IfA Extragalactic Sampler

Fabio Bresolin
Institute for Astronomy
University of Hawaii

A QSO host galaxy and its Lyα emission at z=6.43

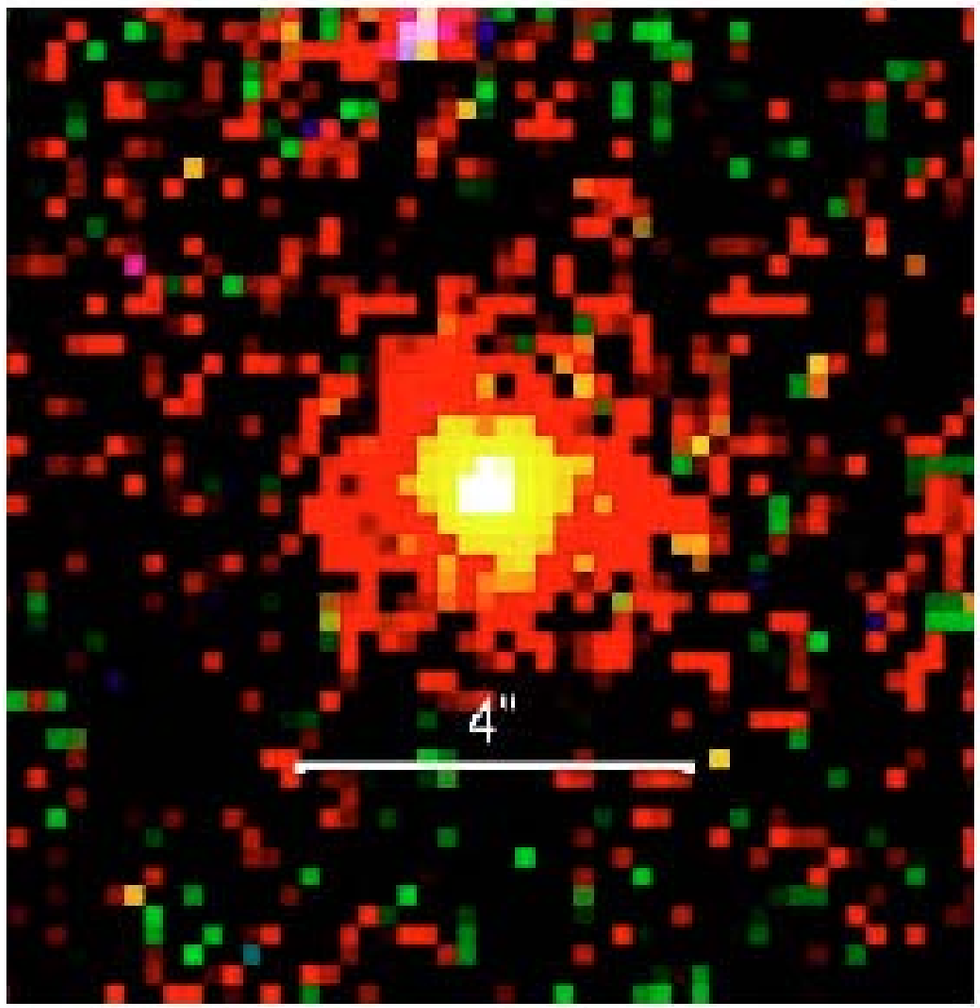


Figure 2. Composite pseudo-color image. The RGB colors are assigned to z', z_P and i'-bands, respectively.

Goto et al., 2009, MNRAS,400,843

Host properties

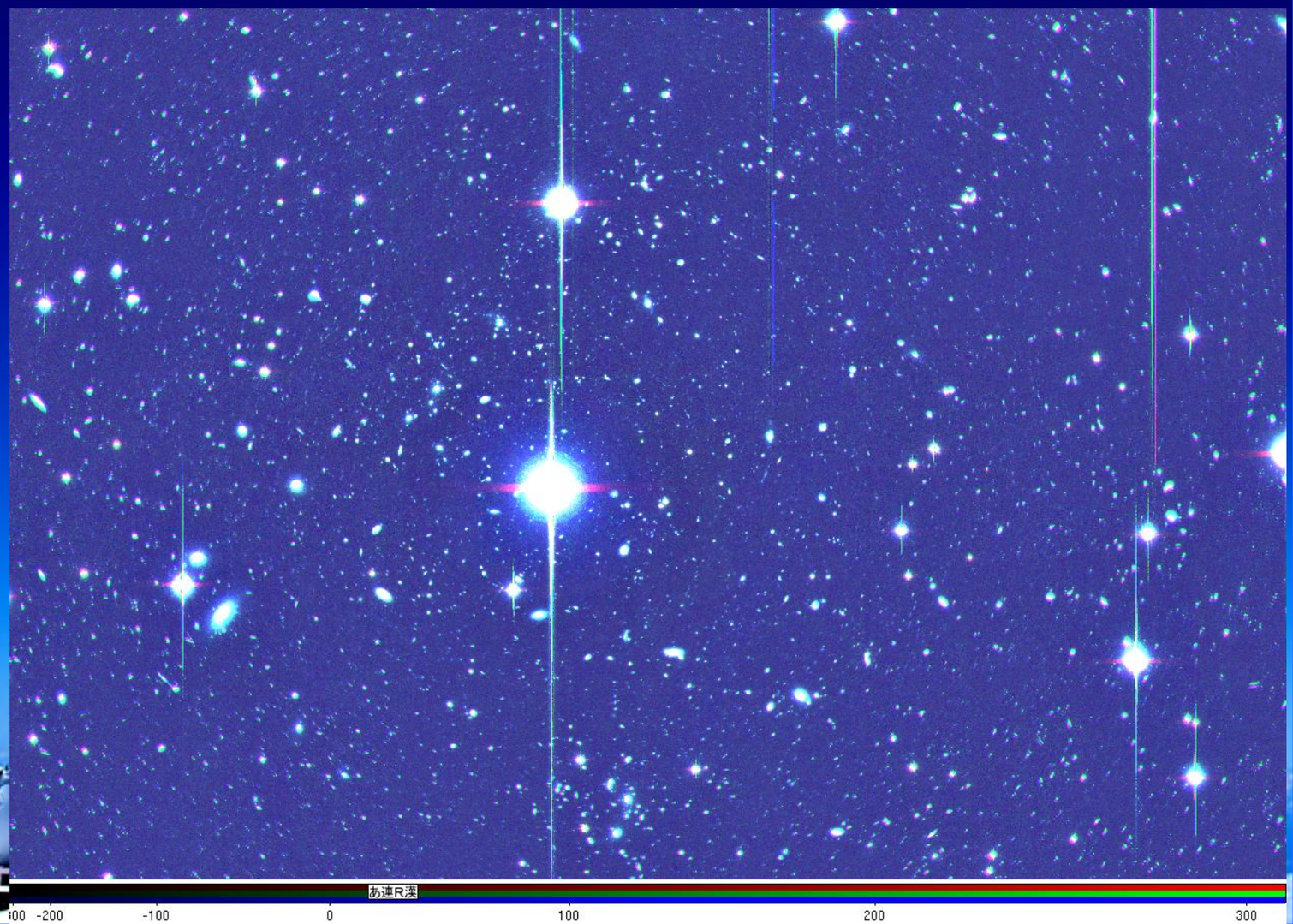
- M_{1450A}=−23.9
- Re>11kpc
- SFR(Lya)>1.6 M_{sun}/yr
- $6x10^{8}$–10^{10} M_{sun}

Tomo GOTO

(Institute for astronomy, University of Hawaii)

Observation: Subaru S-Cam(30x30')
CFHQSOJ2329 z=6.43 (most distant QSO known)

- Limiting magnitude
  - I':26.73
  - Z':25.79
  - Y:25.09
- PSF ∽0.5"



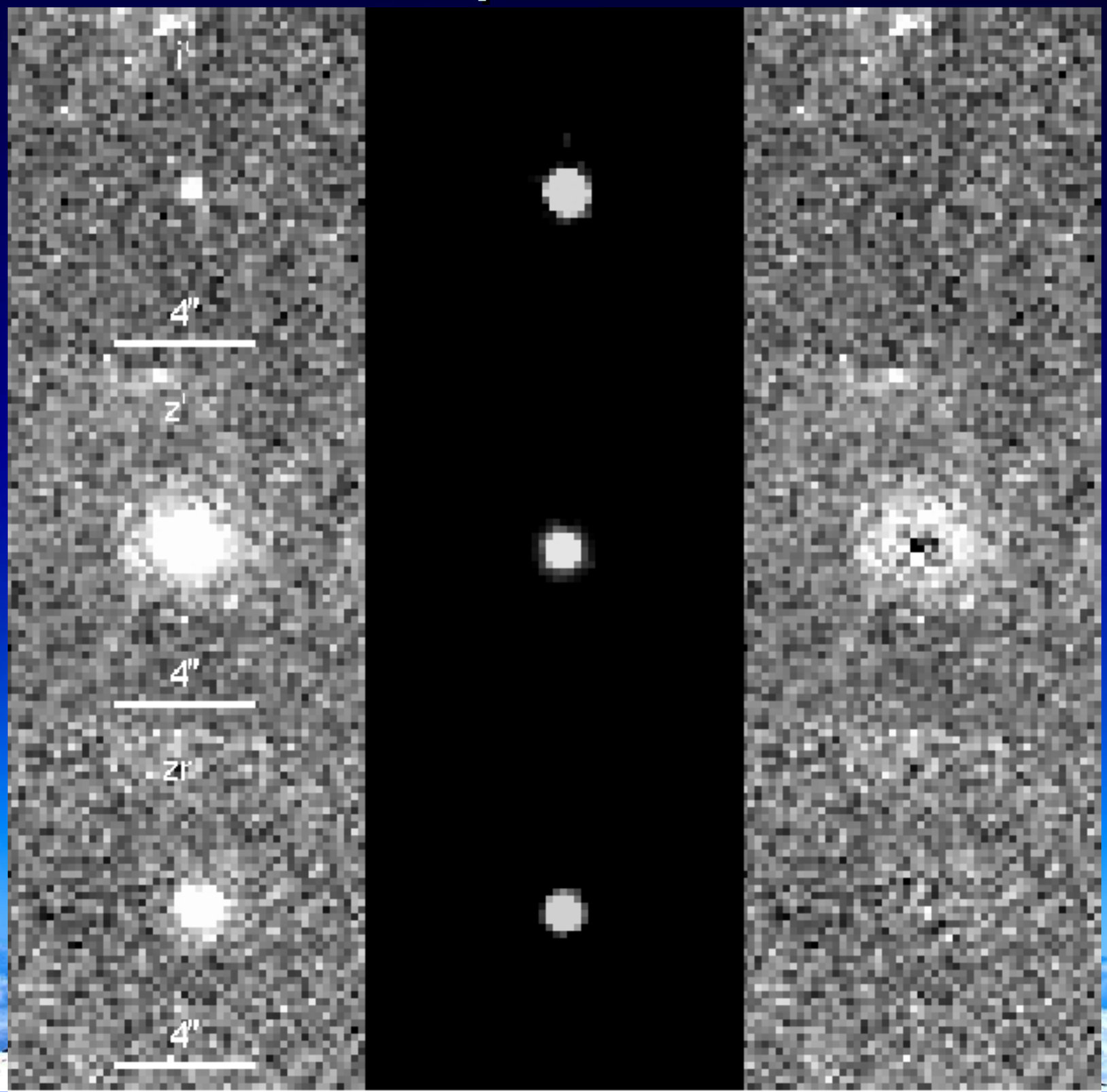
PSF subtraction

psf residual

i’

z’

y



Tomo GOTO

Y-band residual: 3 sigma

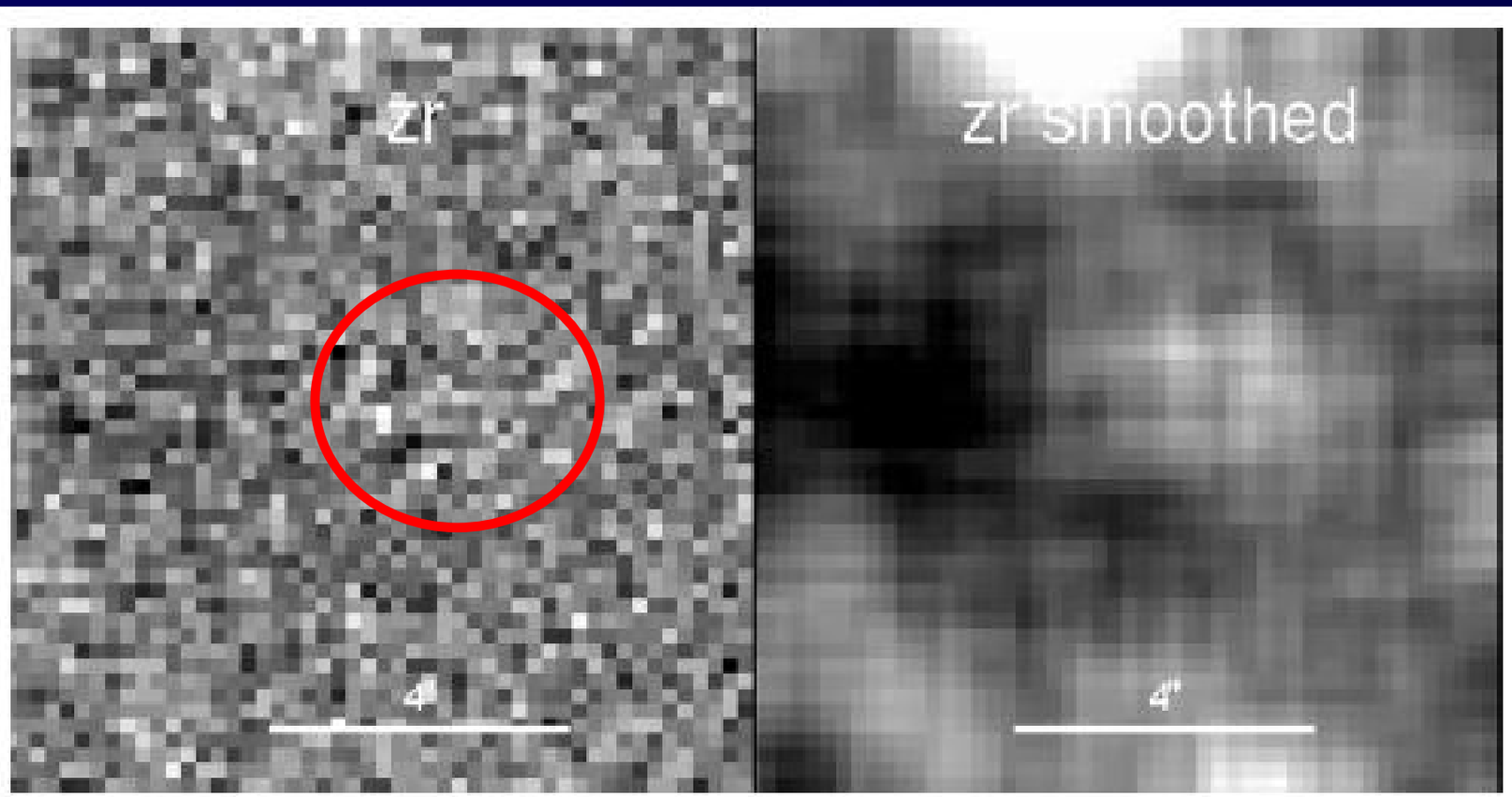


Figure 4. Both panels show residuals from the PSF subtraction in the z_r band. The right-hand panel is box-car smoothed with 10 pixel. The figures are north up, east left.

Radial profile

z’ y

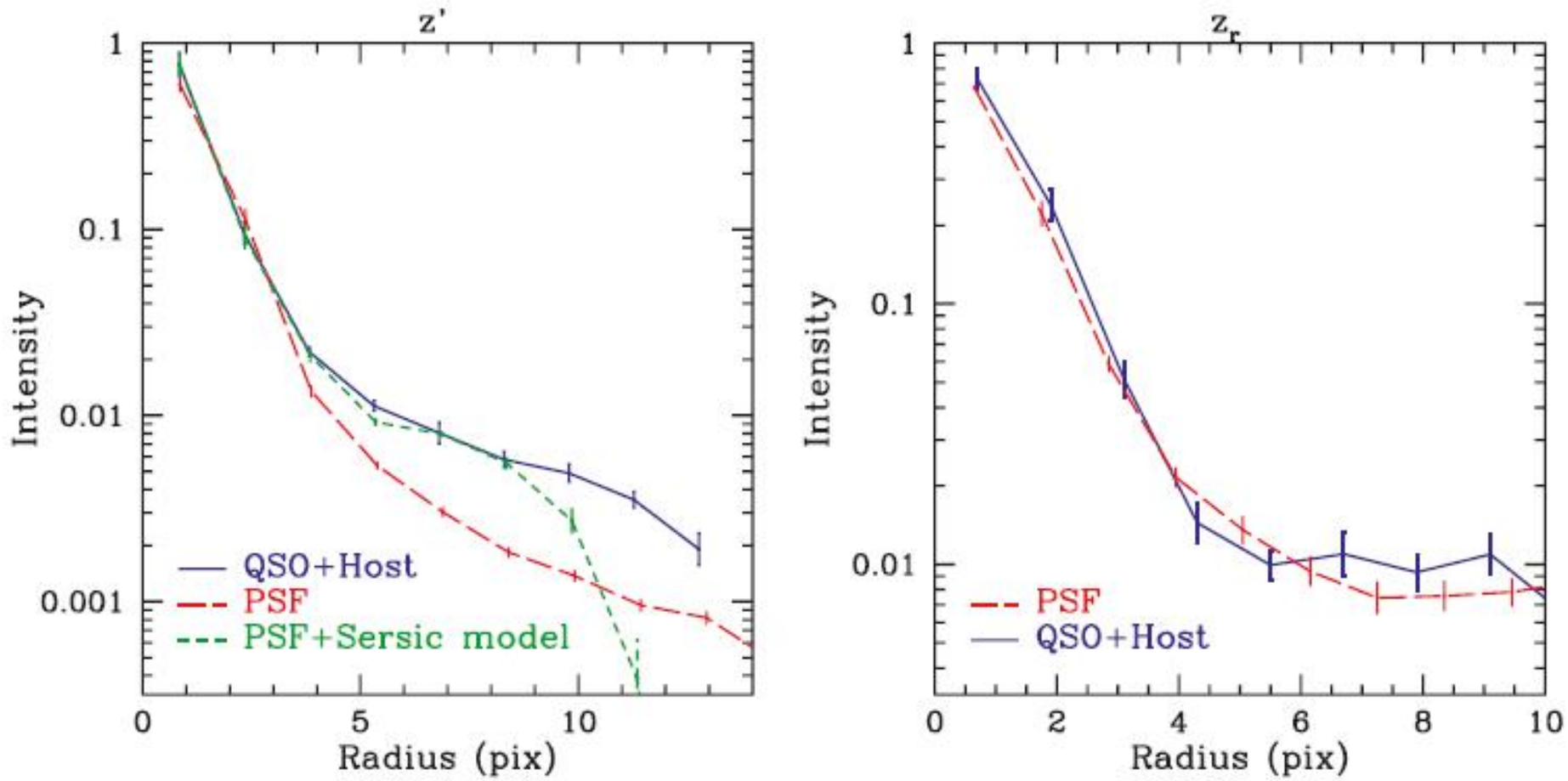


Figure 3. Radial profiles of QSO+host (blue solid line), the constructed PSF (red dashed line) and the PSF+Sérsic model (green short-dashed line) in the z' band (left). The right-hand panel is for the z_r band. Profiles are normalized at a maximum value. The pixel scale is 0.2 arcsec pixel^{-1}.

SED

Table 3. Magnitudes and results of the fit.

Object	i'_{AB}	z'_{AB}	z_{rAB}
QSO+host	25.54 ± 0.02	21.165 ± 0.003	21.683 ± 0.007
Host	>25.34 (1σ limit)	23.5 ± 0.3 (16σ)	24.3 ± 0.2 (3σ)
1σ sky	25.44 (26 pixel diameter)	24.90 (26 pixel diameter)	25.46 (18 pixel diameter)

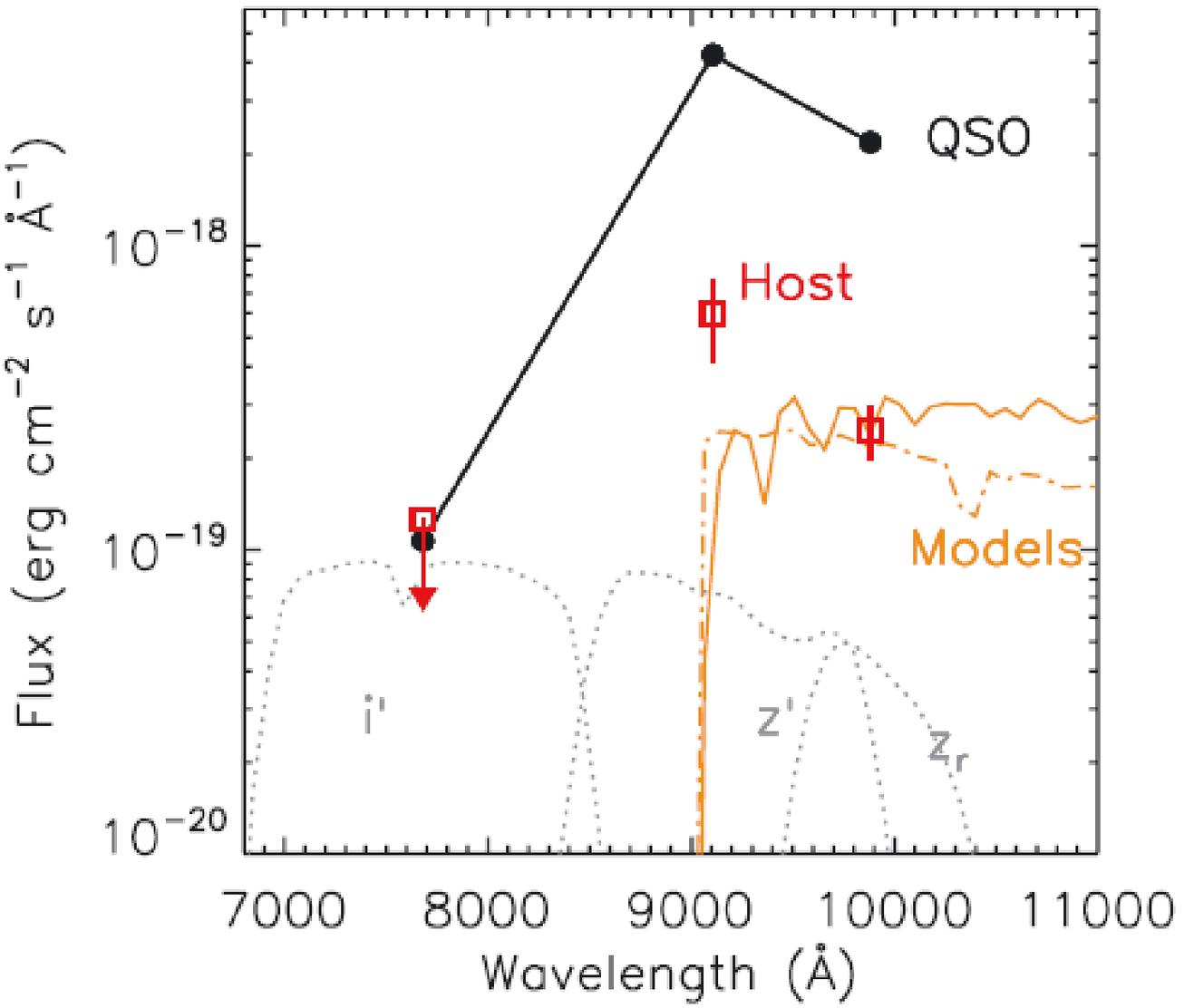


Figure 5. SEDs of QSO and its host galaxy. Overplotted are SED models of constant SFR and delta starburst with 100 Myr of age. The host is not detected in i' band, where 1σ upper limit is shown.

- 40% of z' light is from host (continuum)
- 60% is from Ly α emission

→ Host properties

→ $M_{1450A} = -23.9$

→ Re > 11kpc

→ SFR(Lya) > 1.6 M_{sun}/yr

→ $6 \times 10^8 - 10^{10}$ M_{sun}

Tomo GOTO

Summary

- Using red-sensitive CCDs on Subaru, we found
  - Most distant extended structure (host galaxy + Lya emission) around QSO (Re>11kpc) at z=6.43.

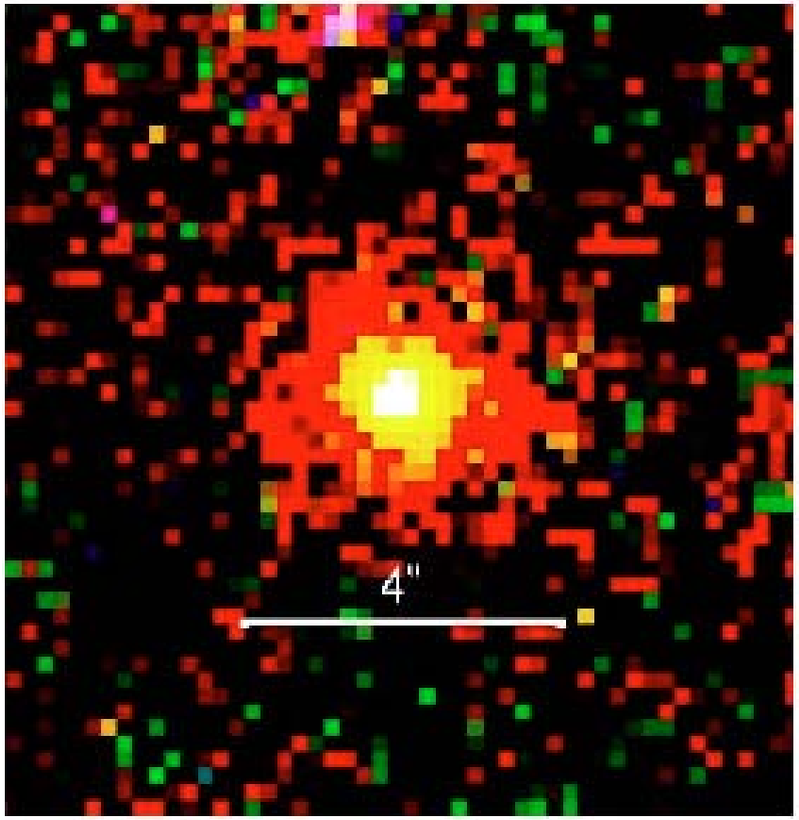


Figure 2. Composite pseudo-color image. The RGB colors are assigned to z', z_P and i'-bands, respectively.

Host properties

- M_{1450A}=−23.9
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Tomo GOTO

Learning from galactic chemical abundance gradients

(HII regions)

Fabio Bresolin

radial abundance gradients

(galactic chemical evolution models)

hosts of core-collapse SNe progenitors

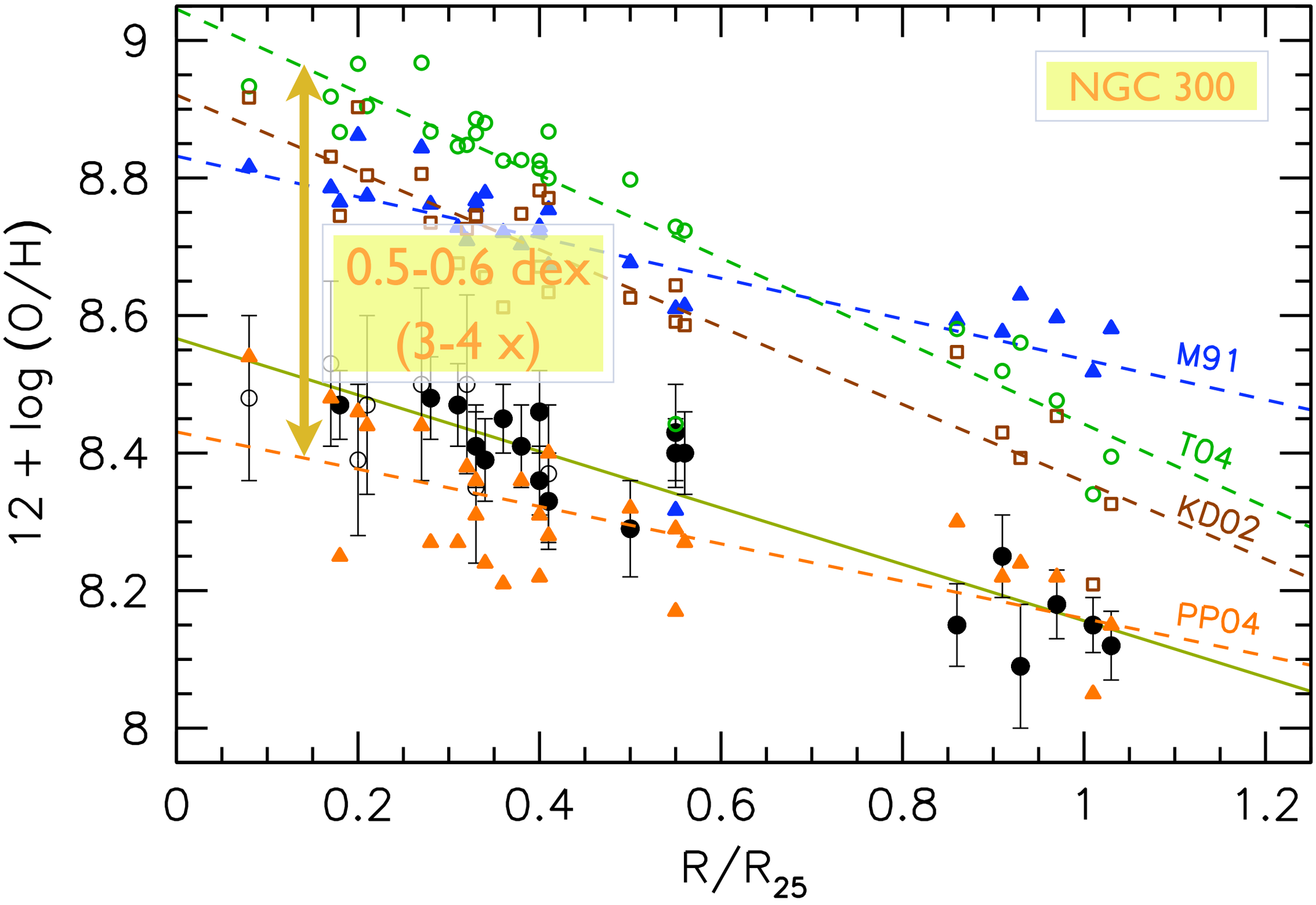
Cepheid PL vs. Z relation

mass-metallicity relationship

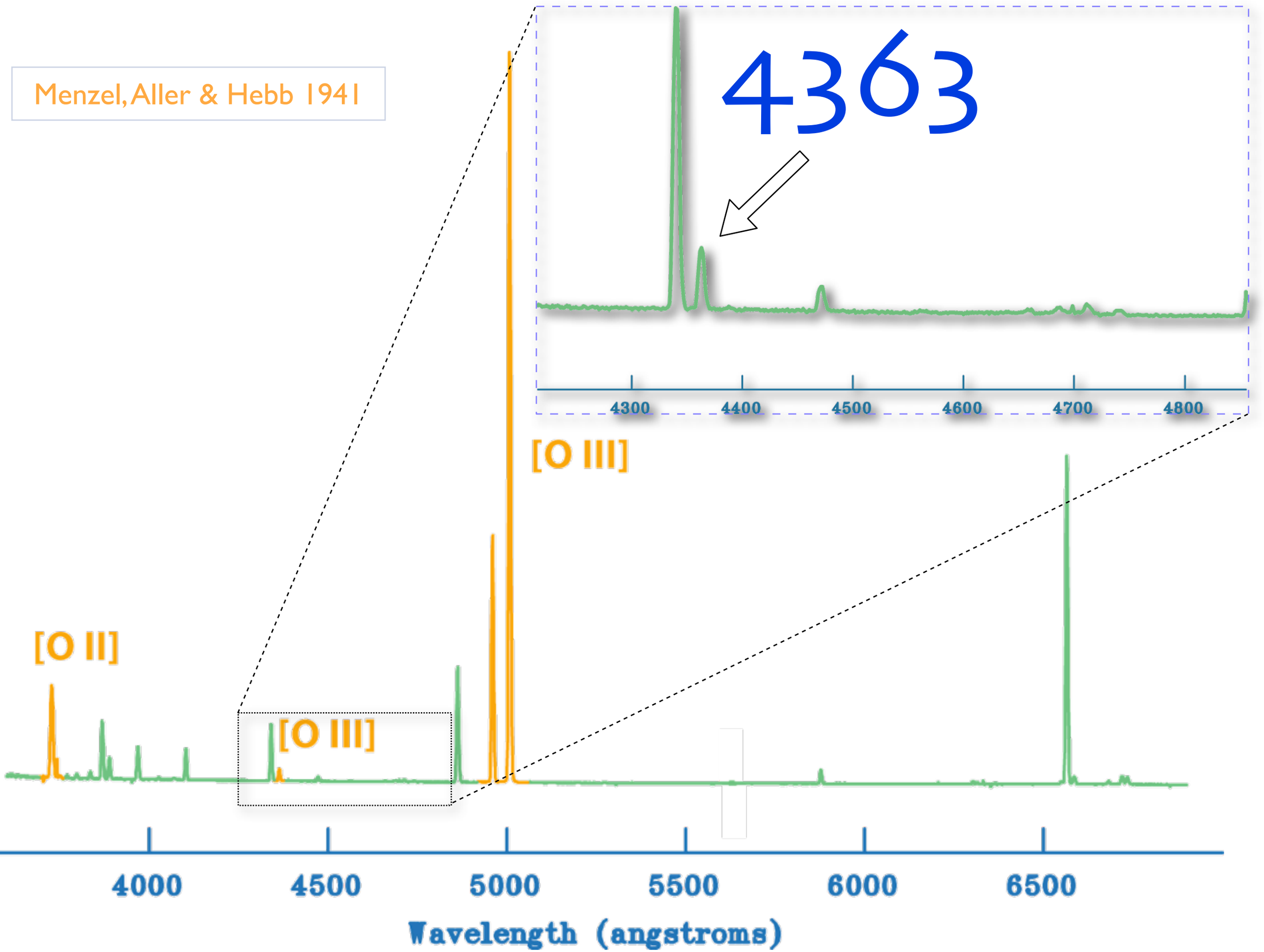
cosmic evolution of metallicity

hosts of gamma-ray burst progenitors

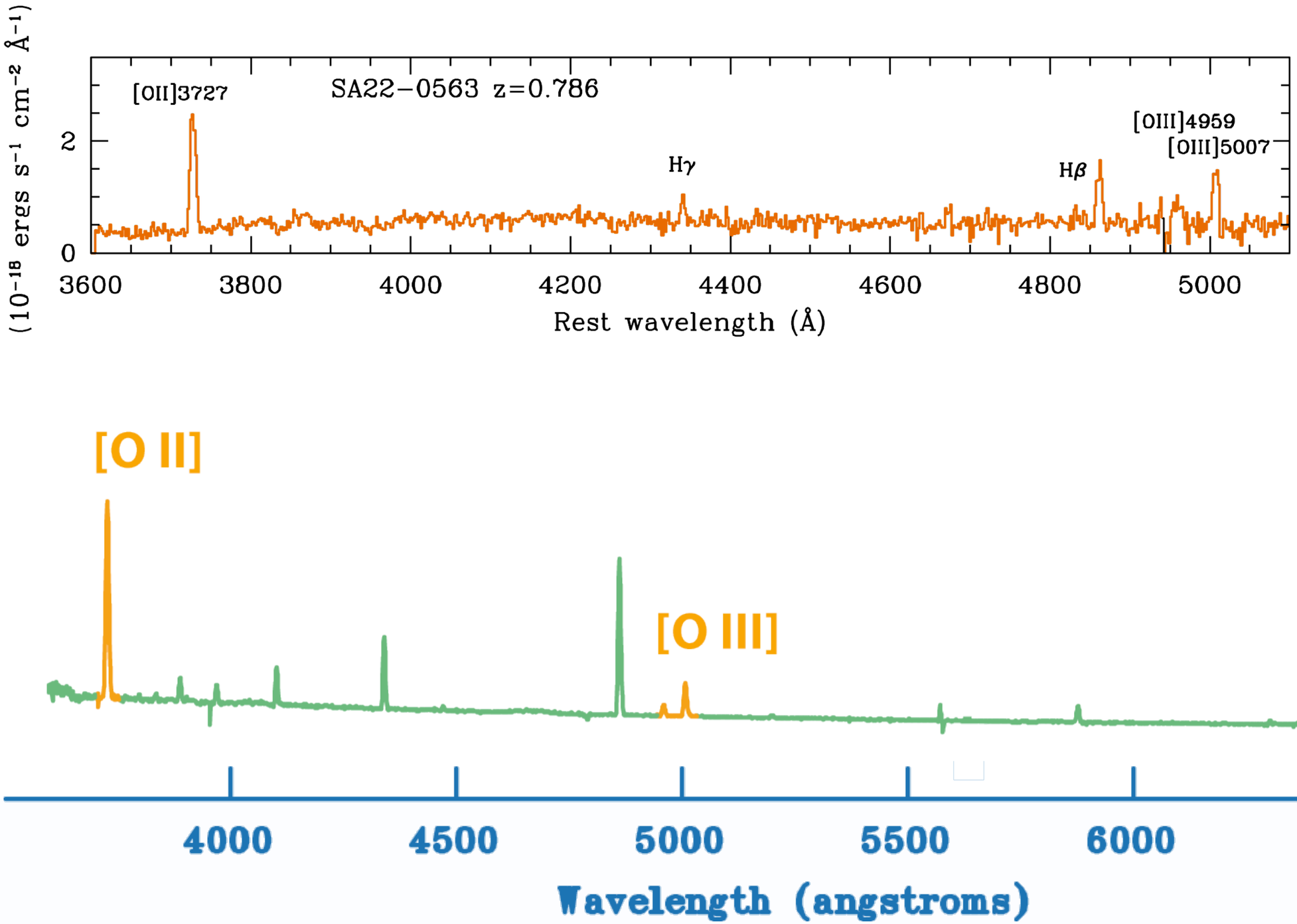
Bresolin, Gieren, Kudritzki, Pietrzynski, Urbaneja & Carraro 2009, ApJ, 700, 309



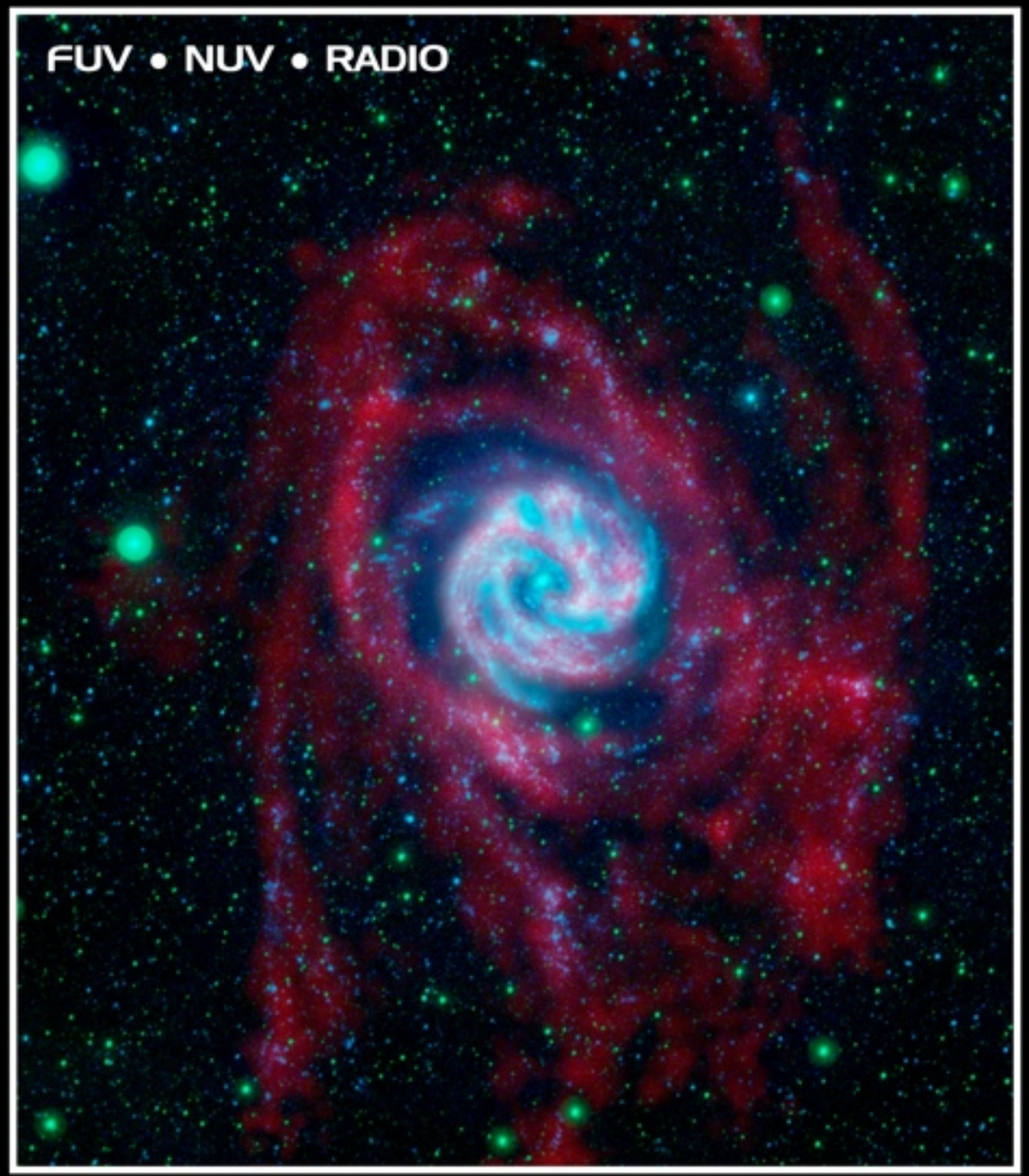
Menzel, Aller & Hebb 1941



Strong-line methods

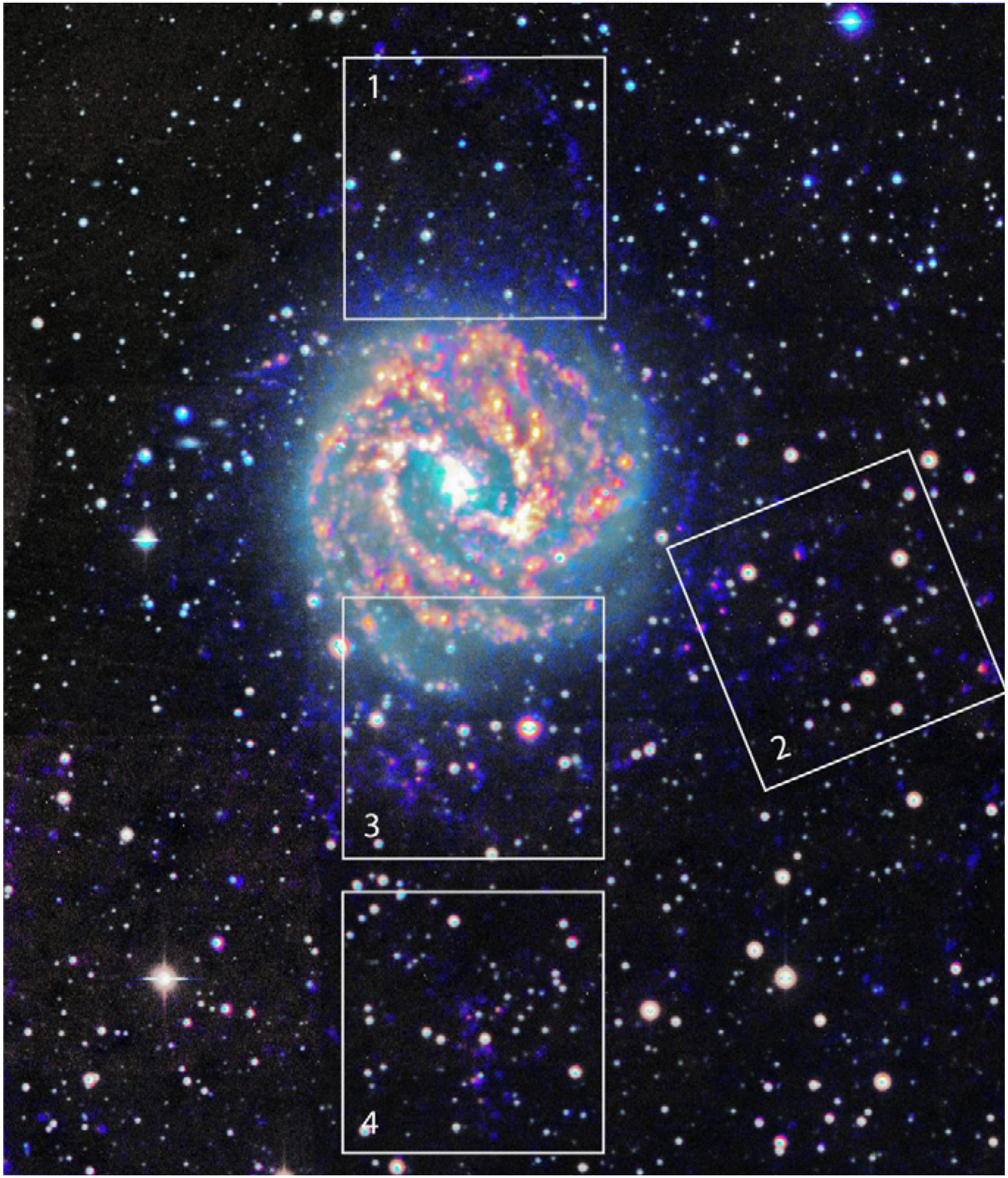


GALEX Galaxy Evolution Explorer



Extended Disk of Galaxy M83

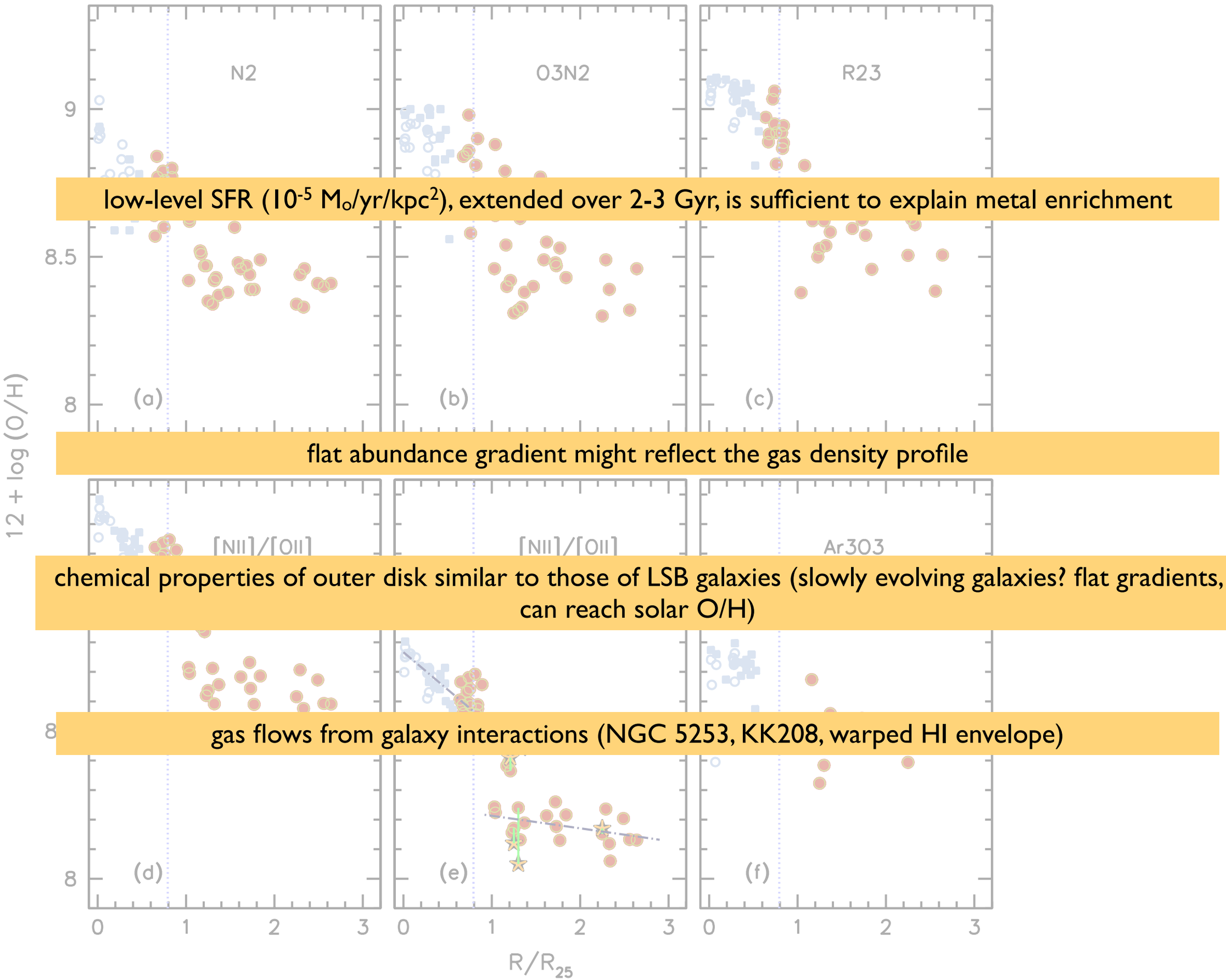
GALEX • NUV • FUV
VERY LARGE ARRAY • RADIO



M83

Bresolin, Ryan-Weber,
Kennicutt & Goddard 2009

N2
O3N2
R23
(a)
(b)
(c)
9
8.5
8
[NII]/[OII]
KD 2002
[NII]/[OII]
Bresolin 2007
Ar303
-0.030 dex/kpc
-0.005 dex/kpc
(d)
(e)
(f)
0
1
2
3
12 + log (O/H)
R/R25



low-level SFR (10^{-5} M_o/yr/kpc^2), extended over 2-3 Gyr, is sufficient to explain metal enrichment

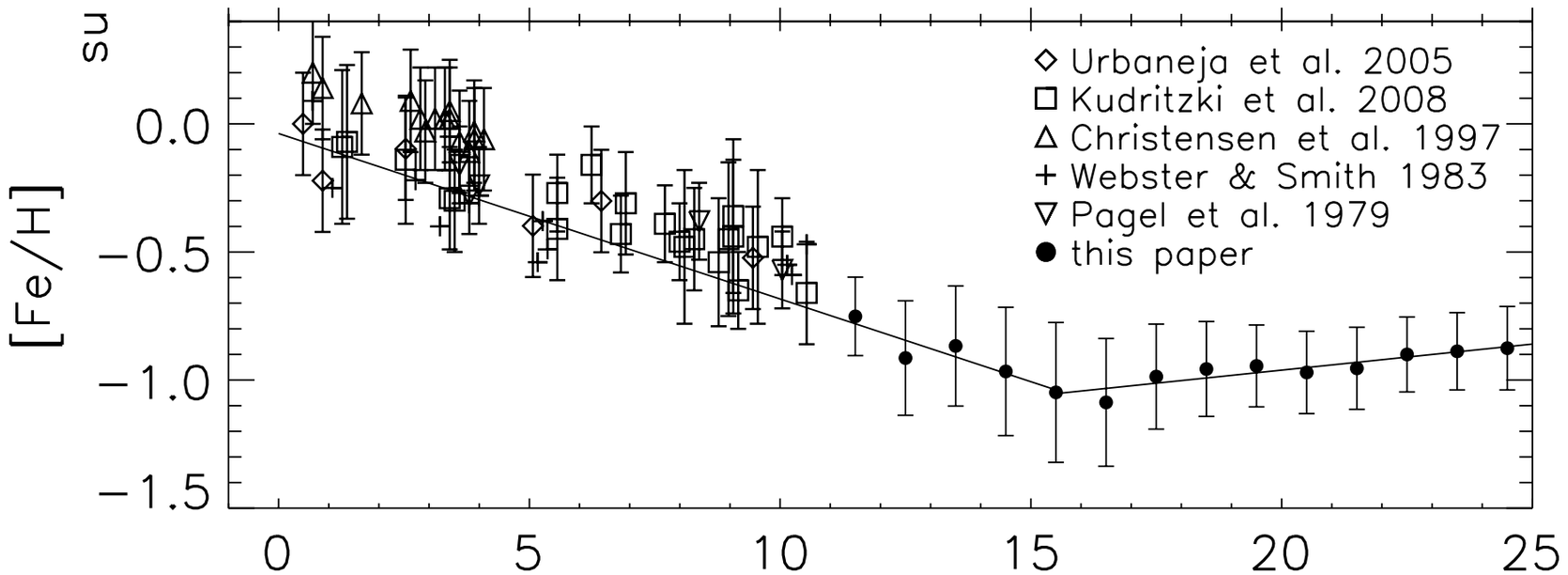
flat abundance gradient might reflect the gas density profile

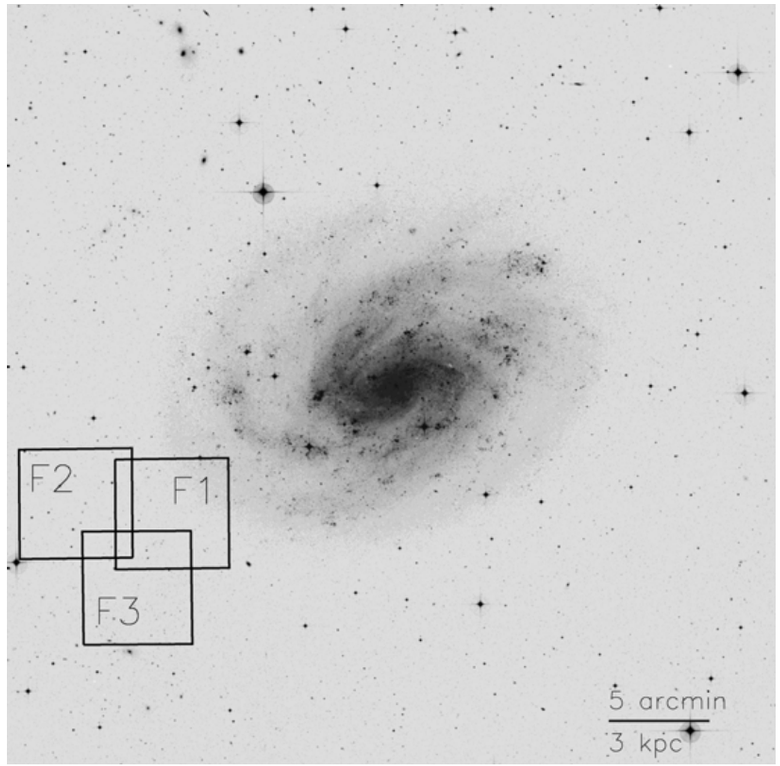
chemical properties of outer disk similar to those of LSB galaxies (slowly evolving galaxies? flat gradients, can reach solar O/H)

gas flows from galaxy interactions (NGC 5253, KK208, warped HI envelope)

NGC 300

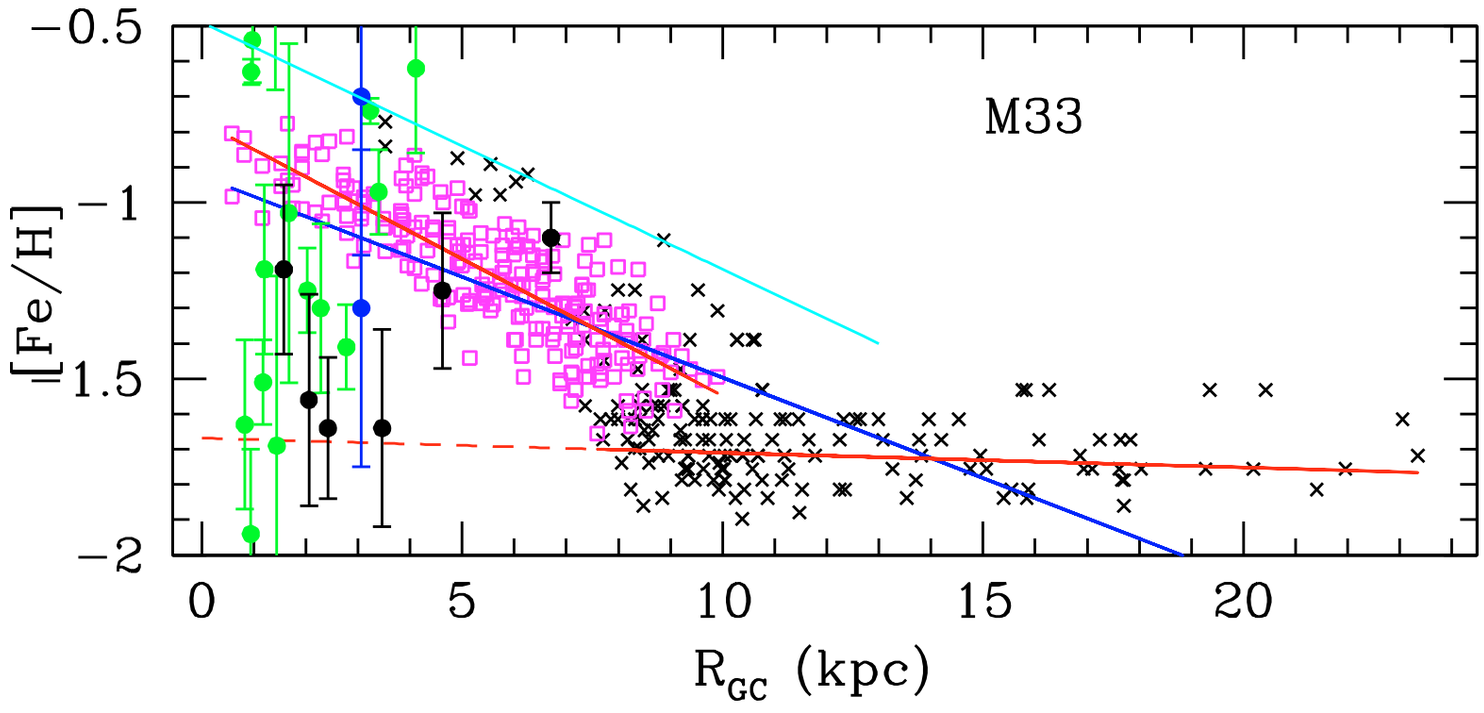
Vlajic, Bland-Hawthorn & Freeman 2009

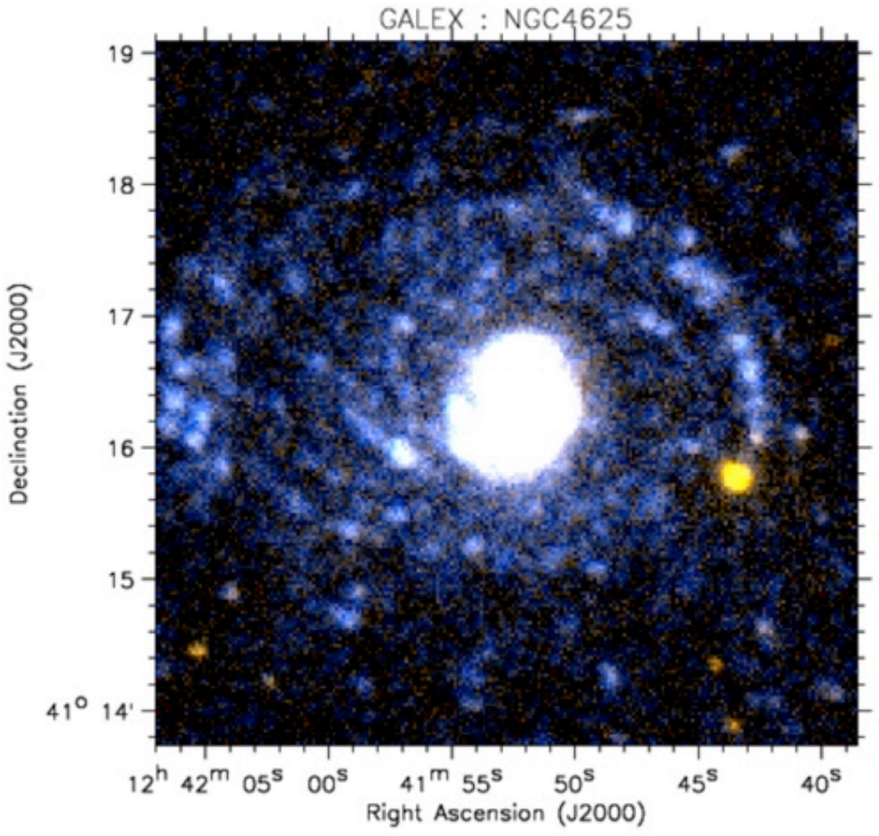


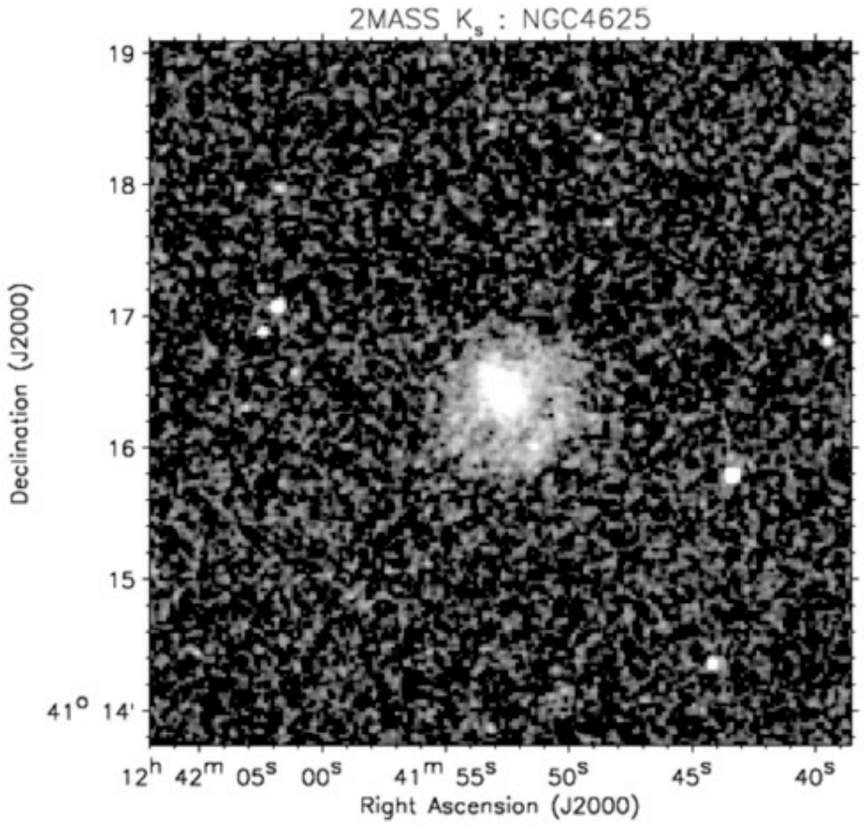


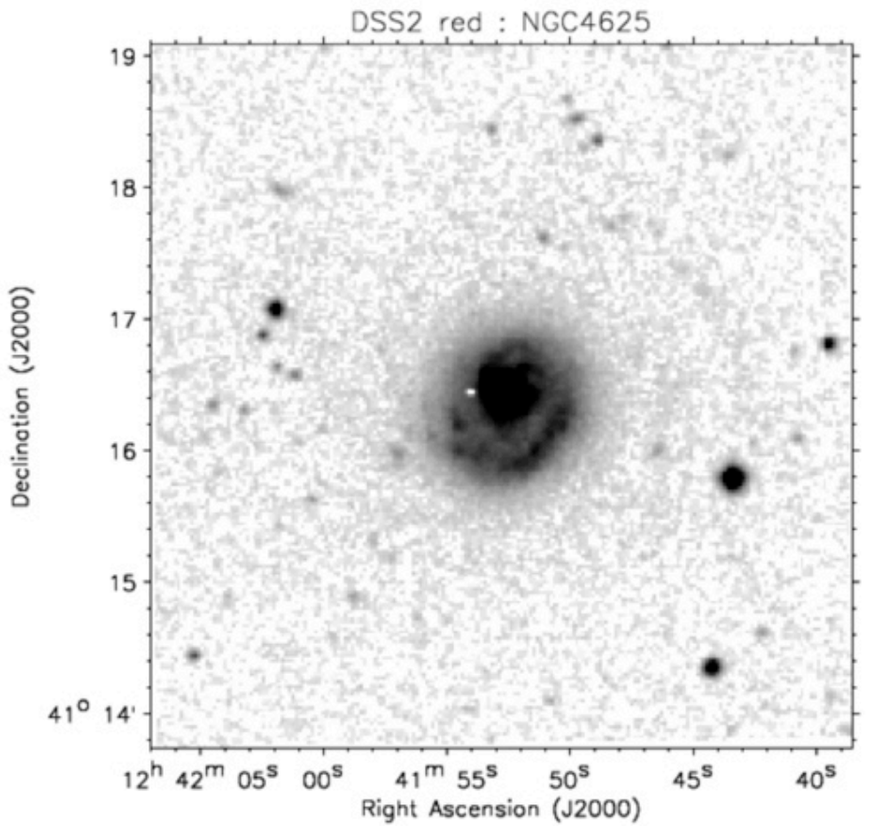
M33

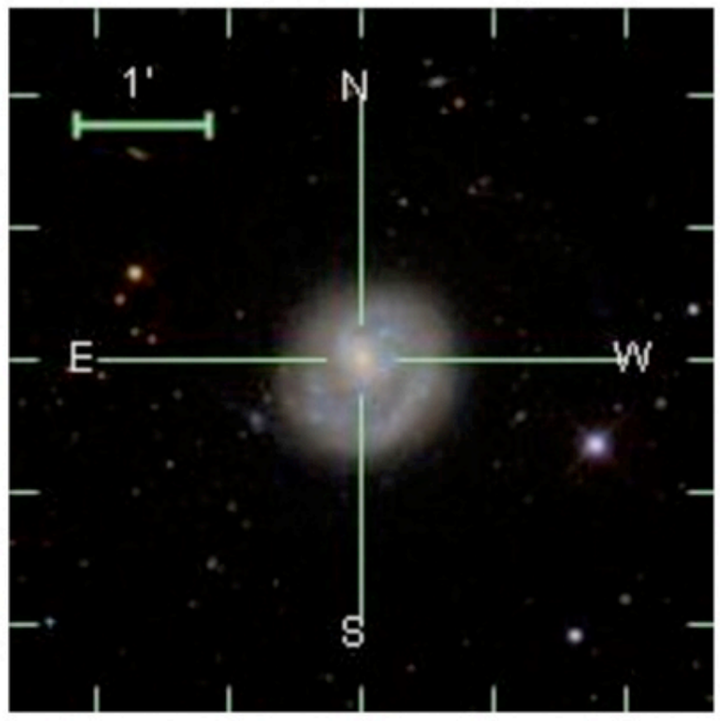
Cioni 2009




GALEX : NGC4625
Declination (J2000)
Right Ascension (J2000)
19
18
17
16
15
41° 14'
12h 42m 05s
00s
41m 55s
50s
45s
40s


2MASS Ks : NGC4625
Declination (J2000)
Right Ascension (J2000)
19
18
17
16
15
41° 14'
12h 42m 05s
00s
41m 55s
50s
45s
40s

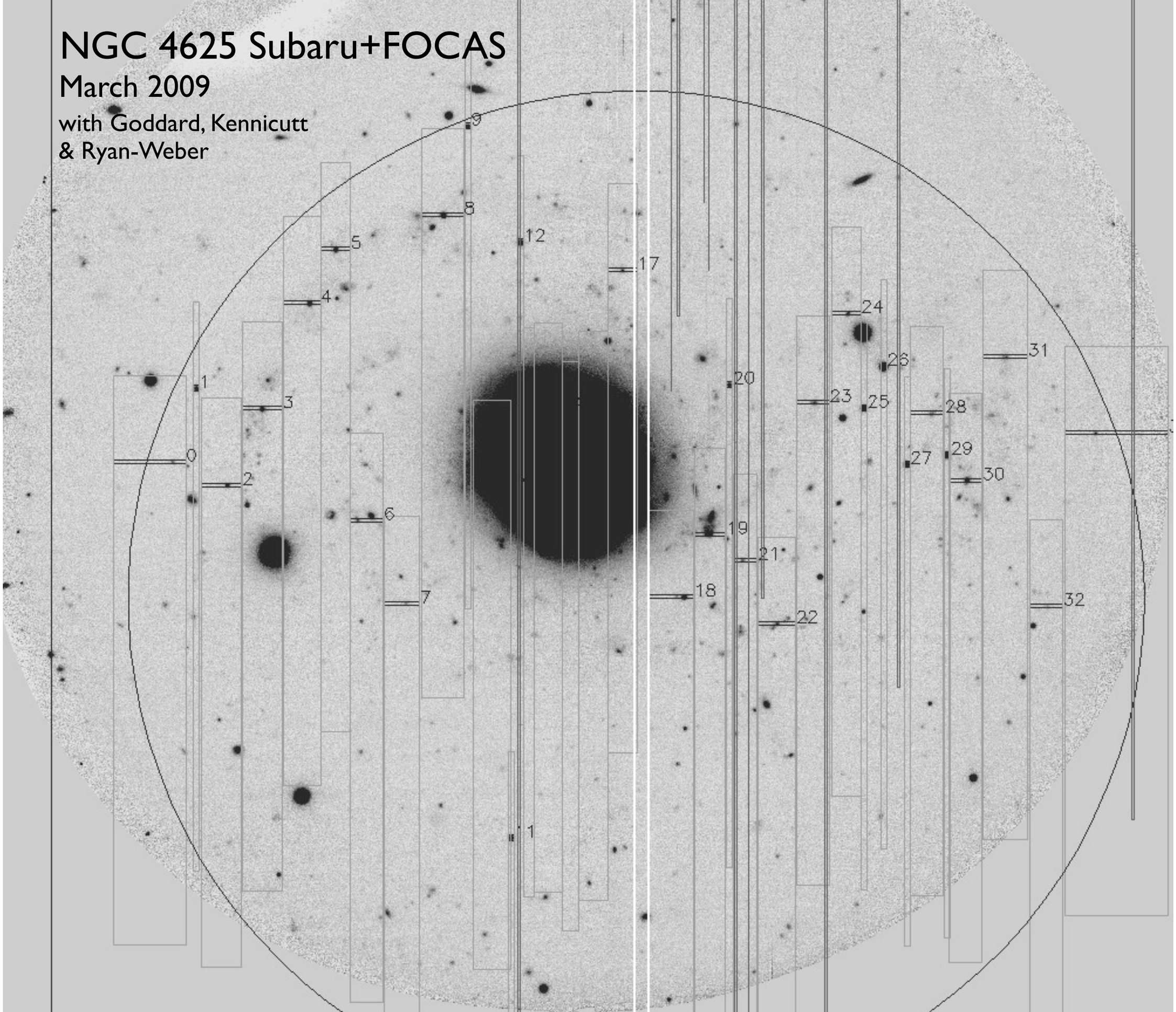

DSS2 red : NGC4625
Declination (J2000)
Right Ascension (J2000)
19
18
17
16
15
41° 14'
12h 42m 05s
00s
41m 55s
50s
45s
40s


1'
N
E
W
S

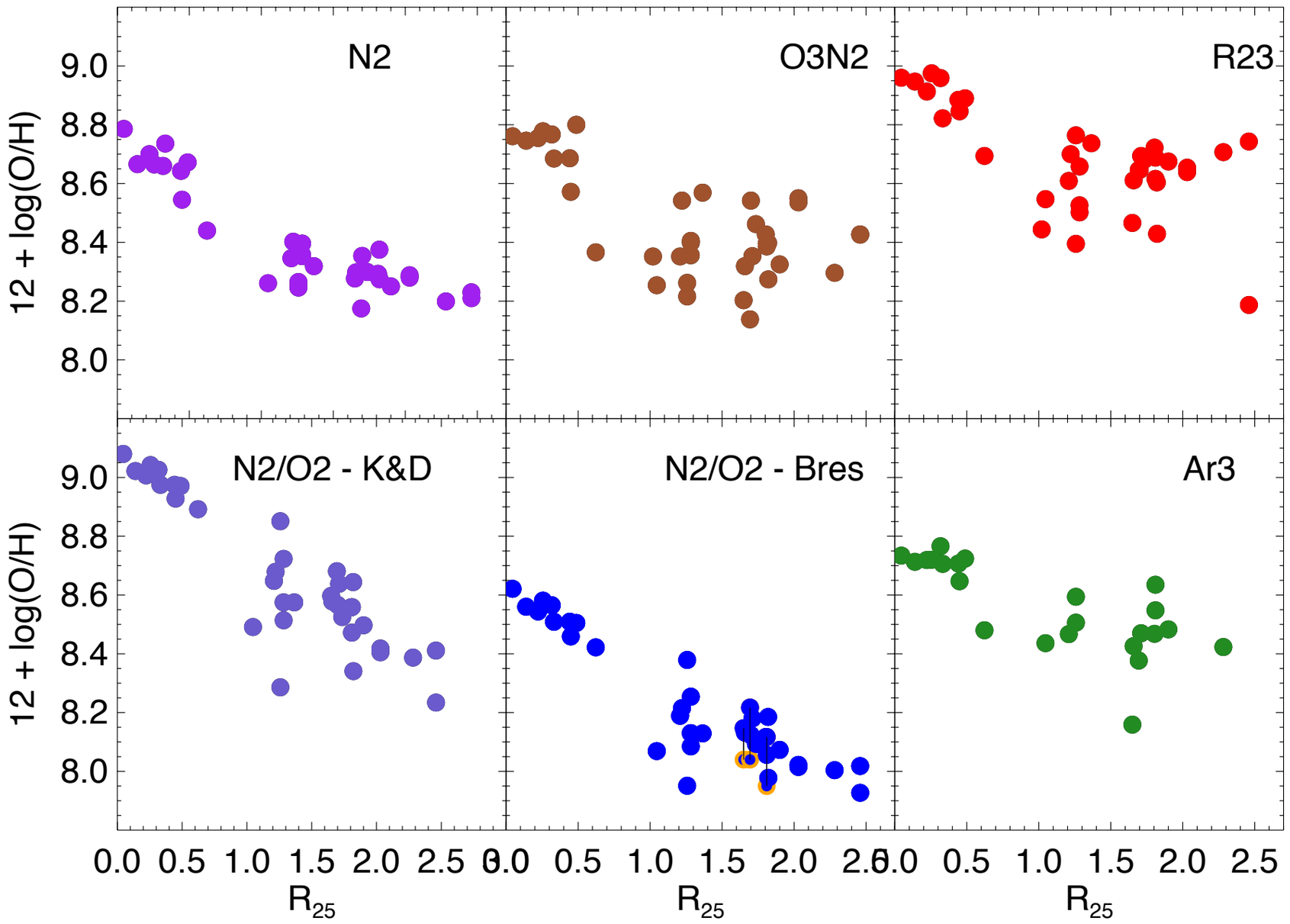
NGC 4625 Subaru+FOCAS

March 2009

with Goddard, Kennicutt
& Ryan-Weber



NGC 4625 Subaru+FOCAS

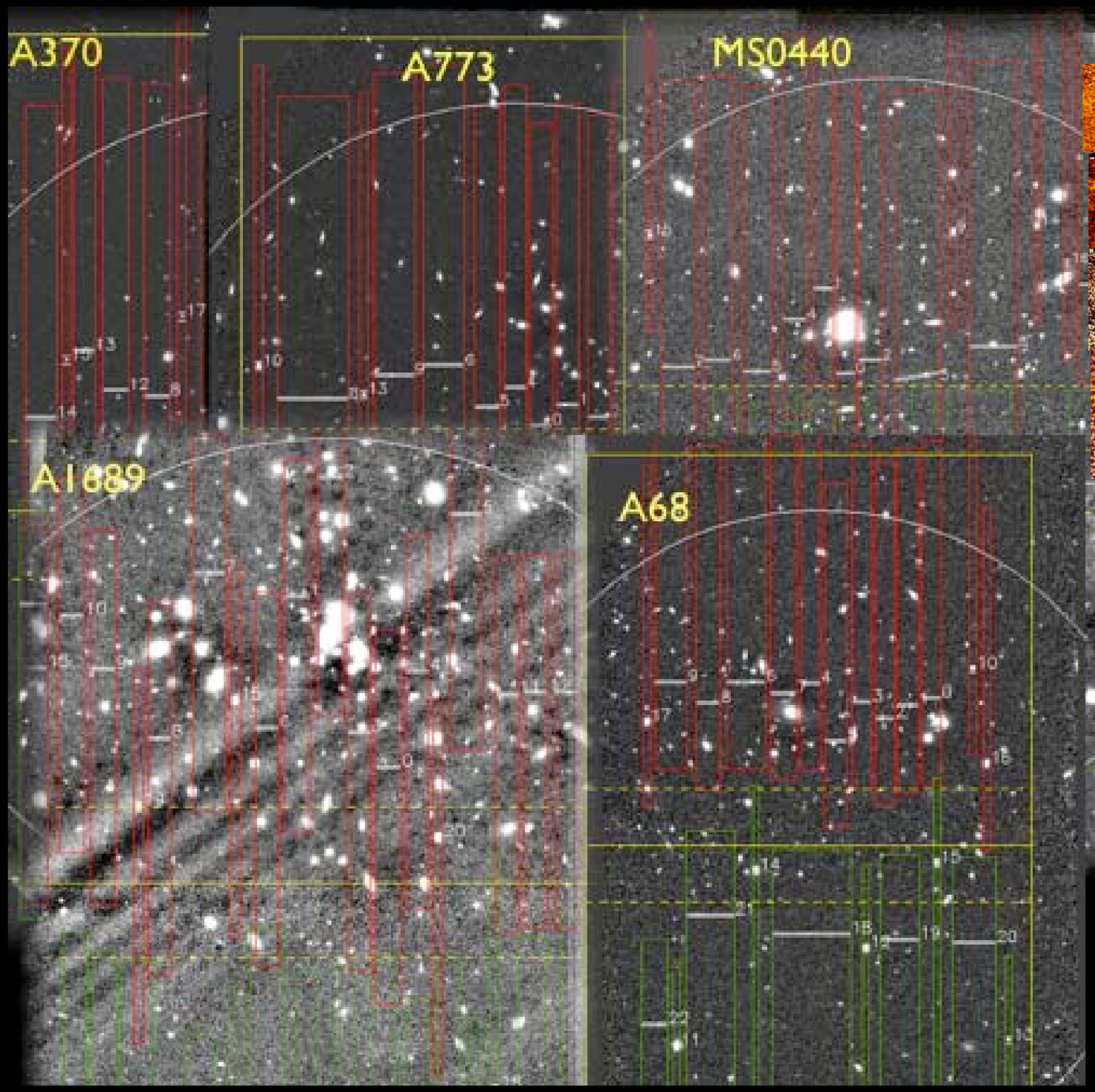


Metallicity of Lensed Star-Forming Galaxies at z=0.8-3
--- a spectroscopical survey with MOIRCS (Tiantian Yuan & Lisa Kewley)

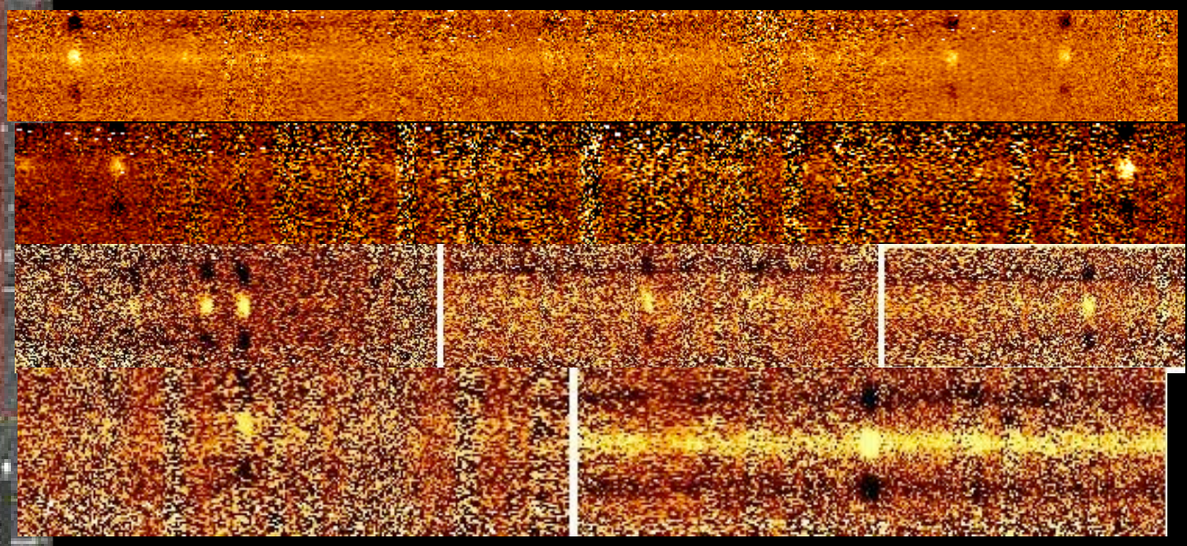
Main Science Goal: obtain a sample of lensed SF galaxies at z>1 with robust global metallicity measurements

By the end of 2009, finished with five Strong Lensing clusters: A1689, A68, A370, A773, MS0440

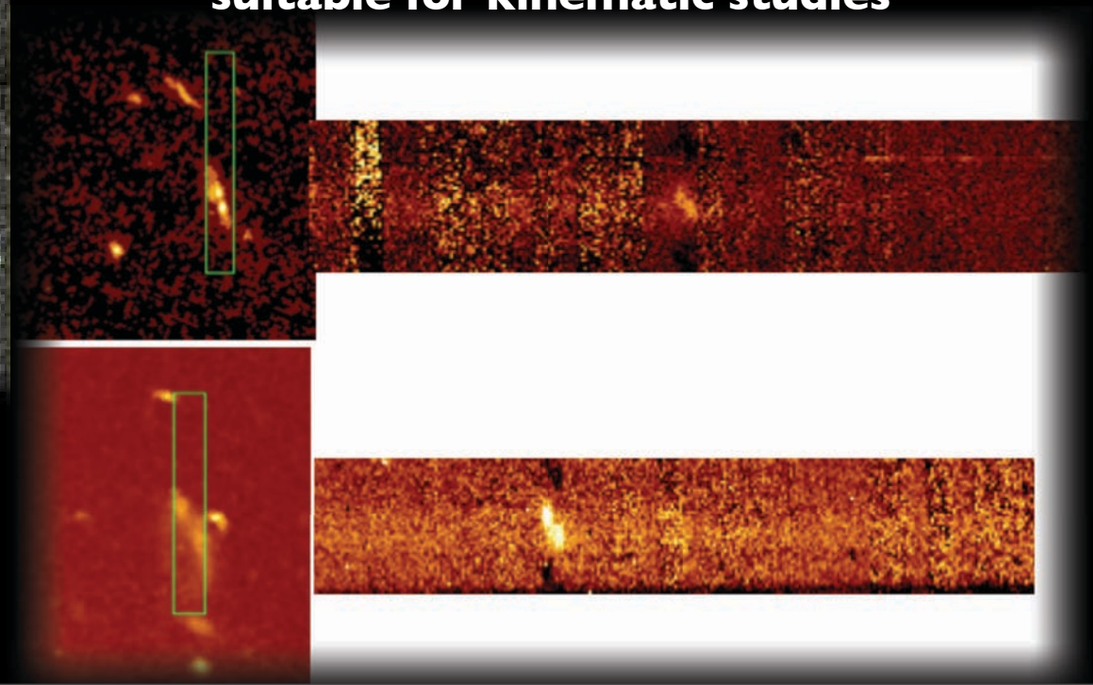
MOIRCS Mask Designs



Typical MOIRCS 2D spectra (rest-frame optical)

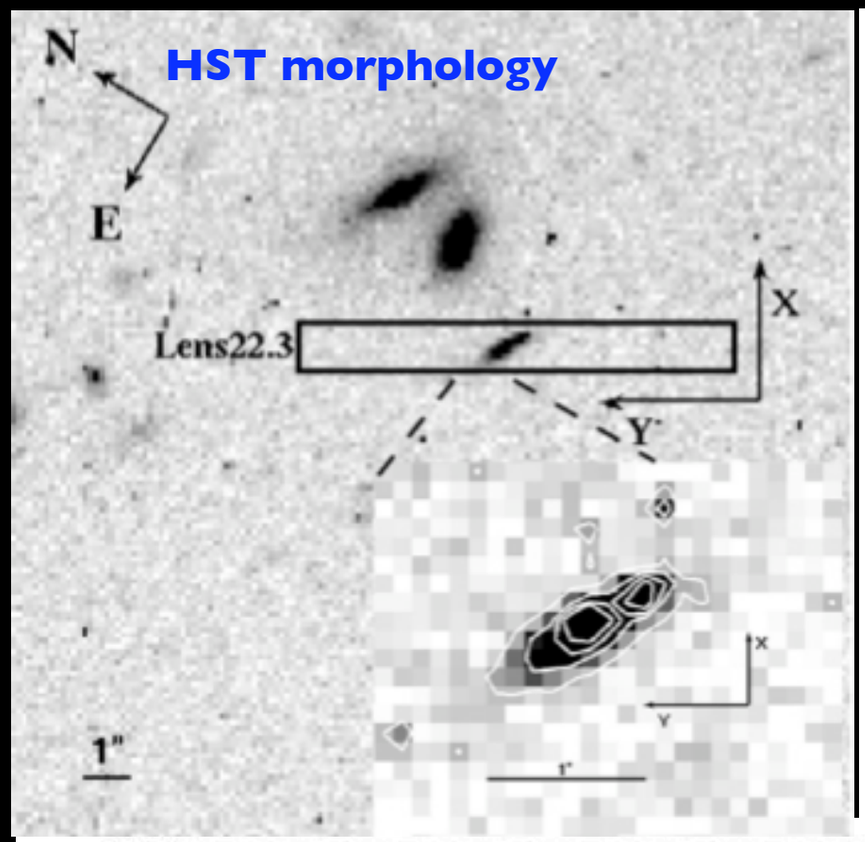


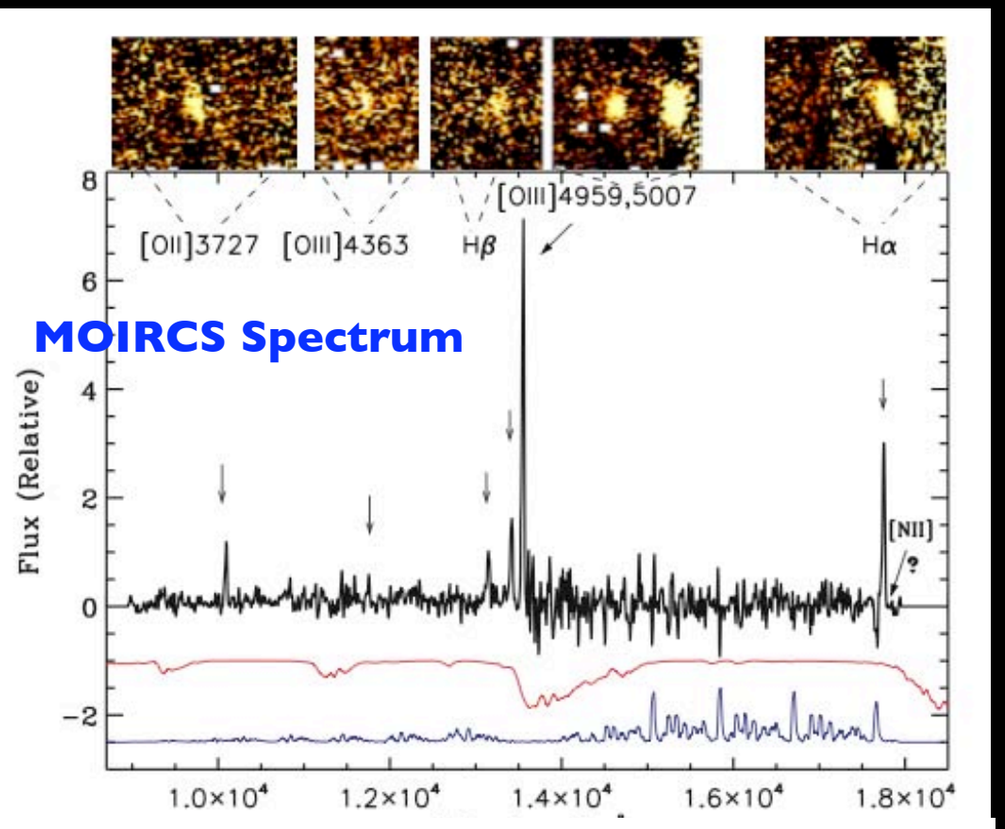
Some spatially resolved spectra (mainly Ha) suitable for kinematic studies

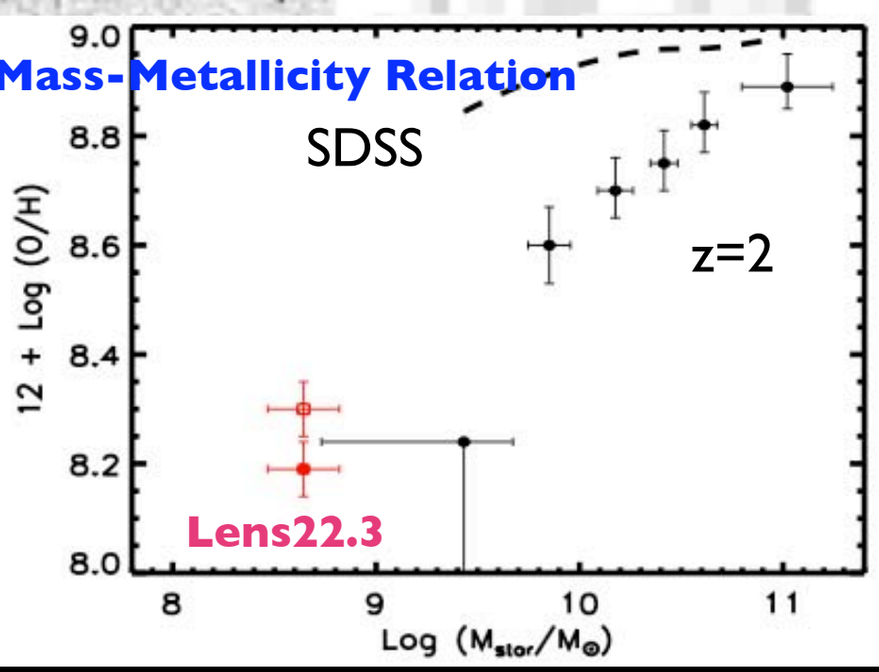


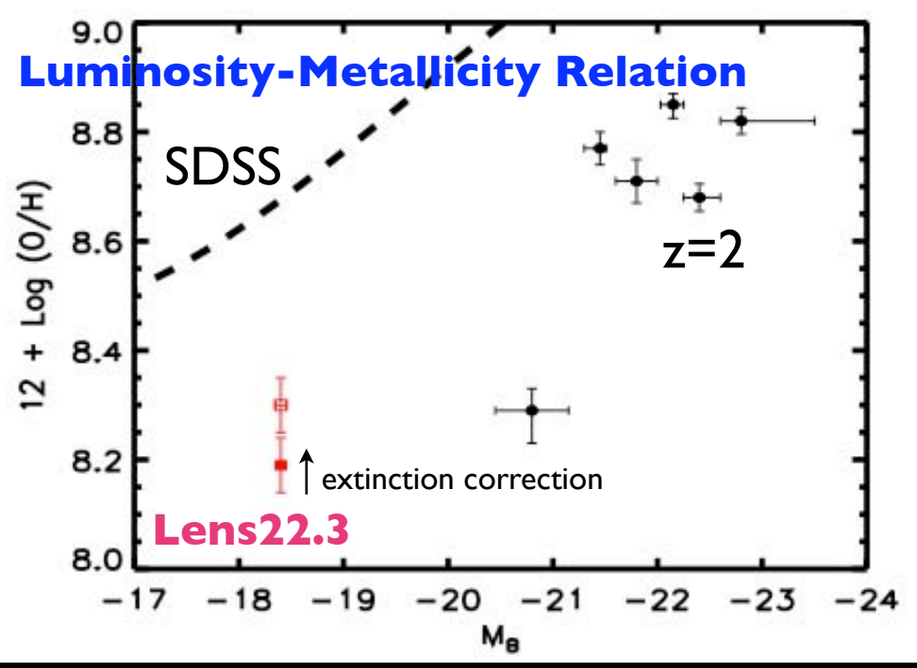
Results Example:

A strong-lensed Low mass, Low metallicity star-forming galaxy at z=1.7 in A1689









Advantages of lensing sample: flux magnification => high S/N spectrum, able to probe lower mass objects

For the five lensing clusters, obtained rest-frame optical spectra for more than 40 lensed SF galaxies at z=0.8-3 (~10 between z=1.5-3), will be a valuable sample for detailed metallicity analysis of high-z SF galaxies

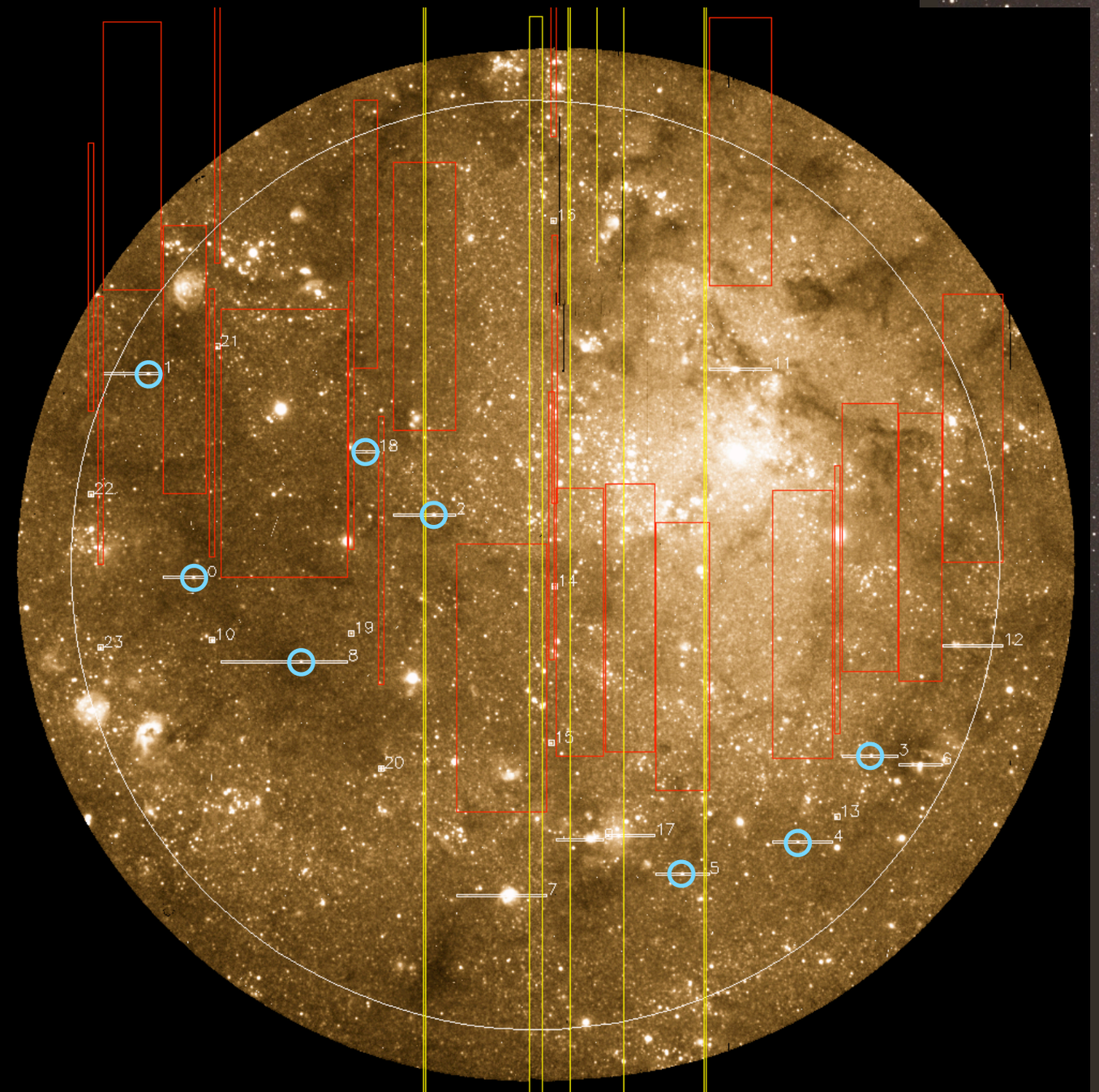
Data analysis still on-going, more results to be published in 2010 !

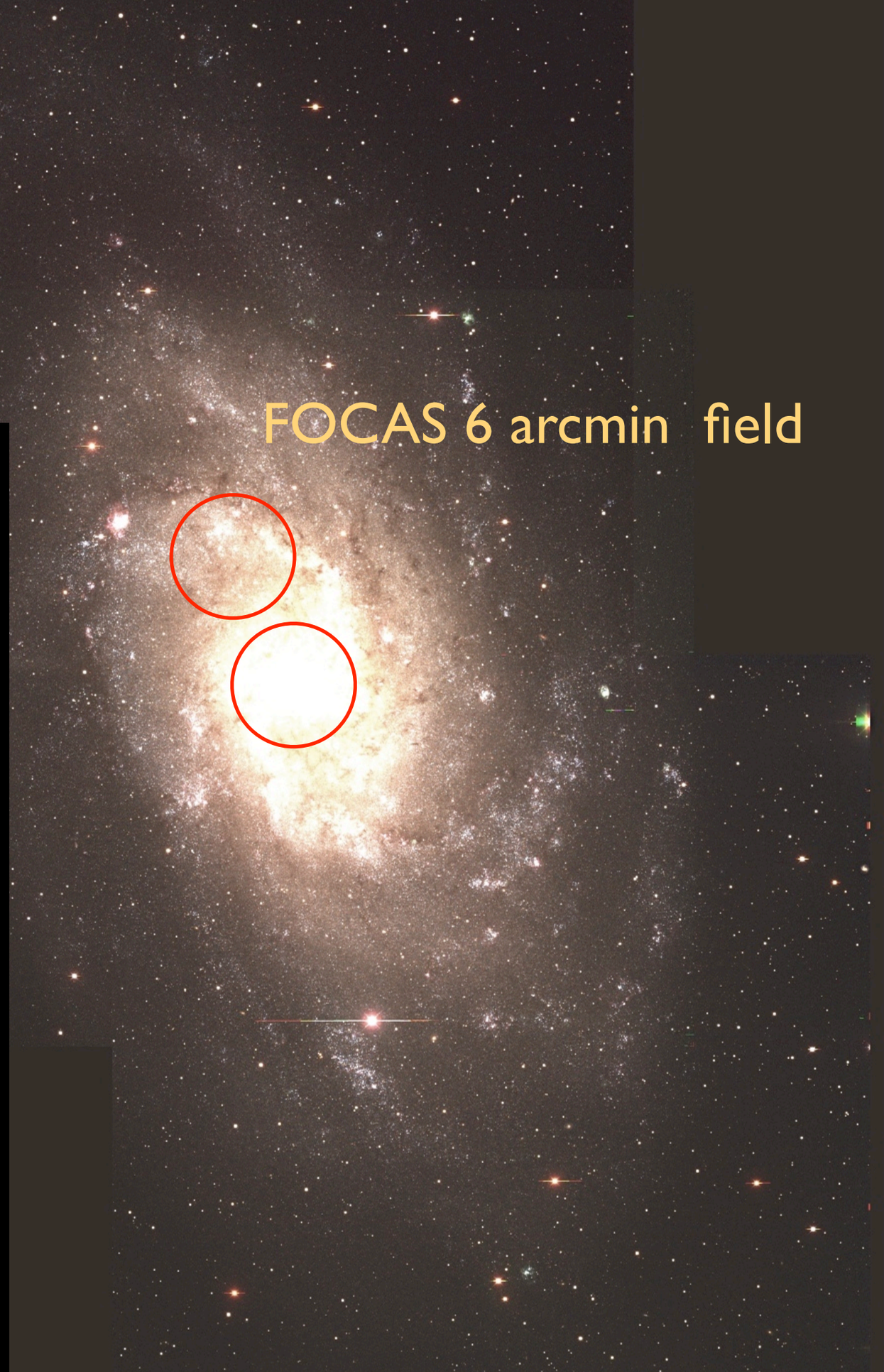
For more details, see Yuan & Kewley 2009, ApJL, 699, 161

PNe M33

F. Bresolin (UH), Stasinska (Meudon), Vilchez (Granada),
Simon (Carnegie) & Rosolowsky (UBC)

MNRAS, in press (2010)





PN 73

PN 76

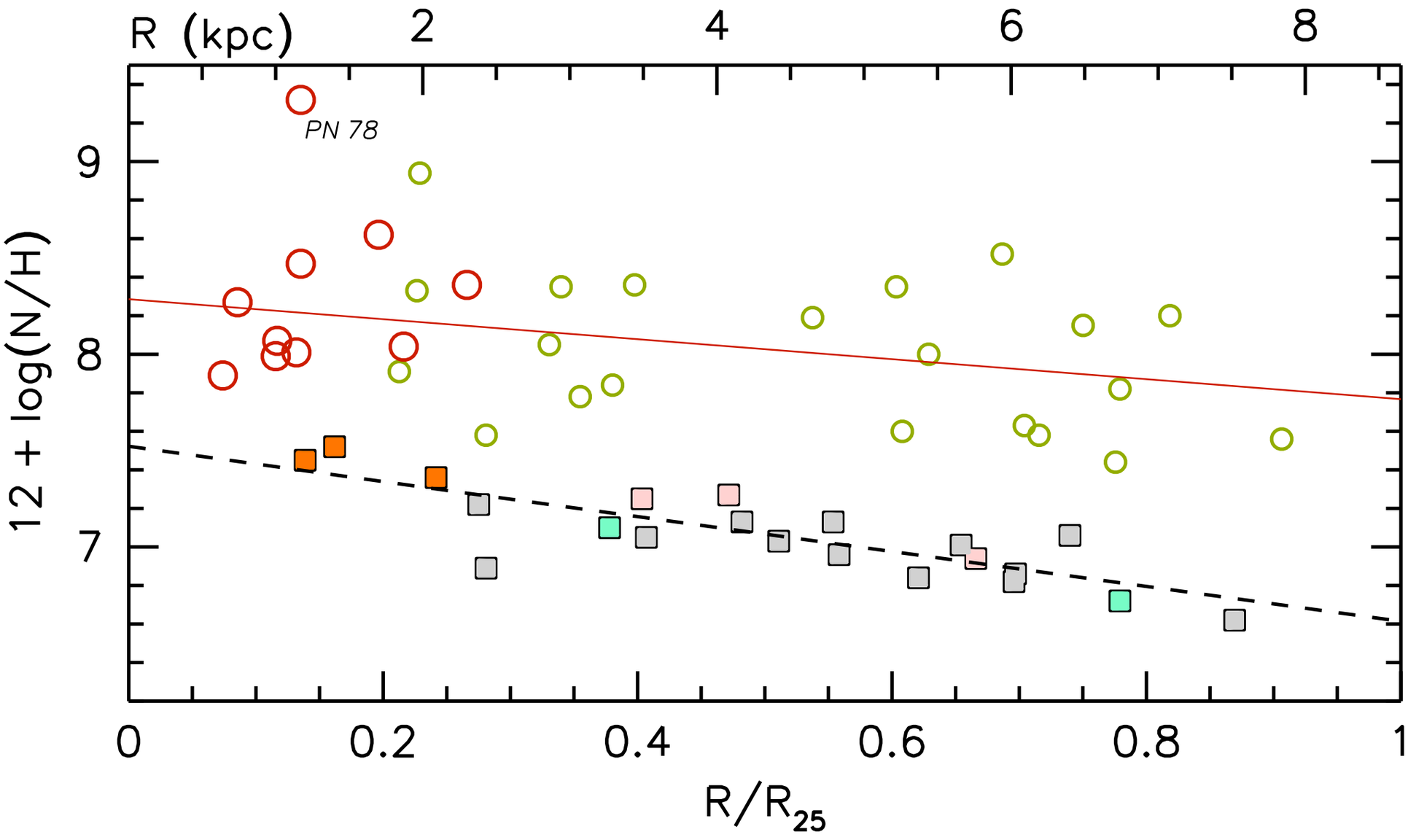
PN 78

PN 83

[O II] 3727
[Ne III] 3868
Hϵ+[Ne III] 3968
Hδ
Hγ
[O III] 4363
He II 4686
Hβ
[O III] 4959
[O III] 5007
He I 5876
[N II] 6548
Hα
[N II] 6583
[S II] 6717,6731
[Ar III] 7135

Flux (10^{-16} erg cm^{-2} s^{-1})

Wavelength (Å)



complex nucleosynthesis in AGB stars (0.8 - 8 Msun)

+

mixing/dredge-up processes

He, C, N enhanced at surface

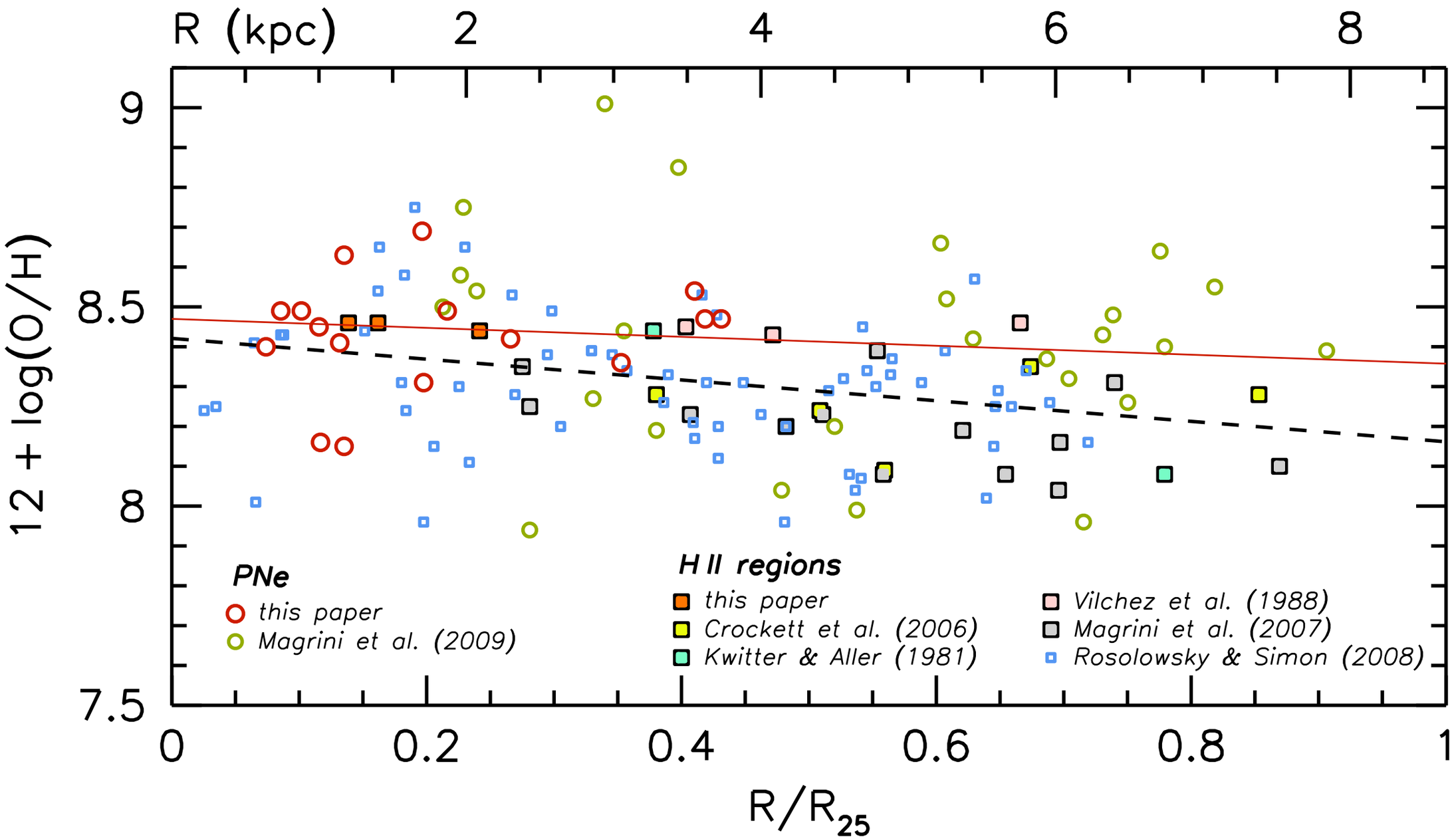
hot bottom burning: C -> N

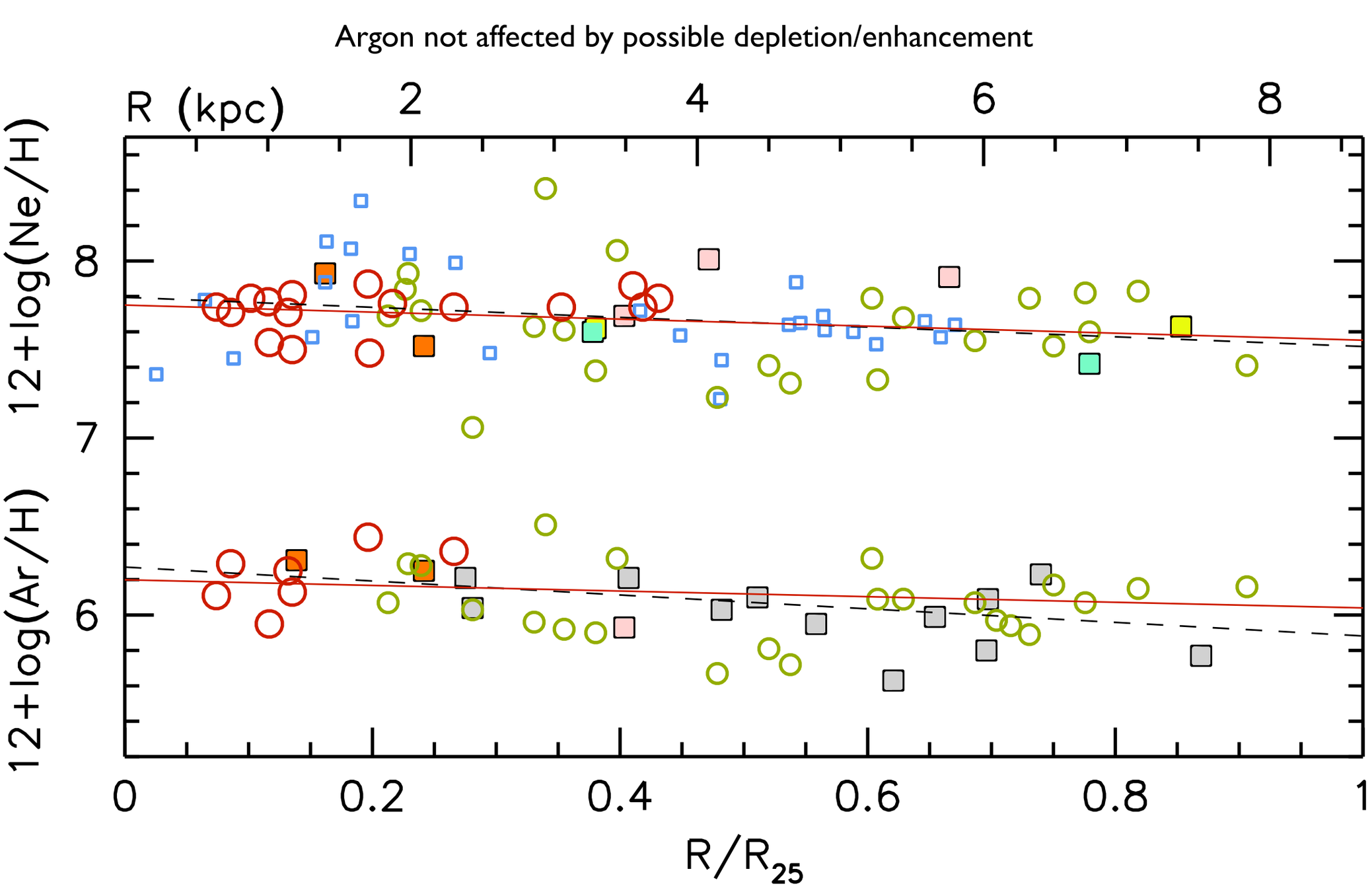
O? depleted (high mass, ON cycle, O -> N);

enhanced (alpha capture on C+3rd dredge up)

all is a function of stellar mass, metallicity

O/H larger in PNe for low Z (<SMC): evidence for freshly synthesized O + 3rd dredge-up





	PNe		H II regions	
Element	Slope (dex kpc^{-1})	Intercept	Slope (dex kpc^{-1})	Intercept
O	-0.013 ± 0.016	8.47 ± 0.07	-0.030 ± 0.008	8.42 ± 0.03
N	-0.060 ± 0.027	8.29 ± 0.12	-0.105 ± 0.015	7.52 ± 0.07
Ar	-0.018 ± 0.014	6.20 ± 0.06	-0.045 ± 0.016	6.27 ± 0.07
Ne	-0.023 ± 0.018	7.75 ± 0.07	-0.032 ± 0.020	7.79 ± 0.08

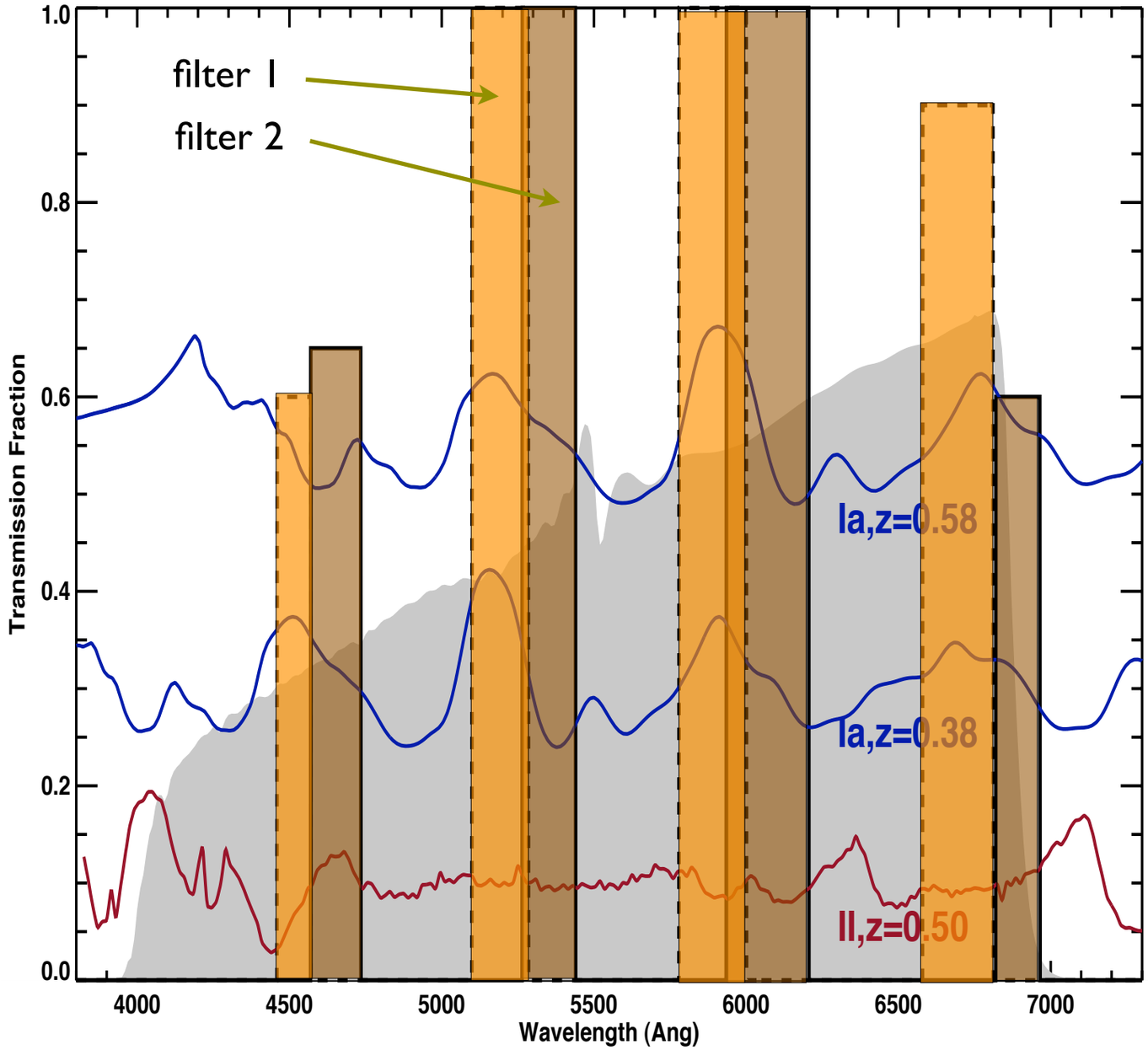
SN CROSS-CORRELATION FILTERS

John Tonry (UH), Steve Rodney (UH, JHU), Adam Riess (JHU, STScI), Dan Scolnic (JHU) & Mark Huber (JHU)

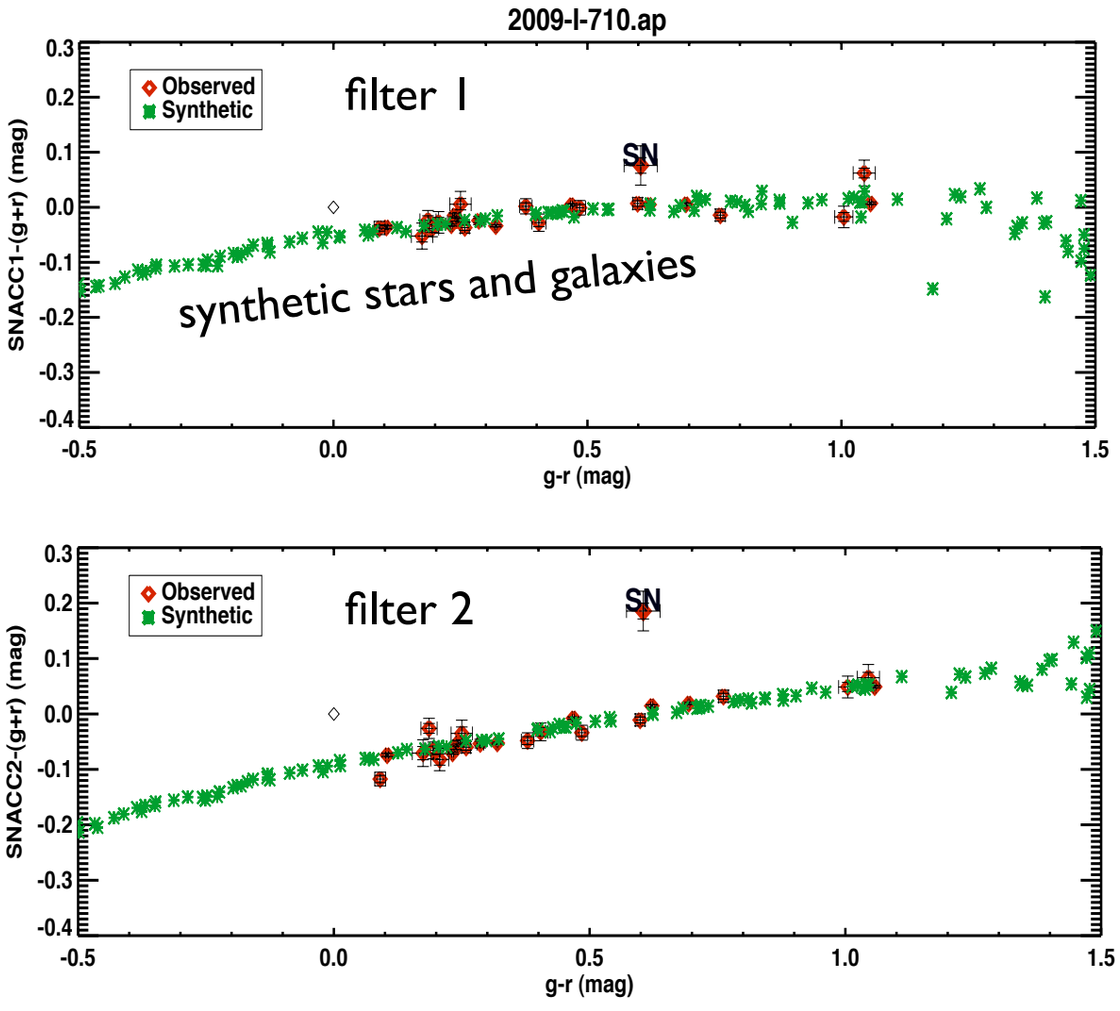
Large samples of SNe: need to quickly determine SN type and redshift

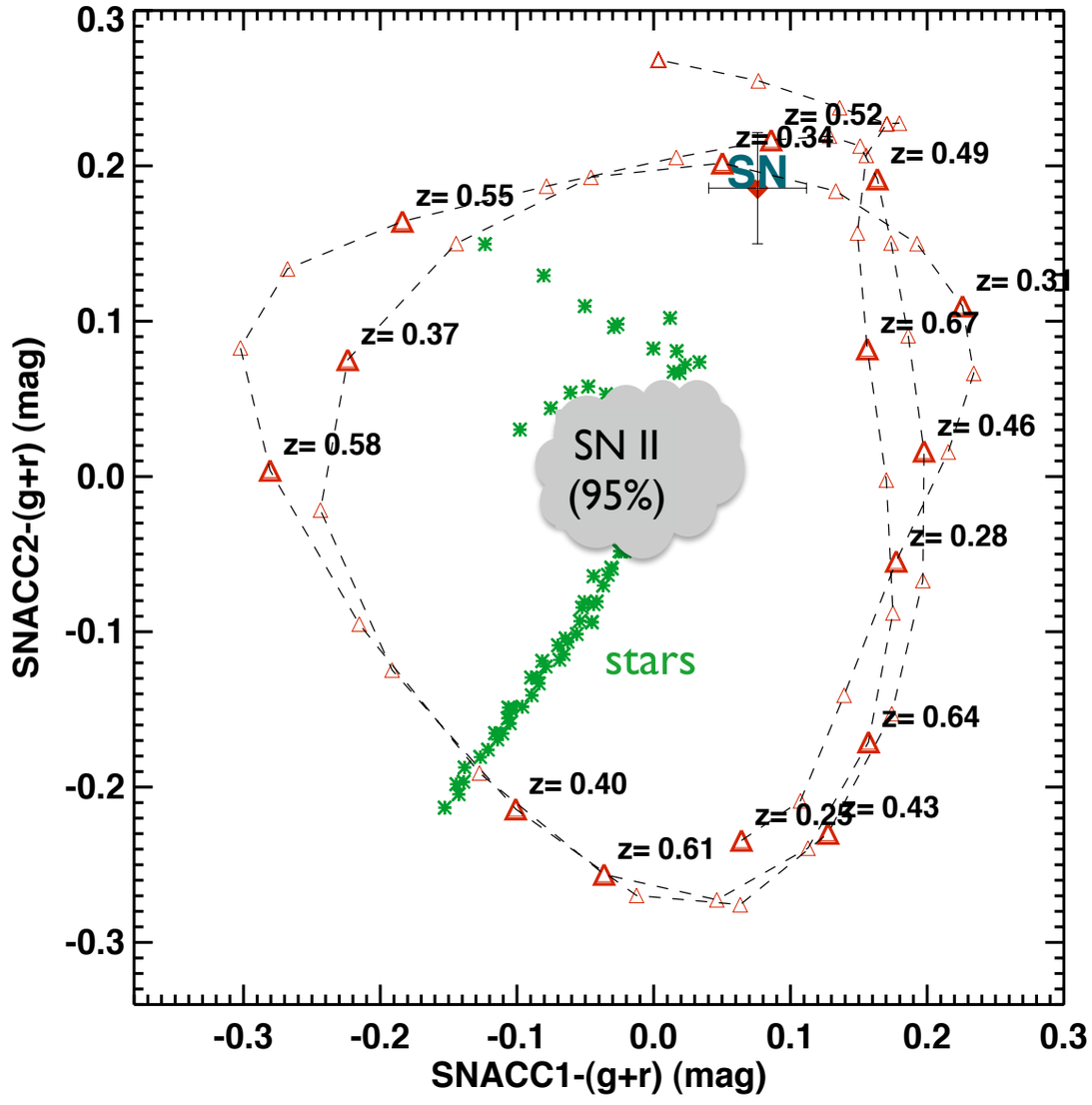
use pair of comb filters with multiple passbands, matching peaks and valleys in broad absorption-dominated type Ia spectra

measure amplitude and phase of cross-correlation between spectrum and SN Ia template



Subaru+SuprimeCam
Type Ia SN observations





in color-color diagram SN Ia lie on outer ring, with location dependent on z

break degeneracy in z with photometric redshift of parent galaxy