SUDARE: SUpernova Diversity And Rate Evolution

AIM and Method

SUDARE is a project devoted to the analysis of the evolution of the Supernova (SN) rate with cosmic time and the properties of the parents population.
The CC SN rate :

- ➢ The survey lasted for 4 years (2011-2015),
- ➢ observations at ESO VST telescope in two extragalactic fields, CDFS and COSMOS.
- ➢ observed bands uigr, J,K,K
- ➢ 4 deg^2 in four pointings, with one pointing for each observing season (August to January)
- ➢ multiband catalogue will be used to study the mass assembly and star for- mation history in galaxies by combining accurate photometric redshifts, stellar masses, and weak lensing maps.

SUPERNOVA SEARCH: Every SN candidate was selected as a detection on the difference image with a reference, the evolution of the detection with the epoch gives the light curve that was then compared with a well know sample of SN templets' lightcurve for the classification (Fig 1.). Finally our sample is composed by 147 SNe plus 33 PSNe, those are object that are weighted with the possibility to not being a SN.

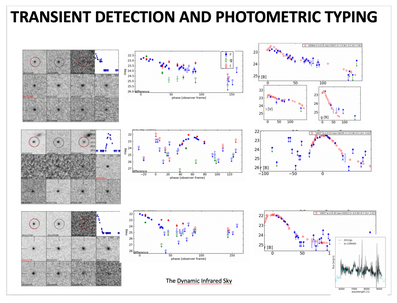


Fig1. SN search and Classification procedure.

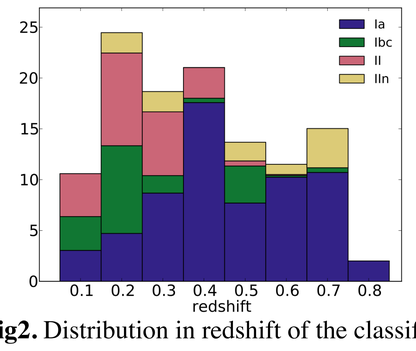
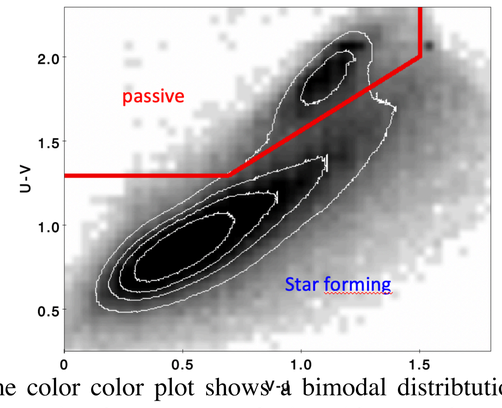


Fig2. Distribution in redshift of the classified SNe

GALAXY SAMPLE ANALYSIS: We have evaluated the photometric redshift and the spectral energy distribution the the galaxies in out samples. We used the color color distribution of the galaxy sample to separate the active galaxies from the active ones (Fig 3) and the analysis of the two samples show specifics properties deleted to the mass and SFR distribution (Fig 4).



Williams et al 2009

Fig 3. The color color plot shows a bimodal distribtution of the galaxy sample,suggesting the presence galaxies with enacted star formation

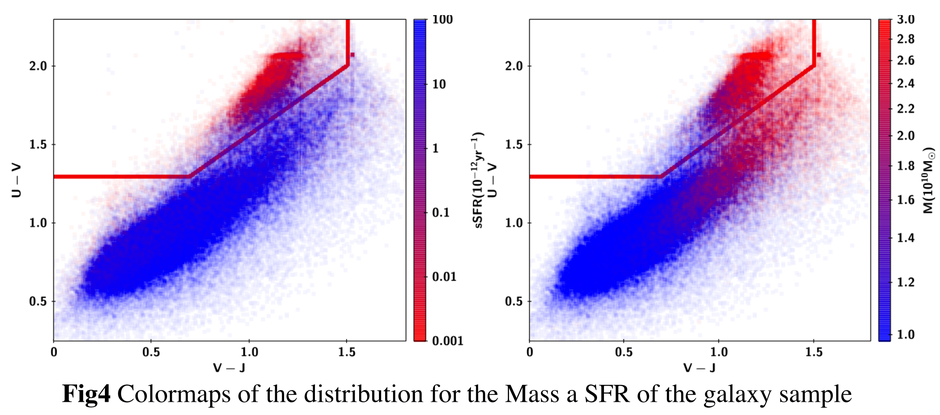


Fig4 Colormaps of the distribution for the Mass a SFR of the galaxy sample

Results

The CCSN rate :

- ➢ becomes progressively higher in bluer galaxies
- ➢ increases for an increasing sSFR with a linear trend (Fig 5)
- ➢decreases for an increasing mass of the parent galaxy due to downsizing effect (Fig 6)
- ➢increases with cosmic time in agreement with the prediction based on 8-40 M$_\odot$ progenitor mass range and cosmic SFH by Madau &Dickinson 2014 (Fig 7)

The SN Ia rate :

- ➢increases in bluer galaxies
- ➢increases of a factor of 5 from passive to star-forming galaxies (Fig 5)
- ➢ decreases for an increasing mass in the star-forming galaxies (Fig 6)
- ➢increases with cosmic time up to z ≈ 1.2 but seems to decrease at higher redshifts suggesting that the DTD is declining with delay time (Fig 7)
- ➢The expected number of SNe Ia in the passive and star-forming galaxy sample is in agreement with that observed for all DTD models but the DDC model seems to be favoured
- ➢The trend of the SN Ia rate with the intrinsic U- J colour in the star-forming sample can be reproduced with all DTD models but in the passive sample only the DDC meets the level of the rate and the galaxy colour
- ➢The observed correlation between the SN Ia rate and the mass of the parent galaxy is best reproduced with a DDC model
- ➢the DDC model appears to perfectly match the steep rise of the rate up to z 1.2 the SD model gives a better fit of rate evolution on the whole redshift range (Fig 7)

The trend of both SN rates :

- ➢as a function of sSFR
- ➢as a function of mass

is similar in the local Universe and at intermediate redshiftsuggesting that the ability of the stellar populations to produce SNe Ia and CC does not vary with cosmic time.

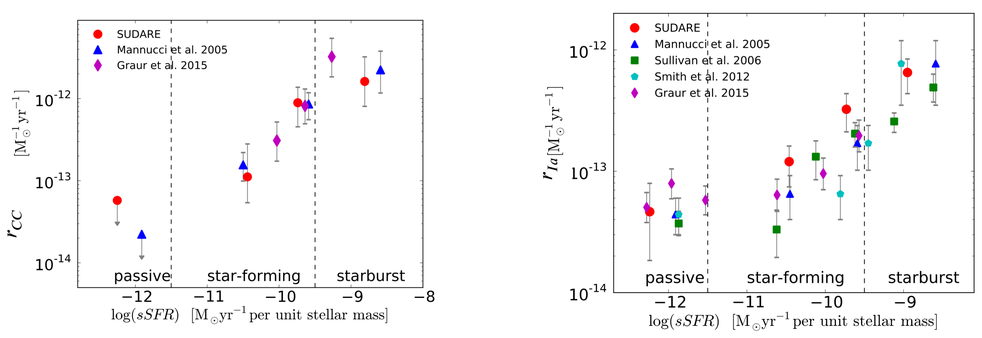


Fig5 Distribution of rates with the logarithm of the specific SFR, we binned the sSFR and for each bin we considered the mean for the parent galaxies sSFR.

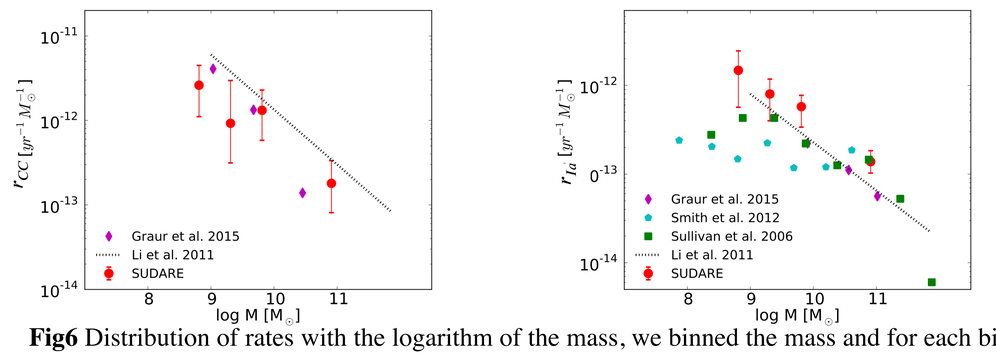


Fig6 Distribution of rates with the logarithm of the mass, we binned the mass and for each bin we considered the mean for the parent galaxies mass.

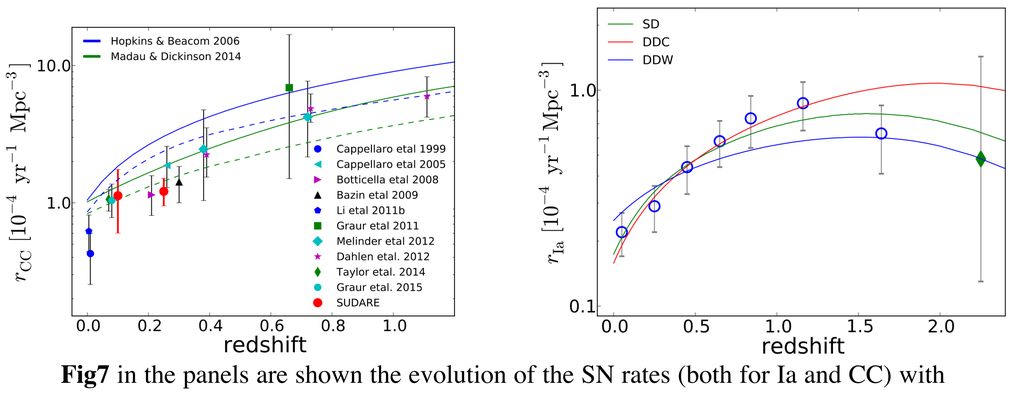


Fig7 in the panels are shown the evolution of the SN rates (both for Ia and CC) with the cosmic time and the comparison with the models

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This work is presented on behave of the SUDARE collaboration

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