Last news about NGC5253: the question of the N-enrichment revisited

Ana Monreal Ibero[(1)]

José Vílchez[(2)], Jeremy Walsh[(1)], Casiana Muñoz-Tuñón[(3)]

[(1)]ESO,[(2)]IAA,[(3)]IAC

(based on Monreal-Ibero et al. 2010, summited)

What do we want to do?

- Starburst: ~hundreds $M_\odot$ yr^{-1} of gas are transformed into stars in an small region in the nuclei of galaxies
- Important impact on the host galaxy. Main contributors to the enrichment of the ISM.
- Some of them expell material into the IGM: the SGW

We want to determine the detailled physical link between SSCs and the ionized gas in starburst galaxies.

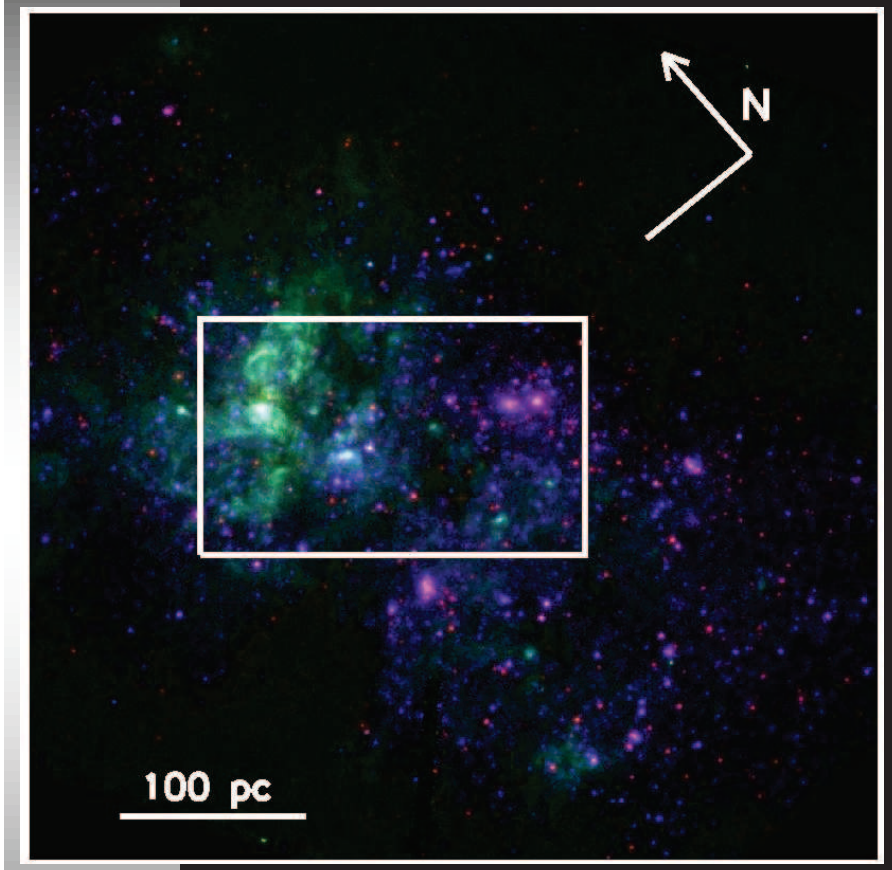
- Analyse the physical conditions (extinction, ionization and electronic density structure…) of the ionized gas.
- Analyse the kinematics of the gas using v and σ maps from Hα (or Hβ) and [OIII]λ5007.
- Identify the SSCs responsible of the gas structure.
- Putting all this together to try to understand under which conditions a SGW is created.

The two questions of today

What is the extinction in this galaxy (both gas and stars)?

Where do we find N-pollution and how could it happened?

NGC5253



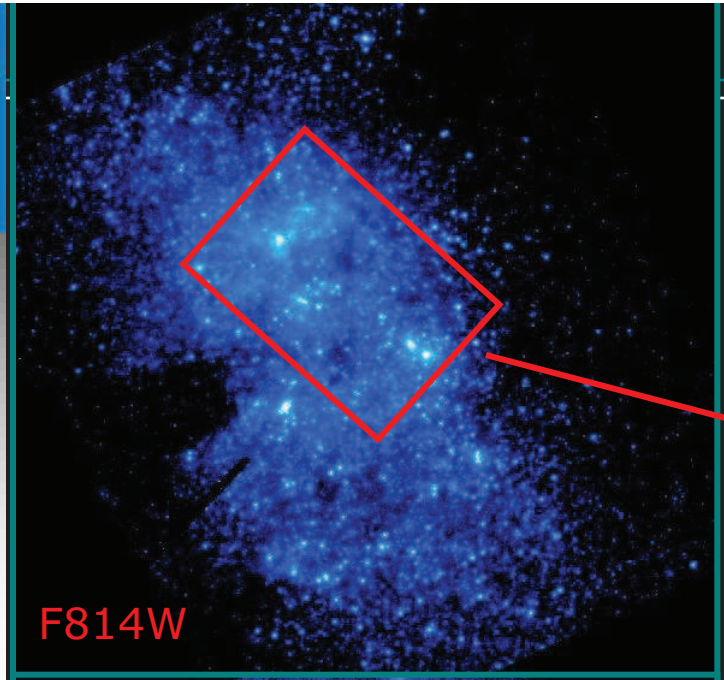
(HST-ACS, I+Hα+B,
program 10609, P.I.: Vacca)

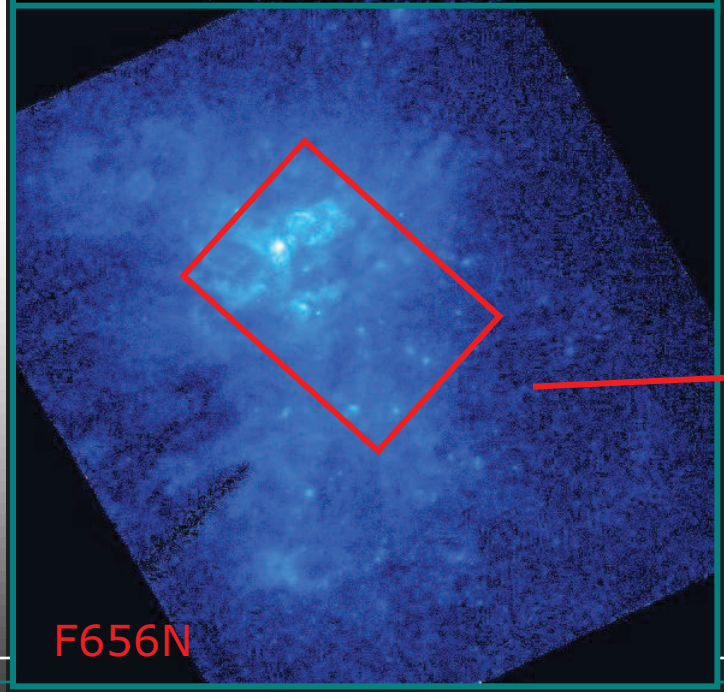
- Very near; z=0.001358, D=3.8 Mpc
- Scale=18.4 pc/”
- $Z \sim 0.30\ Z_{\odot}$
- M_B=-17.13
- $M(HI)=1.4 \times 10^8\ M_{\odot}$
- Filamentary structure
- Hints of inflows/outflows
- Observed in every spectral range

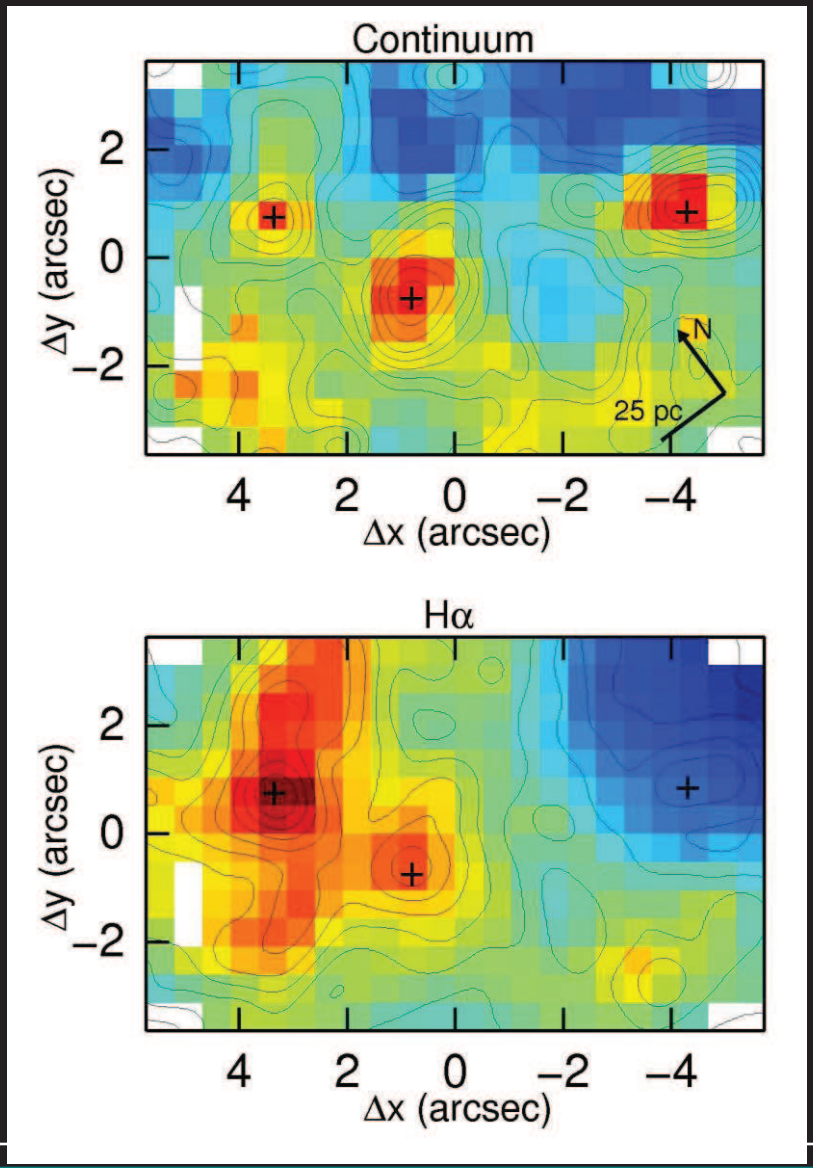
Let´s look at it with FLAMES

- scaling: 0.52”/spa; f.o.v.: 11.5”x7.3”
- L479.7 (R=12000) → Hβ+[OIII]…
- L682.2 (R=13700) → Hα+[NII]+[SII]…
- t_{exp} = 5x1500 s each configuration

First look: Where are we?

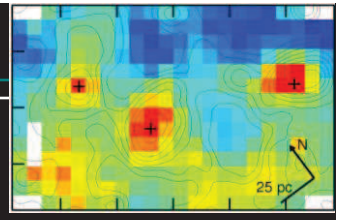


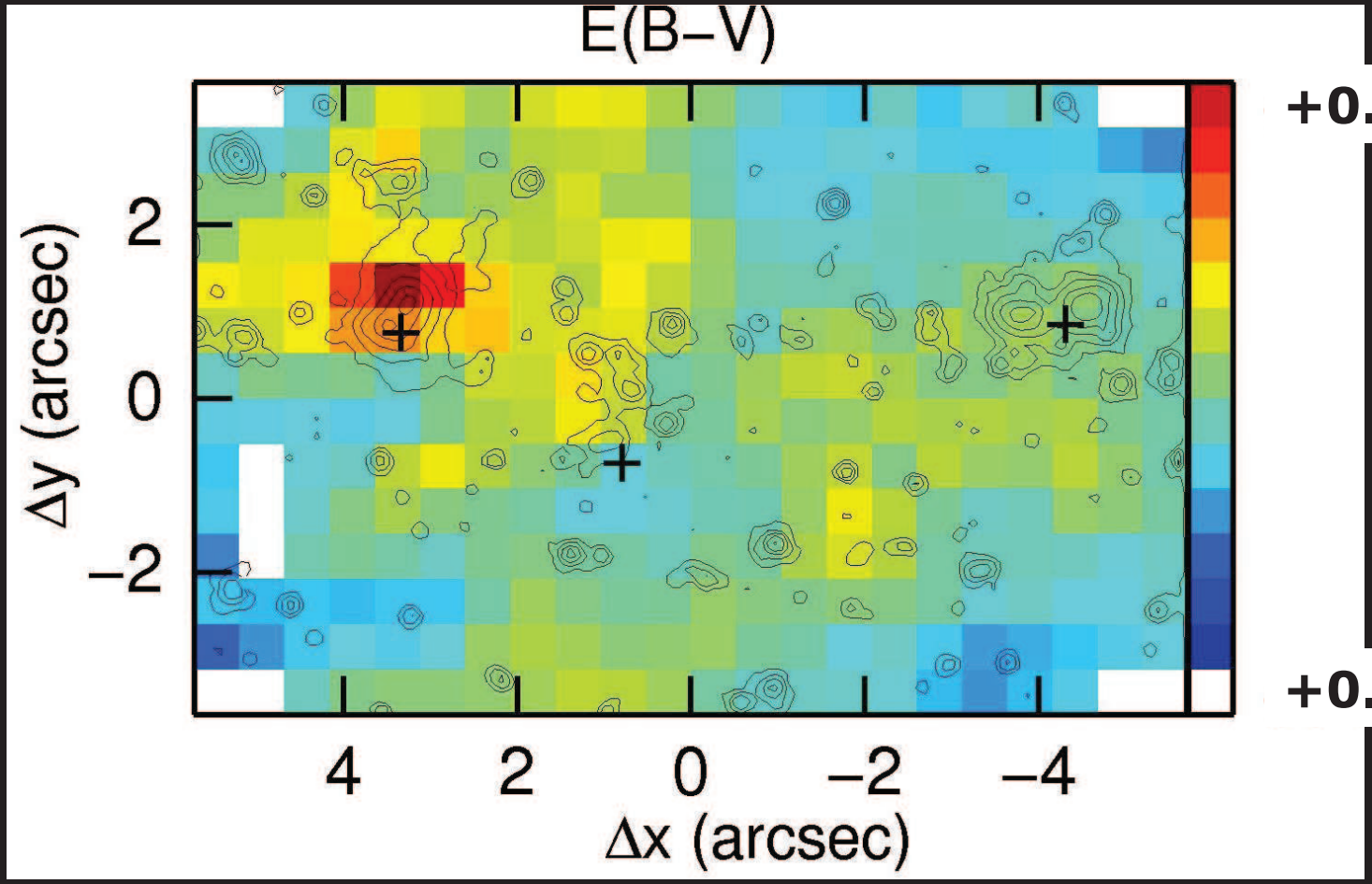




(HST-ACS, program 10609, P.I.: Vacca)

Extinction in NGC5253

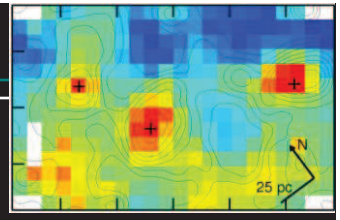


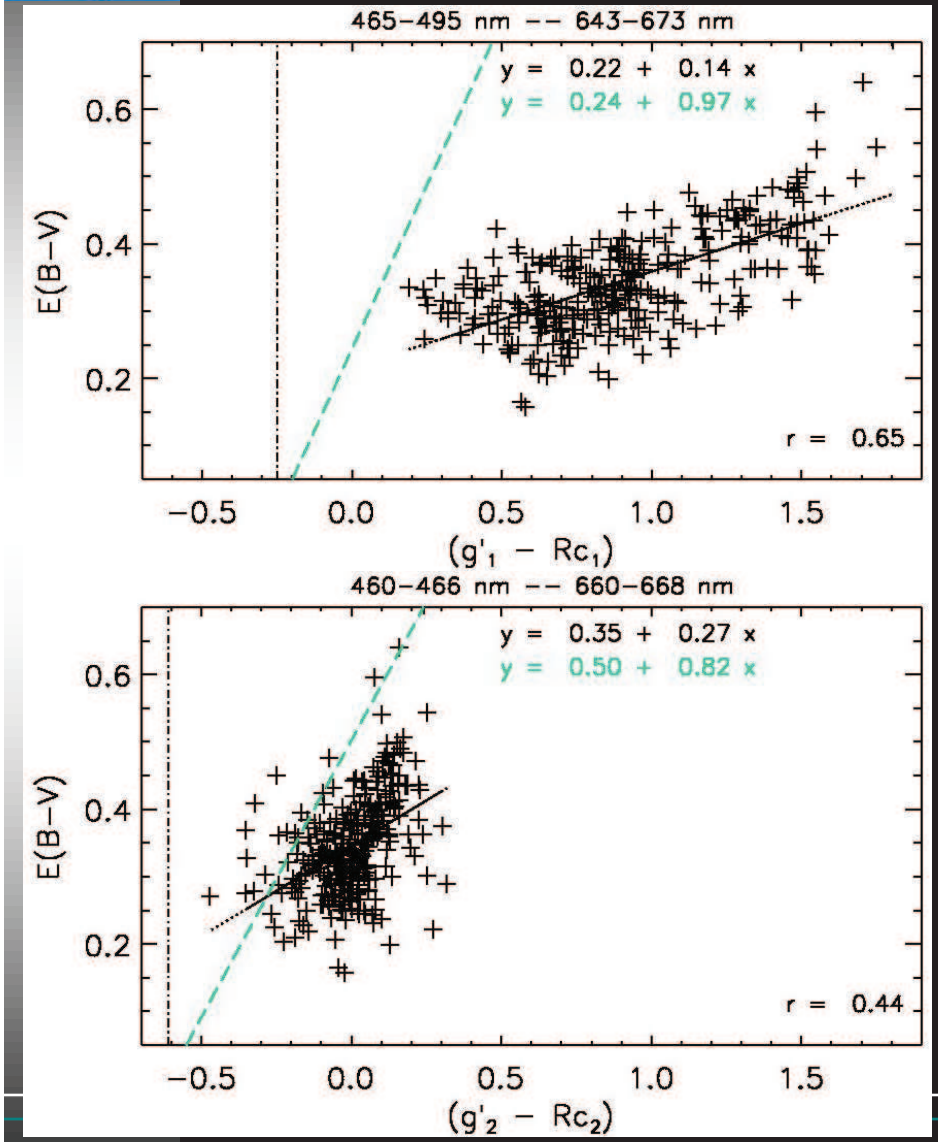


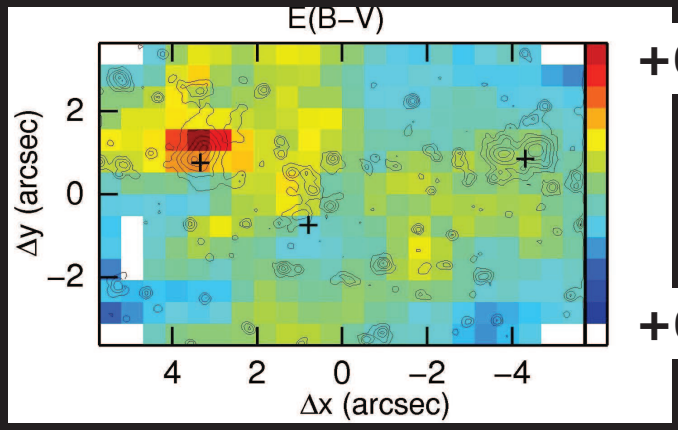
(Contours: HST-NICMOS, F160W, Alonso-Herrero 2004)

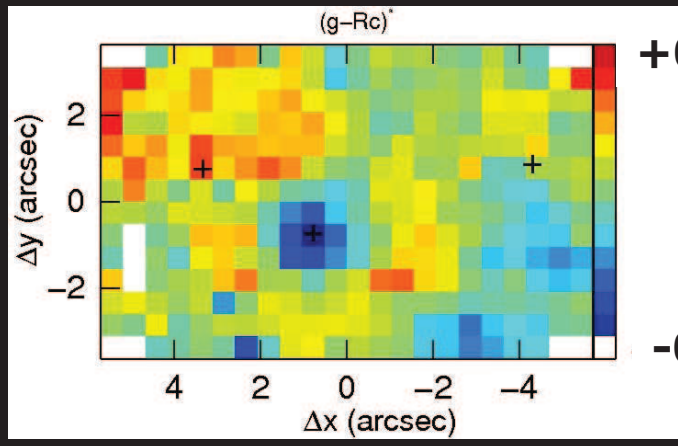
Peak of extinction doesn´t coincide with optical nucleus but with the dominant source in IR, the very reddened C2 from Alonso-Herrero

Extinction in NGC5253: gas vs. stars



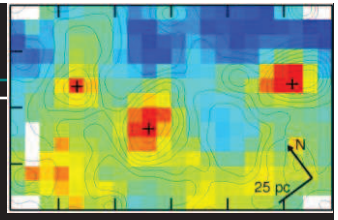


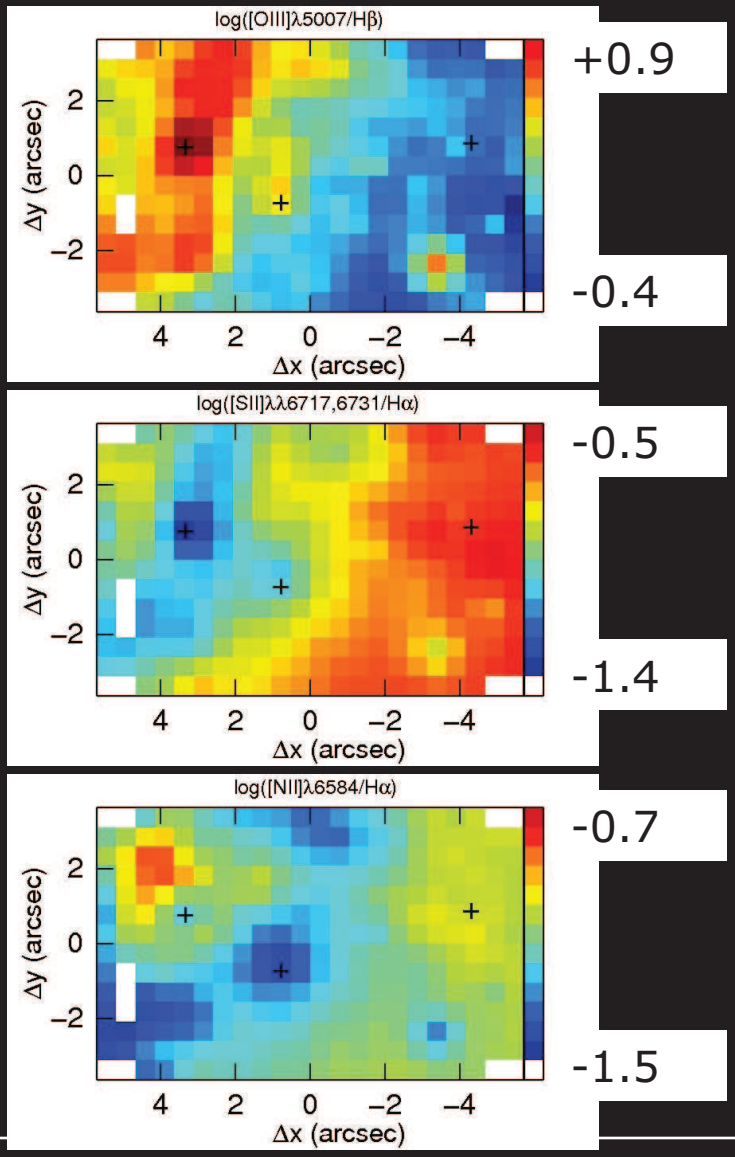


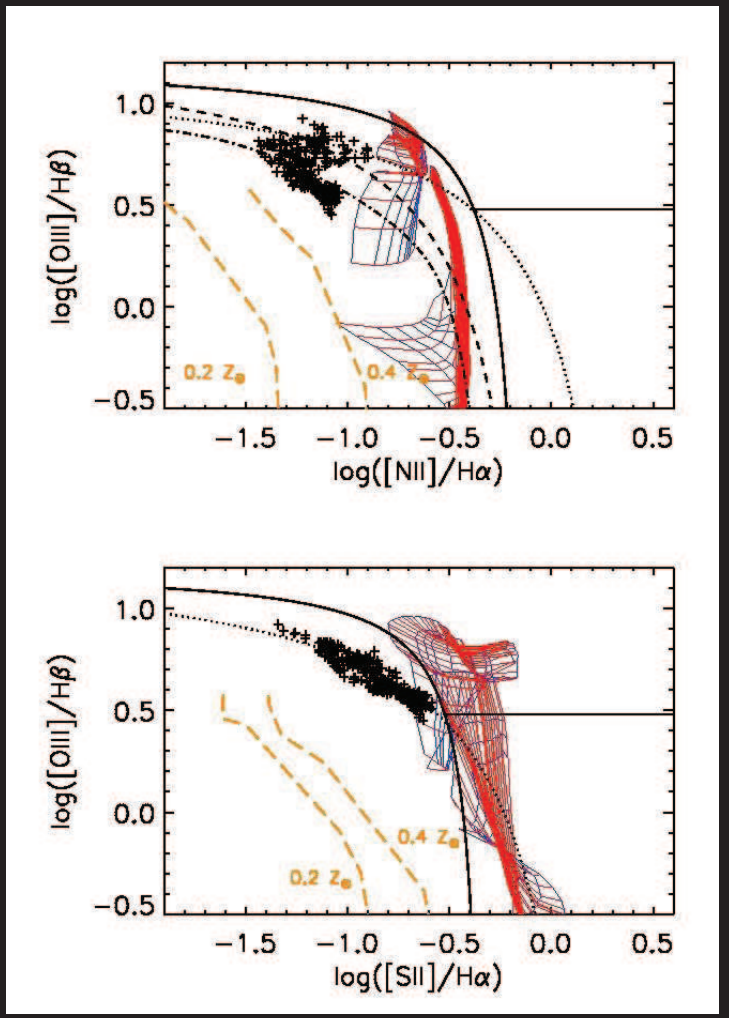


$E(B\text{-}V)_{stars} \sim 0.33\ E(B\text{-}V)_{gas}$

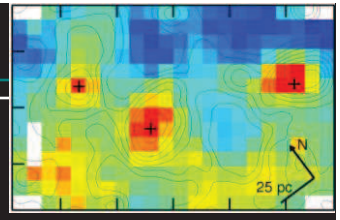
Diagnostic diagrams

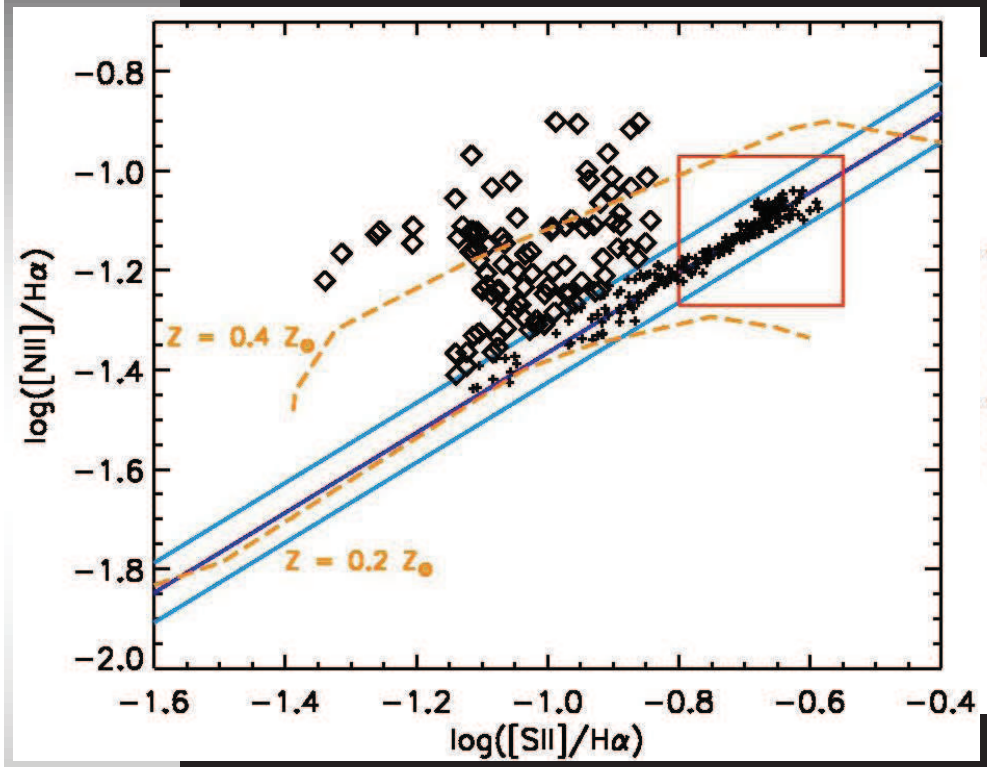


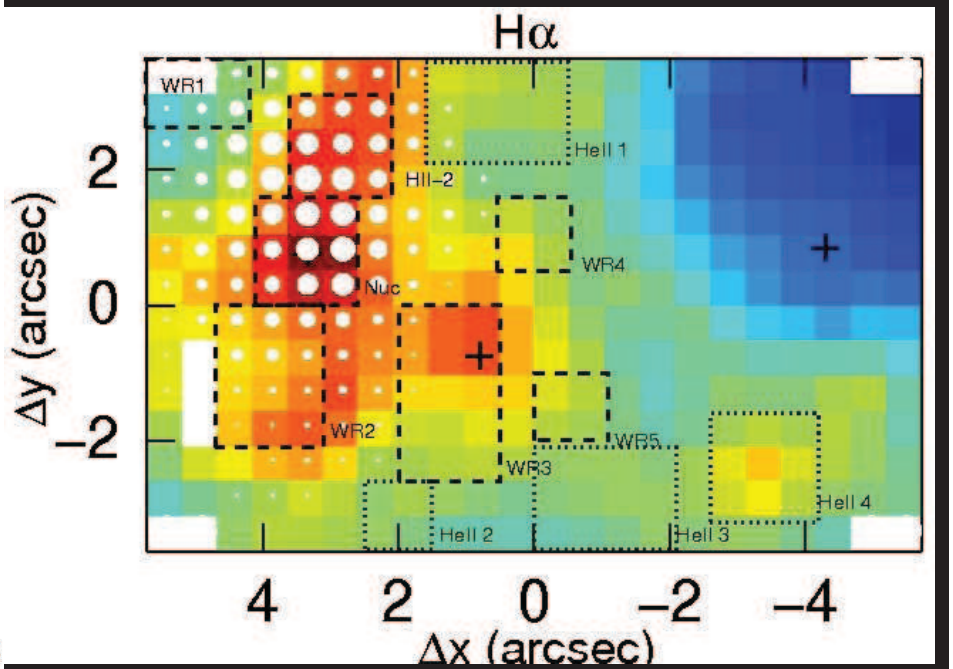




Where do we have extra Nitrogen?

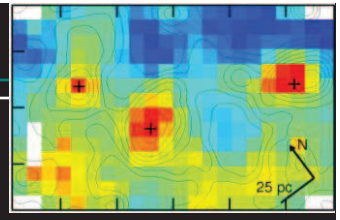






The area of nitrogen enrichment covers the giant HII region + the tonge-shaped extension towards SE + the cluster in the center of the FLAMES´s f.o.v.

The Wolf-Rayet population (I)



- WR: Very bright objects with broad emission line in their spectra
  - WN: lines of Helium and Nitrogen → *Blue bump* ☑
  - WC: lines of Helium, Carbon and Oxygen → *Red bump* ☒
- Result of the evolution of O-stars
- They date very precisely the age of the stellar population where they are found

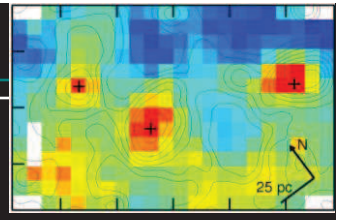
The WR population in NGC5253 has already been studied in specific areas

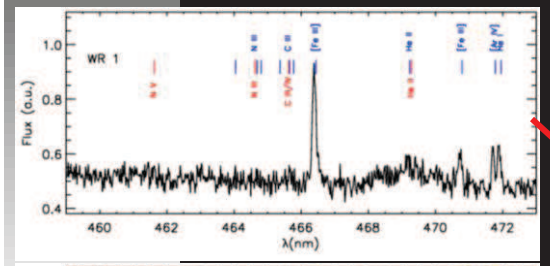
(e.g. Schaerer et al. 1997, 1999)

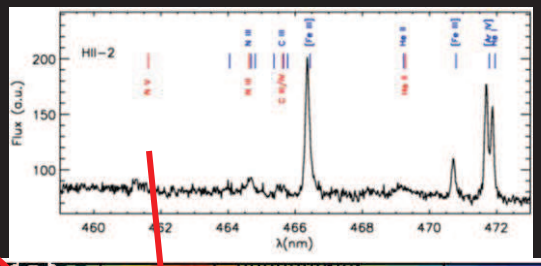
For the moment they are the best candidates for causing the Nitrogen enhancement

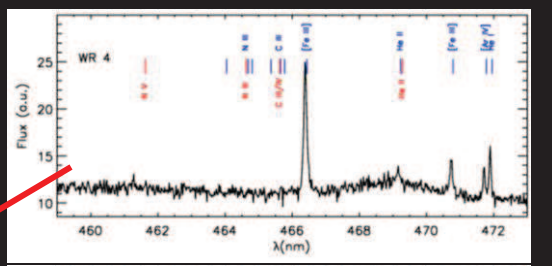
We can map the location of the WR population without any bias due to the slit position to check if it does coincide with the "N-enhanced" area

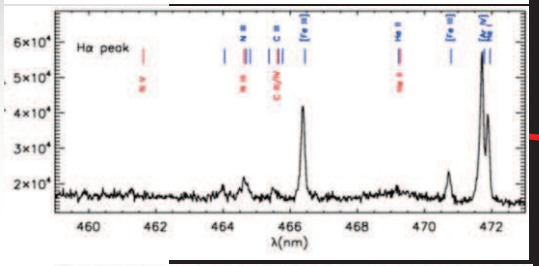
The Wolf-Rayet population (II)

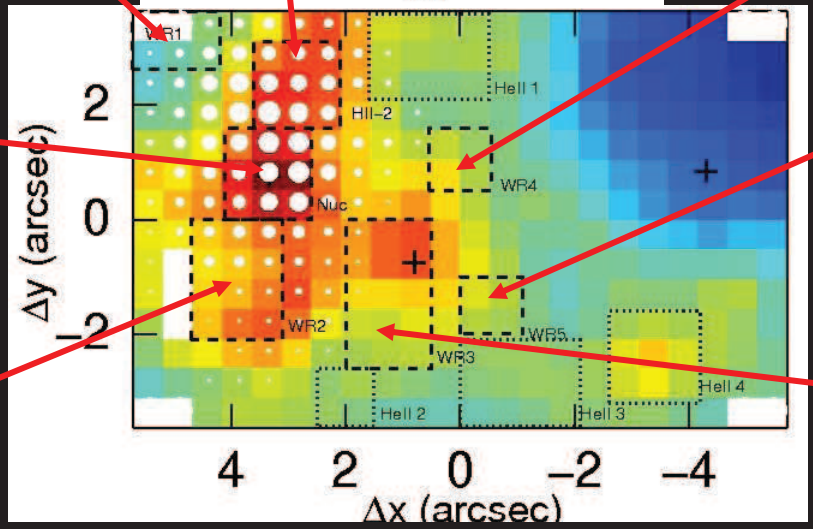


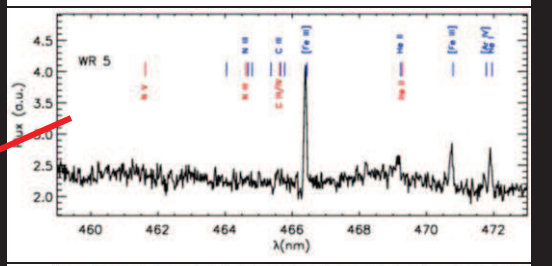


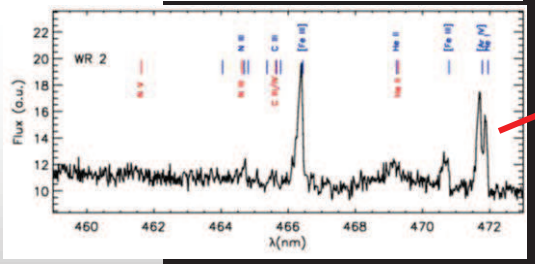


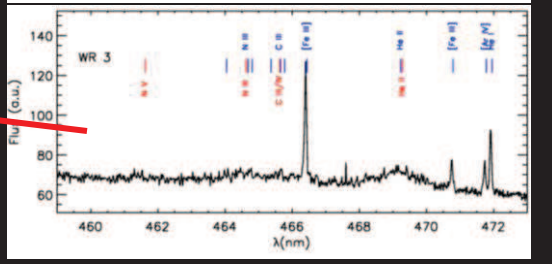








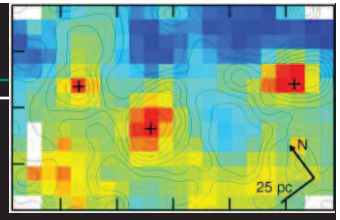




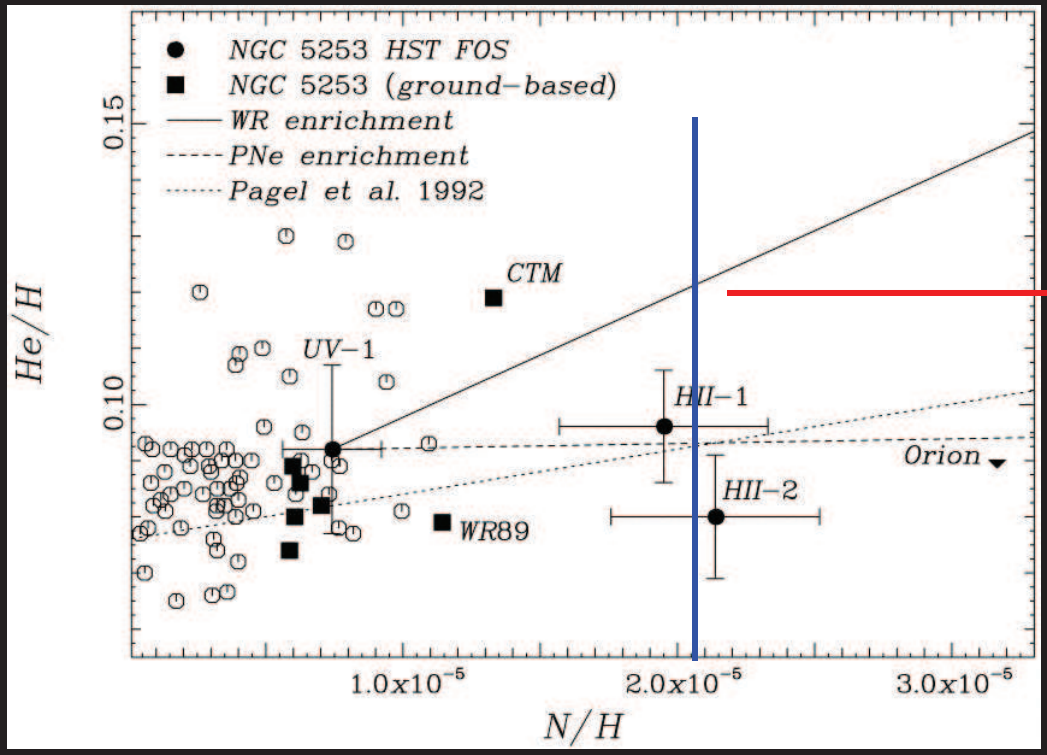
WR features are distributed in an irregular manner in an area much larger than and not necesarely coincident with the one enriched with Nitrogen

In general, WR don´t look the main cause of this N-enrichment. (Possible exception: the SSCs at the nucleus and the two extensions).

The He abundance (I)



"WR causing the N-enrichement" only consistent with a given quantity of Helium

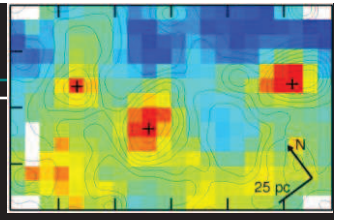


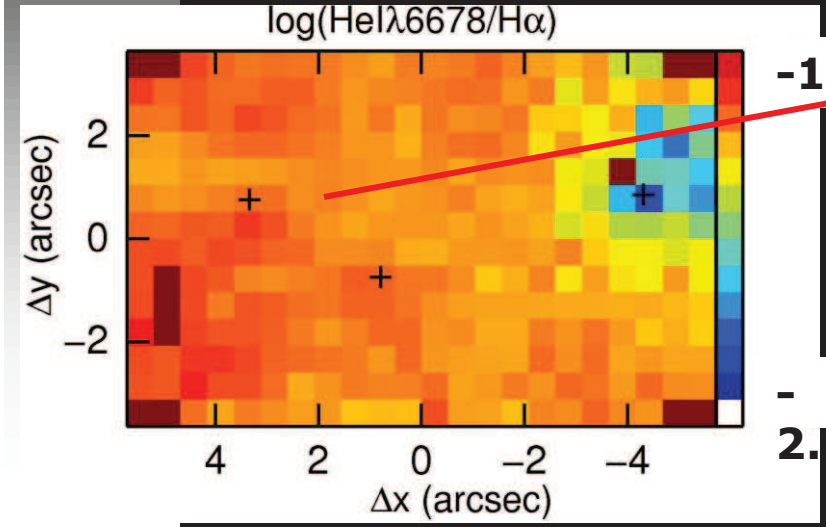
We need He/H~0.12

How much Helium do we have?

(Kobulnicky et al. 1997)

The He abundance (II)





He⁺/H~0.08-0.09

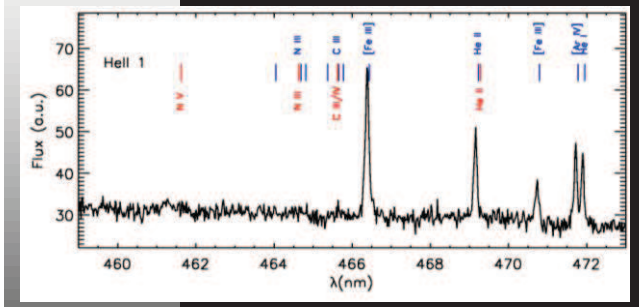
Not enough

And what about the He⁺⁺?

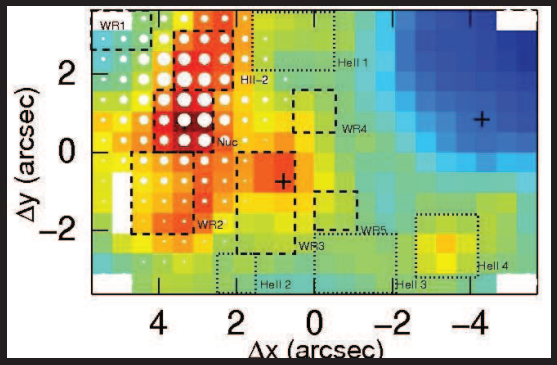
Once what detected but not any more.

(Campbell et al. 1986)

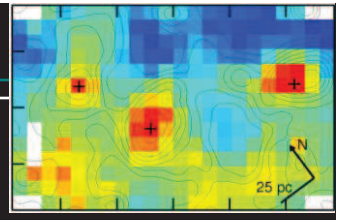
We have found some (He⁺⁺/H<0.005!) BUT



- It is not enough
- It does not always spatially coincide with the WR emission and/or the "N-enhancement" areas.



Summary



- The largest extinction is associated with the giant HII region. The peak of extinction is offset by 0.5” from the peak of emission in the continuum.
- Stars suffer ~0.33 less extinction than gas.
- N-enhancement is located in the whole HII region peaking (more or less) at the peak of extinction.
- WR population is distributed over a much wider area.
- The He that we find is not enough to explain the N-enhancement with WRs.

The end

(based on Monreal-Ibero et al. 2010, summited)