EVOLUTIONARY MODELS OF HII GALAXIES

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INTRODUCTION

- Are HII galaxies young systems?

How the star formation takes place in galaxies?

We have used three tools:

- **Chemical evolutionary code:** (Ferrini et al.1992 , Mollá et al. 1996)

  t=0-13.2 Gyr, Δt=0.5 Myr

  ➡ **age, metallicity, abundances**
- **Evolutionary synthesis code: (**García –Vargas et al. 1995, Mollá & García-Vargas, 2000)
- ➡ **S.E.D ionizing continuum**
- **Photoionization code:** (CLOUDY, Ferland et al. 1991)

  ➡ **Emission lines**

Our evolutionary model of HII galaxies

- From t=0 to t=13.2 Gyr , Δt= 0.5 Myr
- M_{tot}= $100 \cdot 10^6 M_\odot$
- R= 500 pc (Telles et al. 1997)

❖ Bursts model:

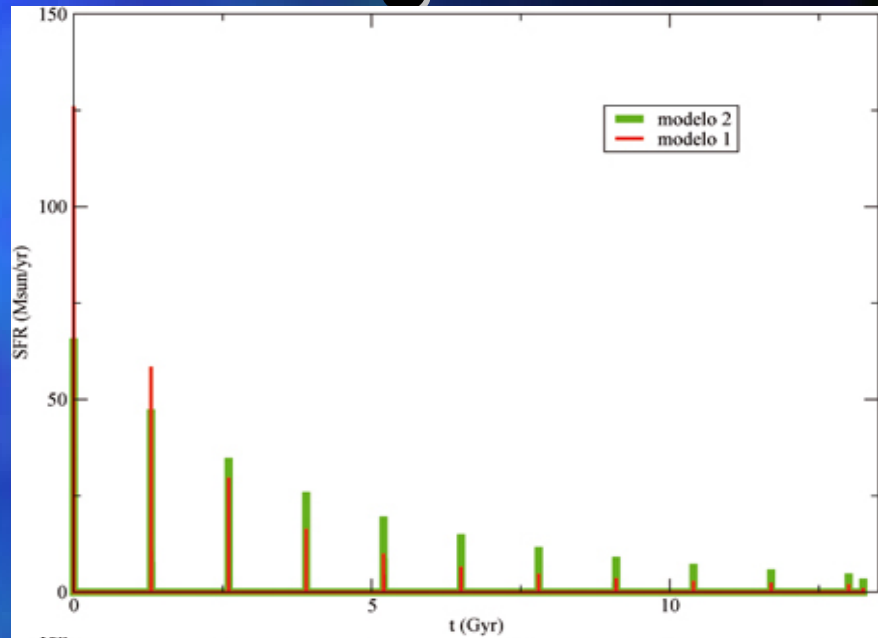
10 bursts every 1.3 Gyr with same efficiency

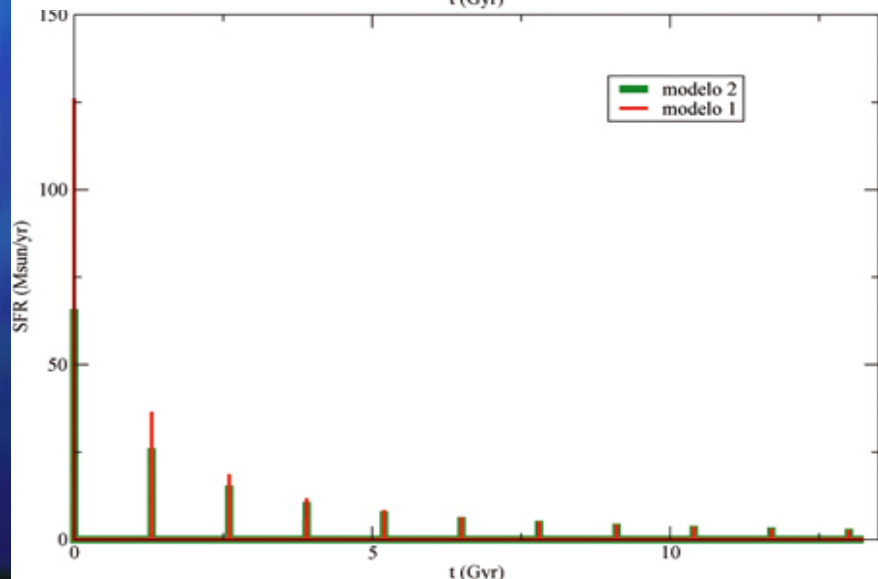
- **model 1**: 64.3%
- **model 2**: 33.1%

❖ Attenuated Bursts model:

10 attenuated bursts every 1.3 Gyr. Not the same efficiency.

- **model 1**: initial efficiency: 64.3%
- **model 2**: initial efficiency: 33.1%





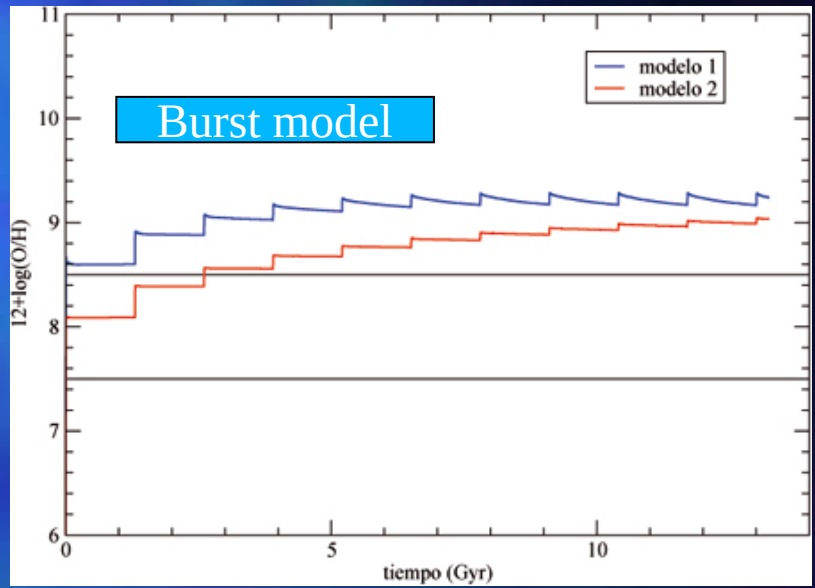
Results of chemical evolution

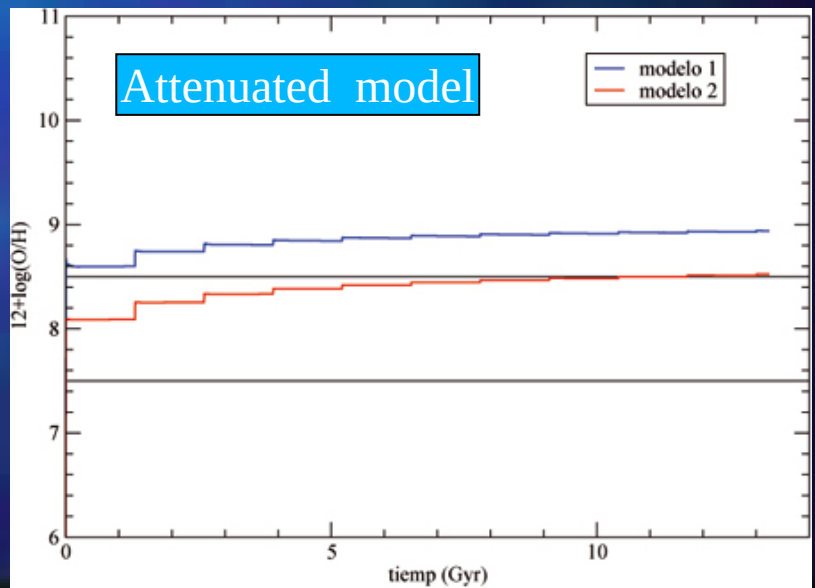
- Oxygen abundance:

HII galaxies:

7.5 < 12+log(O/H) < 8.5
(Hoyos & Díaz 2005, Terlevich et al. 1991)

Attenuated bursts, model 2.

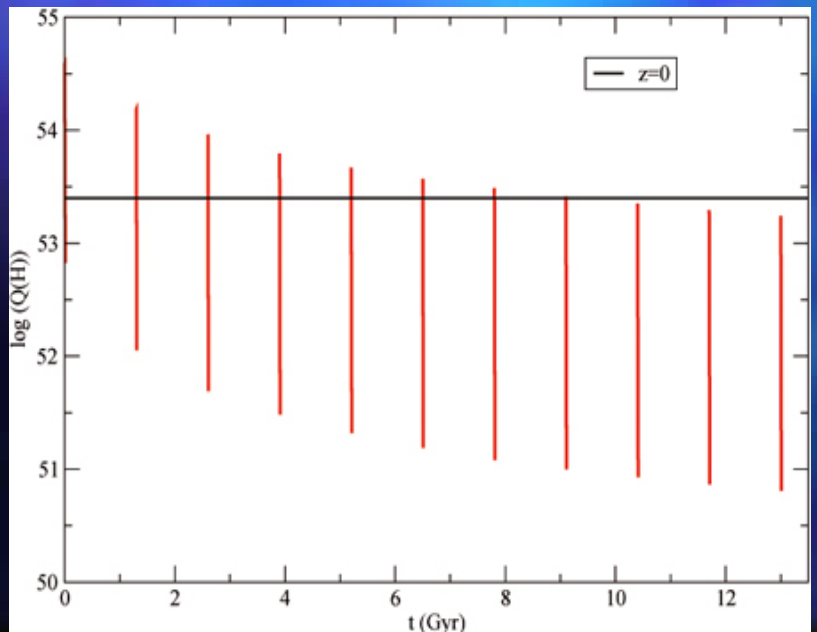


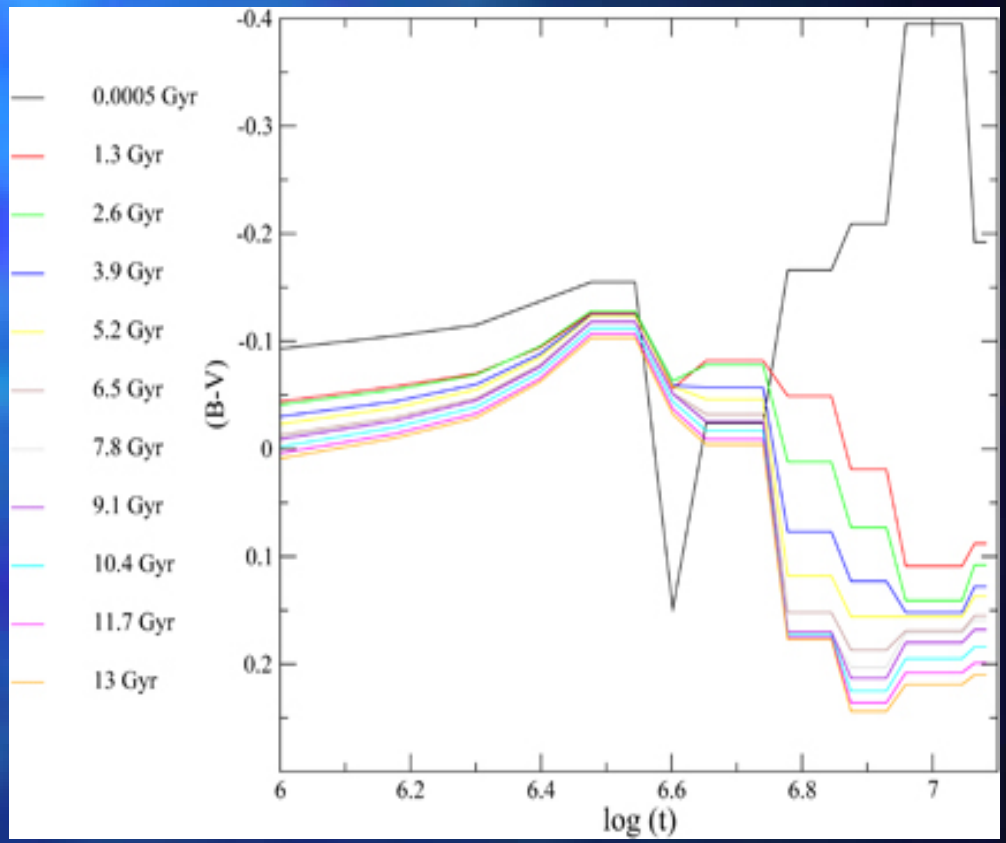


Results of evolutionary synthesis code: Ionizing continuum

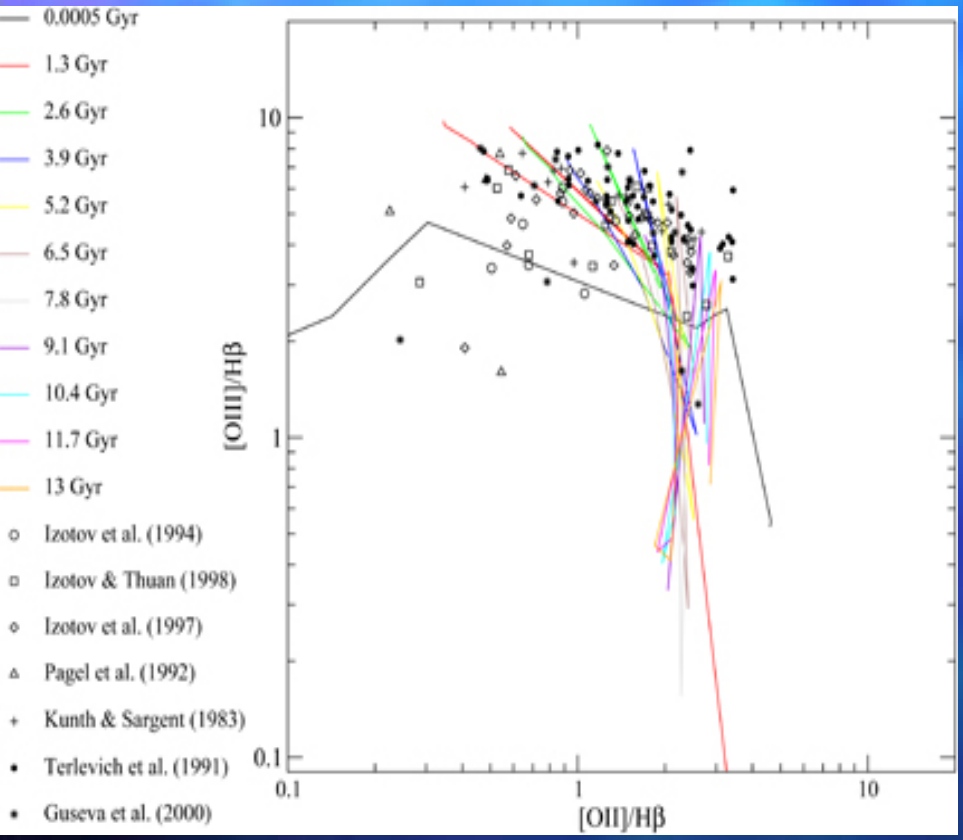
*$\log(U)_{localHII}$=-2.5
(Hoyos & Díaz 2005)
*R=500pc *n_H=100 cm^{-3}

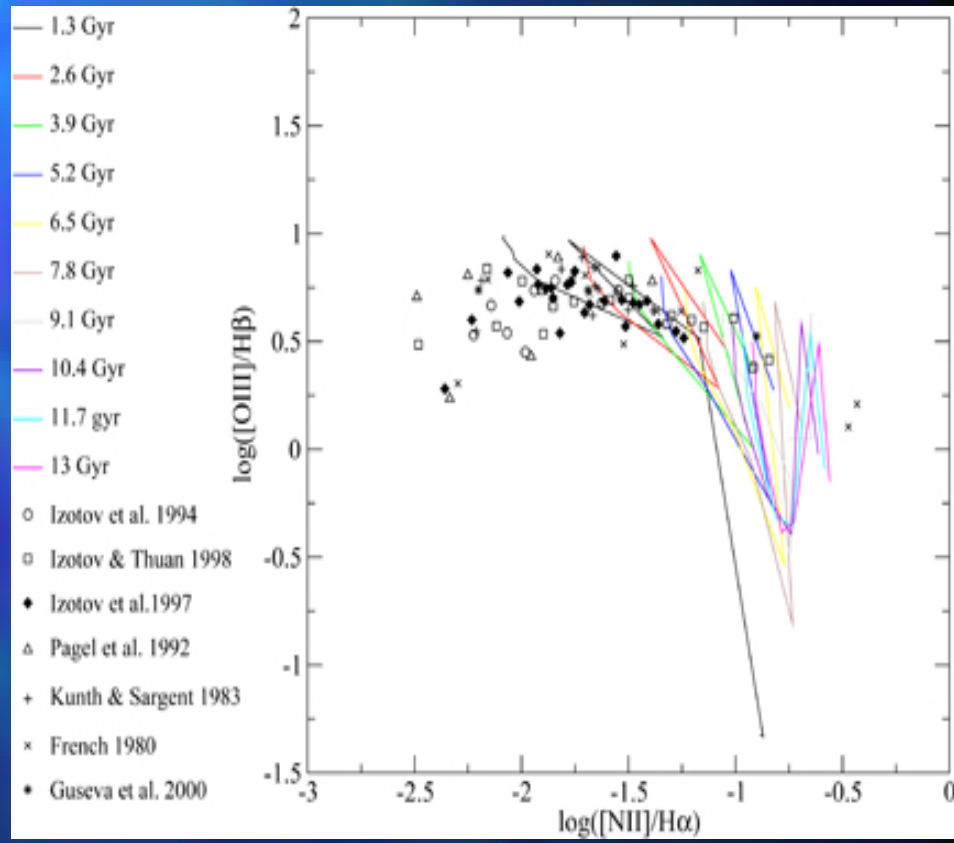
$\log(Q(H))_{localHII}$=53.4
$L(H\beta)\sim10^{41}$





Results of photoionization code : ionized gas

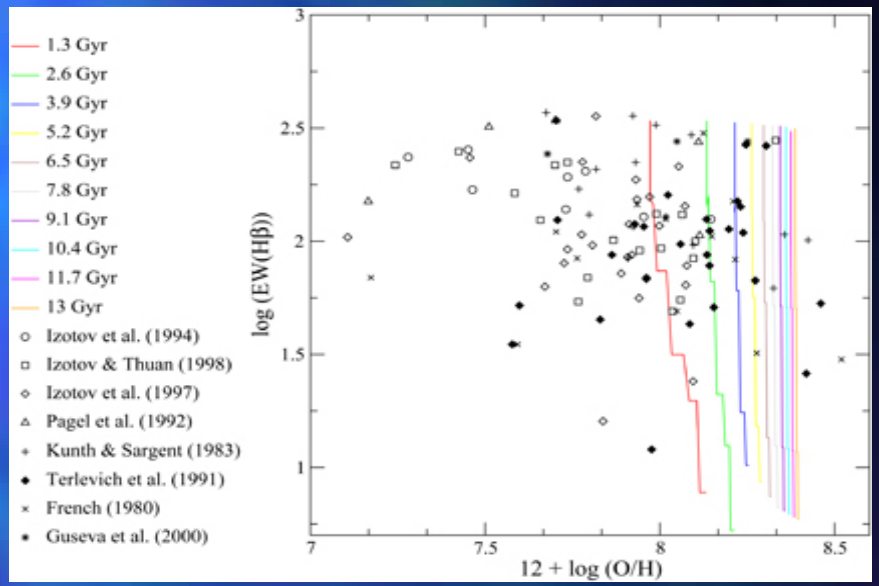


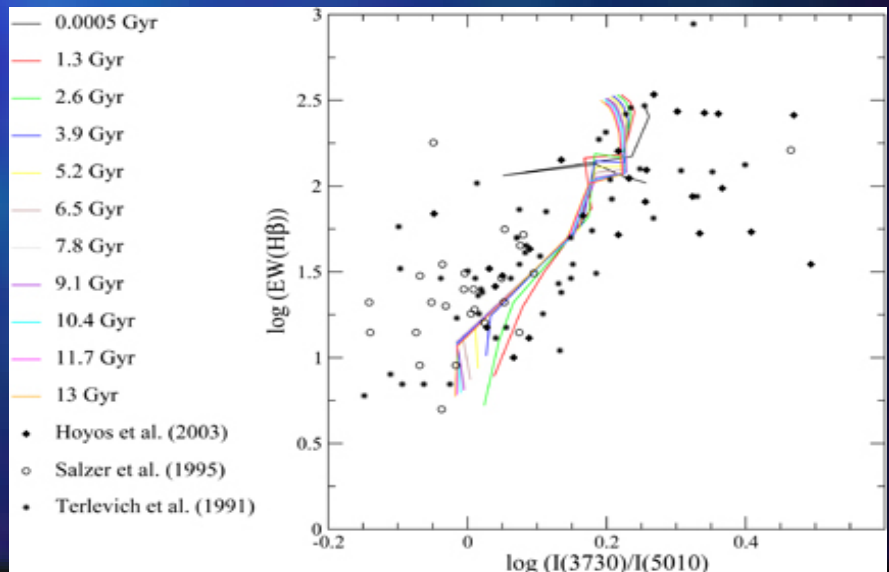


Continuum & gas: 1.evolution of oxygen abundance and color

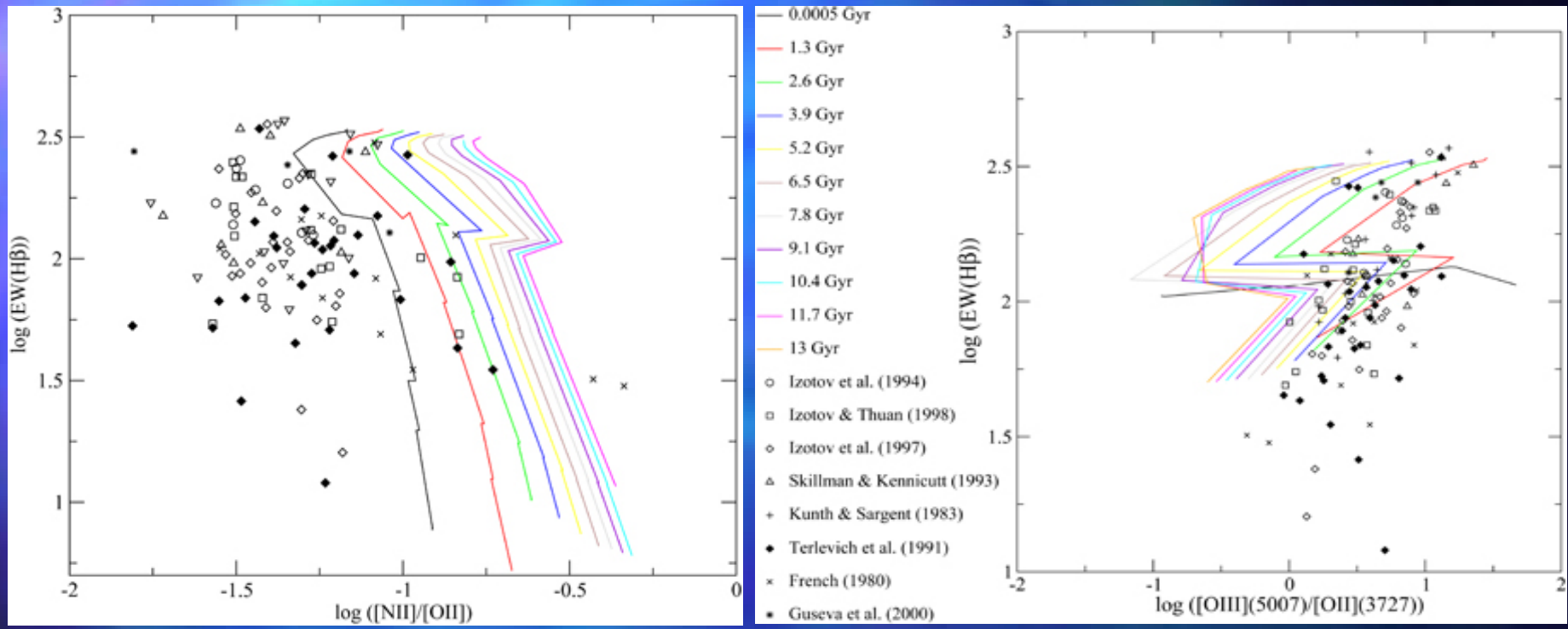
$$EW(H\beta) = \frac{L(H\beta)}{L_{cont}(H\beta)}$$

- The model reproduces the most metallic galaxies of the sample: bursts are too strong!!
- Evolution of colour is reproduced with an underlying population, not with a SSP.





2.Line ratios vs equivalent width



- Models reproduce the range of equivalent width, but only up to the 8th burst in line ratios.
- Initial oxygen abundance is too high.
- According to our model any galaxy of the sample is older than 9 Gyr and most of them have underlying populations

SUMMARY & CONCLUSIONS

- We have made **models combining a chemical evolutionary code, evolutionary synthesis code and photoionization code,** from **t=0 to t=13.2 Gyr, $M_{tot}=10^8 M_\odot$ and R= 500pc, with 10 starburts every 1.3 Gyr**
- The best fit model, according to the oxygen abundance of the observations, is the **attenuated burst model** with **33.1%** of initial efficiency, that reproduces parameters of **HII galaxies at z=0** 8 Gyrs after the beginning of the star formation, according to the number of ionizing photons, and L(Hβ) (Hoyos & Díaz 2005)
- Diagnostic diagrams show that the **models reproduce the observational oxygen lines data ranges. T**he **nitrogen lines values of the model are too high** compared with observations: bursts are too strong, initial oxygen abundance is too high.
- The figures of emission lines ratios vs. equivalent width shows that models reproduces observational data from the first to the 8th burst, so, **according to our model**: any galaxy of tha sample is older than 9 Gyr, and most of them have an **underlying populations,** of**, at least, 1 Gyr**

Future work

- We need to reproduce the left part of the nitrogen and oxygen abundance diagrams. We can:
  - change intial efficiency, to reach lower values in metal content.
  - change the attenuation of the sucesive bursts

- Other models can be made using other synthesis evolutionary models, more complicated assumptions in photoionization models…

- Once we are able to see what parameters are most appropiate to reproduce HII galaxies, we can try to model other objects like LINERs, Seyfert, etc.. At any other redshifts, that lie in other regions in diagnostic diagrams.