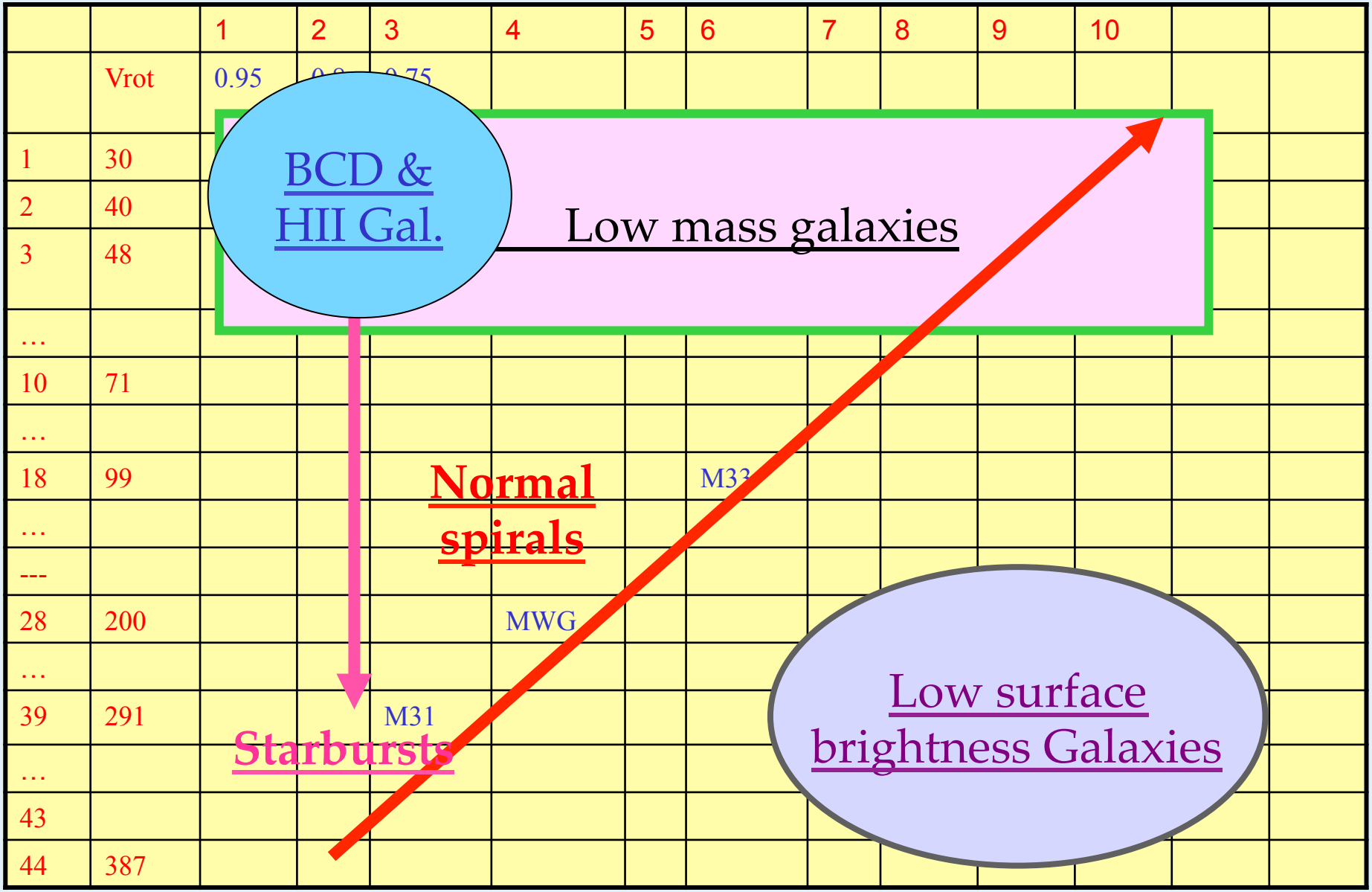
Hands on 5.1
Theoretical modeling of galaxy spectra

Mercedes Mollá

Yago Ascasíbar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Vrot
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44
387
BCD &
HII Gal.
Low mass galaxies
Normal
spirals
M33
MWG
M31
Starbursts
Low surface
brightness Galaxies

		1	2	3	4	5	6	7	8	9	10		
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44	387												

BCD &

Table 1. Theoretical galaxy models selected to represent a simulated Hubble sequence

dis	*Vmax* km s^{-1}	*Mgal* 10^{11} M$_\odot$	*Ropt* kpc	τ_c Gyr	*nt*	ϵ_v	ϵ_δ
3	48	0.3	2.3	31.6	8	0.037	$2.6\ 10^{-4}$
10	78	1.3	4.1	15.5	7	0.075	$1.5\ 10^{-3}$
21	122	4.3	7.1	8.1	6	0.15	$1.0\ 10^{-2}$
24	163	9.8	10.1	5.4	5	0.30	$5.0\ 10^{-2}$
28	200	17.9	13.0	4.0	4	0.45	$1.4\ 10^{-1}$
35	250	33.5	16.9	2.9	3	0.65	$3.4\ 10^{-1}$
39	290	52.7	20.6	2.3	1	0.95	$8.8\ 10^{-1}$

M31

Starbursts

Low surface brightness Galaxies

Chemical evolution models

- Mollá & Díaz, 2005
- Mollá et al. 2006
- Mollá 2014

- http://vizier.cfa.harvard.edu/viz-bin/VizieR?-source=J/MNRAS/358/521
- http://vizier.u-strasbg.fr/viz-bin/VizieR-3?-source=J/MNRAS/358/521

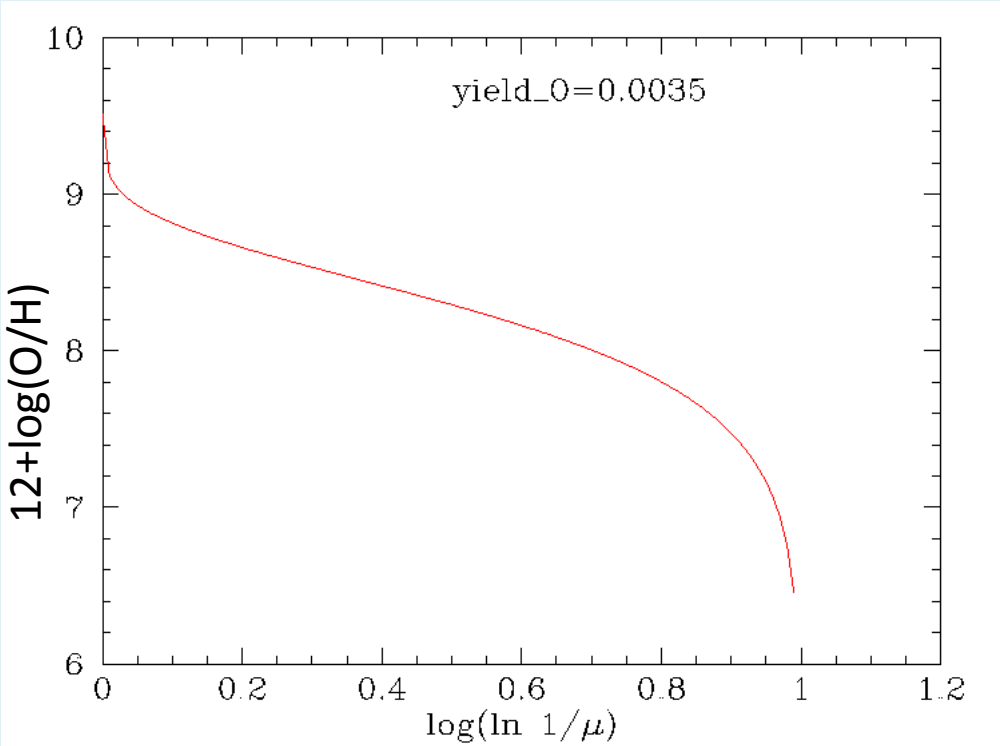
- Tables: (Mollá et al.2005)
  - table3.dat.gz
  - table4.dat.gz
  - table5.dat.gz
- Tables adding all radial regions to represent a galaxy (sumagal)
  - sfr_gal*
  - masas_gal*
  - abun_gal*

1) Try to reproduce the closed box results:

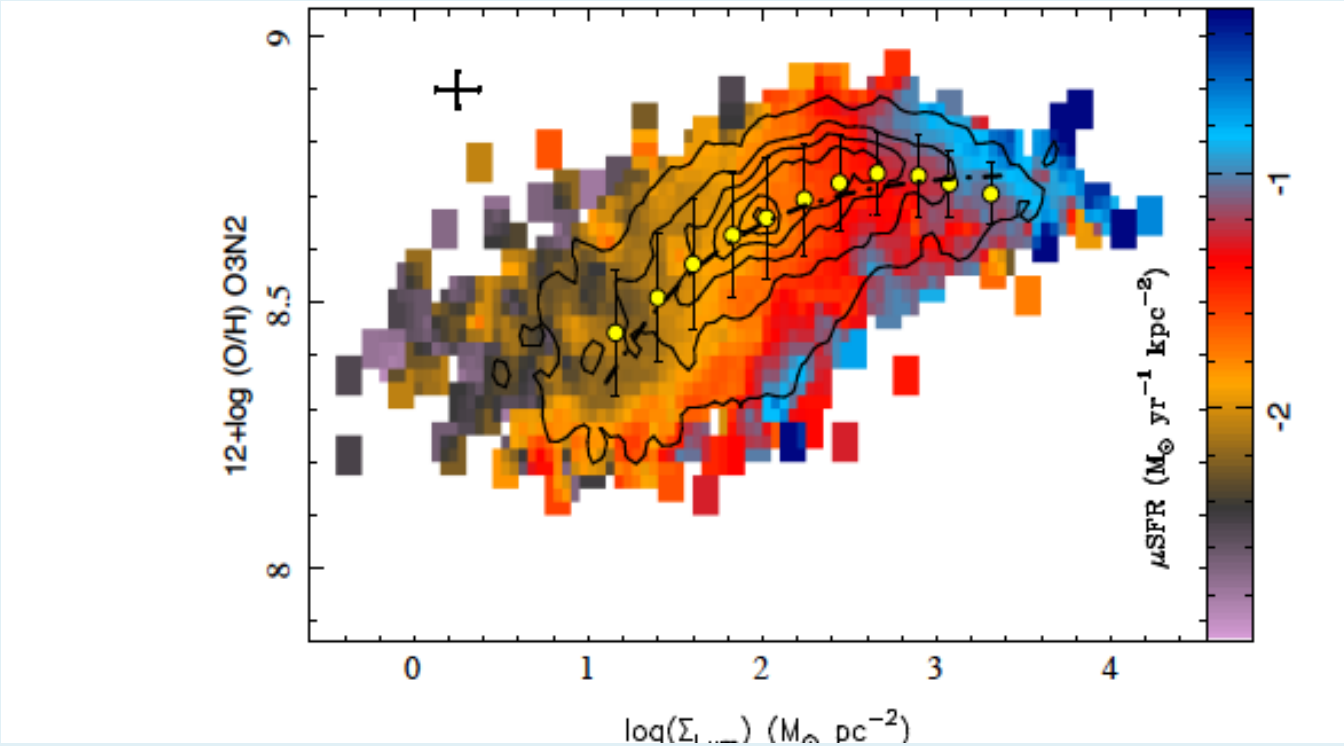
O/H vs gas fraction (MHI+MH2)/Mdisk

$$Z = y \ln \frac{M}{Mg} = y \ln \mu^{-1}$$

p=$O_{\odot}$/2=3e-3



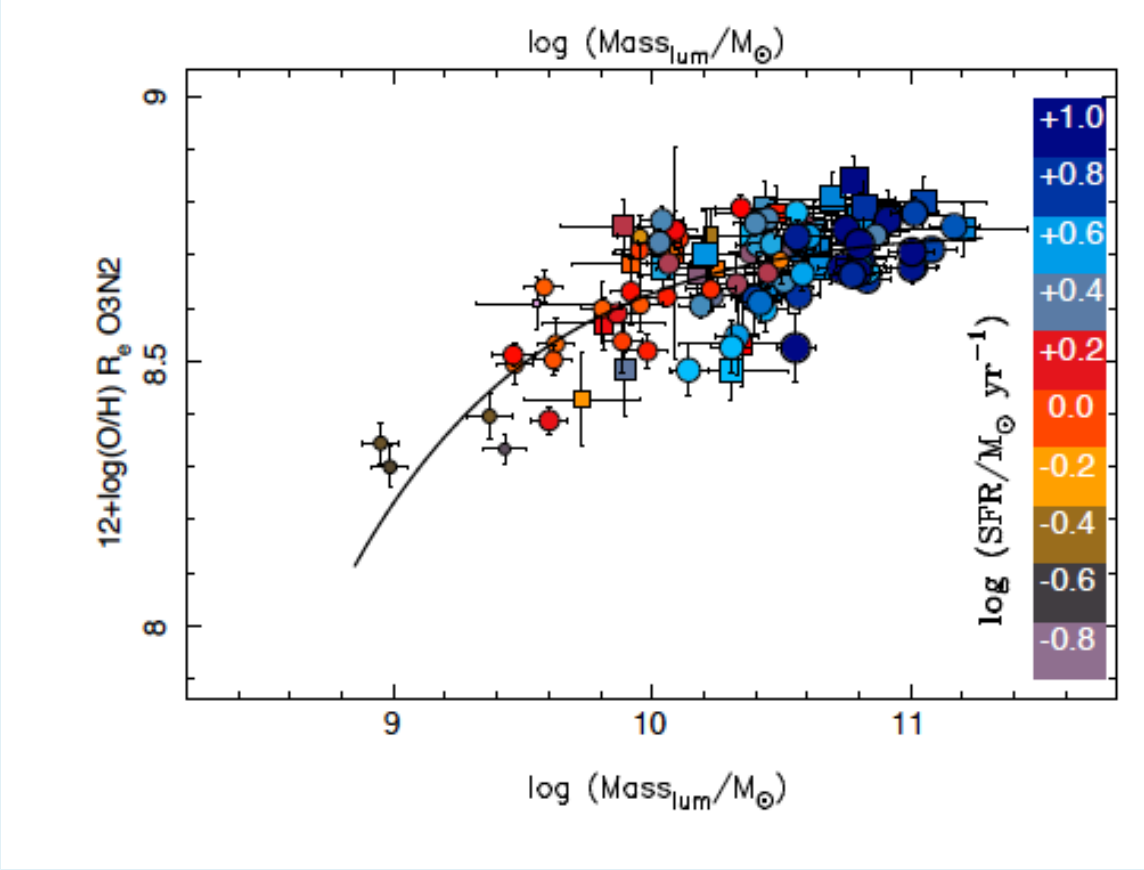
2) Try to reproduce the correlation O/H vs Σ_* from Rosales +2012



GH14-IFS techniques and analysis

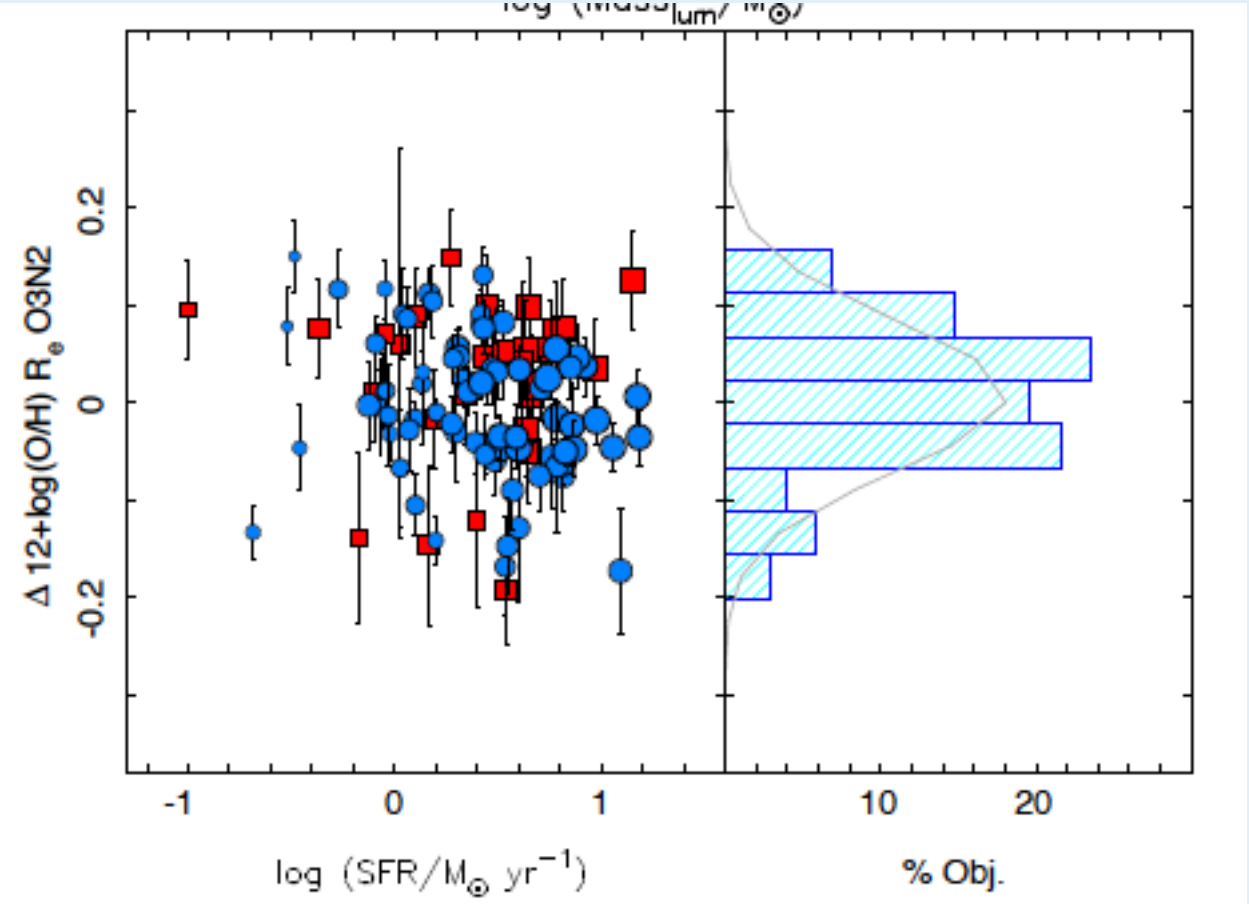
3) Try to reproduce the correlation O/H vs M_* from Sánchez +2014:
12+log(O/H)=a+b(x-c)exp(-(x.c))

- a=8.74 (0.01)
- b=0.018(0.007)
- c=3.5(0.3)

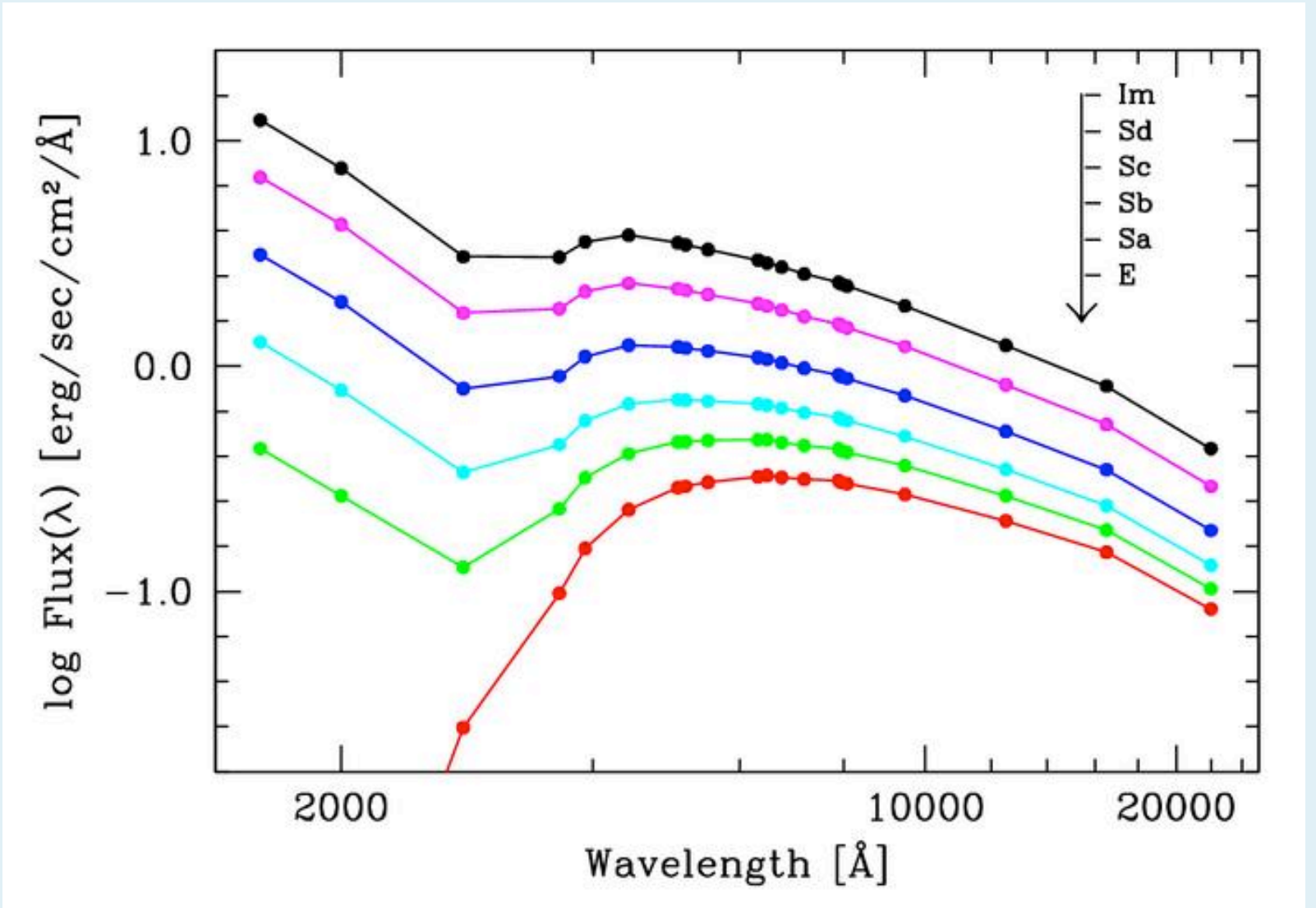


GH14-IFS techniques and analysis

4) Try to see if there is a correlation of O/H vs SFR (besides the one with $M_{*)}$



GH14-IFS techniques and analysis



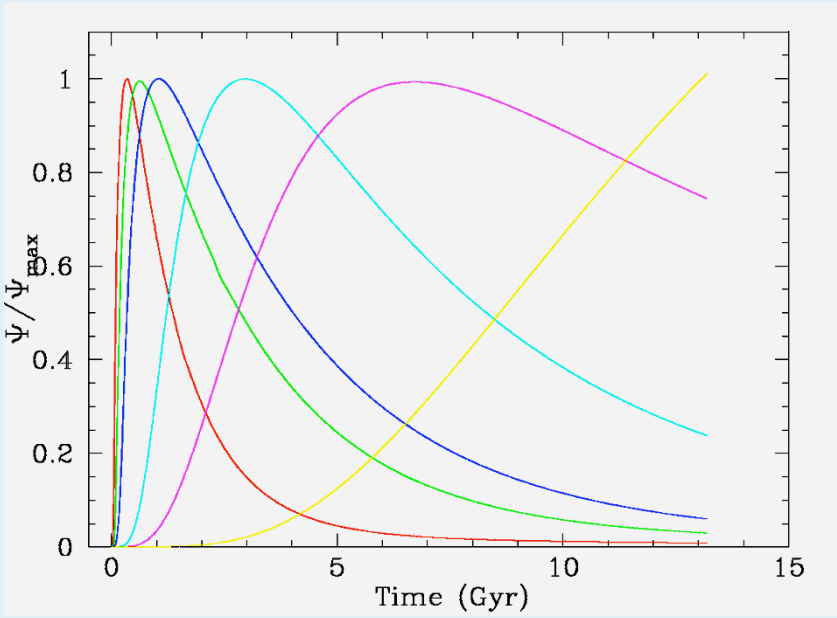
GH14-IFS techniques and analysis

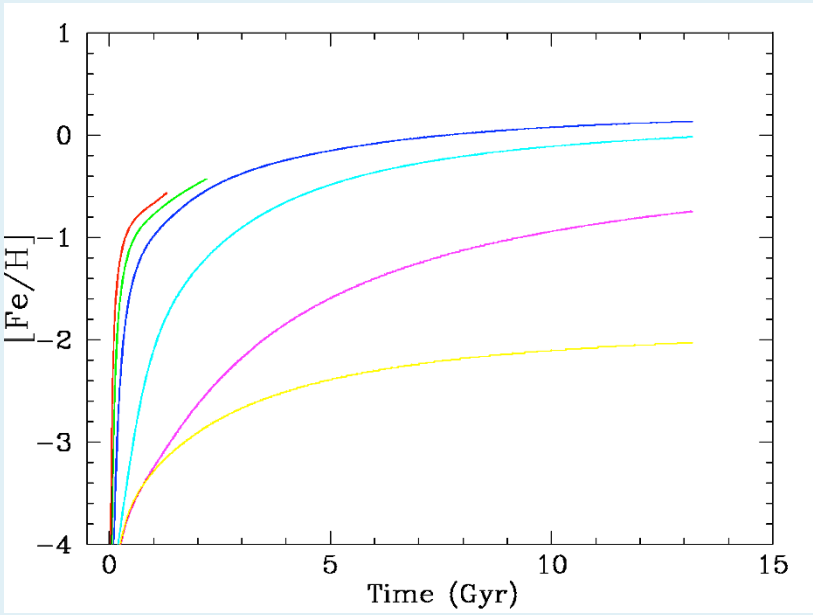
Spectro-photometrical models

- The shape of the SED proceeds from the star formation and metal enrichment histories
- We compute realistic SEDs with galaxy models using SFH and SMR, evolutionary histories
- By using the star formation history and the age-metallicity relations obtained in chemical evolution models, the spectral energy distribution (SED) Fλ(t) for each galaxy is calculated by the deconvolution equation:

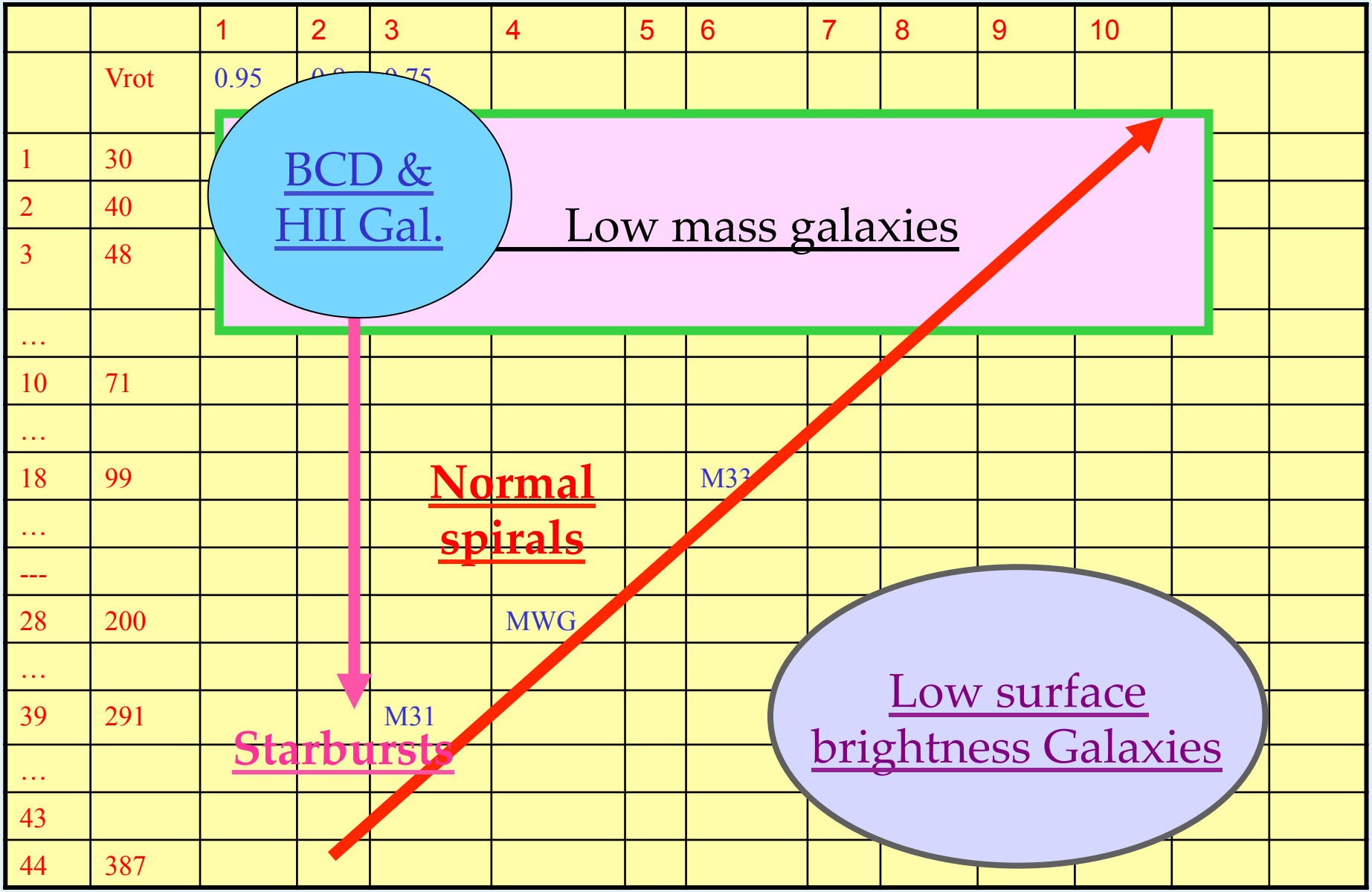
$$F_\lambda = \int S_\lambda(\tau, Z)\Psi(t-\tau)dt$$

To each stellar generation created in a time step, a SED of a SSP of a given τ and Z is assigned





Star formation and metal enrichment histories resulting from chemical evolution models for different galaxy masses and εs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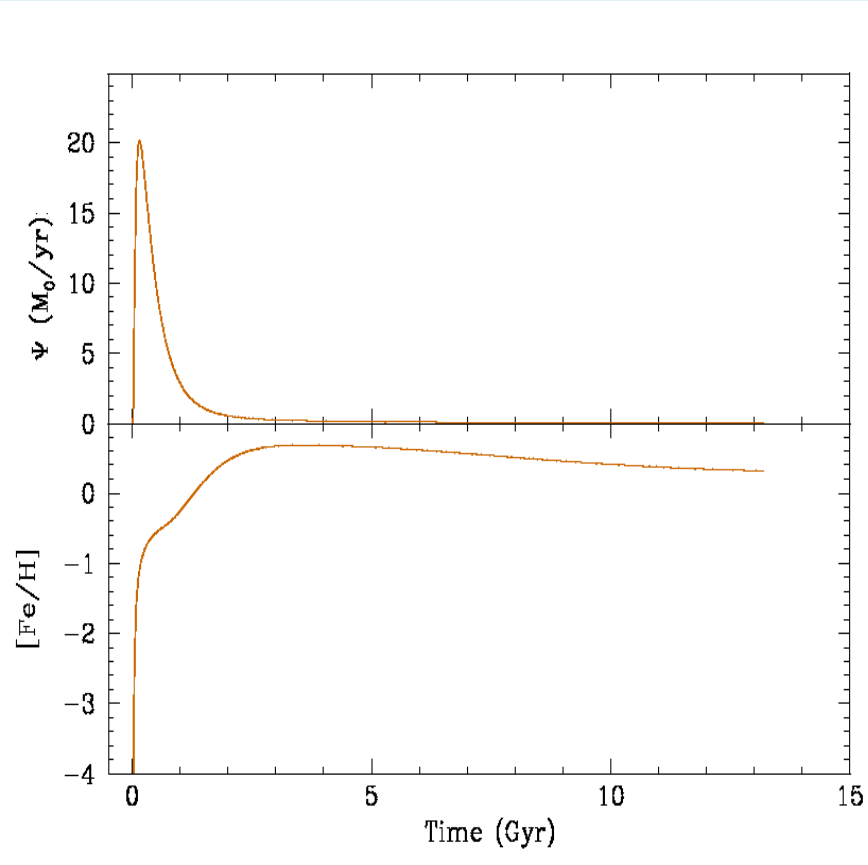
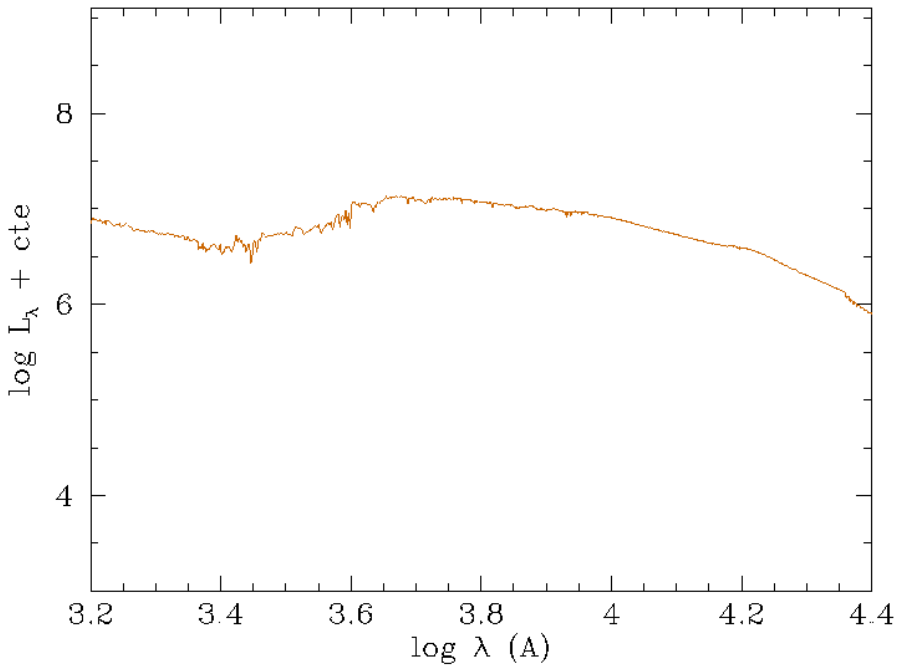
N=1 Vrot= 290 km/s



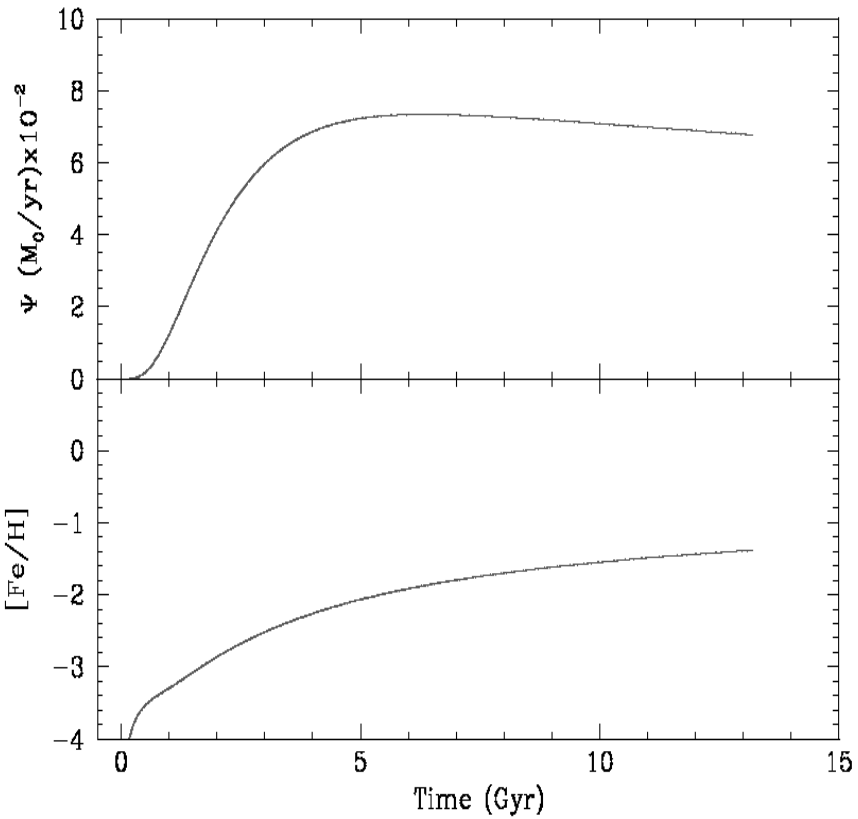
High metallicity [Fe/H] =0.2

SFH starburst ~20 Msun/yr

Mean age > 12 Gyr



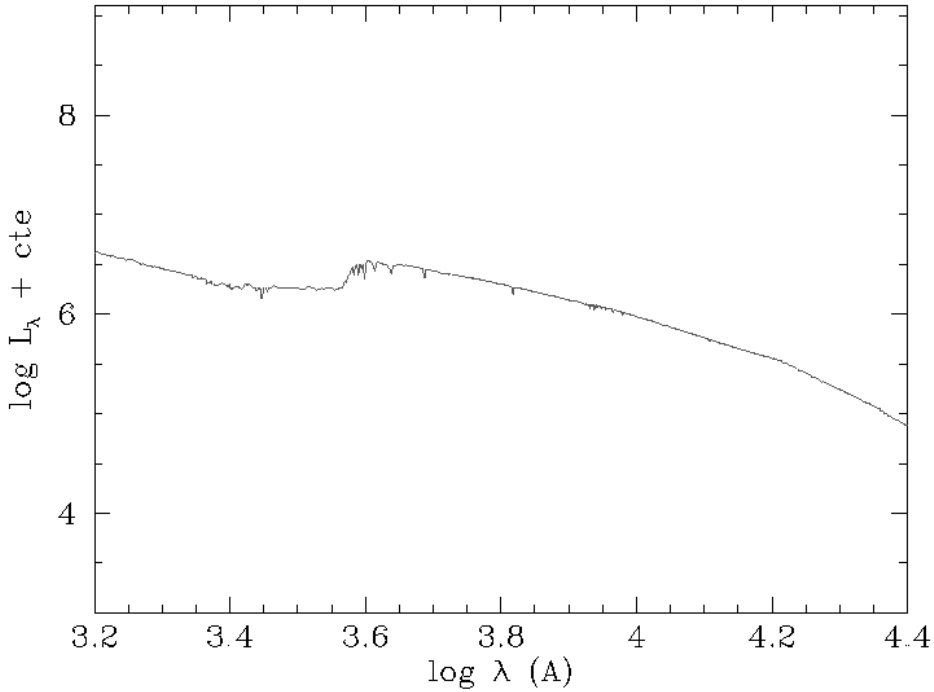
N=10 Vrot= 290 km/s



Low metallicity [Fe/H] =-1.4

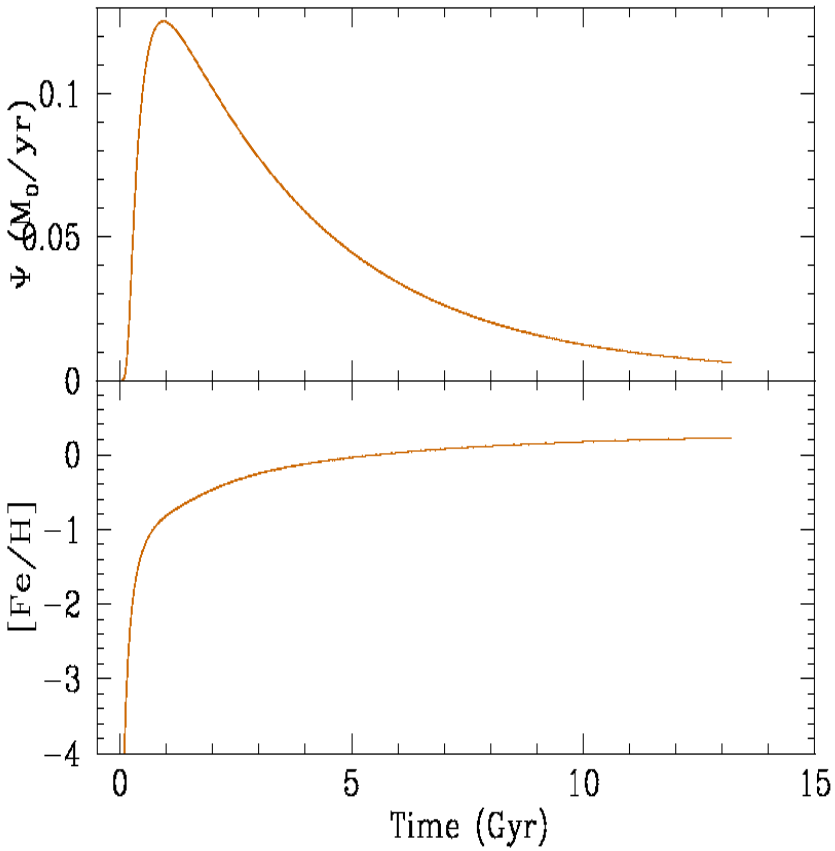
SFH almost constant ~0.08 Msun/yr

Mean age < 8 Gyr



GH14-IFS techniques and analysis

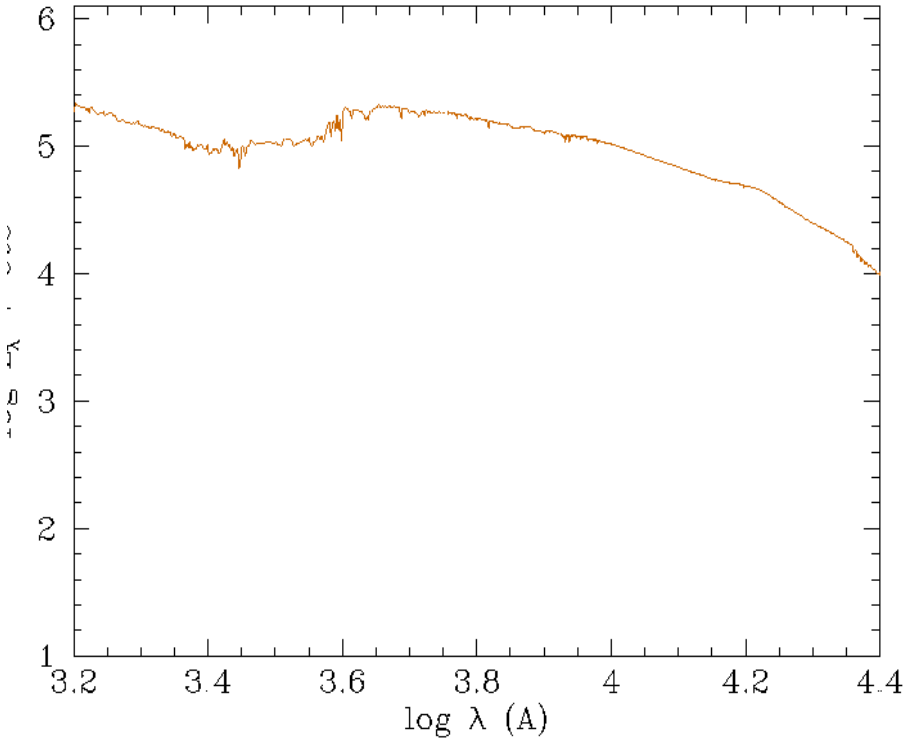
N=1 Vrot= 70 km/s



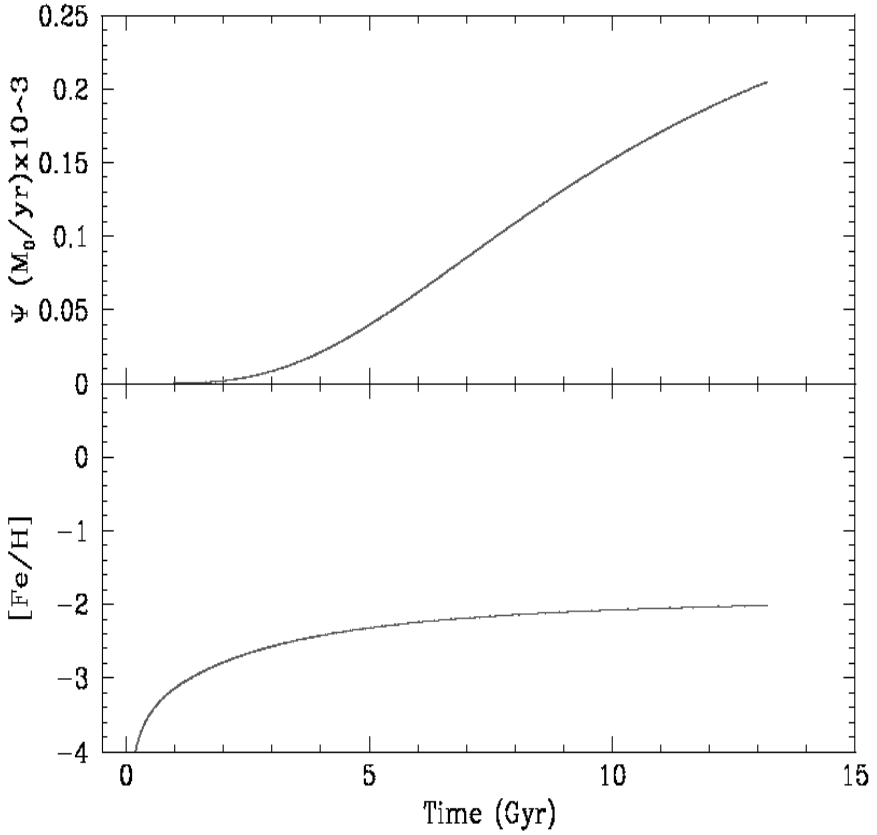
High metallicity [Fe/H] =0.2

SFH max ~0.1 Msun/yr

Mean age > 12 Gyr



N=10 Vrot= 70 km/s

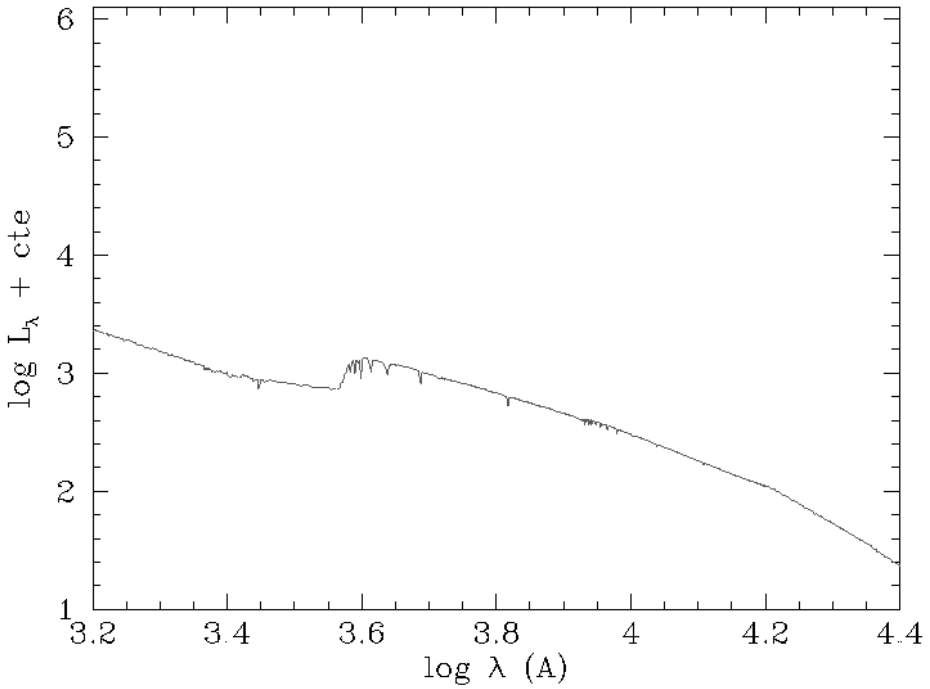


Vey low metallicity [Fe/H] =-2.0

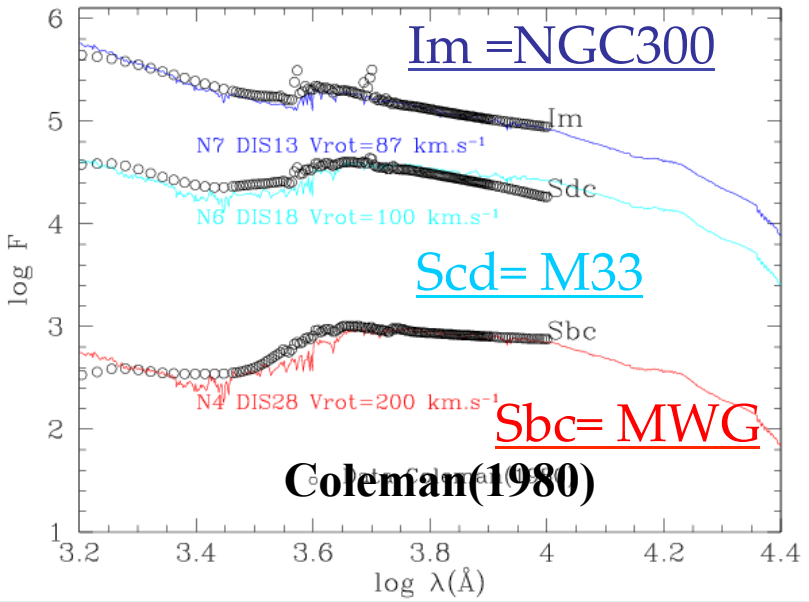
SFH increasing

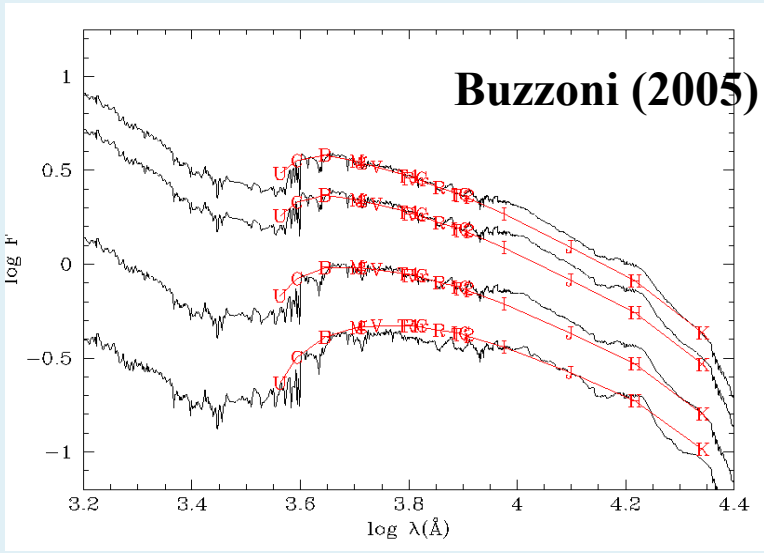
~2 10^{-4} Msun/yr

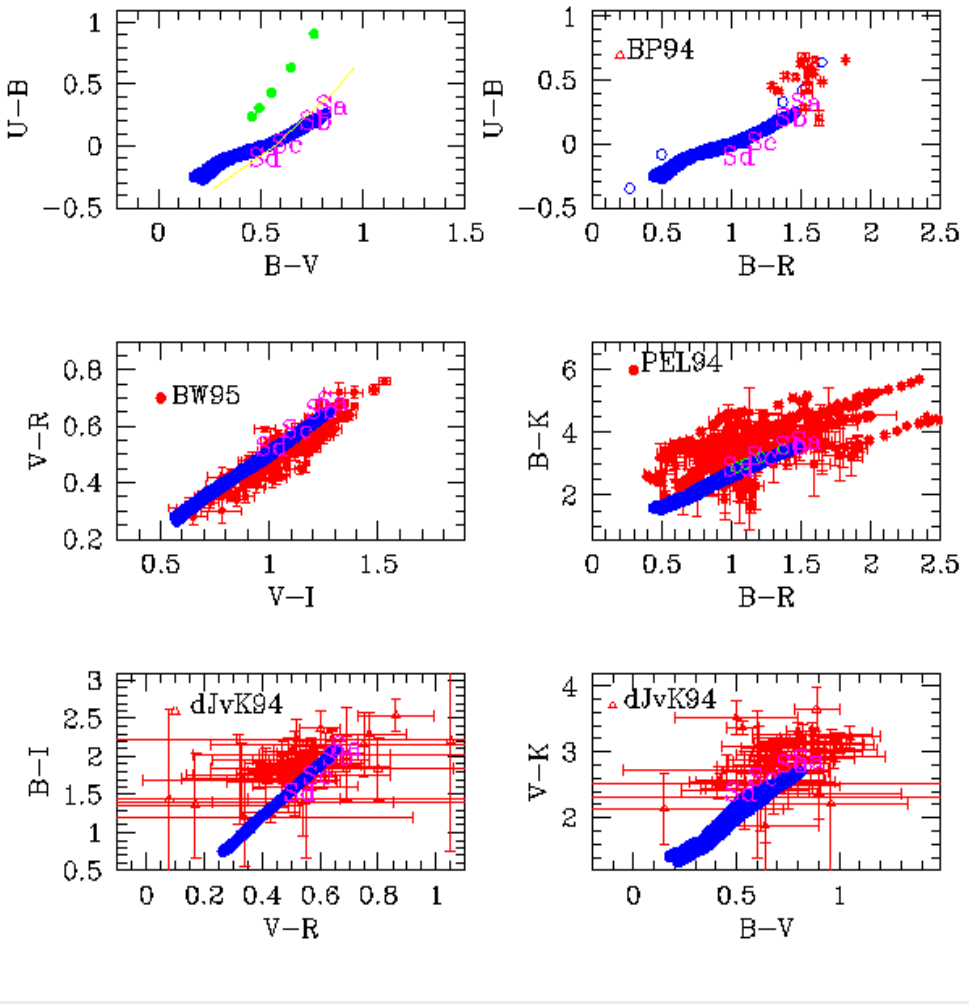
Mean age ~2 Gyr



SEDs and colors for some galaxy models:







Spectral energy distribution observed in some compact blue galaxies