RESOLVING IONISATION AND METALLICITY ON PARSEC SCALES ACROSS PRIMORDIAL ANALOGUES WITH HST-WFC3

ioa
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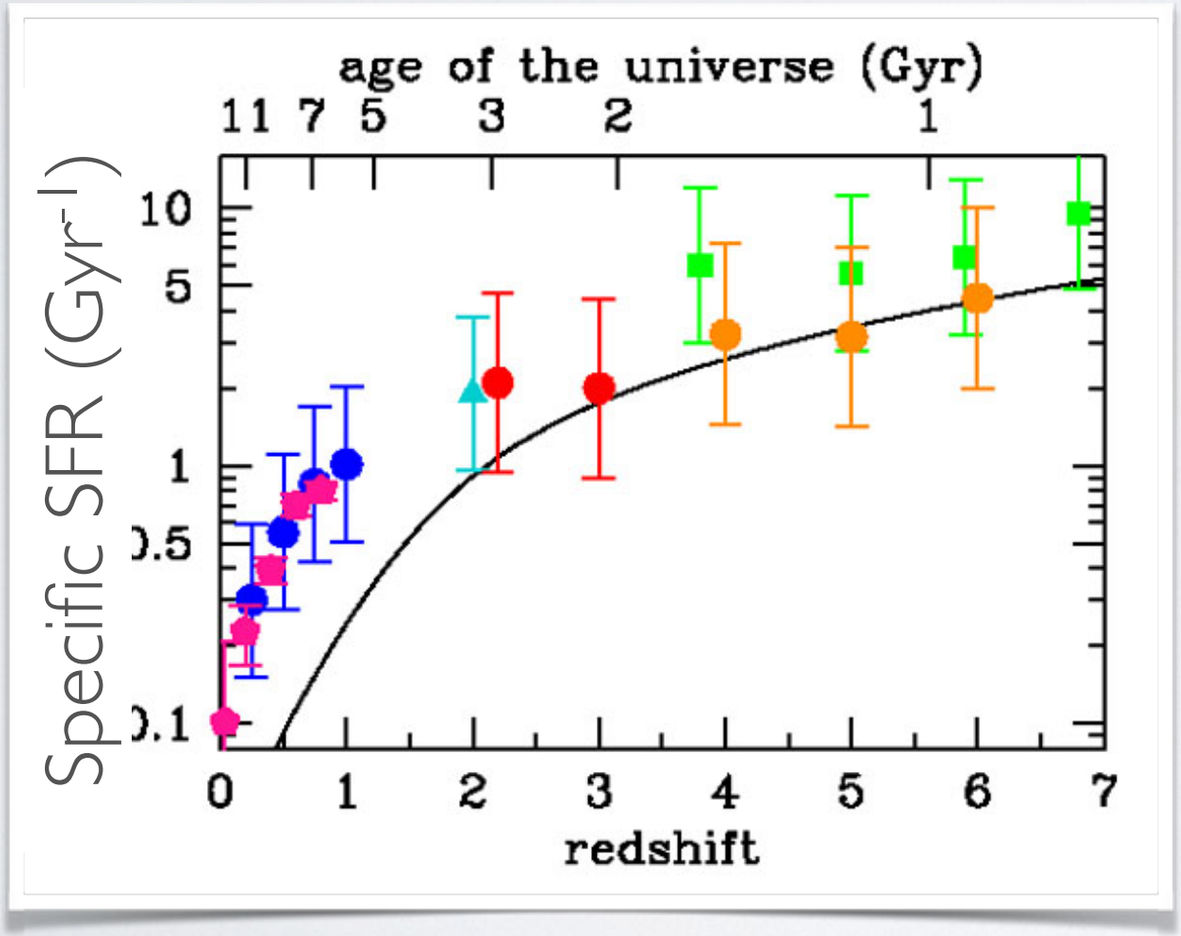
My questions/themes:

- What can we learn from metal-poor galaxies?
- Spatially resolving metal-poor galaxies at different redshifts
- What's the most efficient way of detecting and studying them?

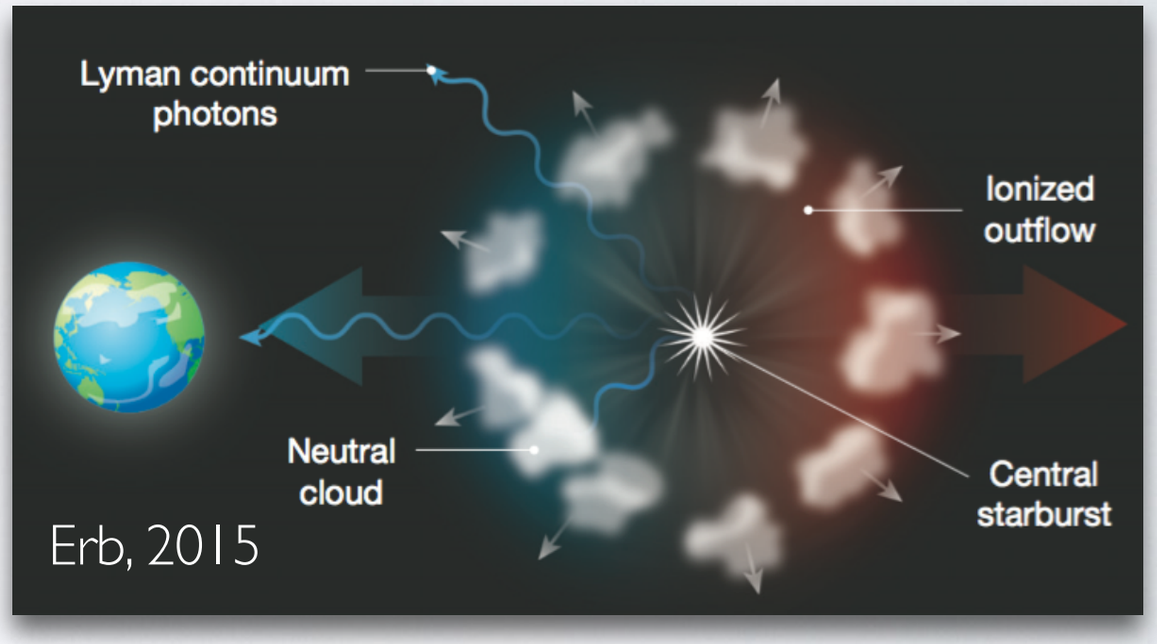
The Interplay Between Local And Global Processes In Galaxies Cozumel April, 2016

What are the effects of stellar feedback in metal-poor environments?

Did dwarf galaxies play a role in cosmic reionization?



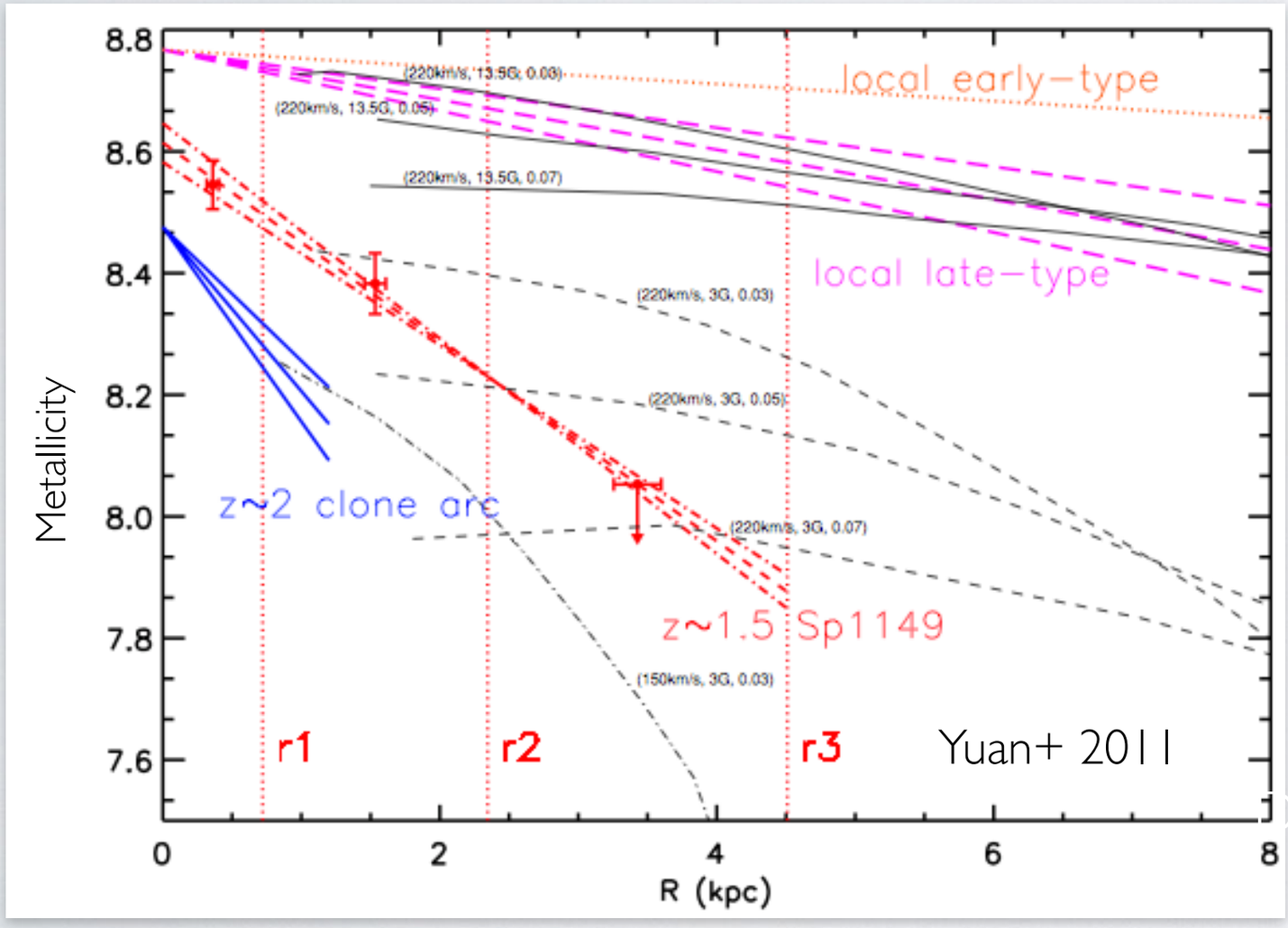
Madau & Dickinson 2014

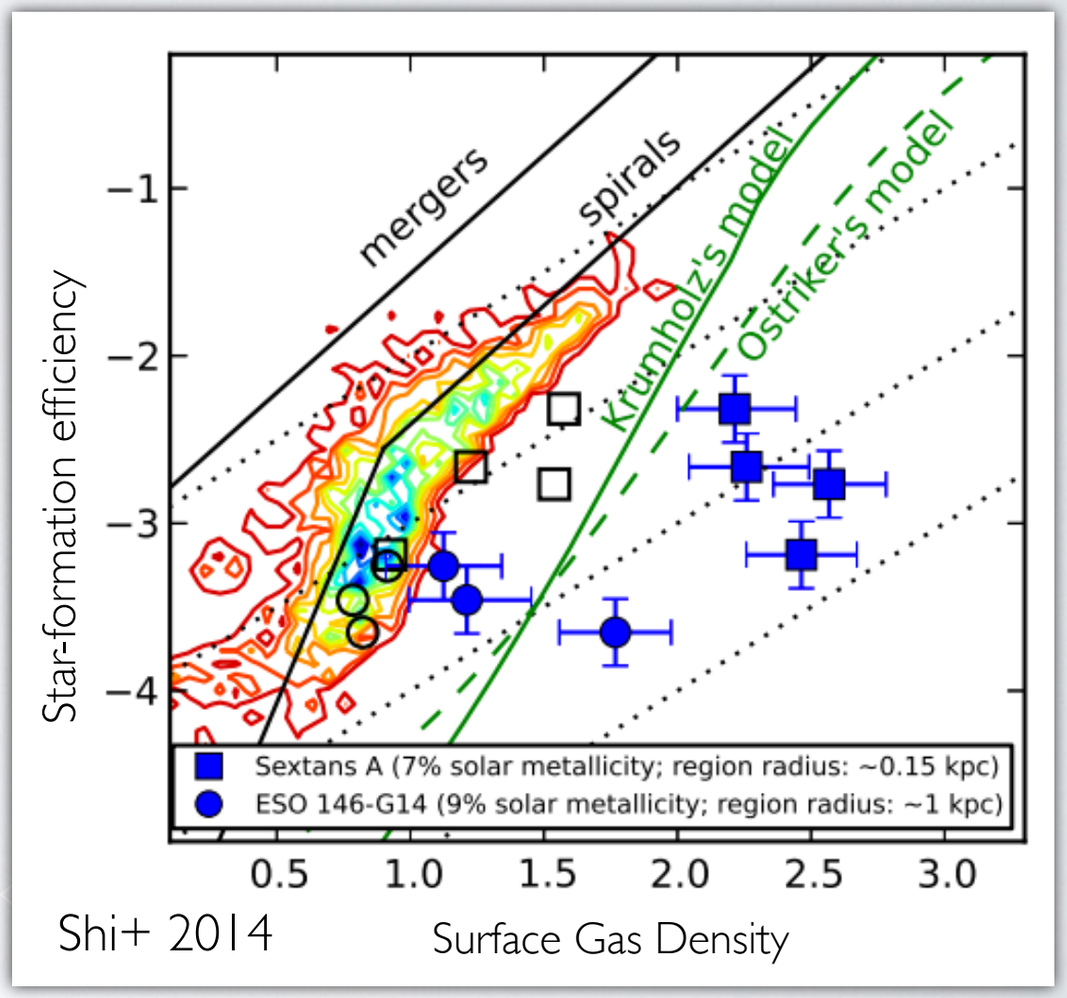


Erb, 2015

Are star-forming galaxies chemically homogeneous?

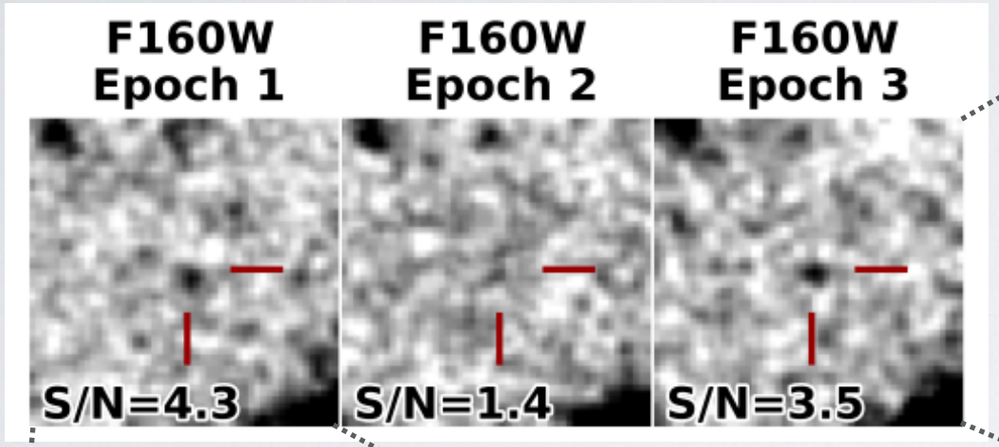
How is star-formation triggered?





NEARBY ANALOGUES TO THE FIRST GALAXIES

z~10 candidate XDFj-38126243 (Oesch+ 2013)



Mostly blue compact dwarf galaxies (BCDs)

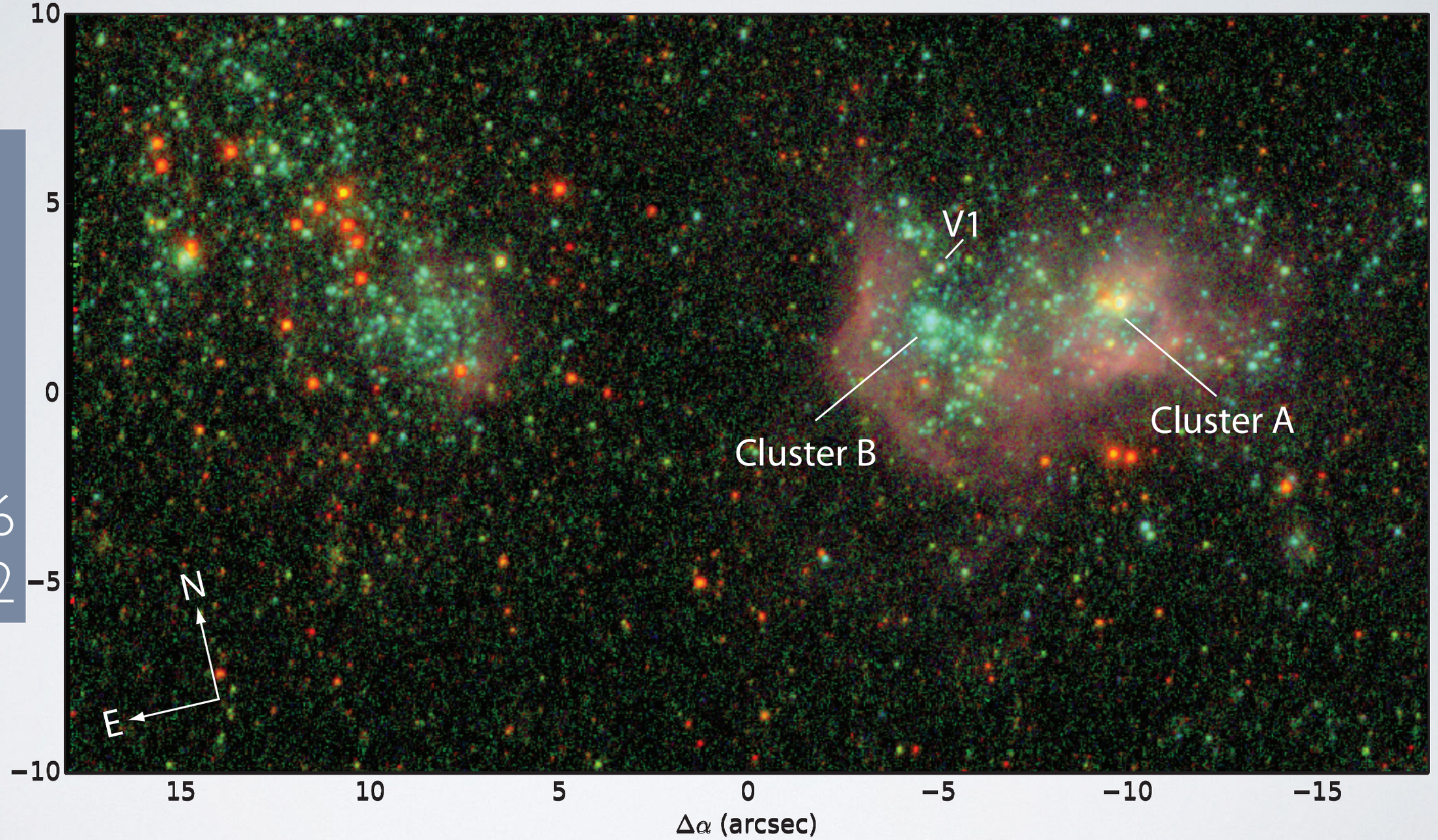
Metal poor
+
(often) starbursting
≈ High-z galaxies

MAPPING STELLAR FEEDBACK IN MRK 71

11 filters: 7 emission lines: HST-WFC3
10 orbits, 2 BCDs, PI: James

James et al., 2016a, ApJ

[OII]
HeII
Hβ
[OIII]
Hα
[SII]6716
[SII]6732



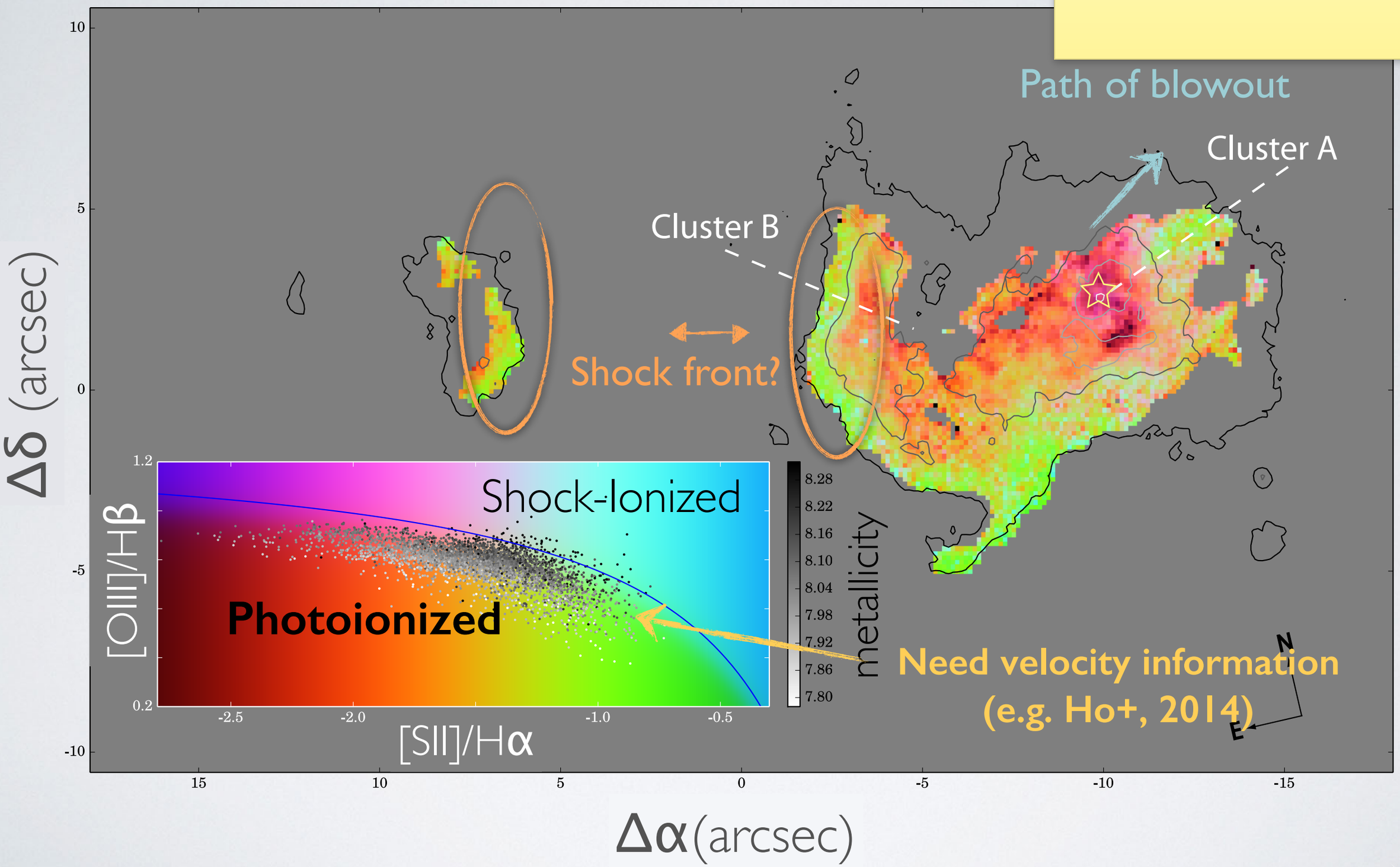
D=3.44 Mpc, **0.04"/pixel, ~0.7 pc/pixel**

Stellar: b=U, g=V, r=I
Gas: b=[OII], g=[OIII], r=Hα

EMISSION LINE DIAGNOSTIC IMAGING

put in spare sllide with models

Ja



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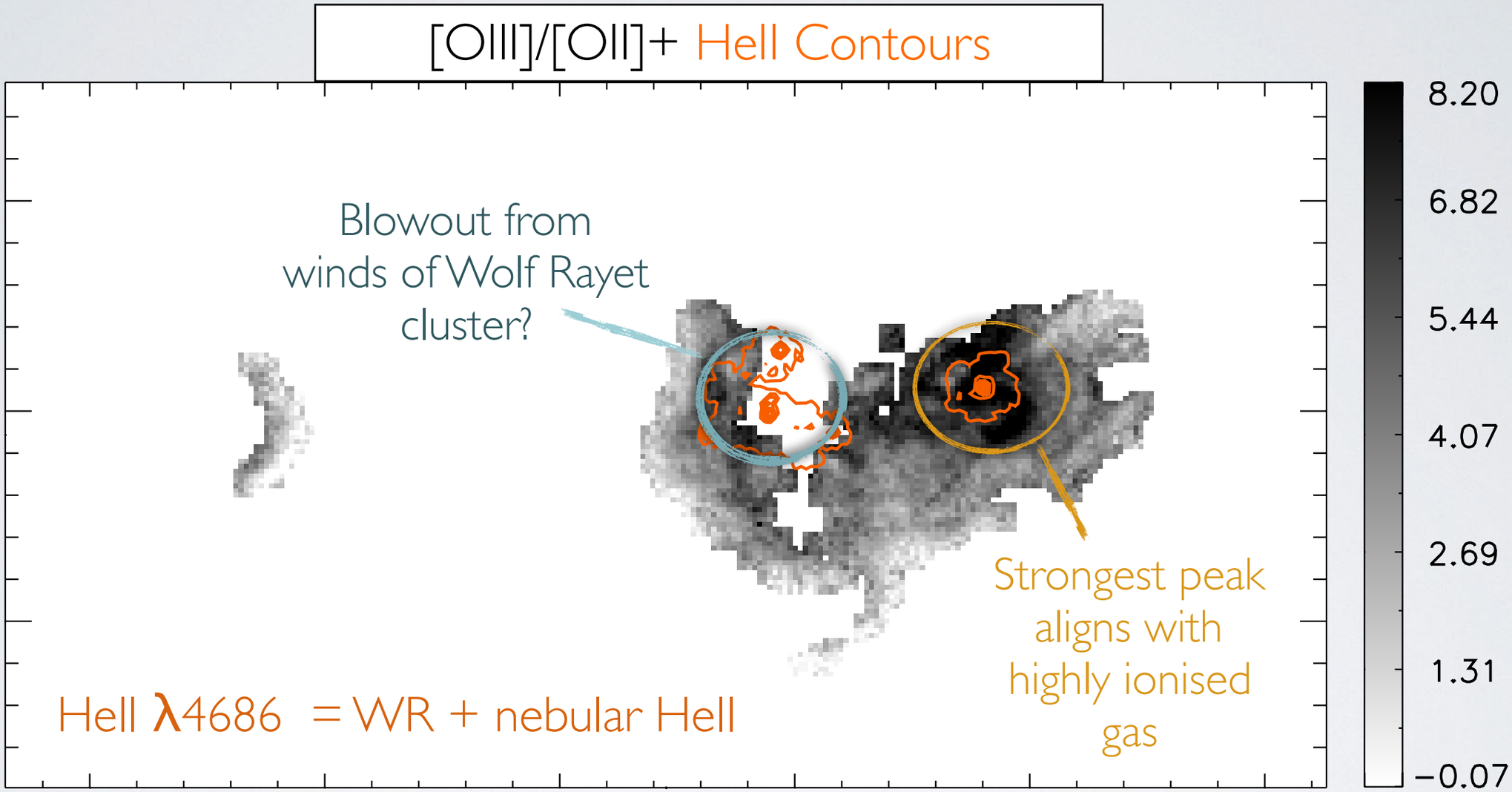
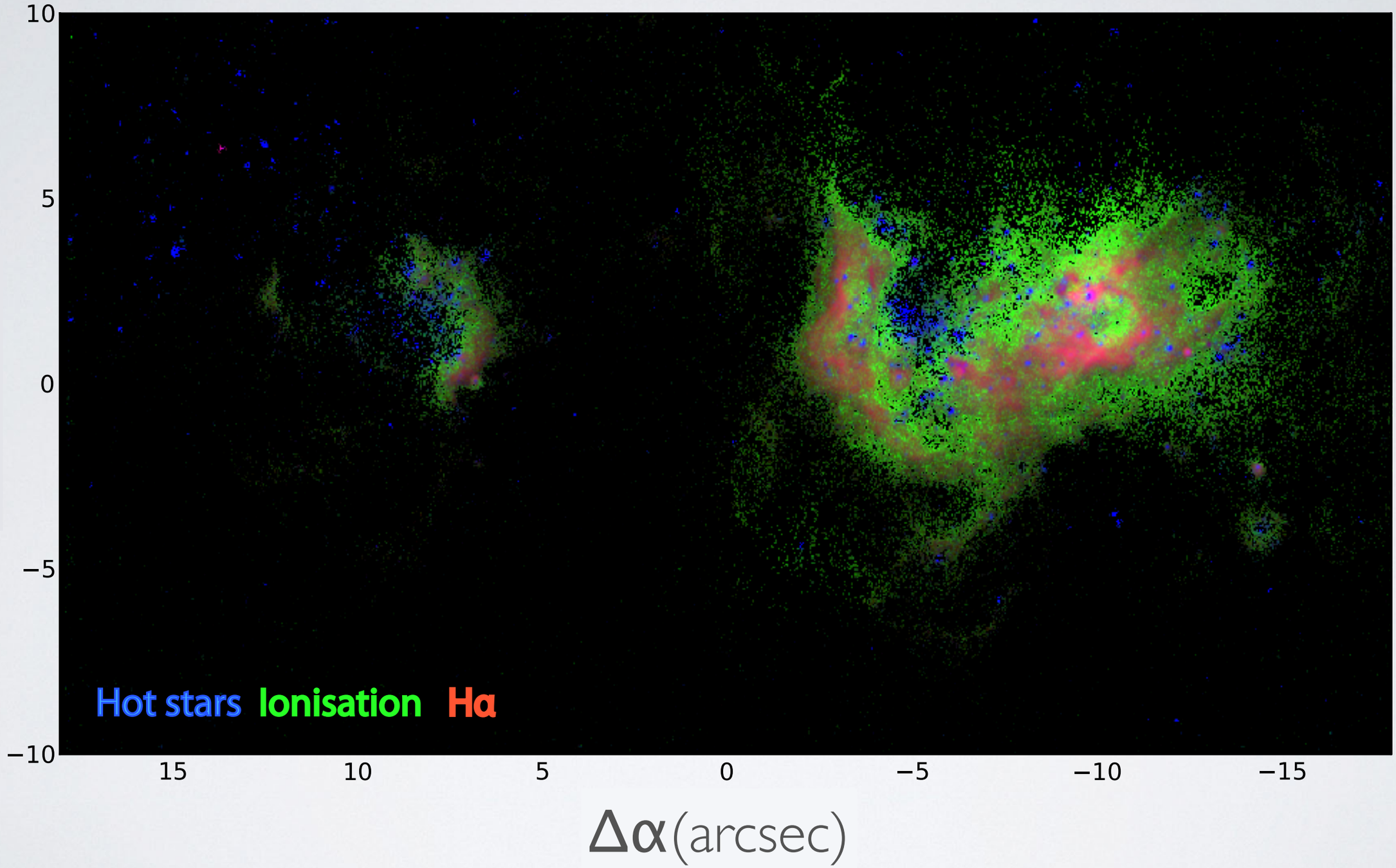
STELLAR FEEDBACK IN MRK71



(Ionisation parameter image)

"FEEDBACK IMAGING"

James et al., 2016a, ApJ



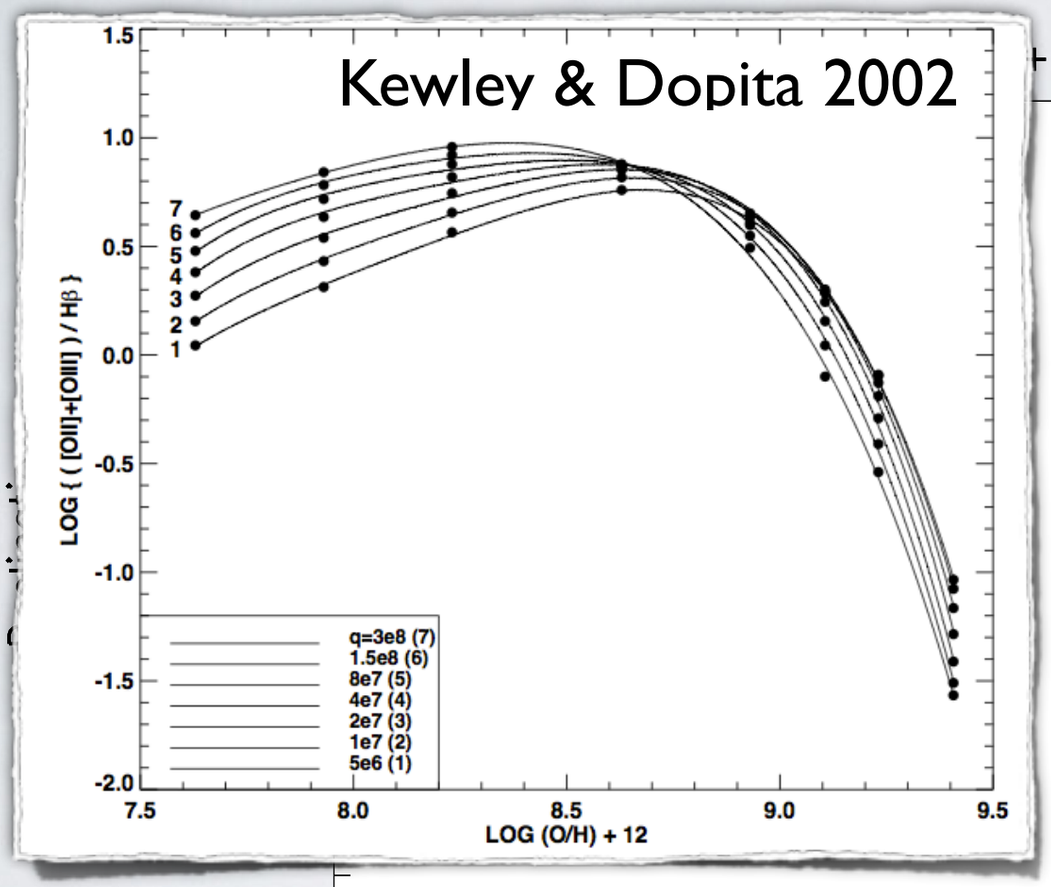
What are the effects of stellar feedback in metal-poor environments?

➡Feedback mechanisms create gas cavities: suppress star-formation …and dwarf galaxy evolution? (but can also trigger SF)

➡Stellar super winds transport photons: reionization of the IGM

➡Shock-excitation: very difficult to detect…large consequences?

METALLICITY "IMAGING" OF MRK 71



Decrease in O/H surrounding main super star cluster:

- Blow-out of primordial gas?
- Pollution from young clusters hasn't mixed?
- Has the R_{23} diagnostic broken down?…

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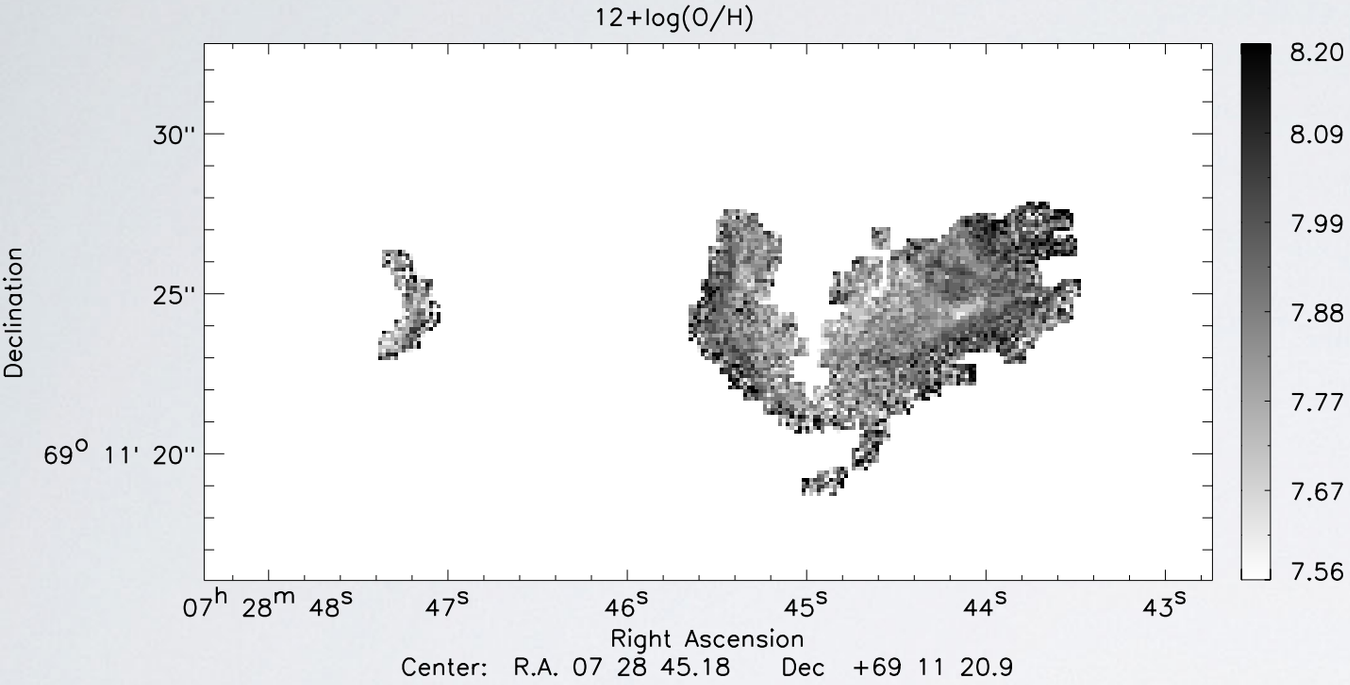
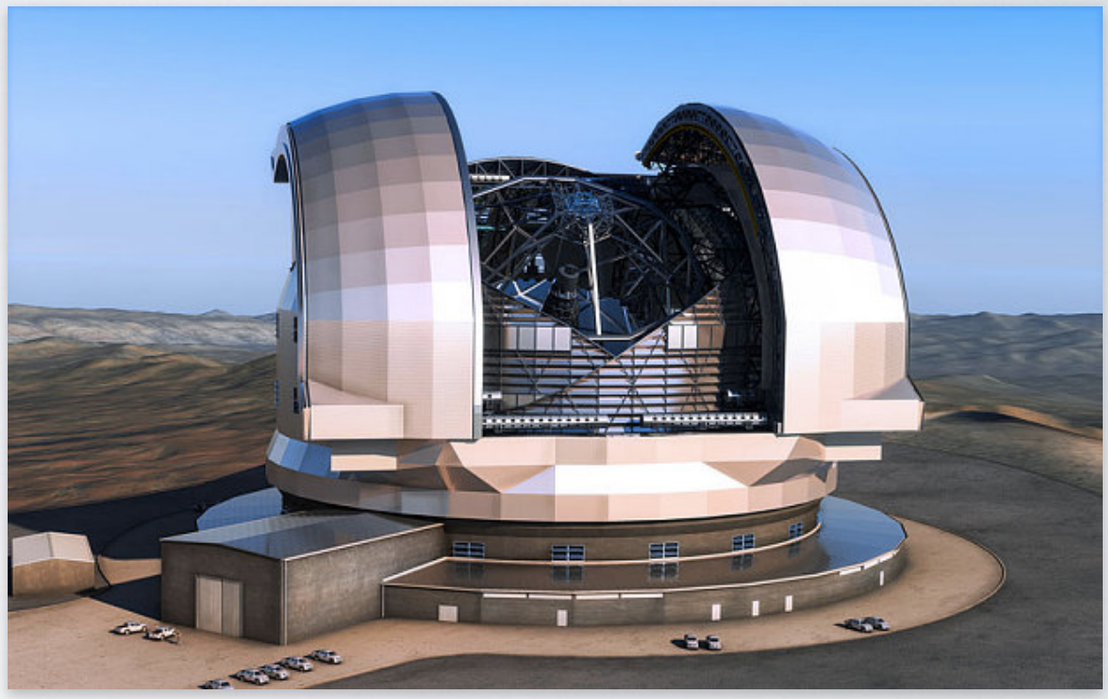
CHEMICAL MAPPING @LOW-Z: DEPENDENCE ON SCALE

The era of 30/40m telescopes is approaching…
Each one will have an IFU.



HST-WFC3 dataset: (0.04''/pixel)
Structure observed <50 pc scales

Do emission-line diagnostics have a minimum spatial scale?



e.g. **E-ELT Harmoni**
0.04''/spaxel (5''x10'' FoV)
0.02''/spaxel (2.5''x5'' FoV)
We will probe <50pc scales at z=2

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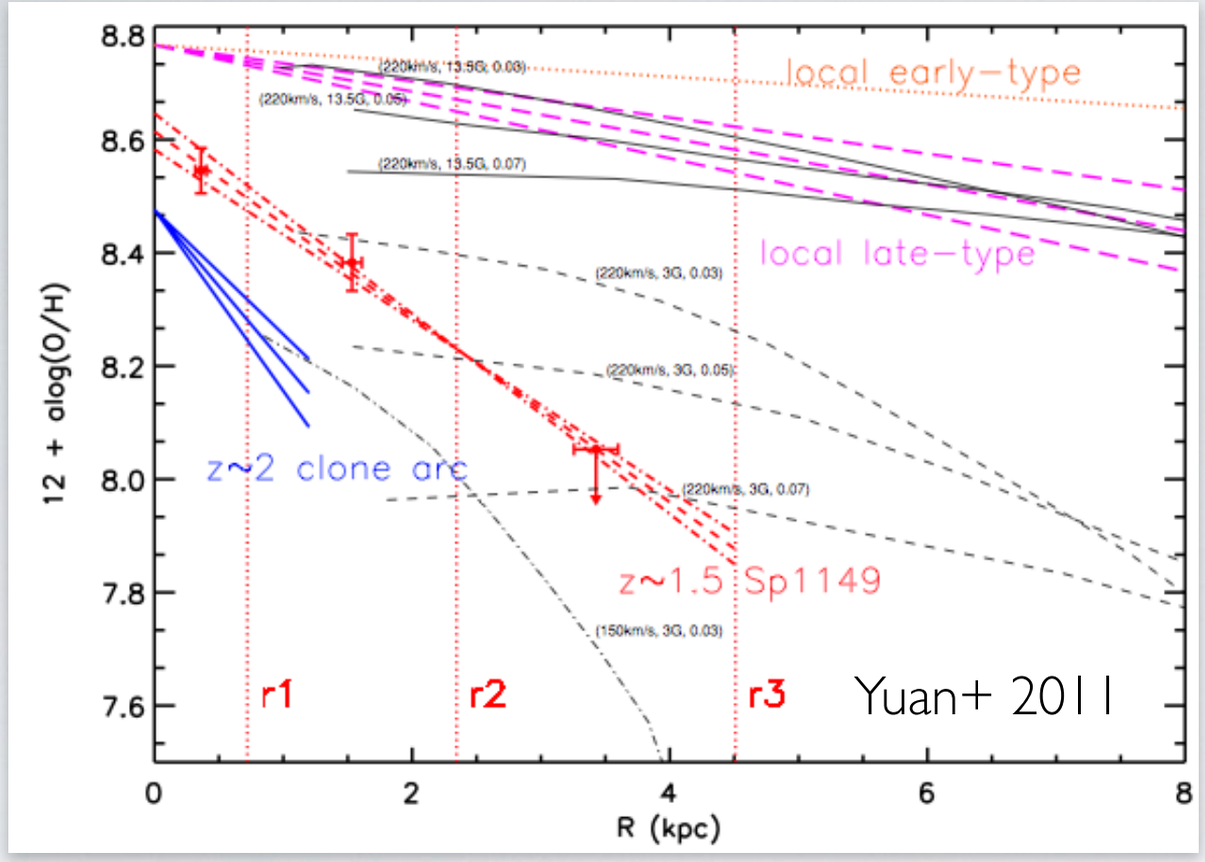
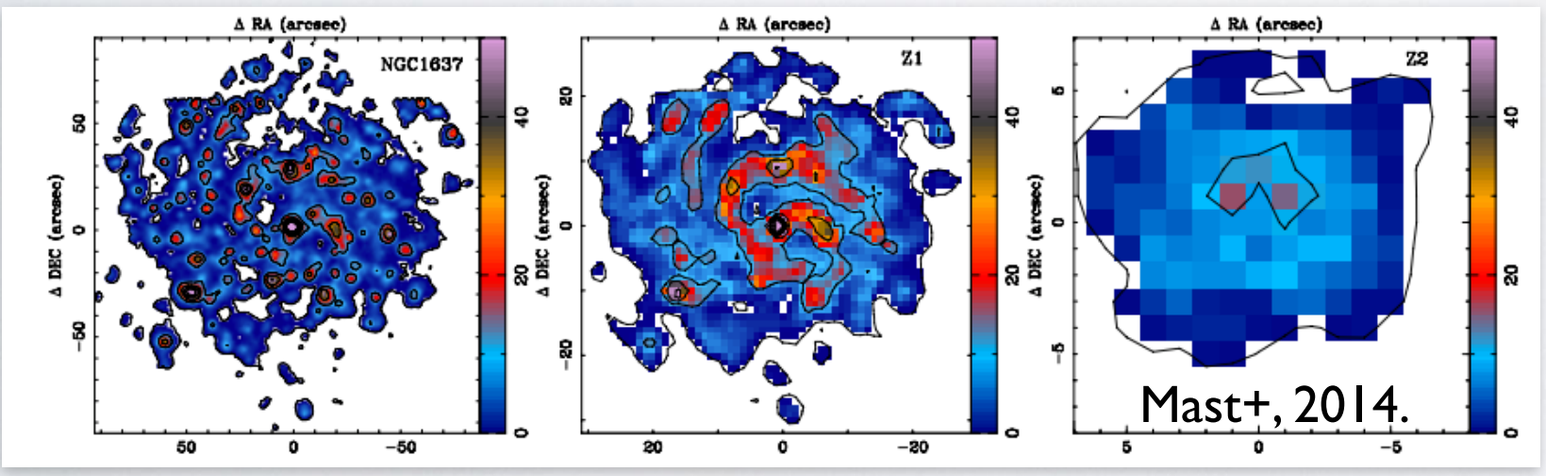
CHEMICAL MAPPING @HIGH-Z: DEPENDENCE ON SCALE

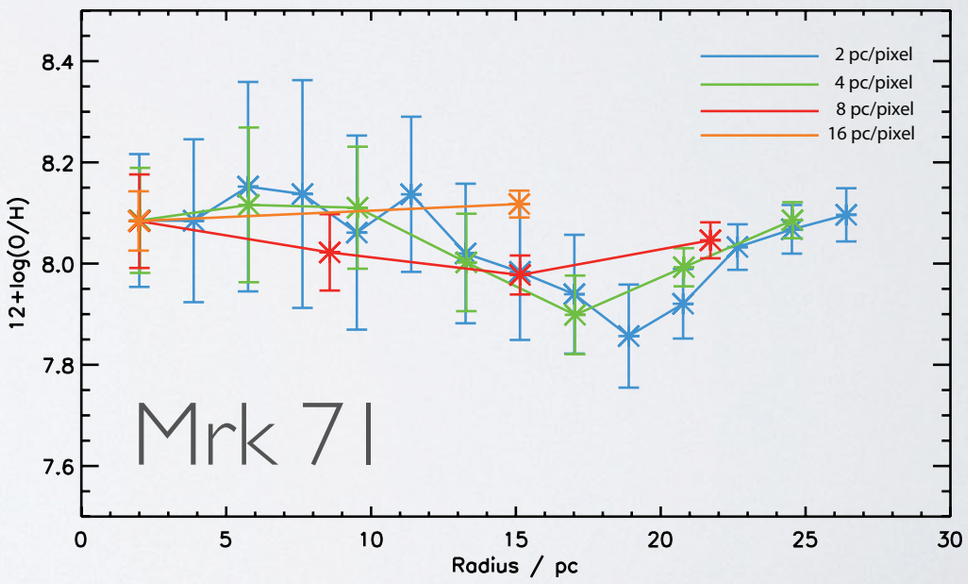


Are gradients evolving? or Discrepancy due to resolution?

Scales **<1kpc** are needed for a reliable gradient (Yuan+ 2013)



0.05 kpc/pix 0.144 kpc/pix 0.562 kpc/pix



Although **ΔZ** is lost, <Z> (usually) remains

Are star-forming galaxies chemically homogeneous?

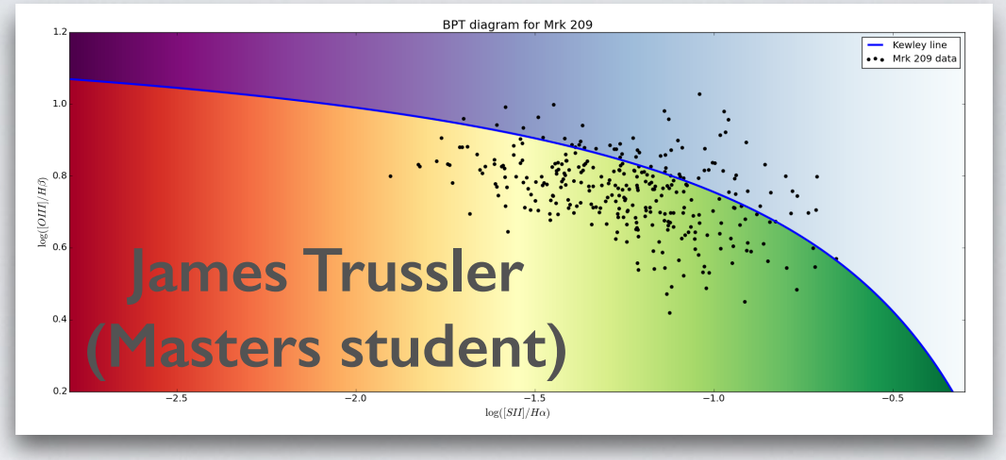
➡Not always!

➡Environments affect mixing timescales & star-formation, + evidence for accretion

➡Spatial scales play a big role - at both low-z & high-z.

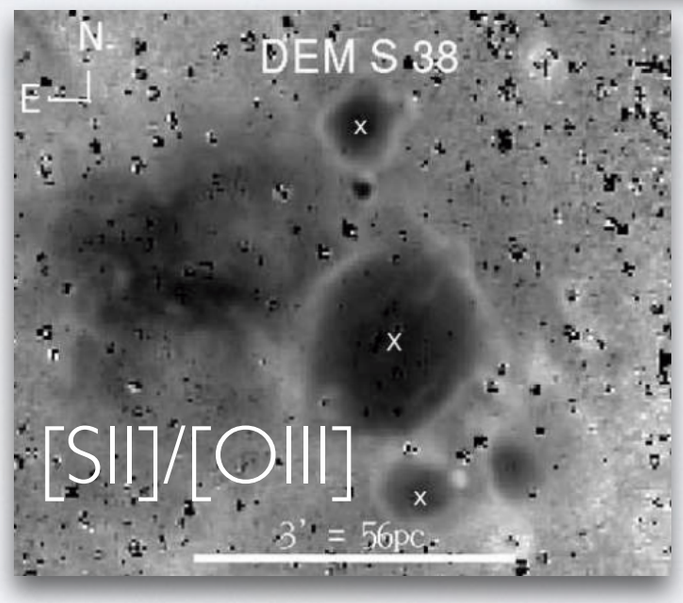
EMISSION-LINE MAPPING: FUTURE PATH

Pin-down shocks at low-z with IFUs

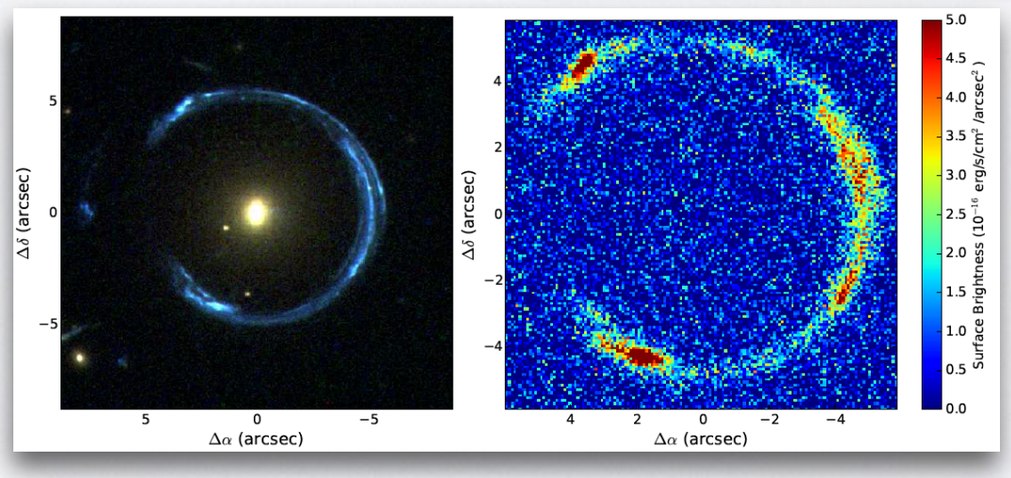


Assess how LyC photons escape

Ionisation Parameter Mapping
12 HST-WFC3/ACS orbits, PI: Oey
LyC emitters: Haro 11, Tol 1247-232



Stellar Feedback at z=2.4 with HST



Simulated 3 Orbits
HST-WFC3 F167N

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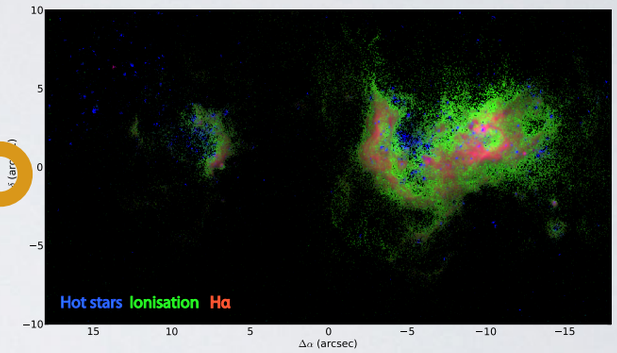
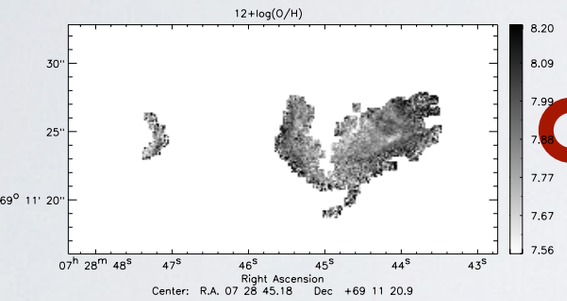
Metal-poor galaxies are key in understanding galaxy evolution

Stellar feedback: suppresses star-formation & transports photons…shocks?





Star-forming galaxies are not chemically homogeneous: effects?

IFS studies of nearby systems allow extended insight into the 'realistic' ISM of star-forming galaxies at **all** redshifts → constrain high-z galaxy evolution.
A major scientific objective of all future observatories.

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