Connecting supernova rates with the host galaxies parameters: results from the SUDARE survey

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CC SNe rates

$$r^{CC}(z) = N^{CC} \times \text{SFR}$$

N^{CC} = number of CC SN progenitors from one solar mass of stellar population

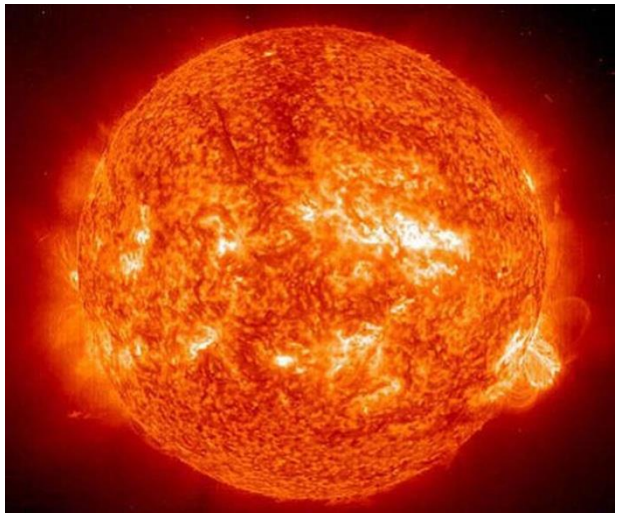
$$N^{CC} = \frac{\int_{m_L^{CC}}^{m_U^{CC}} I(m)dm}{\int_{m_L}^{m_U} mI(m)dm}$$

I(m)=IMF

SFR=> Star formation rate

SNe Ia rates


Double degenerate

Single degenerate

$$r^{Ia}(t) = N_a P^{Ia} \int_{\tau_a}^{\min(t,\tau_x)} f^{Ia}(\tau)\varphi(t-\tau)d\tau$$

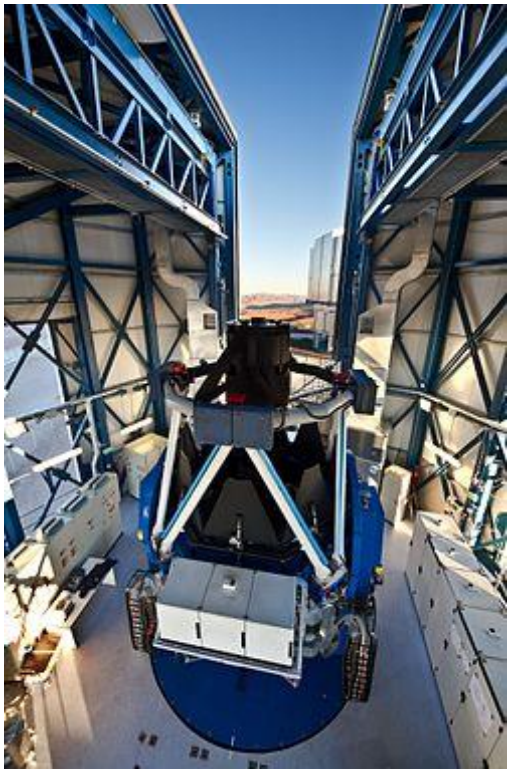
N_α => number of stars per unit mass of the stellar generation
P^{Ia} => realization probability of the SN Ia scenario
$f^{Ia}(\tau)$ => distribution function of the delay times
$\varphi(t-\tau)$ => star formation rate at the epoch t-τ.

SUDARE
(Supernova Diversity and Rate Evolution)

Survey instrument => VST+OMEGACAM (1°x1° FoW) in the g,r i filters

Monitoring frequency => r every ~3 days, g and i once a week.

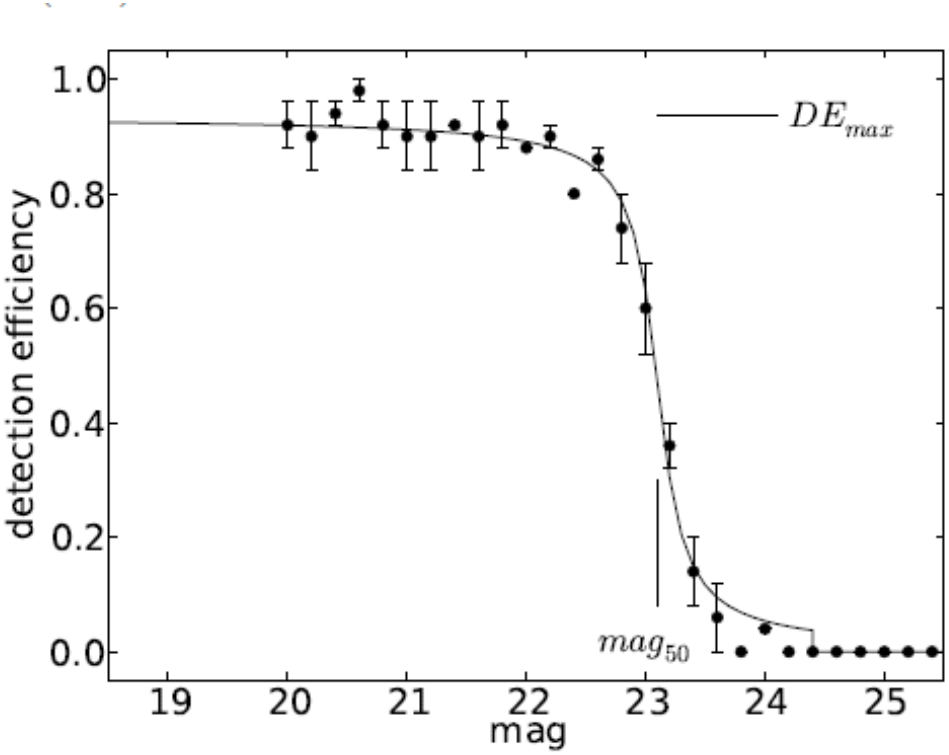
We use also public available J, H, K deep VISTA images from UltraVISTA & VIDEO



Searching fields:
COSMOS (PI G. Pignata)
CDFS (PI E. Cappellaro)

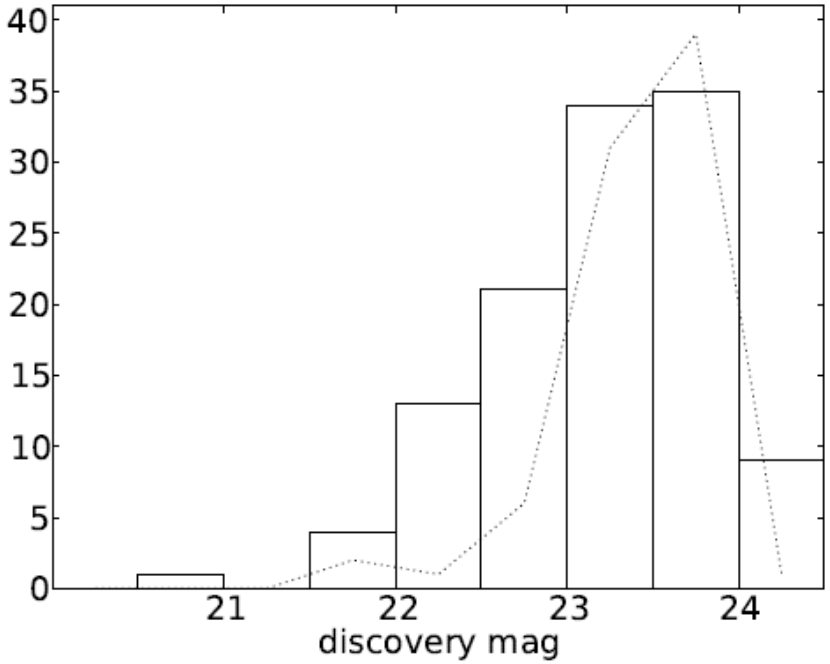
Results based on 117 SNe
Final sample ~ 400 SNe

Detection efficiency

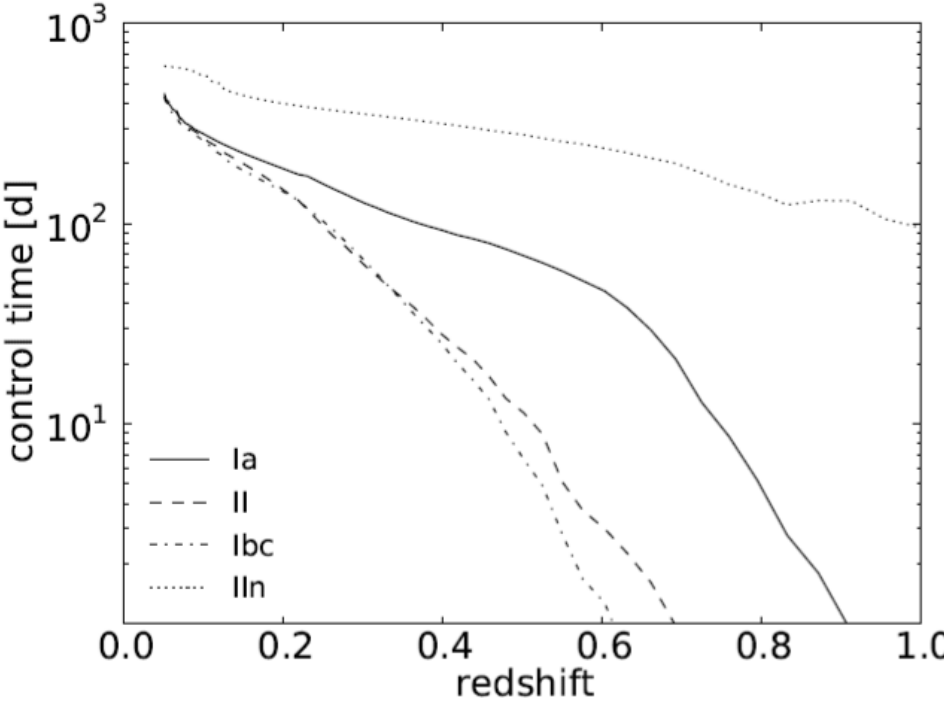


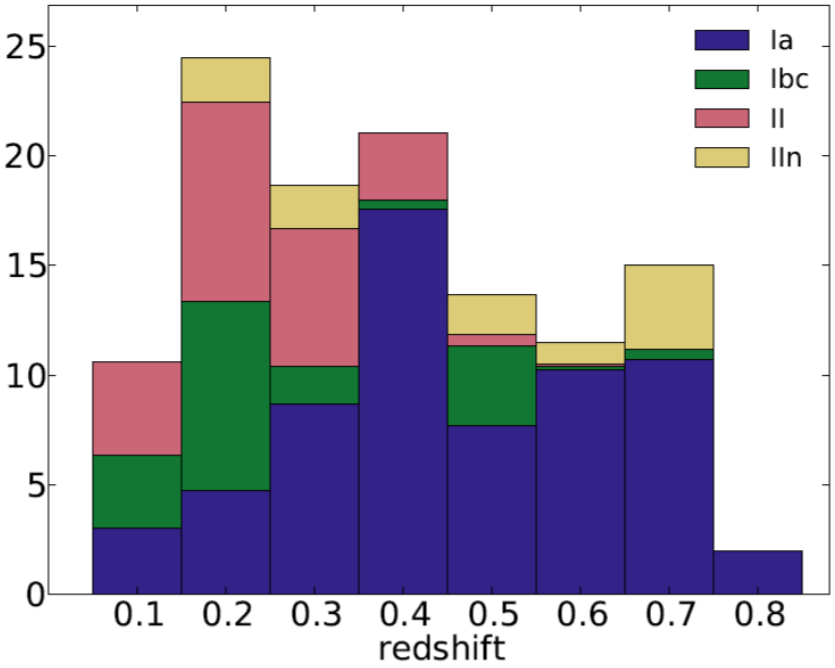
Artificial star experiment

Discovery magnitude



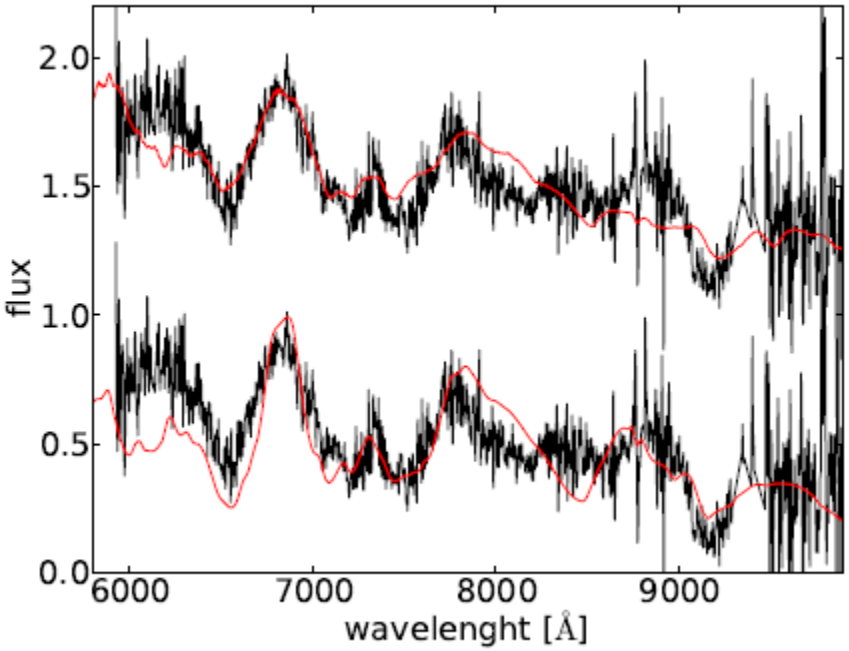
Control time

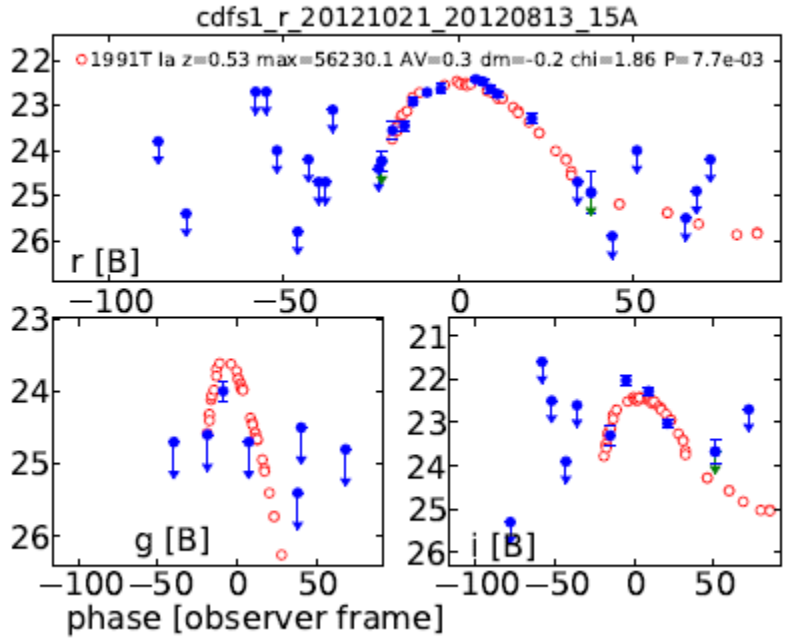




Candidates SN classification

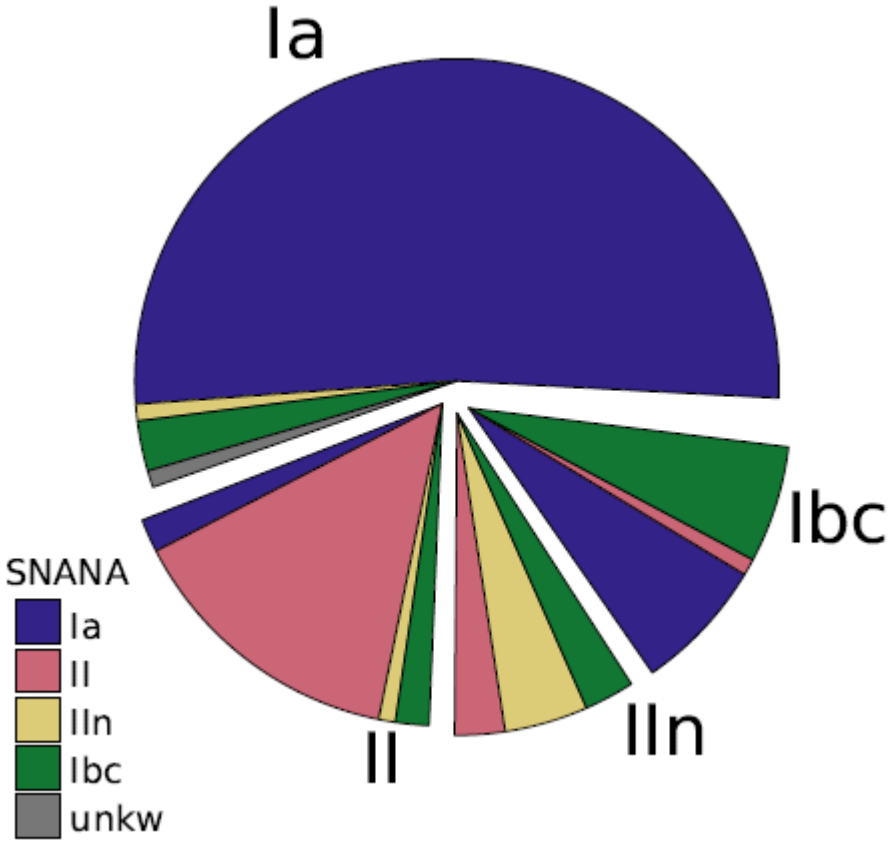
Photometric classification based on template comparison





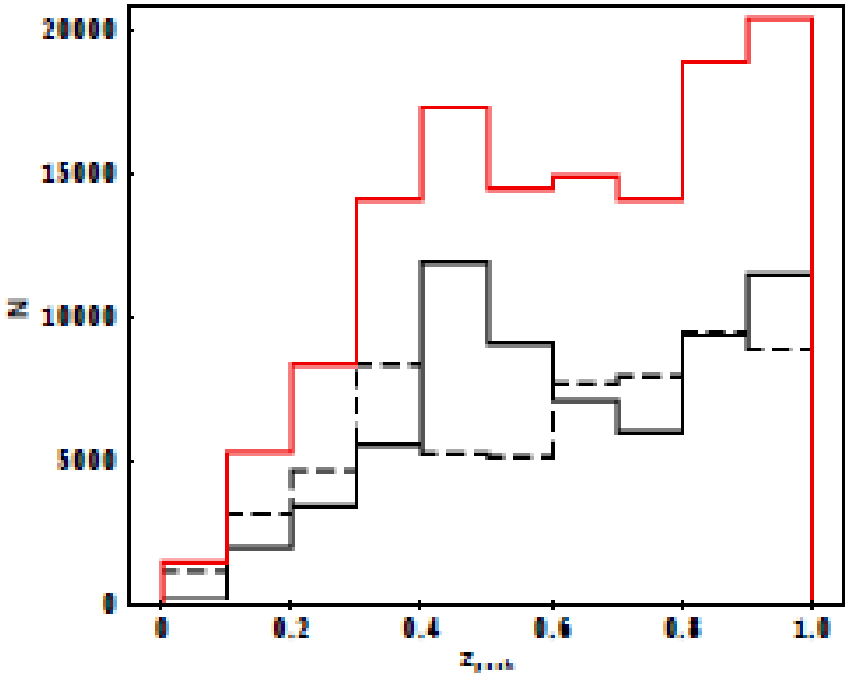
Best fit with a Type Ic at -9 (tot)
but also compatible with a Type Ia at +14

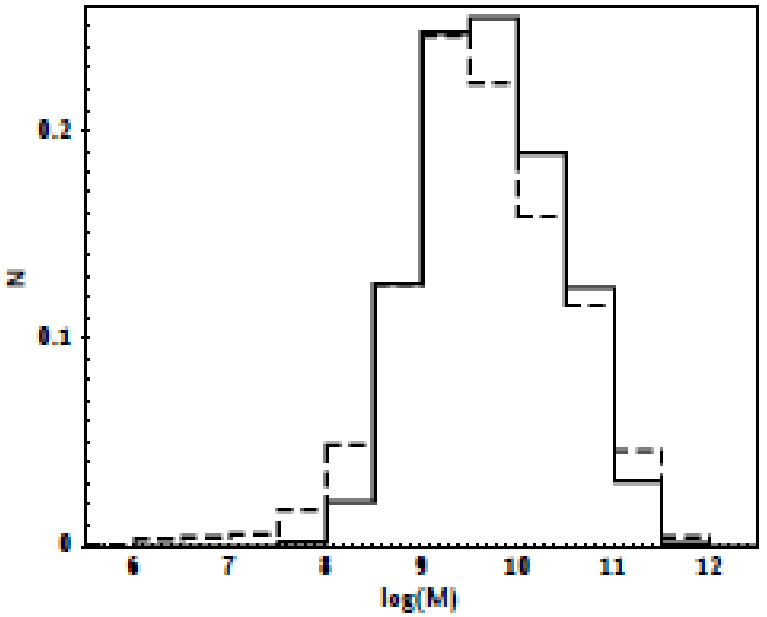
Photometric classification say Type Ia
The epoch of the peak is not compatible
with the spectroscopic classifications

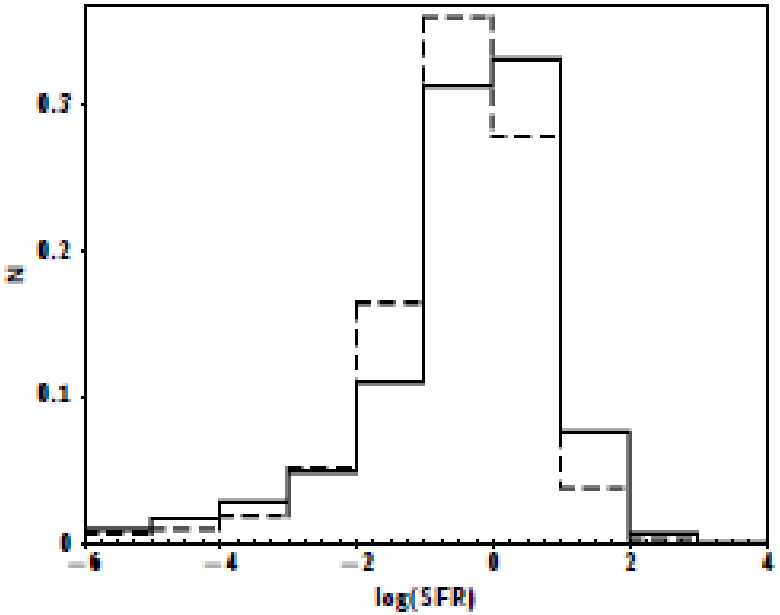


	SUDARE	SNANA
Ia	67	72
II	22	21
IIn	11	7
Ib/c	17	15
All	117	115

Galaxies mass and SFR estimation





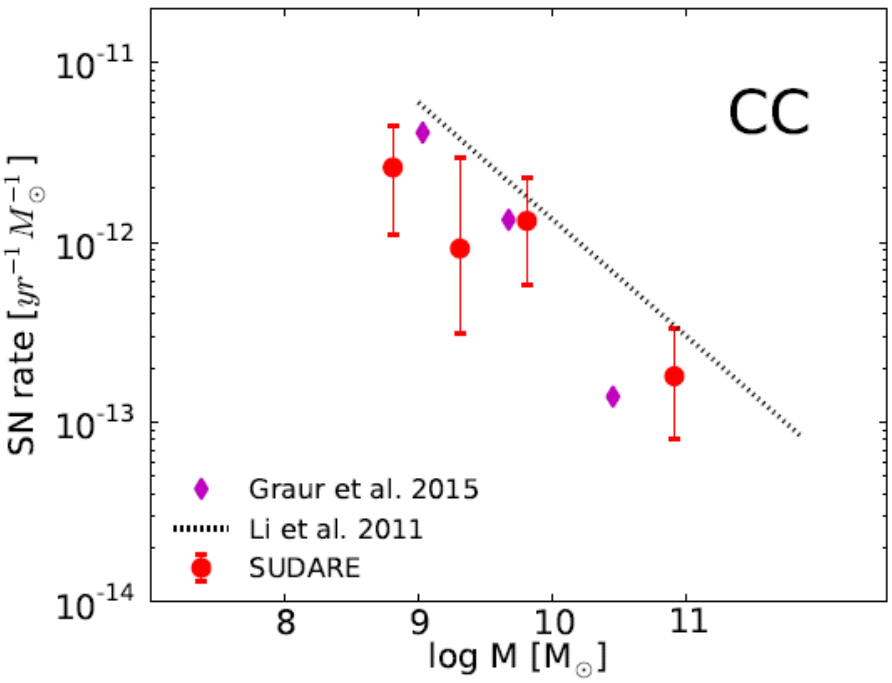


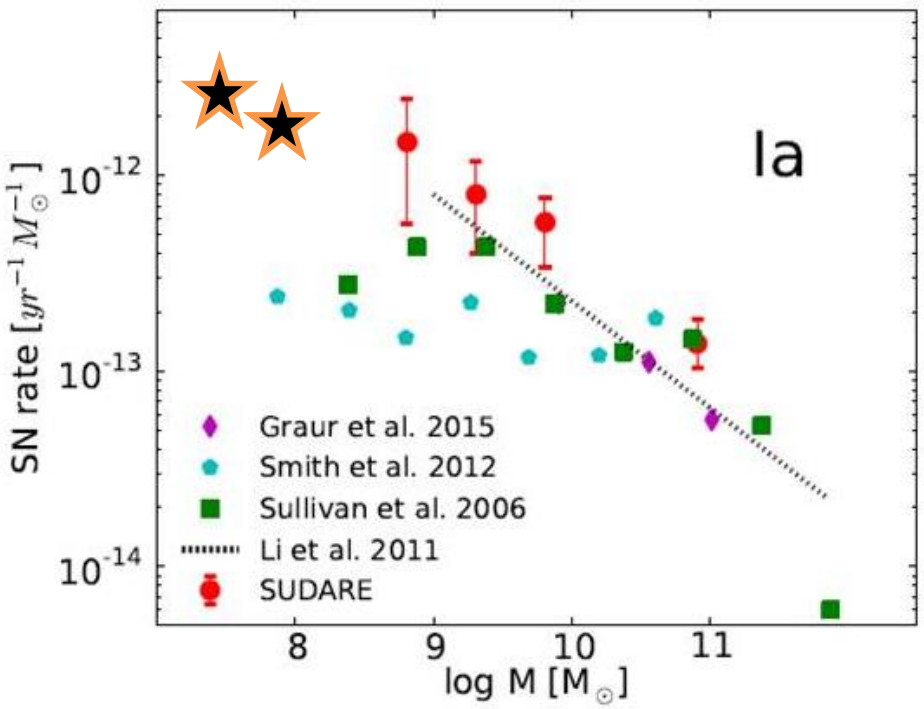
Galaxies redshift obtained with EASY (Baramer+08)

Galaxies Mass and SFR with FAST5 code (Kriek+09)

To select the galaxies we applied the following cut:
$K_s < 23.5$ $0.15 < z < 0.75$ $Qz < 1$

Rate in function of the galaxy mass

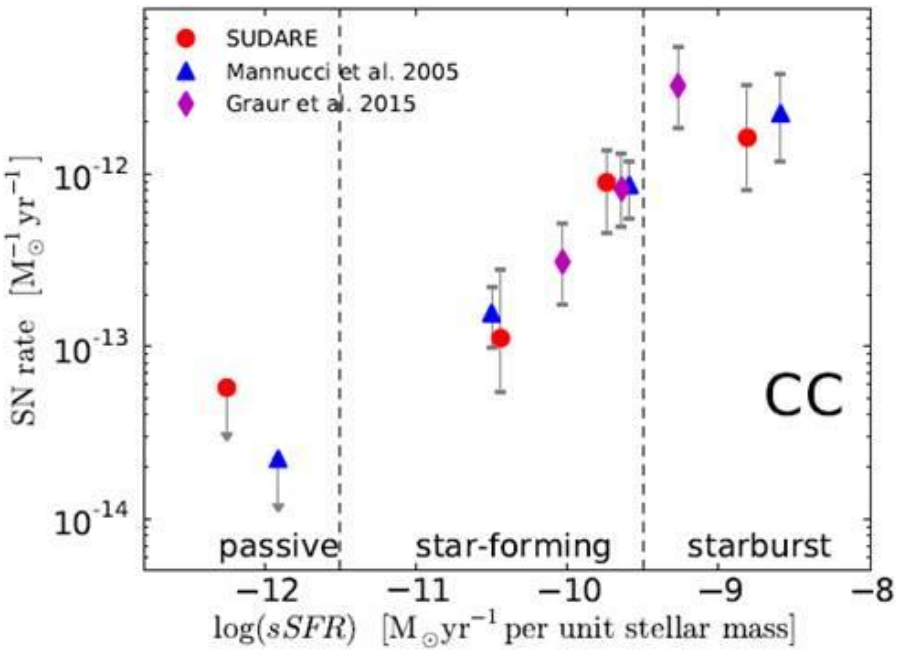


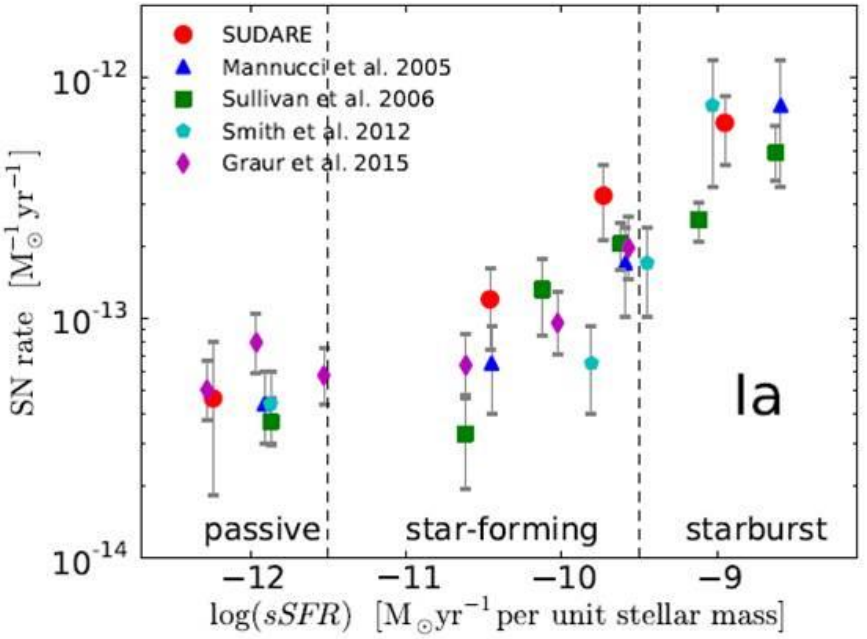


Botticella+2017

Brown+2018

Rate in function of the specific star formation



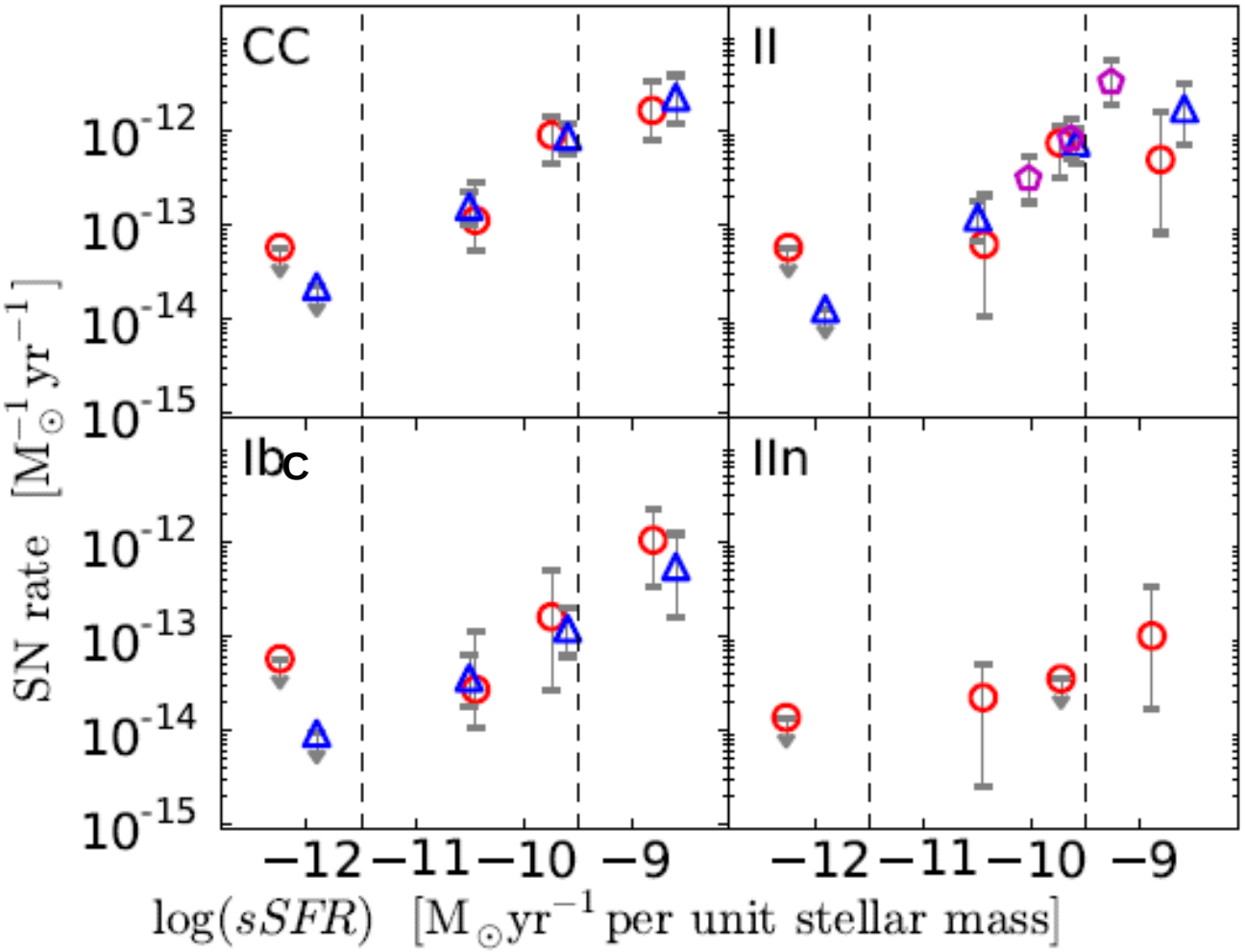


Botticella+2017

Considering SFR => 40% of the CC SNe are missing

Larger M_L^{CC} ?

CC SN sub-type rate



SUDARE

Mannucci+ 2005

Grau+ 2015

Work in progress

Improve the photometric classification.

Compare the “IR” SN rates with “optical” SN rate on the full SN sample.

Summary

We found that the SN Ia rate per unit mass is higher in the star-forming galaxies with respect to the passive galaxies
Confirming the suggestion that DDT less populated at long delay times than at short delays.

Considering SFR 40% of the CC SNe are missing, which can may indicate a higher lower limit for the CC progenitor mass
But the statistics is still low.

Thank you