ALFALFA Follow-Up: Nebular Abundances

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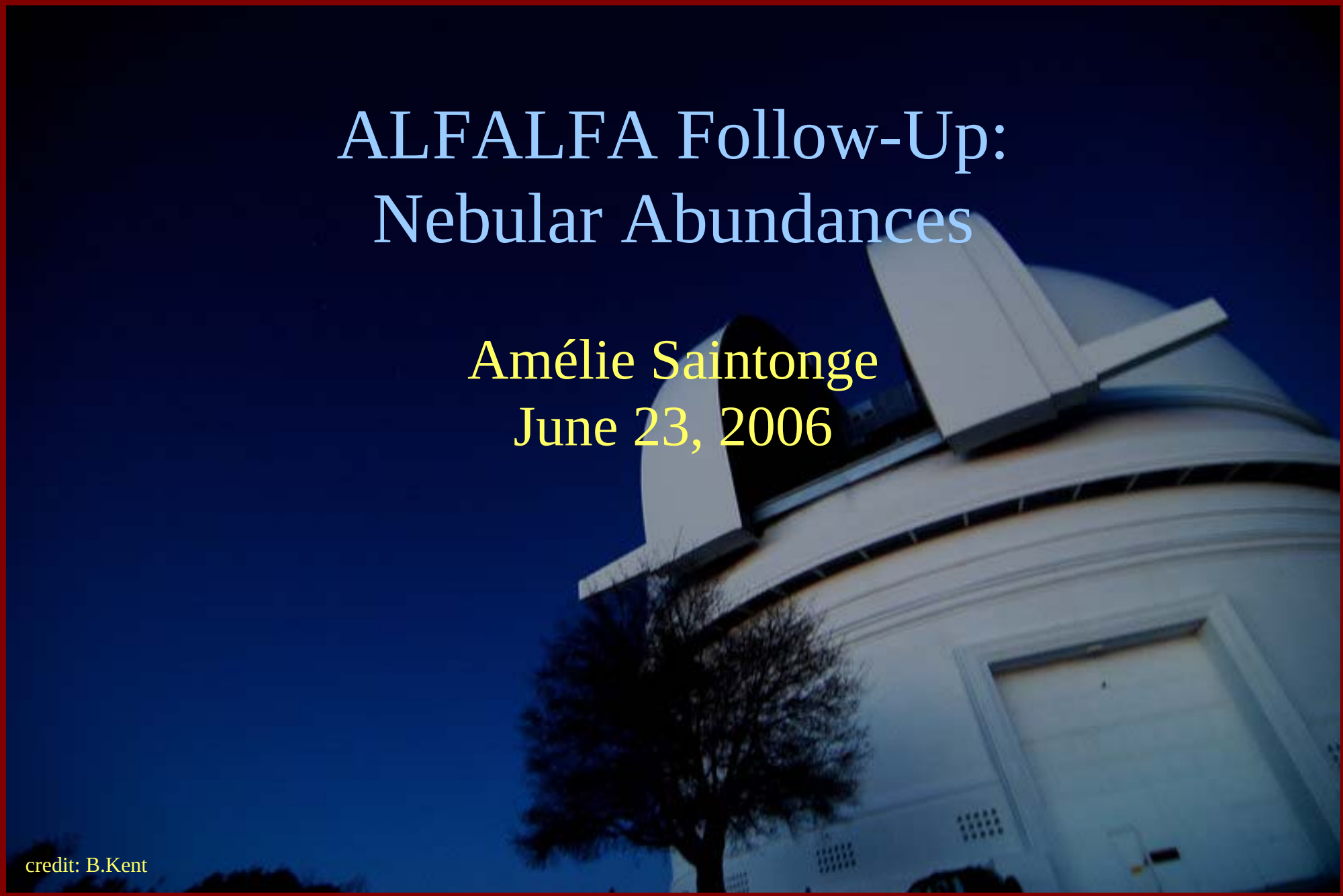
June 23, 2006

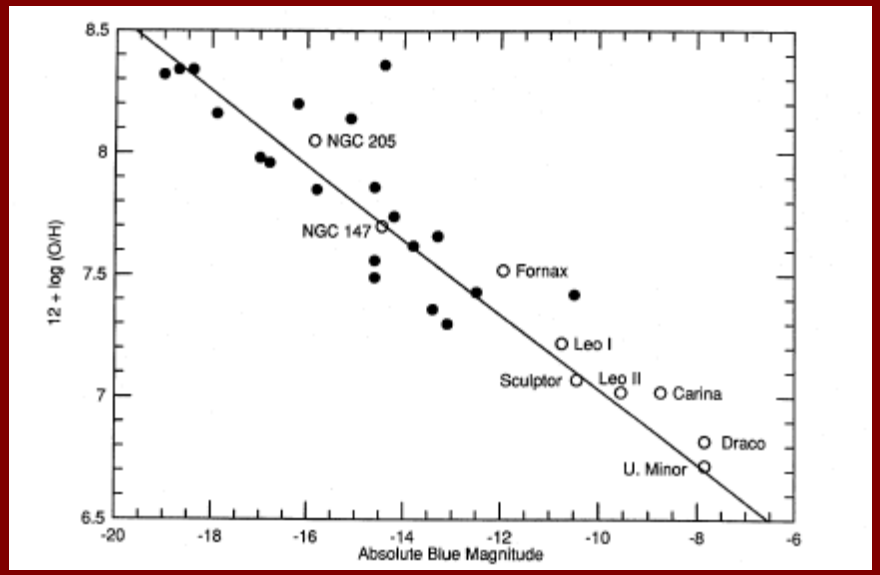


credit: B.Kent

Context – Dwarf galaxies

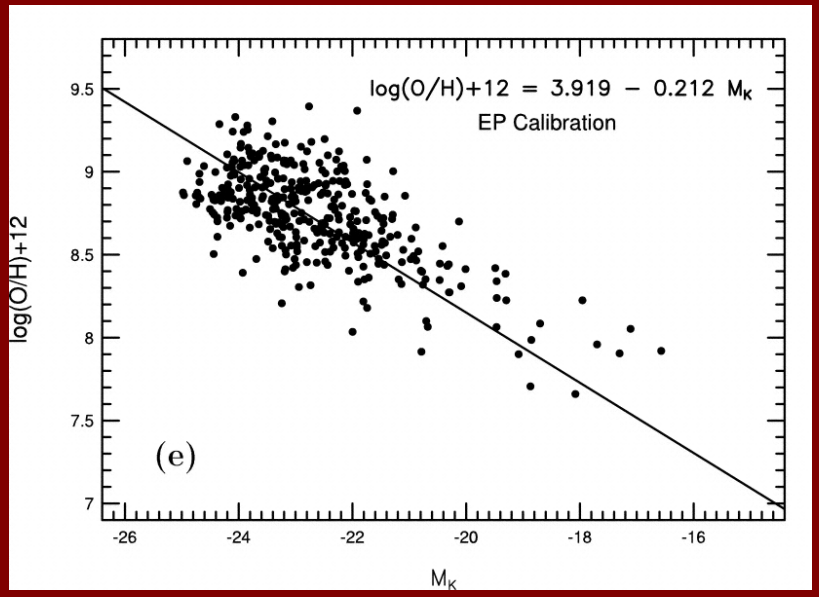
- Relation between the mass and metallicity

Optical Z-L relation



Skillman et al. (1989)

NIR Z-L relation



Salzer et al. (2005)

Context – Dwarf galaxies

- Have the gas-rich dwarf galaxies been inefficient at forming stars?
  - gas surface density is too low?
  - no star formation triggers?
  - still in the process of collapsing?
- Have they formed stars but remained metal-poor?
  - lost metals?
  - different IMFs?
  - metals “diluted”?

Context – Dwarf galaxies

heavy elements abundance ~ age of stellar population

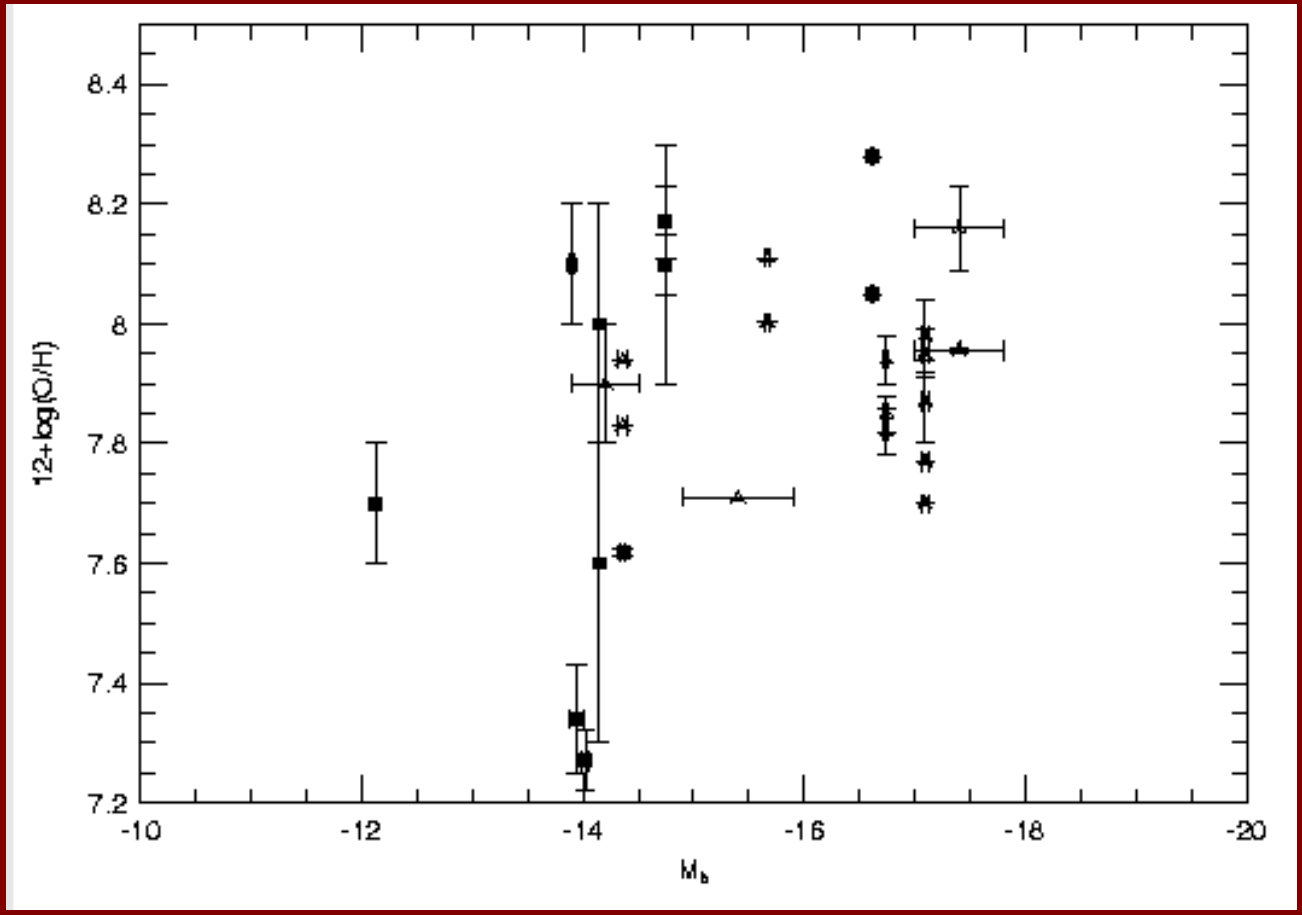
→ nearby, metal-poor systems ~ “young” galaxies

Gas rich, metal poor dwarf galaxies may reproduce
the conditions found in normal present-day systems
at earlier epochs.

Context – Dwarfs and their environments

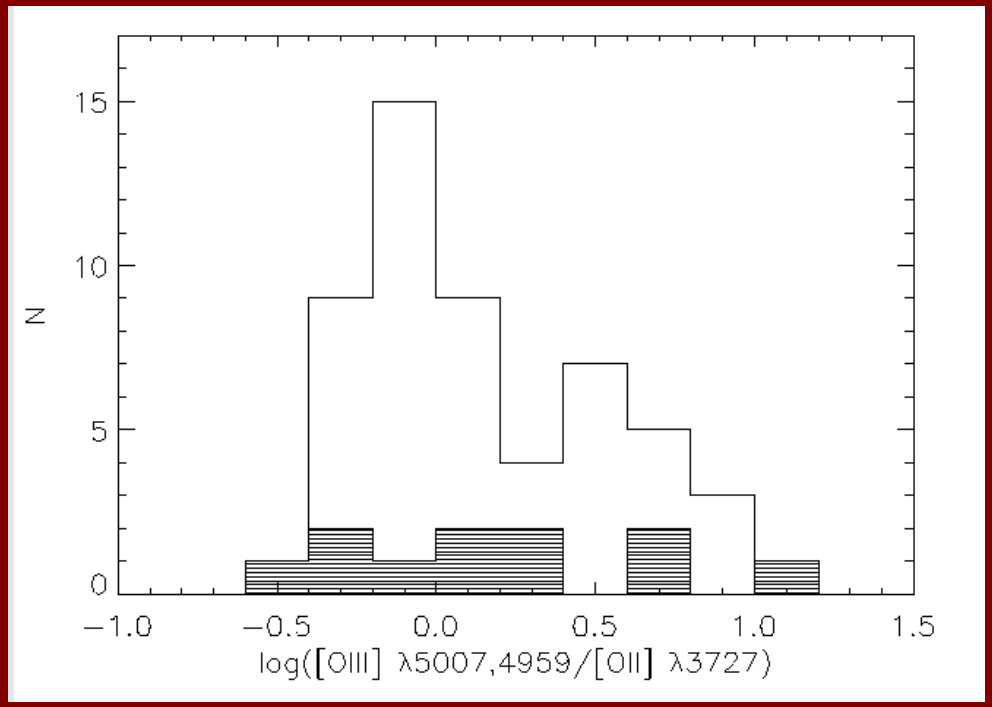
- Dwarfs may trace primordial gas composition
  - Intra cluster medium (ICM): $Z \sim 1/3 Z_{\odot}$
  - Galaxies? Population III stars?
  - dwarfs in all environments
  - slow evolution pristine gas
  - difference with environment?

Context – Dwarfs and their environments

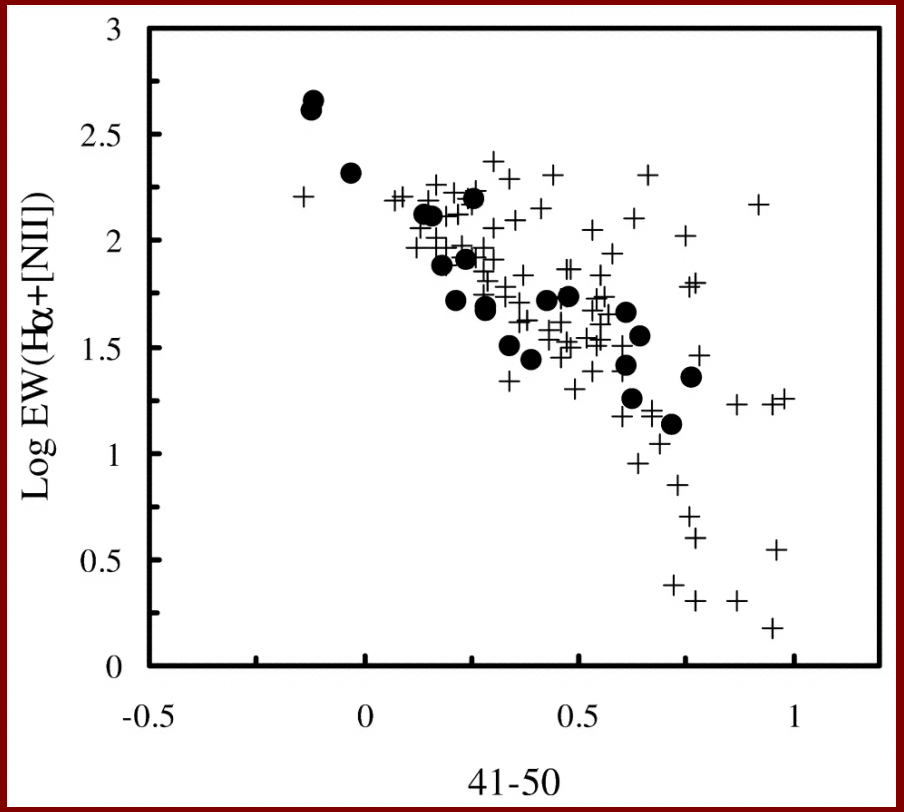


Hidalgo-Gamez & Olofsson (1998)

Context – Dwarfs and their environments



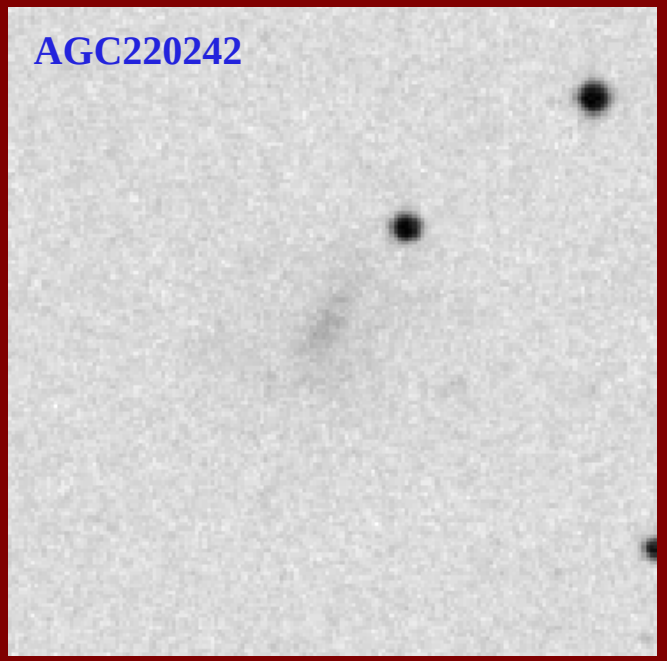
Popescu et al. (1999)

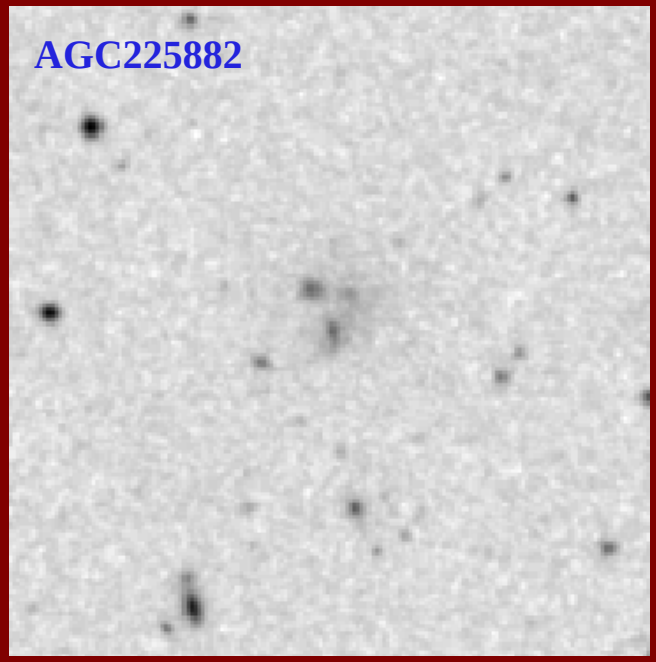


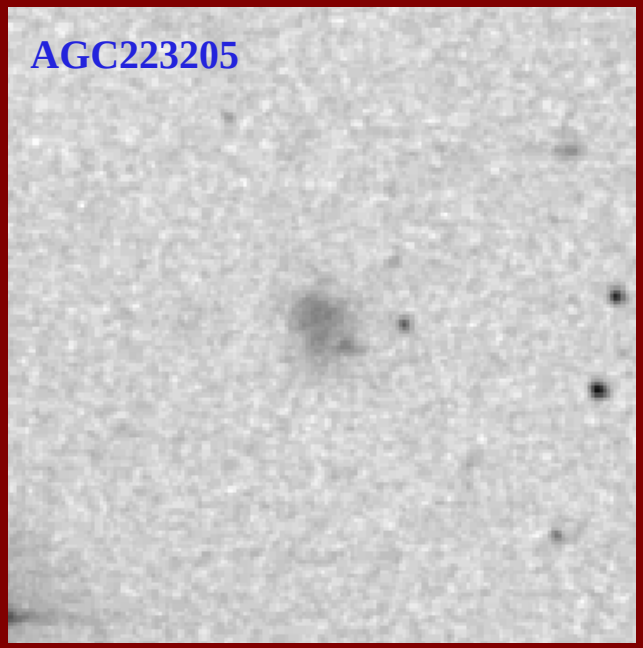
Cruzen et al. (2002)

Selection of targets from ALFALFA

- Sample: low mass galaxies in various environments
  - w, $cz \rightarrow M_{HI}$
  - PSCz $\rightarrow \rho$

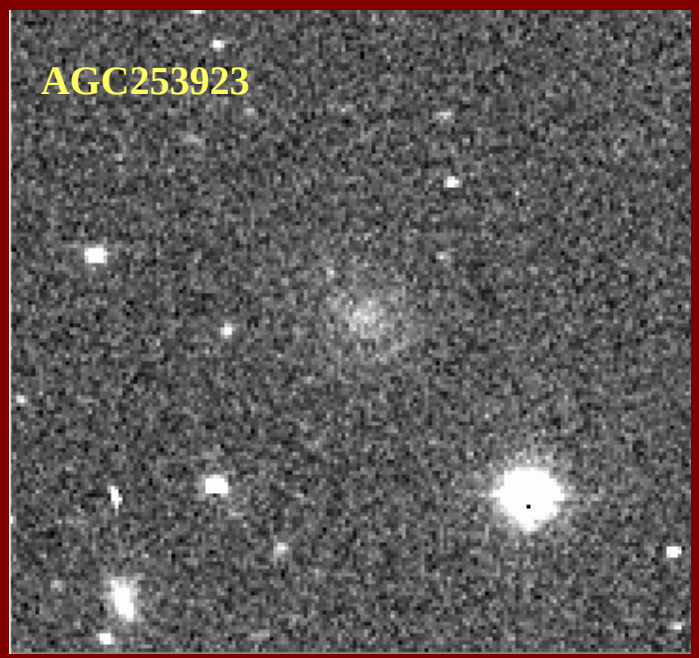


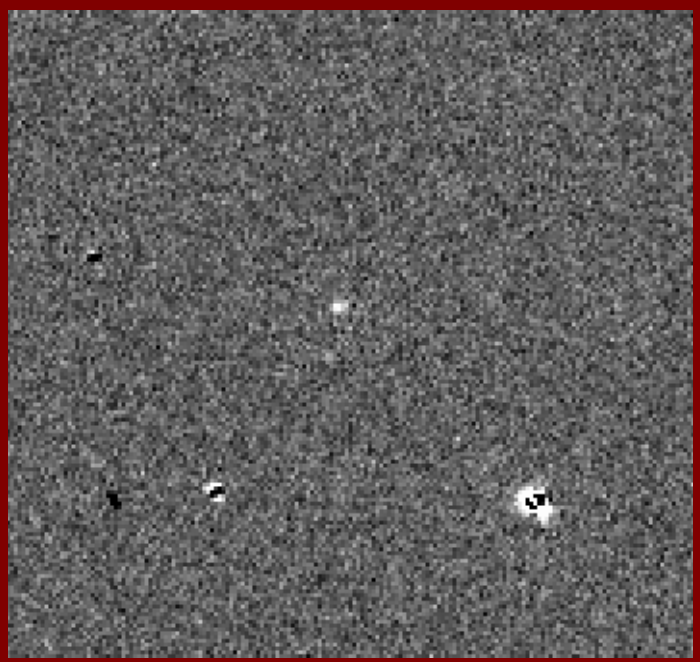




Coordination of Observations

- Spectroscopy requires significant preliminary work!
- Process:
  - identify candidates from ALFALFA
  - Hα imaging (N.Brosch, J.Salzer, G.Gavazzi)

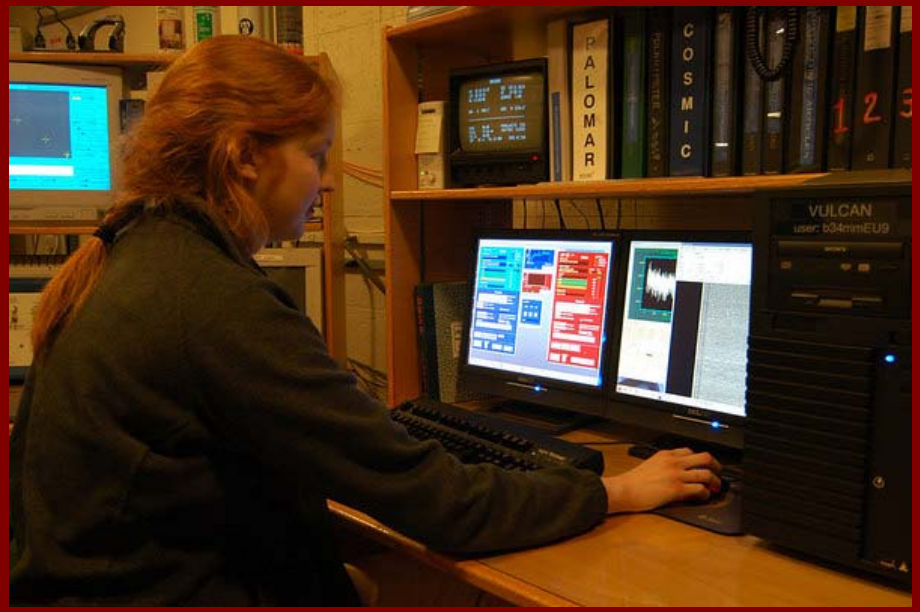




Hα image: WIYN 0.9m, J.Salzer

Observations Overview

- Mount Palomar's Hale 5m with DBSP
  - spectral range: 3000-7600 A
  - 2” slit, 1-2.5 A/pix resolution
- 8 nights (5 photometric) + 3 (Nov.2006)

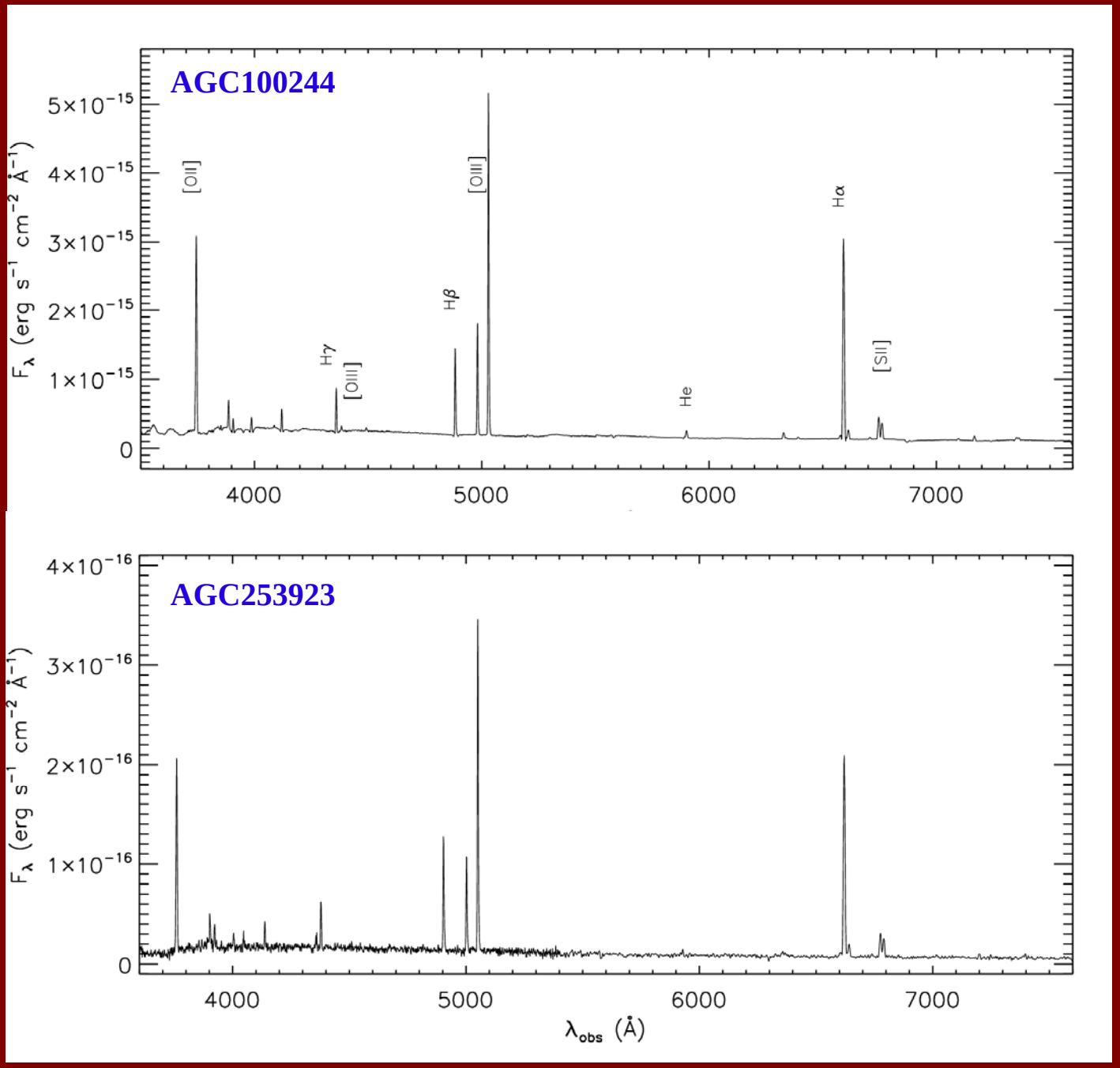


credit: B.Kent

Summary of Observations

AGC #	Other Name	*cz*	*w*	dens	t (s)	run
10351		892	67	-0.32	4800	aug05
320926	ADBS2255+2610	2643	55	-0.77	7200	aug05
100244		1383	105	0.28	3600	aug05
110482		359	38	0.54	7200	aug05
112521		280	31	0.54	12000	aug05
10281	KKR23	1089	119	-0.62	5400	aug05
12122	ADBS2237+2347	1339	328	-0.35	7200	aug05
122212		985	26	0.11	9600	aug05
3755	ADBS0713+1031	316	40	0.54	3600	jan06
180167	ADBS0817+2110	2156	172	-0.4	3600	jan06
202042	ADBS1003+1105	3299	72	1.1	7200	jan06
212064	ADBS1131+2530	2868	154	-0.04	3600	jan06
221245	ADBS1258+1308	1900	59	1.37	4800	jan06
122206	KDG17	1596	73	-0.11	6000	jan06
3775	ADBS0715+1207	2135	91	-0.32	3600	jan06
181491	ADBS0815+2107	4165	141	-0.68	2500	jan06
225882		1304	24	5.23	6000	apr06
220478	VCC618	1890	40	1.75	7200	apr06
253923		2647	21	-0.54	7200	apr06
210023		778	52	2.27	3600	apr06
220242	VCC132	2085	30	1.09	7200	apr06
223205		1785	40	3.27	7200	apr06

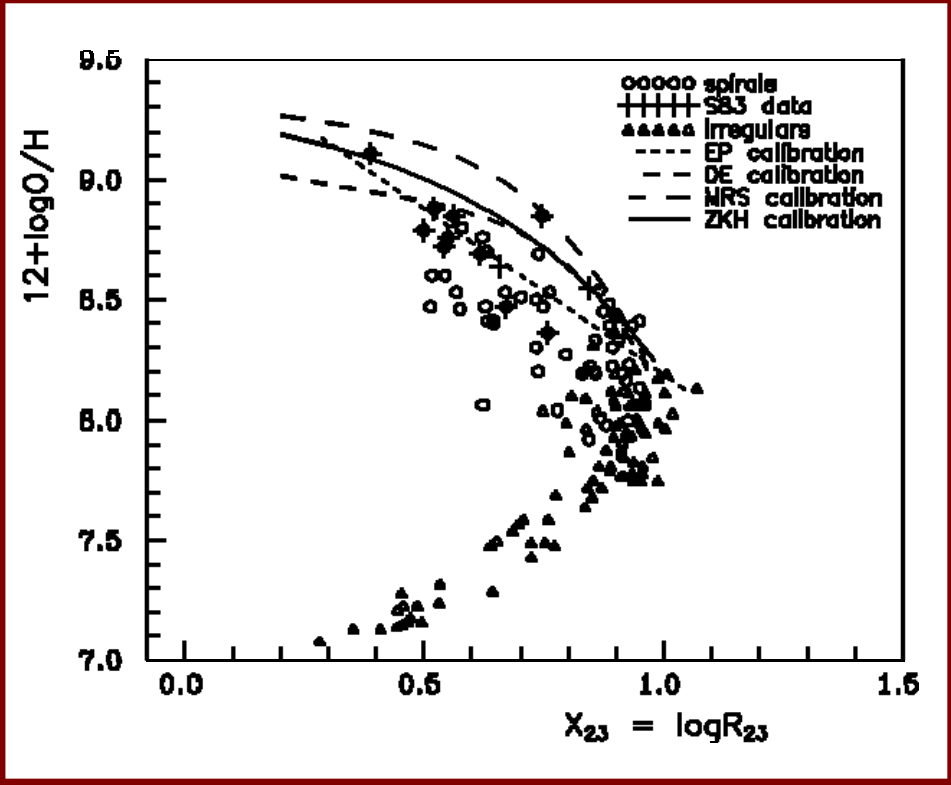
Examples


AGC100244
[OII]
Hγ
[OIII]
Hβ
[OIII]
He
Hα
[SII]
F_λ (erg s^{-1} cm^{-2} Å^{-1})
5×10^{-15}
4×10^{-15}
3×10^{-15}
2×10^{-15}
1×10^{-15}
0
4000
5000
6000
7000
AGC253923
4×10^{-16}
3×10^{-16}
2×10^{-16}
1×10^{-16}
0
λ_{obs} (Å)

Calculating Abundances

- [OIII]4363 detected for ~1/2 of the galaxies
- First look: strong lines method

$$R_{23}=\frac{f([OIII]\ \ 4959,5007)+f([OII]\ \ 3727,3729)}{f(H\beta)}$$



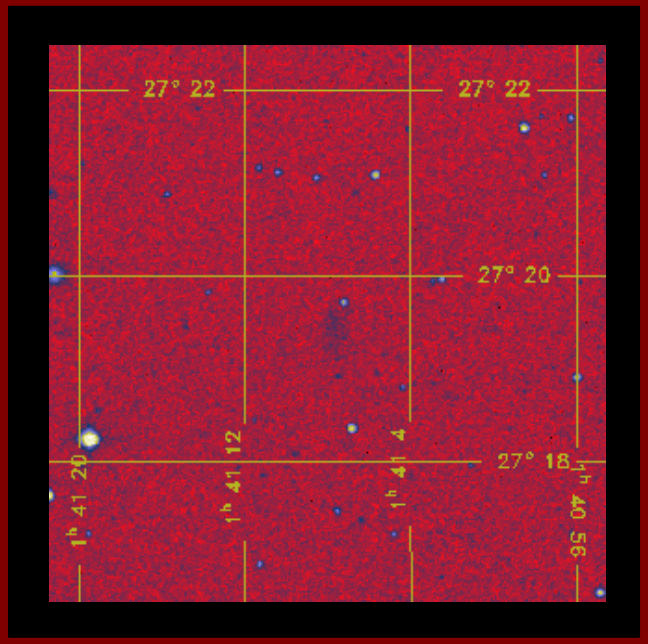
Pilyugin (2000)

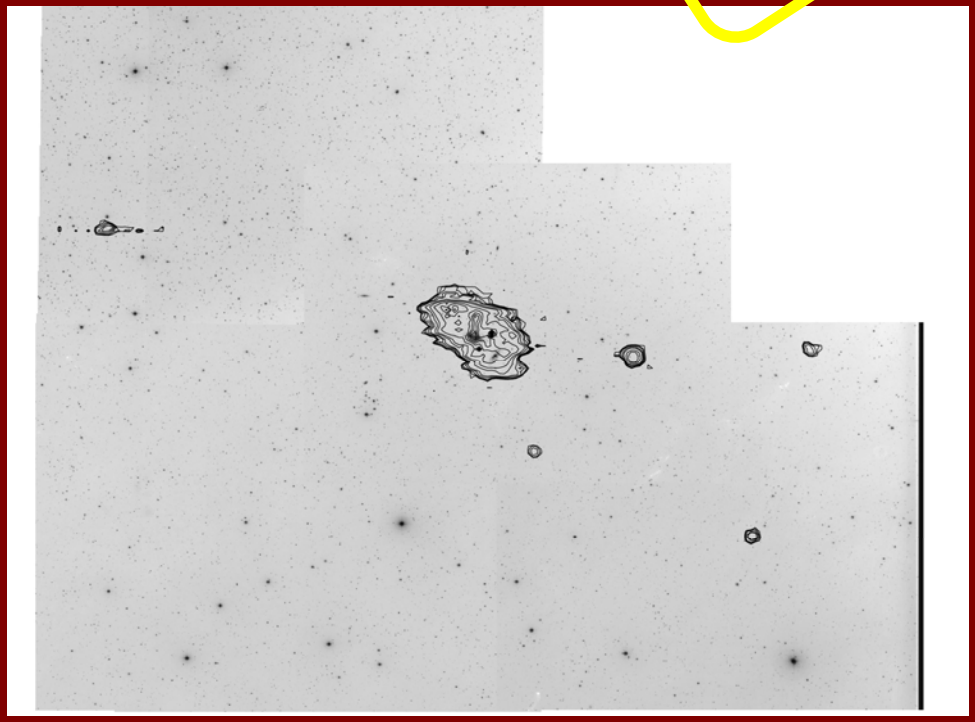
Summary of Observations

AGC #	Other Name	*cz*	*w*	dens	log(O/H)+12
320926	ADBS2255+2610	2643	55	-0.77	7.89
181491	ADBS0815+2107	4165	141	-0.68	8.1
10281	KKR23	1089	119	-0.62	
253923		2647	21	-0.54	7.76
180167	ADBS0817+2110	2156	172	-0.4	7.79
12122	ADBS2237+2347	1339	328	-0.35	
3775	ADBS0715+1207	2135	91	-0.32	7.88
10351		892	67	-0.32	8.19
122206	KDG17	1596	73	-0.11	7.76
212064	ADBS1131+2530	2868	154	-0.04	
122212		985	26	0.11	
100244		1383	105	0.28	7.94
110482		359	38	0.54	
3755	ADBS0713+1031	316	40	0.54	7.87
112521		280	31	0.54	7.35
220242	VCC132	2085	30	1.09	7.64
202042	ADBS1003+1105	3299	72	1.1	7.83
221245	ADBS1258+1308	1900	59	1.37	
220478	VCC618	1890	40	1.75	7.82
210023		778	52	2.27	7.94
223205		1785	40	3.27	7.97
225882		1304	24	5.23	7.77

A very metal-poor galaxy?

- AGC112521 (HI014105.8+272007)
- log(O/H)+12=7.35 → Z ~ 1/40 Z





CAUTION
WORK IN
PROGRESS