Metallicity effects on the cosmic SNIb/c and GRB rates

Supernovae lb/c are likely to be associated to long GRBs, therefore it is important to compare the SN rate in galaxies with the GRB rate. We computed Type Ib/c SN rates in galaxies of different morphological type (ellipticals, spirals, irregulars) by assuming different histories of star formation and different SN lb/c progenitors. We included some recent suggestions about the dependence of the minimum mass of single Wolf-Rayet (WR) stars upon the stellar metallicity and therefore upon galactic chemical evolution. We adopted several cosmic star formation rates as functions of cosmic time, either observationally or theoretically derived, including the one computed with our galaxy models. Then we computed the cosmic Type lb/c SN rates. Authors: Grieco* V., Matteucci F., Meynet G., Longo F., Della Valle M., Salvaterra R.



Chemical evolution models

Galaxies of different morphological type are characterized by different star formation histories:

- ellipticals: intense and short star formation episode
- spirals and irregulars: milder star formation rates (SFR), still forming stars now.

We assume that both irregular and spiral galaxies assemble all of their mass by means of a continuous infall of pristine gas. The basic ingredients are:









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τ_{infall} [Gyr]	0.4	6	3
Wind	yes	no	yes
SFE [Gyr ⁻¹]	10	2	0.05
Z	0.036 @ t _{GW}	0.03	0.0096
SFR [M_{\odot} yr ⁻¹]	-	1.67	0.16
M _{gas} / M _{tot}	-	0.18	0.66
${ m M}_{ m star}({ m M}_{\odot})$	0.26. 1011	$4.17 \cdot 10^{10}$	$1.4 \cdot 10^{9}$

Conclusions

The predicted Type Ib/c SN rates in spirals and irregulars can well reproduce the present time observed rates if both single WR stars and massive binary systems are taken into account as Type Ib/c SN progenitors

✤ If a dependence on stellar metallicity is assumed for the WR stars, differences arise in the Type Ib/c SN rates only at early evolutionary times in galaxies

✤ We have compared the local observed Type lb/c rates in spirals and irregulars with the local GRB rate and derived a local ratio



GRB/SNe lbc of $3 \cdot 10^{-3}$ The ratio cosmic GRB rate / cosmic Type Ib/c rate varies in the range 10⁻²- 10⁻⁴ in the whole redshift range ✤ Different theoretical CSFR, computed under different scenarios of galaxy formation, produce SNIb/c cosmic rates which differ mainly at very high redshift