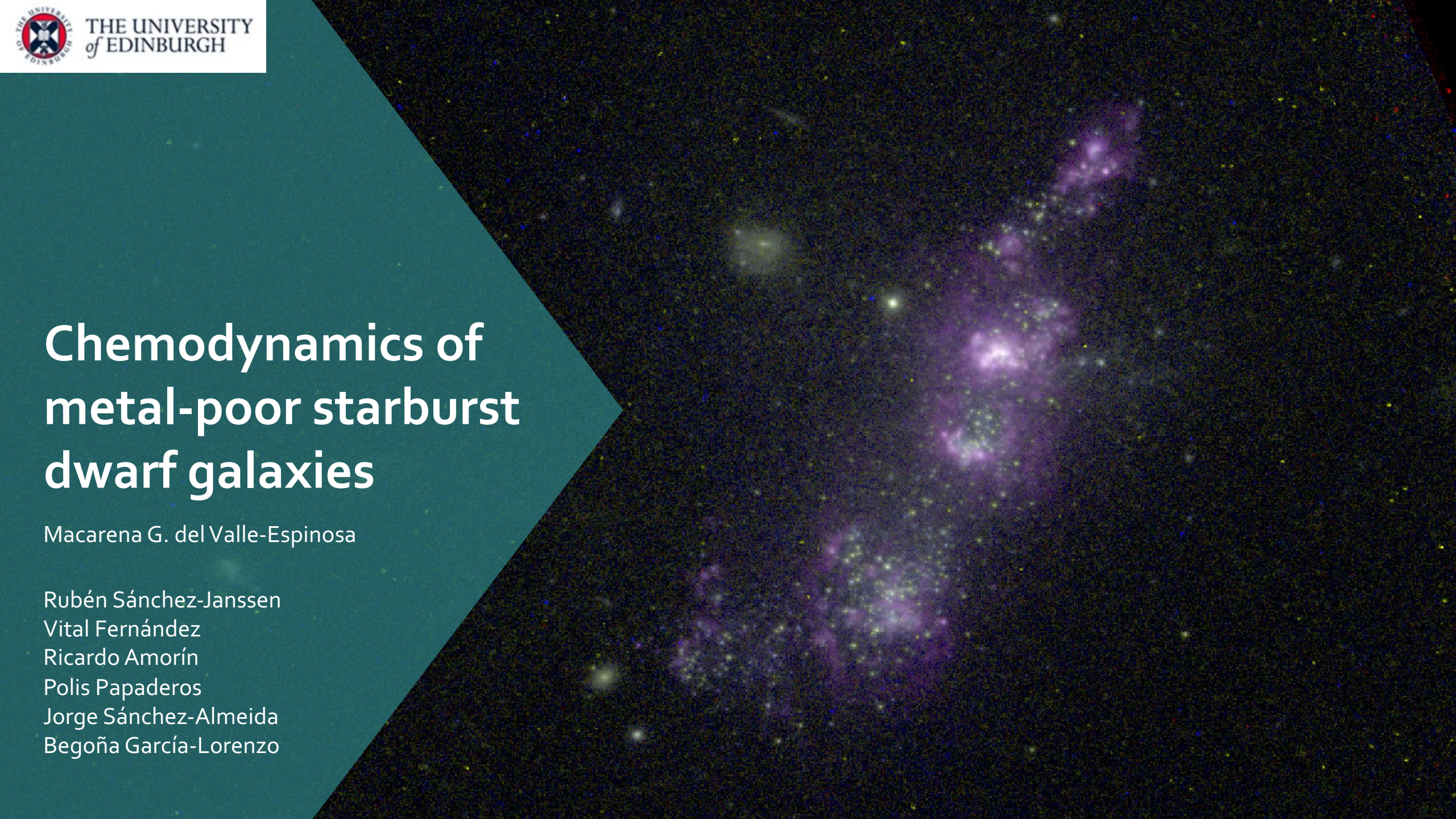


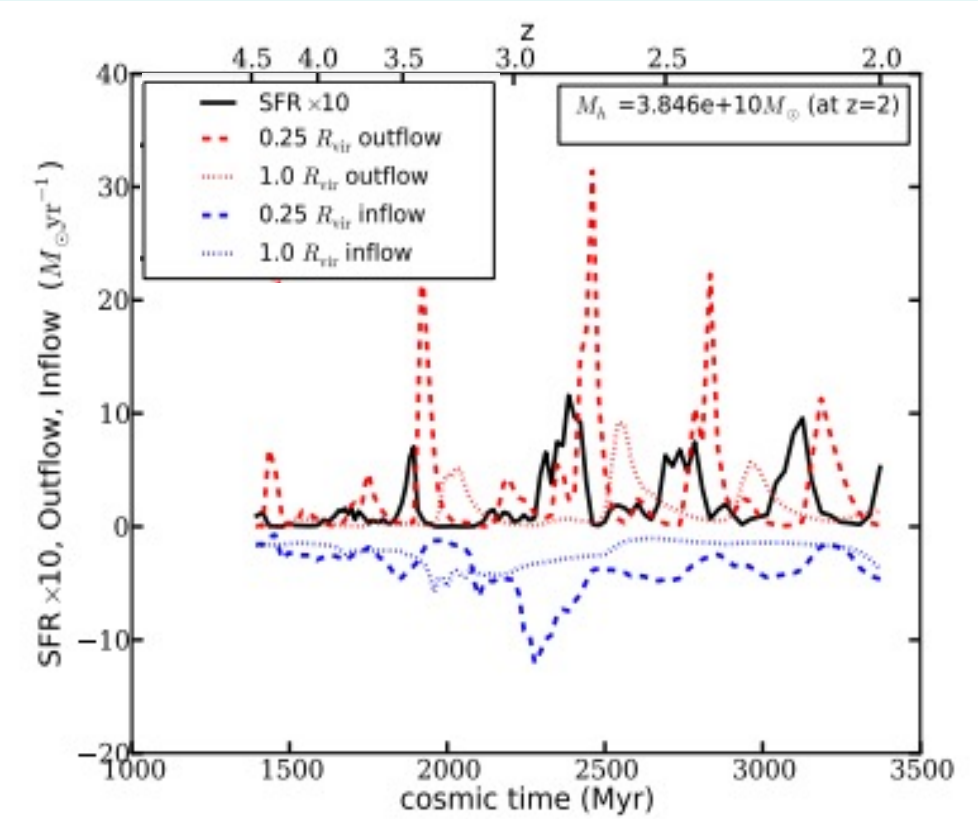
Chemodynamics of metal-poor starburst dwarf galaxies

Macarena G. del Valle-Espinosa

Rubén Sánchez-Janssen
Vital Fernández
Ricardo Amorín
Polis Papaderos
Jorge Sánchez-Almeida
Begoña García-Lorenzo

Introduction

Simulations predict burstiness is a common feature of star formation at high redshift and/or low galaxy masses



Muratov et al. (2015)

High ISM turbulence when $f_{gas} > 0.3$

⇩

Efficient feedback and bursty SFHs

Hayward & Hopkins et al. (2017)

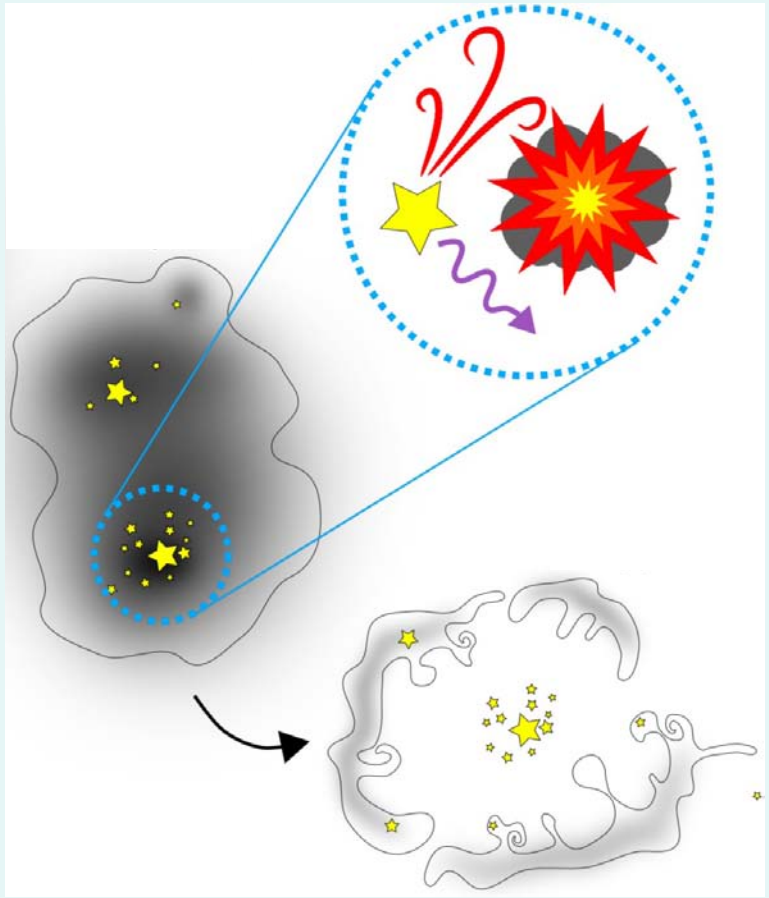
Galaxy mass, SFR and metallicity are linked by gas inflows and outflows

⇩

Fundamental Metallicity Relation

Mannucci et al. (2010)

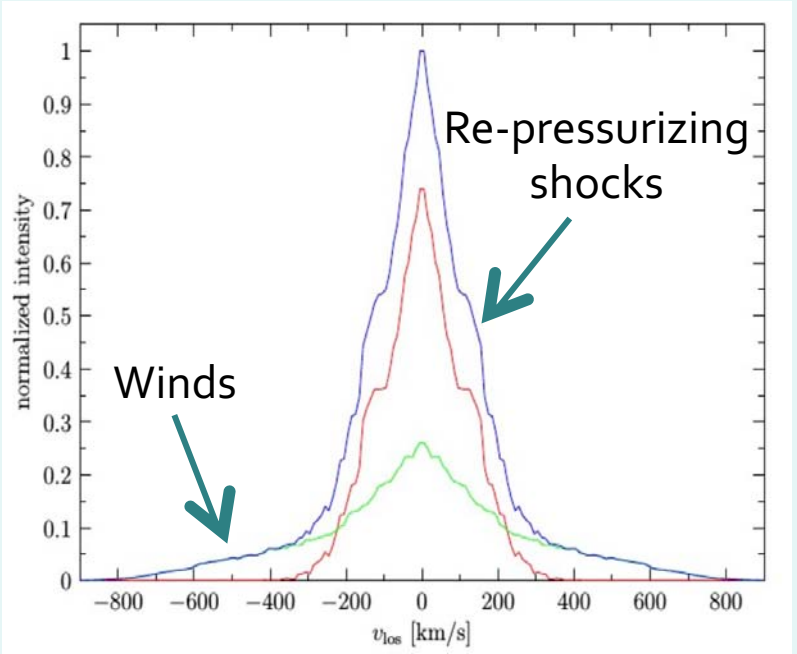
Stellar feedback regimes



Rahner et al. (2017)

Negative feedback
Material is swept away from the galaxy and star formation is inhibited.

Positive feedback
Material remains in the cloud, allowing a posterior star formation episode.

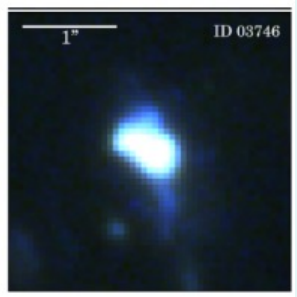


Tenorio-Tagle et al. (2010)

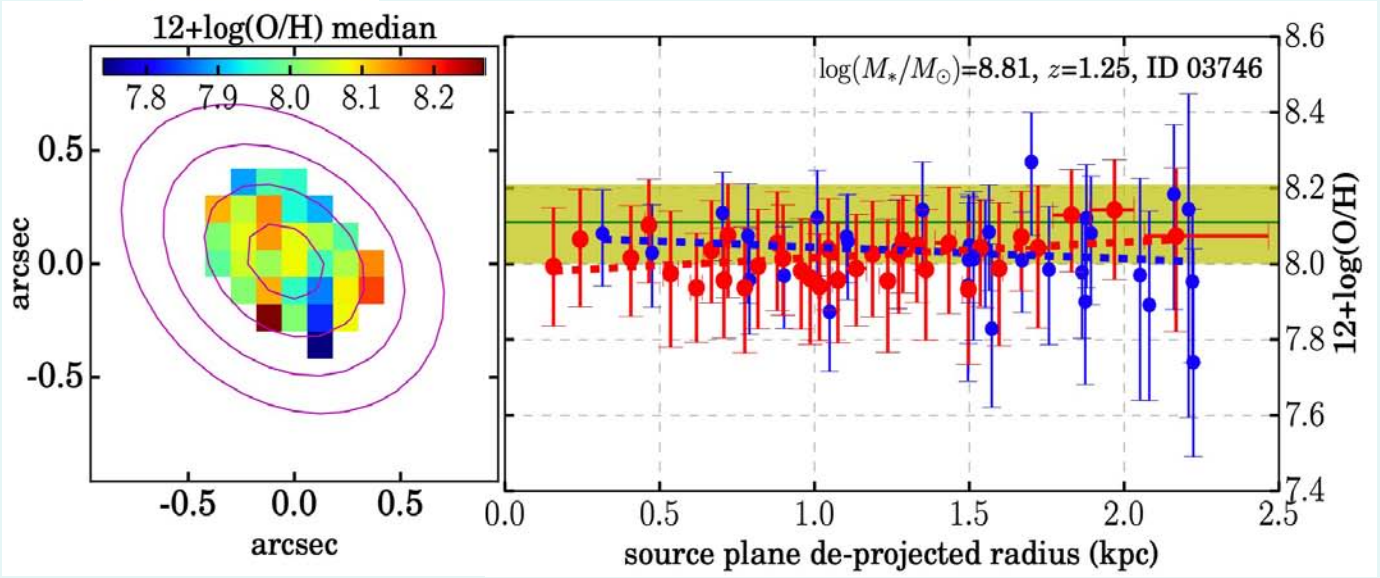
Tools to constrain feedback recipes

Metal enrichment of dwarf galaxies is one of the most powerful discriminant of feedback prescriptions

Agertz et al. (2020)

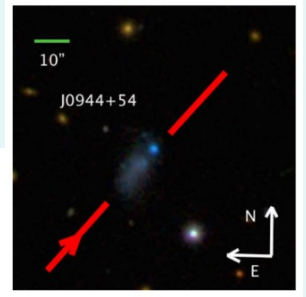


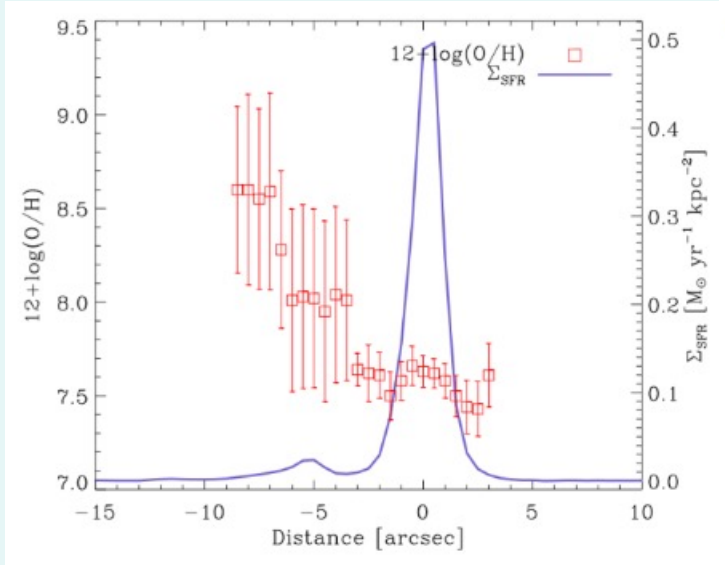
Metallicity gradients



Wang et al. (2017)

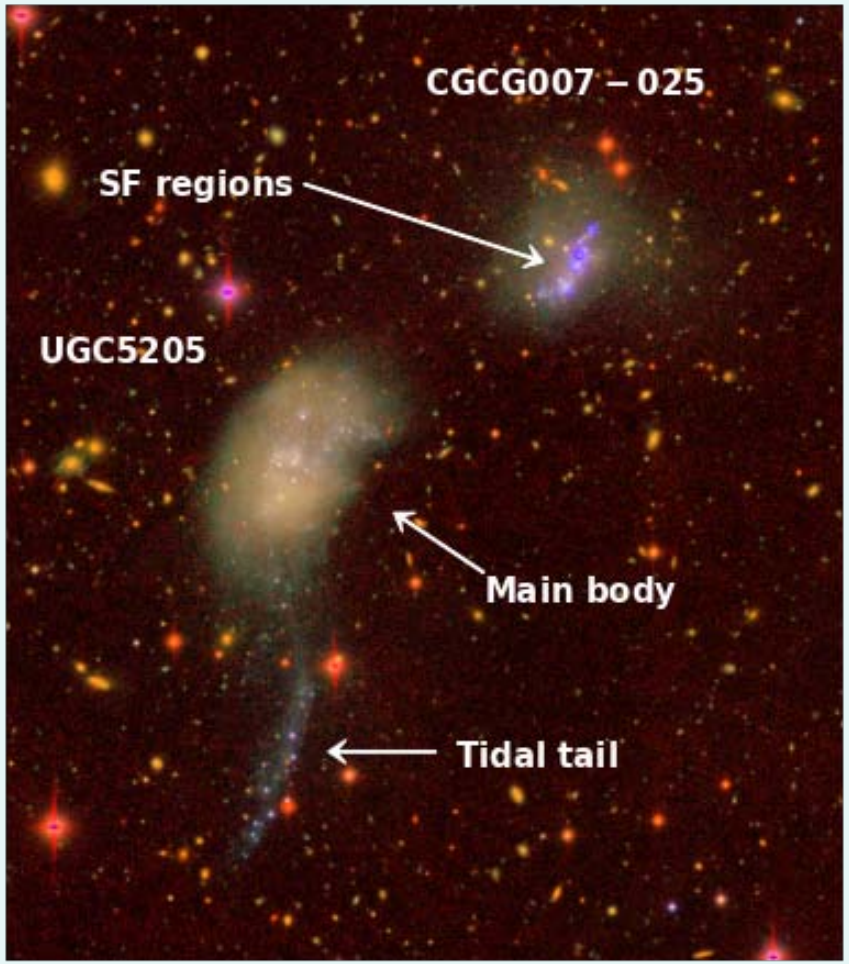
Chemical inhomogeneities





Sánchez-Almeida et al. (2015)

An interacting pair of dwarf galaxies at 20 Mpc



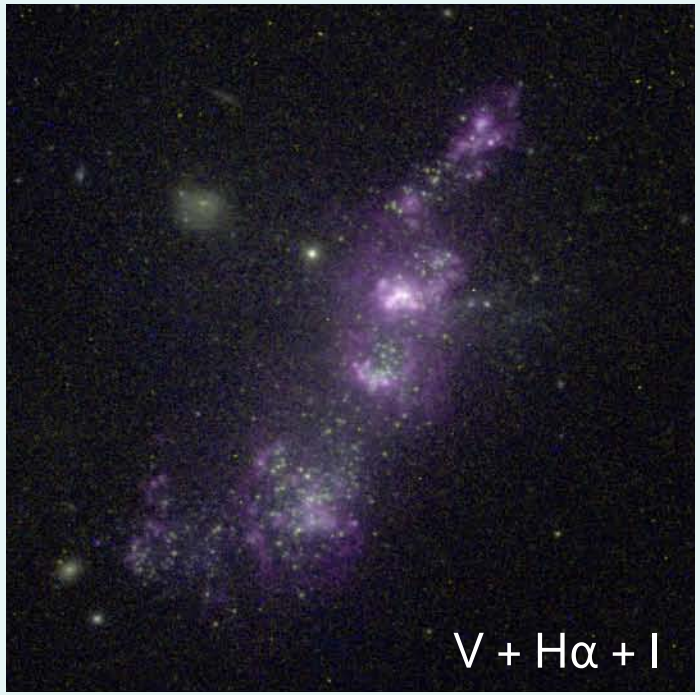
Credits: Subaru/HSC

Dwarf-dwarf interacting systems provide a unique window into the hierarchical processes that should operate more frequently at higher redshifts.

UGC 5205	Post-starburst galaxy Stellar mass ~ 3×10^8 M_o Age of clusters ~ 80 Myr
CGCG 007-025	Nucleated dSph galaxy with an off-center metal-poor starburst Stellar mass ~ 8×10^7 M_o 12+log(O/H) = 7.65 Age of clusters ~ 4Myr

An HST+MUSE study of the starburst CGCG 007-025

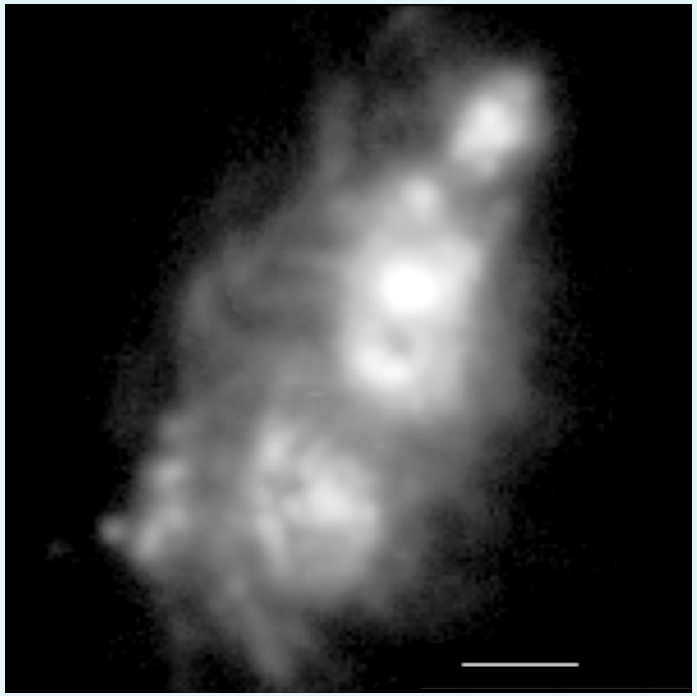
HST/WFC3



Spatial resolution element of 0.08" (8 pc)

NUV+U+B+V+Hα+I

VLT/MUSE Hα map



Spatial resolution element of 1" (100 pc)

4800 to 9300 Å at R=2400

Fitting procedure

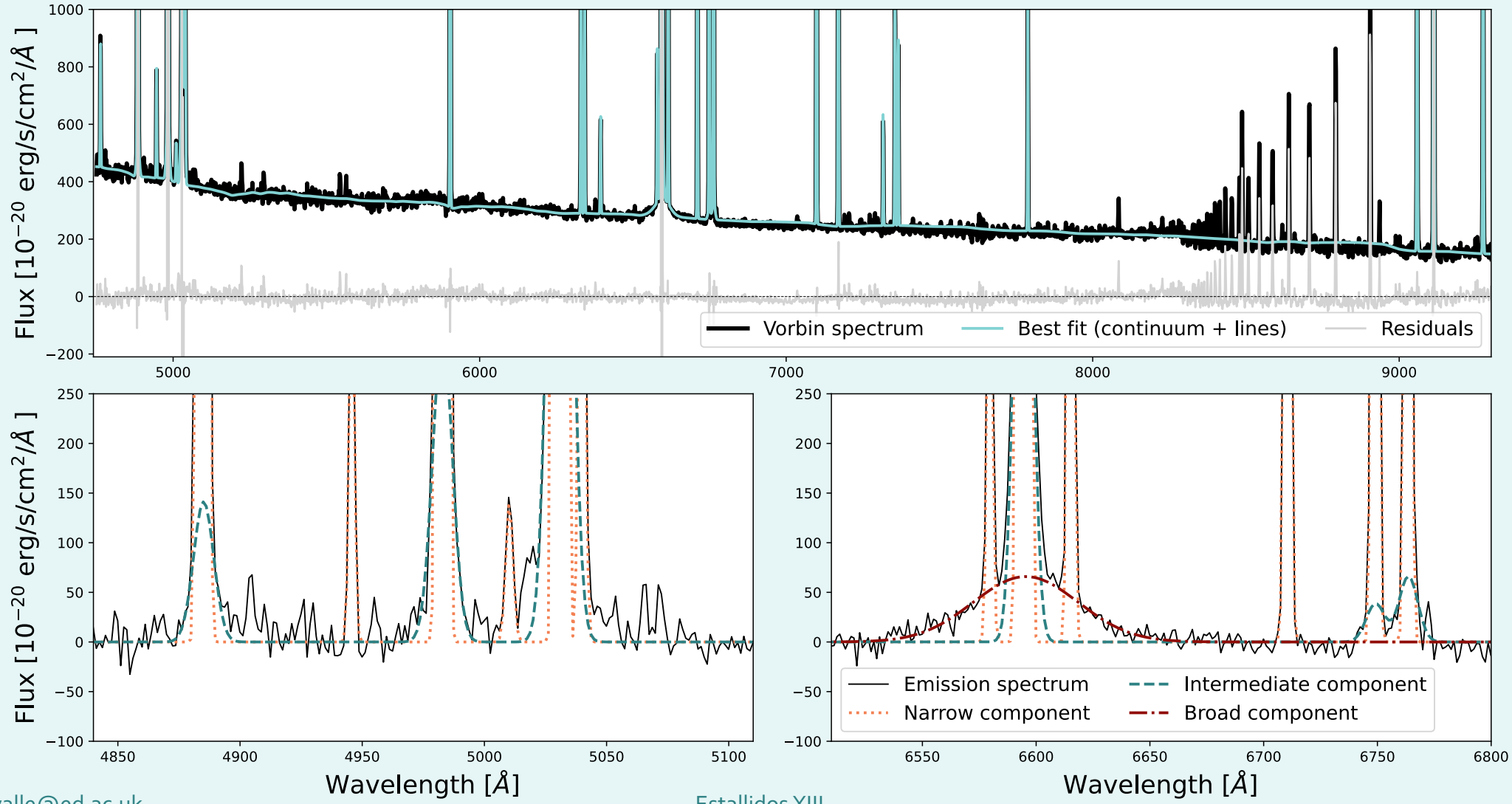
Voronoi tessellation optimized to the study

Fitting of Hα, Hβ, [OIII]λλ4959,5007, [NII]λλ6548,6584, [SII]λλ6717,6732

Hα: up to 3 components
Hβ, [OIII], [SII]: up to 2
[NII]: one component

Model selection based on BIC

Modeling of the nebular emission

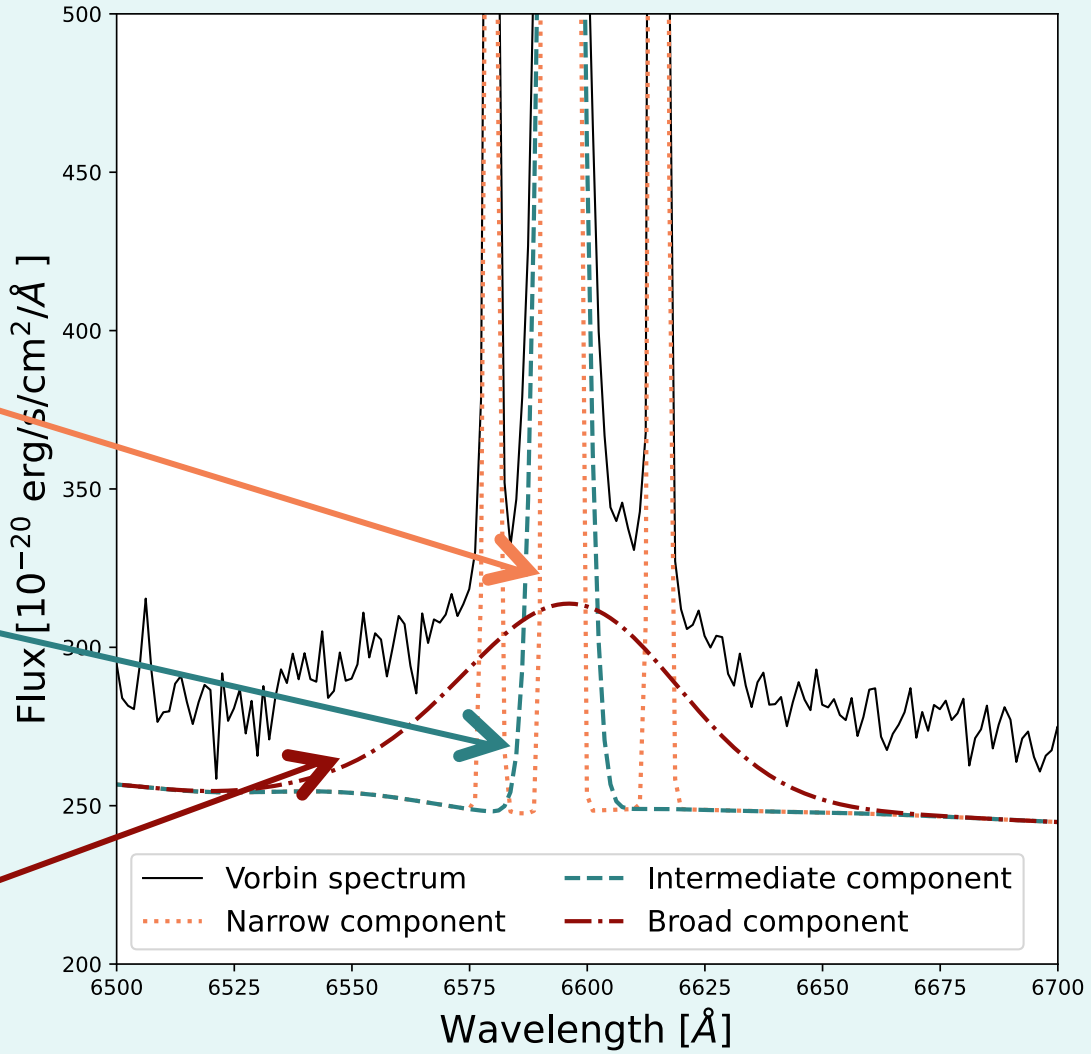


Multiple kinematic components: Evidence of outflows?

Narrow (unresolved)
σ_{gas} = 35 km/s from R20.000 Echelle MIKE spectrum

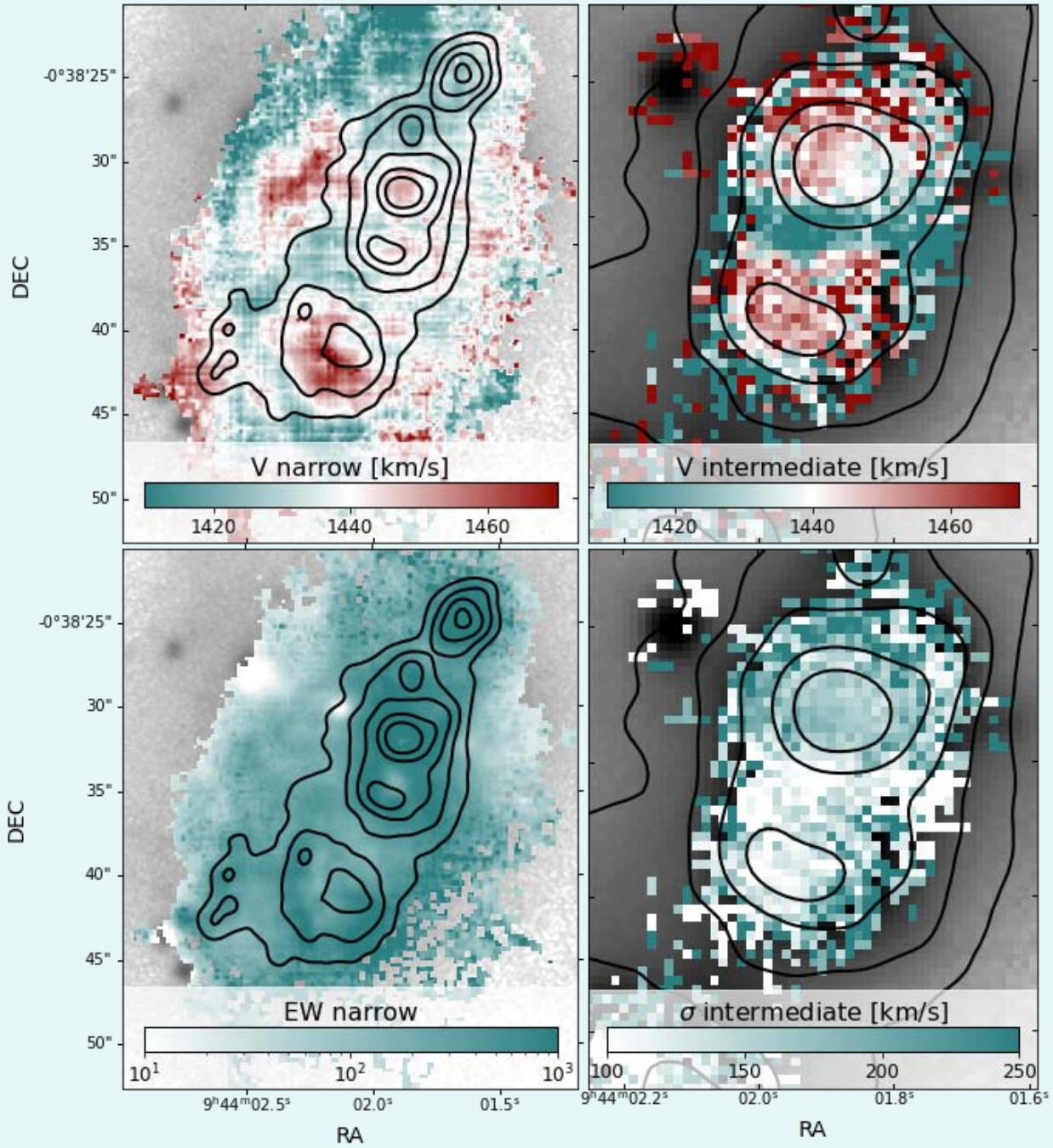
Intermediate
σ_{gas} ~ 150 km/s

Broad σ_{gas} ~ 850 km/s



Disordered gas motions and an expanding shell

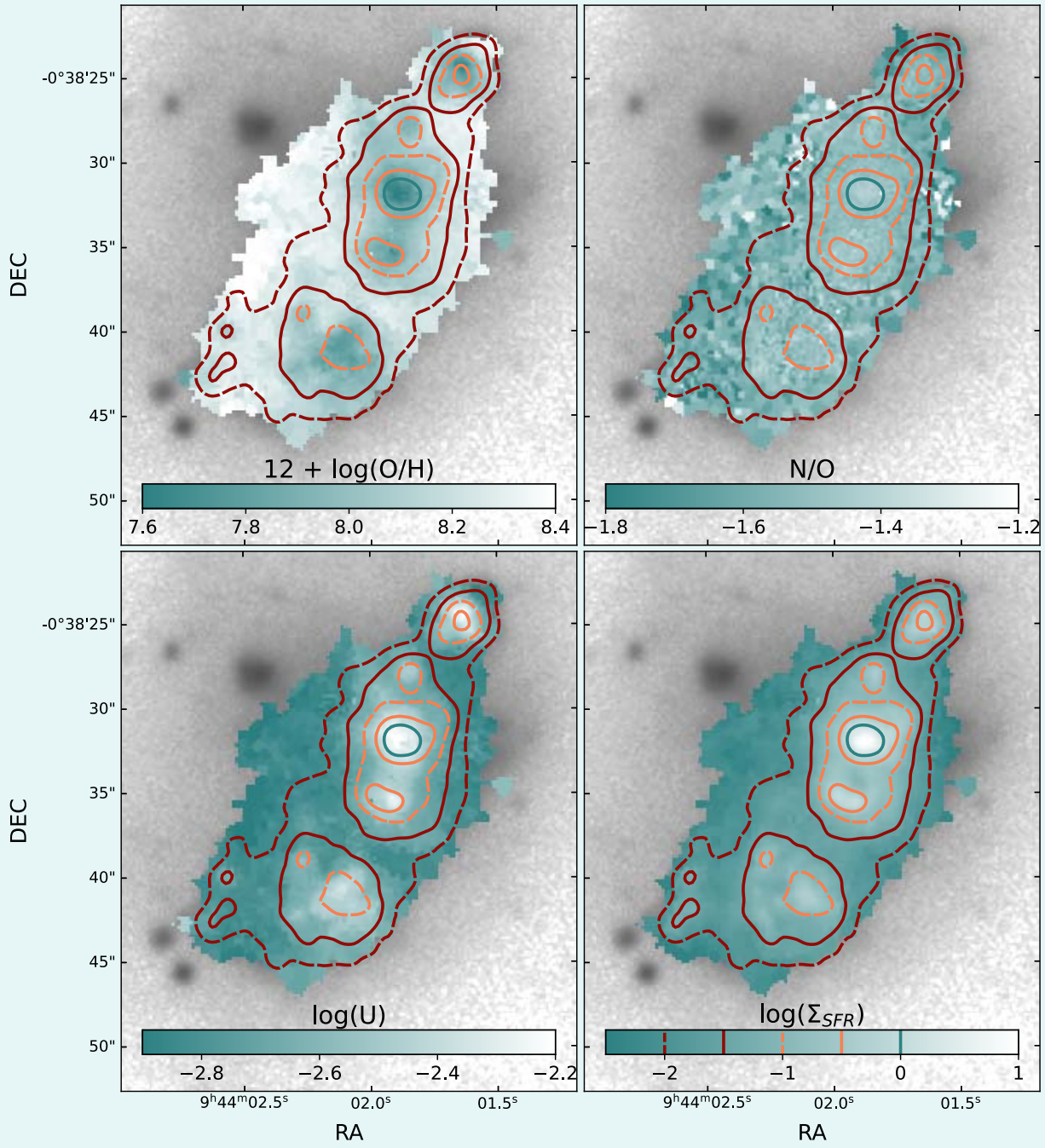
- Velocity field dominated by disordered motions
- High EW indicative of young burst
- Velocity field and dispersion of intermediate component suggest presence of an expanding bubble



Metal content and SFR

Chemistry derived with HII-CHI-mistry
Pérez-Montero (2014)

SFR calculated with Kennicut calibration
Kennicut (1998)

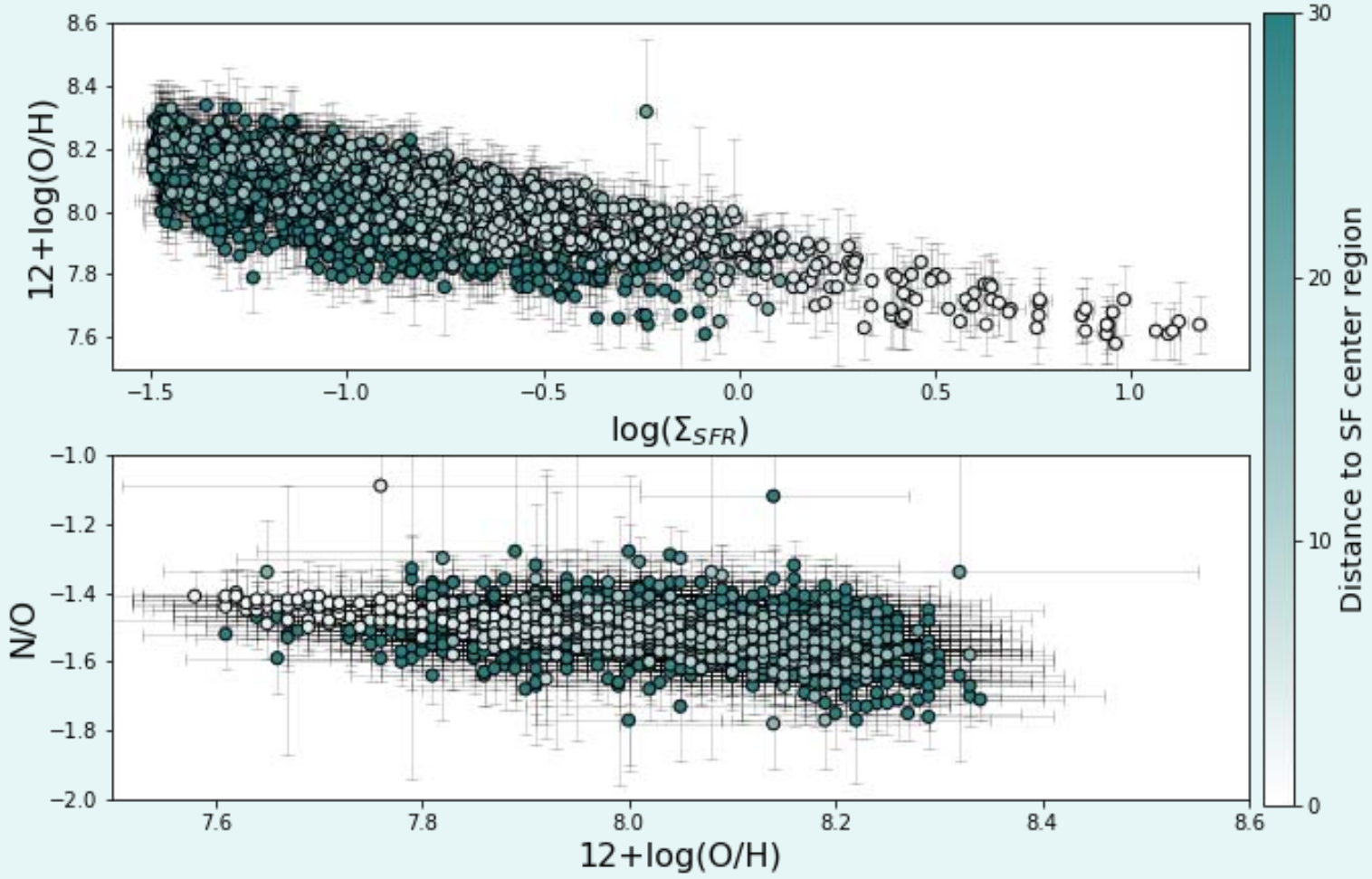


Metal content and SFR

Probe of gas accretion scenario:

metallicity drops where SFR peaks whereas N/O stays flat

Luo et al. (2020)

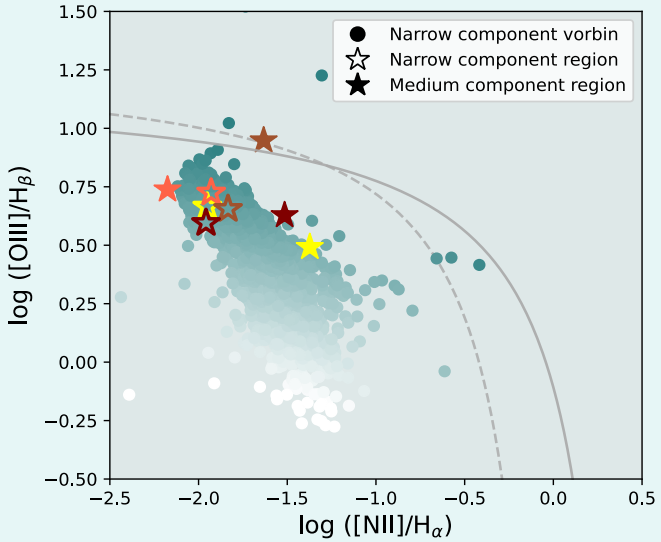


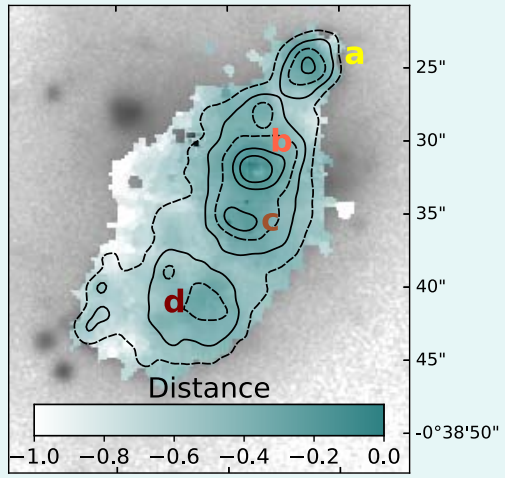
BPT diagrams

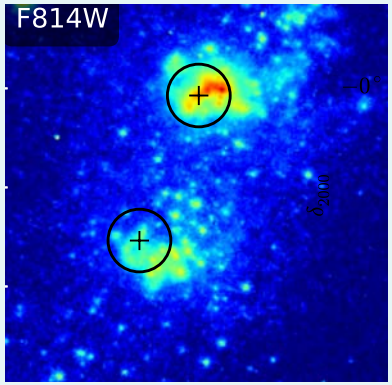
4 main star-forming regions

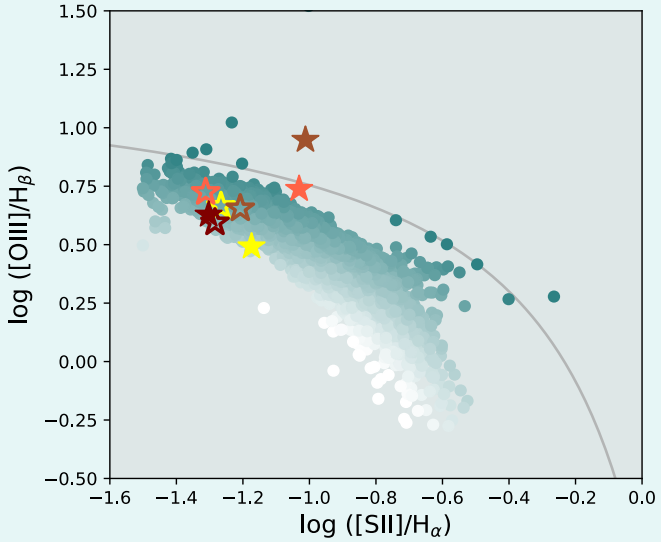
Intermediate component of regions b and c moves towards the shock BPT region

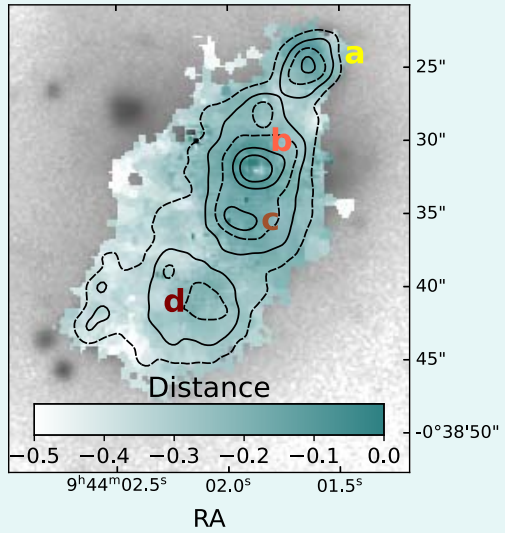
X-ray (Chandra) detection in regions b and c



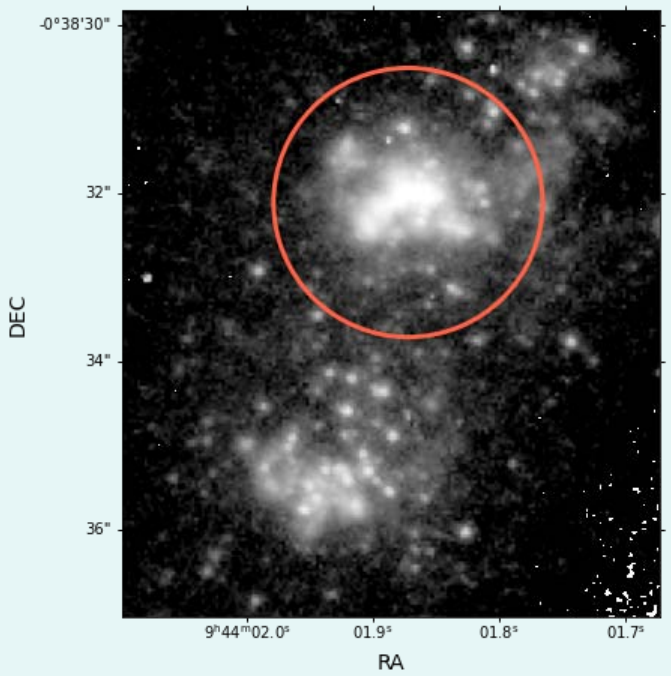


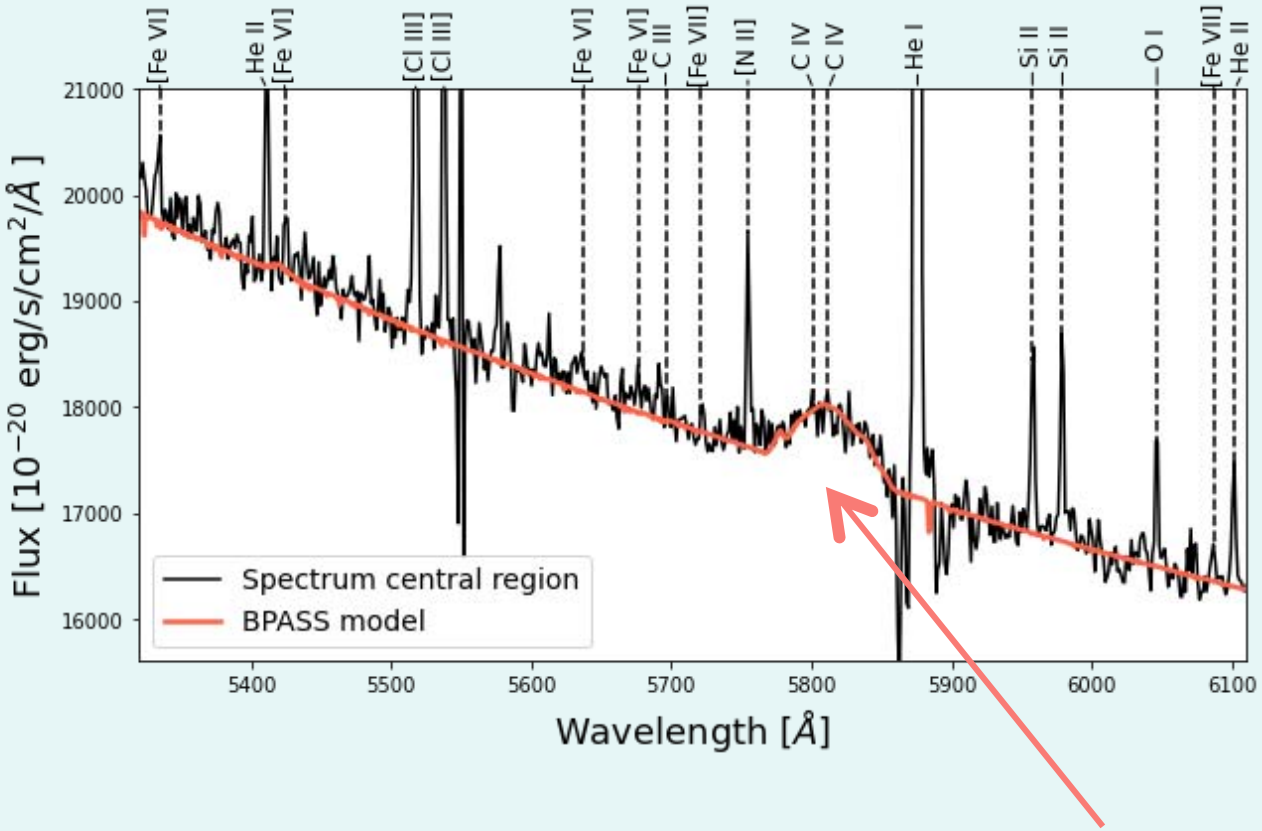






Ongoing… The WR population





PoWR model of WC with sub-SMC metallicity

We estimate around 35 WC

BPASS models with Z = 0.002
~ 3Myr

WR bump at 5800 Å
$3 \cdot 10^{-16}$ erg/s/cm²

Conclusions / Open questions

CGCG 007-025

Interacting dwarf starburst galaxy at 20 Mpc
HST/WFC3 + VLT/MUSE observations
Analogue to high-z galaxies
Unique environment to study extreme star formation and feedback

- Large scale gas has disordered motions, with the presence of broad components
- Chemistry reveals SF clumps within low metallicity* gas regions
- Evidences of gas accretion scenario, where O/H anti-correlates with SFR but N/O remains (almost) constant
- Presence of WR-C features

- How to discern if the Hα broad component is an outflow or WR winds?
- Weak anti-correlation between N/O and O/H (?)
- WR-C already in place at 3Myr?

* This measurement is biased low