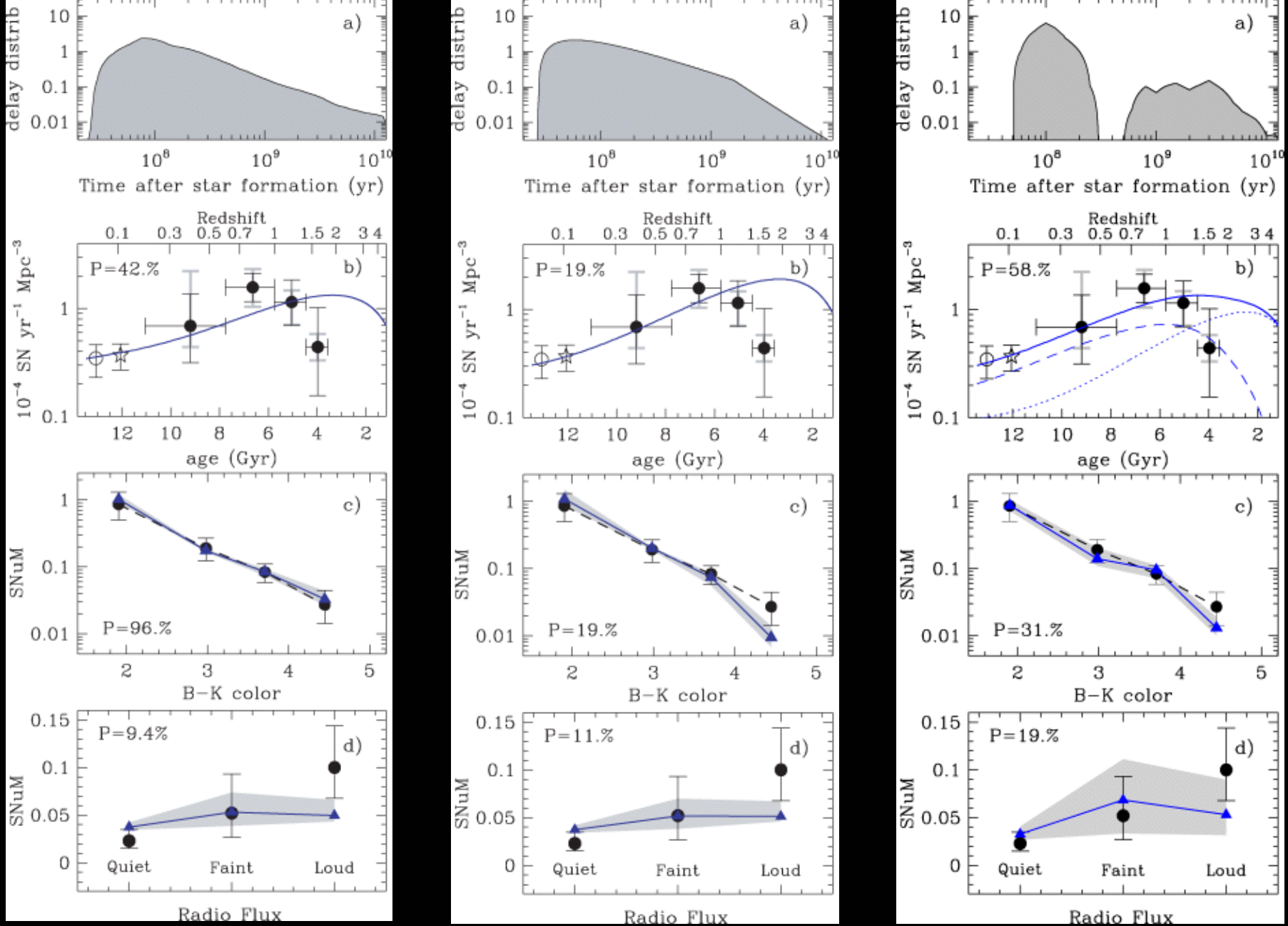




Strolger

Greggio 2005
Theory – wide DD

Mannucci



Yungelson & Livio 2000
Theory -- DD w/ Ch mass

Matteucci & Recchi 2001
Theory -- SD

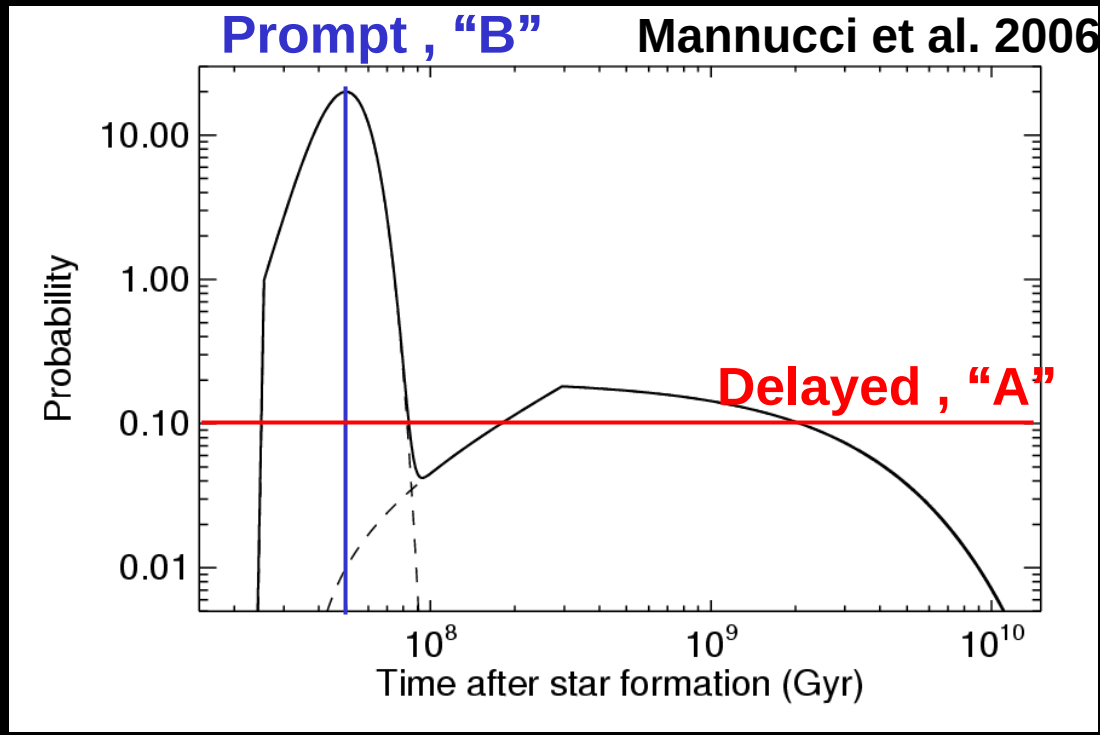
Belczynski et al. 2005
Theory SD w/ low CE eff

Scannapieco & Bildsten 2005 vs. Mannucci 2006

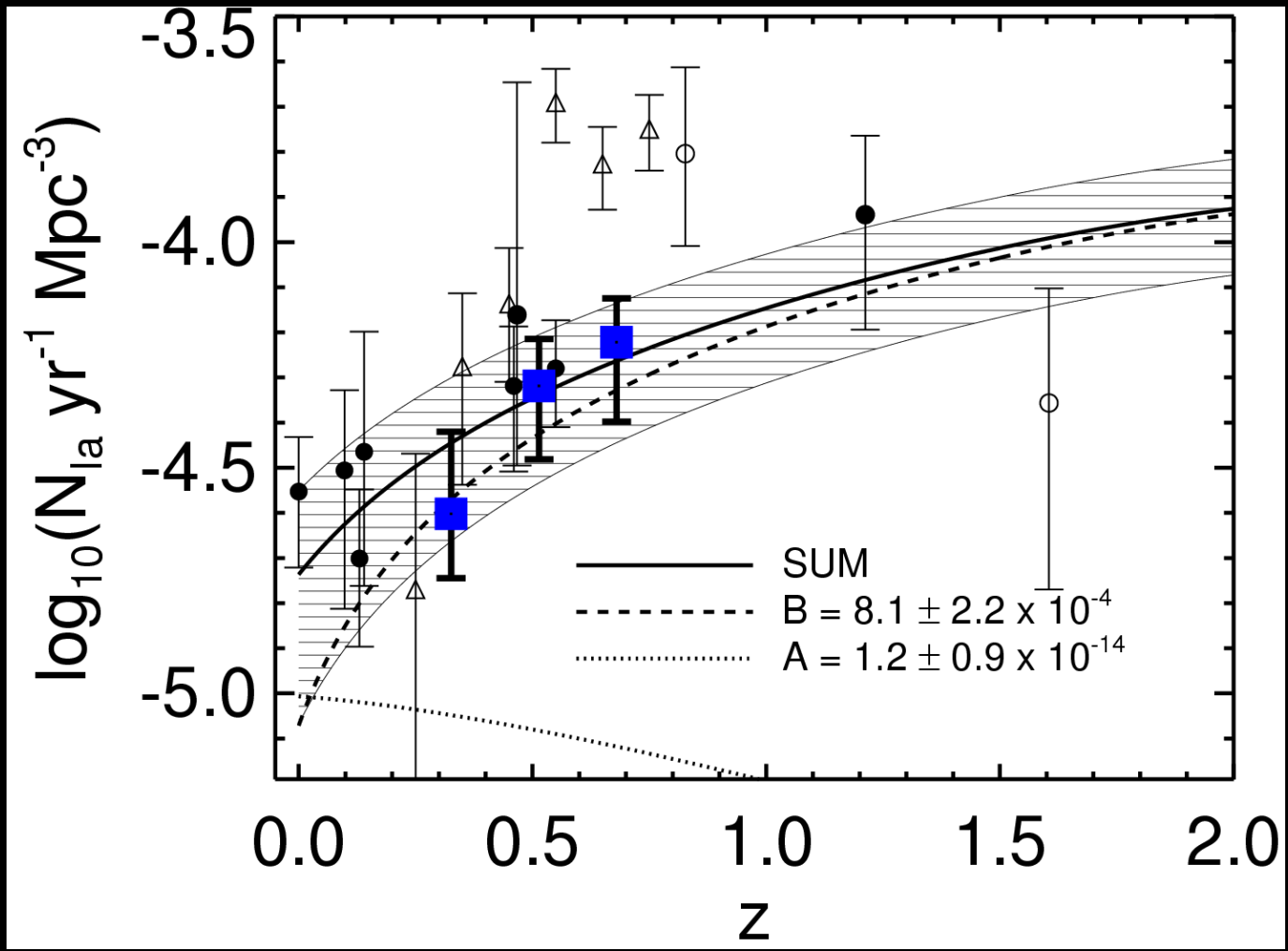
Scannapieco & Bildsten 2005:
SNR = A * Mass + B * SFR

Benefits:
• Simple – avoids arbitrary DTD assumptions
• A and B can be determined from observations in two ways (Mannucci just assumes 50% prompt, 50% delayed)

Drawbacks:
• Too simple? SNR at 10^{10} yr the same as at 10^{9} yr.
• Could come to wrong conclusion if distribution is



Neill et al. 2007



Open circles are photometrically typed.

Optical Typing of SNe Ia hosts

Passive

Star forming

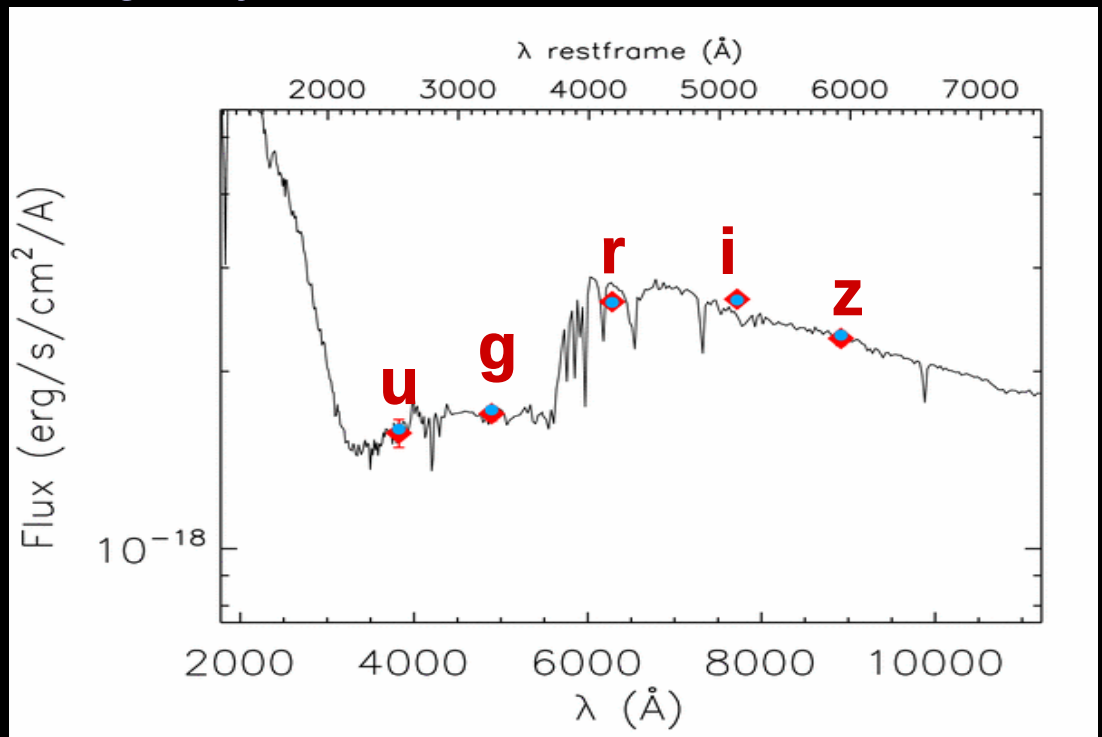
Starbursting

Sullivan et al. 2006

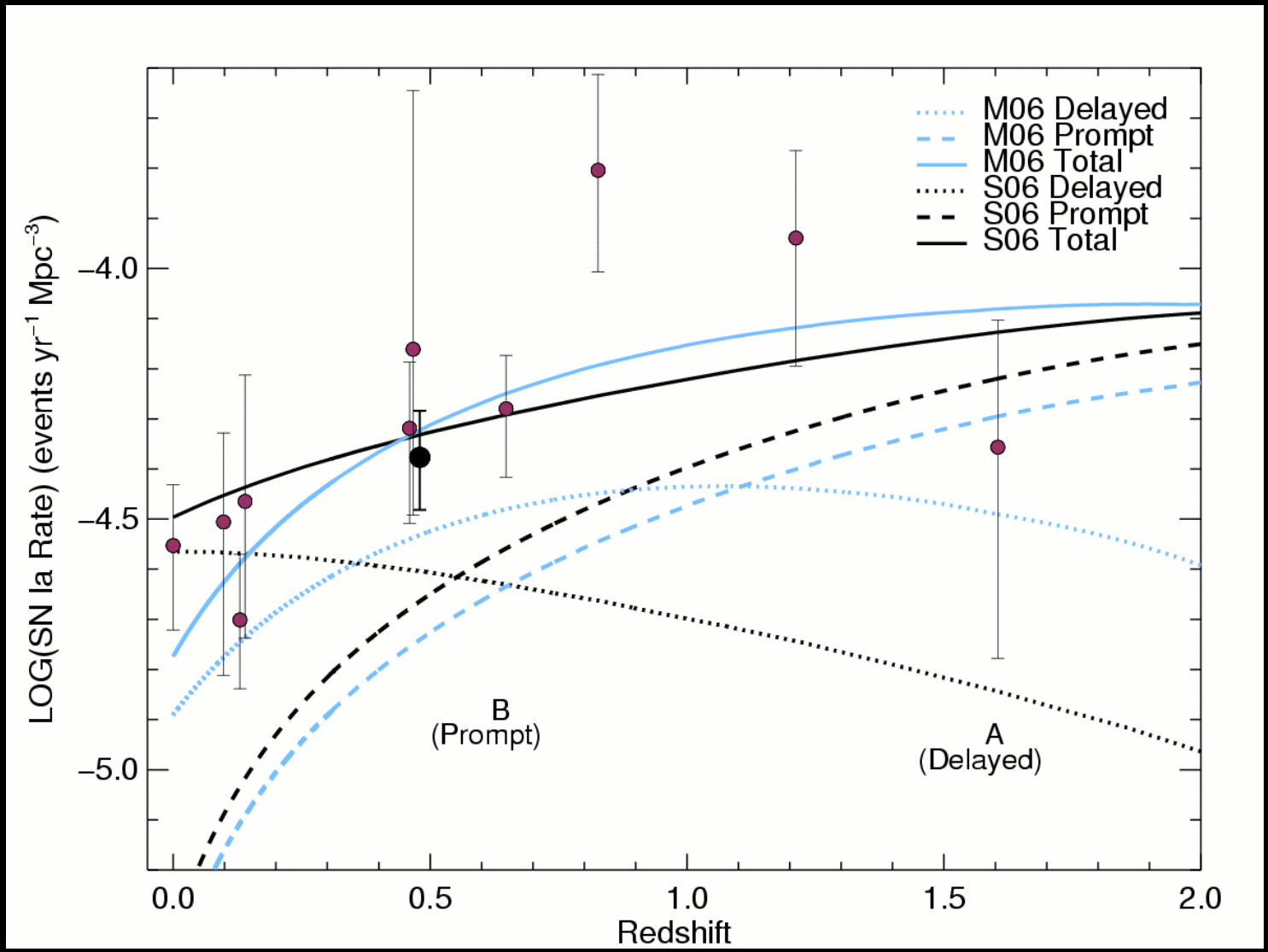
CFHT u*g'r'i'z' imaging

Fit PEGASE 2 galaxy models

Estimate recent star formation rate, total mass of host galaxy



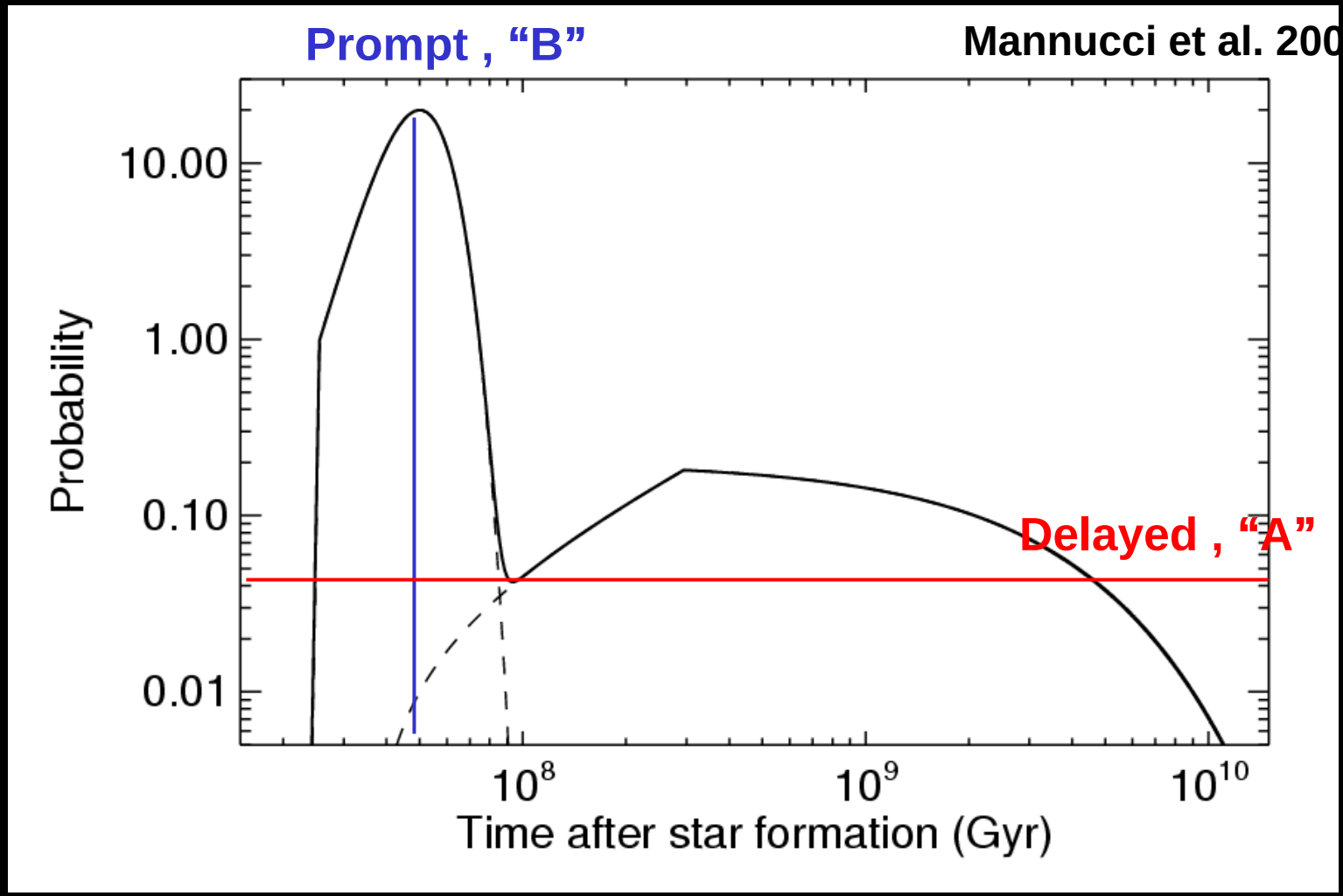
SN Rates vs. Redshift



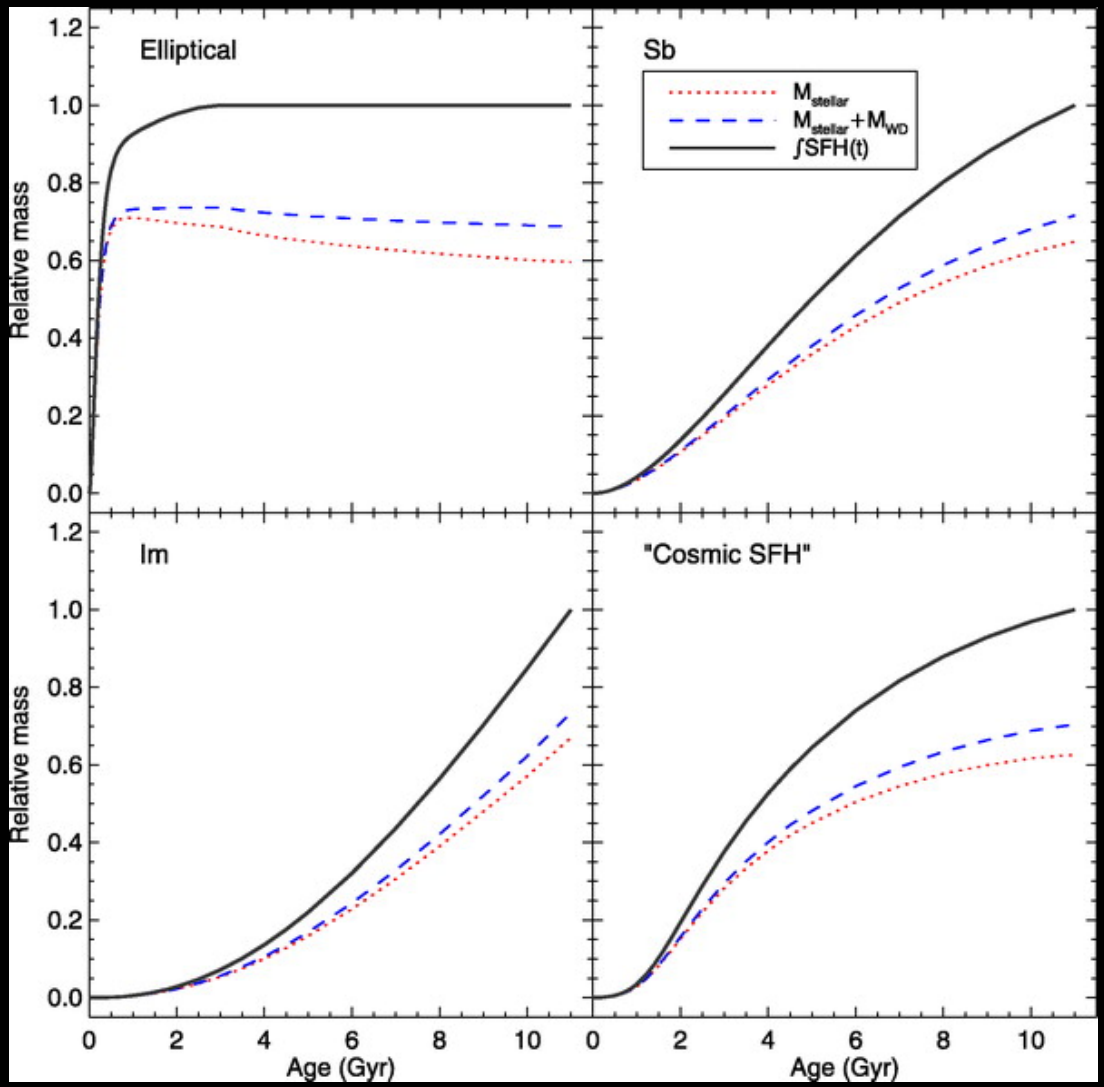
Adopt cosmic star formation history from Hopkins & Beacom 2006

Predict relative contribution from each component vs. redshift for Mannucci and Sullivan models

Scannapieco & Bildsten 2005 vs. Mannucci 2006



Which A and B?



S&B 2005, Neill et al. A and B are *total* masses integrated from SFH (no mass loss)

Sullivan et al. 2006: A and B are relative to current galaxy *stellar* mass

Conclusions

- All methods have drawbacks:
  - Arbitrary DTD like Mannucci has timescale so prompt and delayed rates can't easily be determined from galaxy models
  - A+B overpredicts A component at low-z because it has no timescale
  - Getting DTD from rate vs. z relies on uncertain rates, especially high-z data.
- Mind your A's and B's
- Beware of rates from photometric typing