Spiral Galaxy Evolution as Seen with SpIOMM

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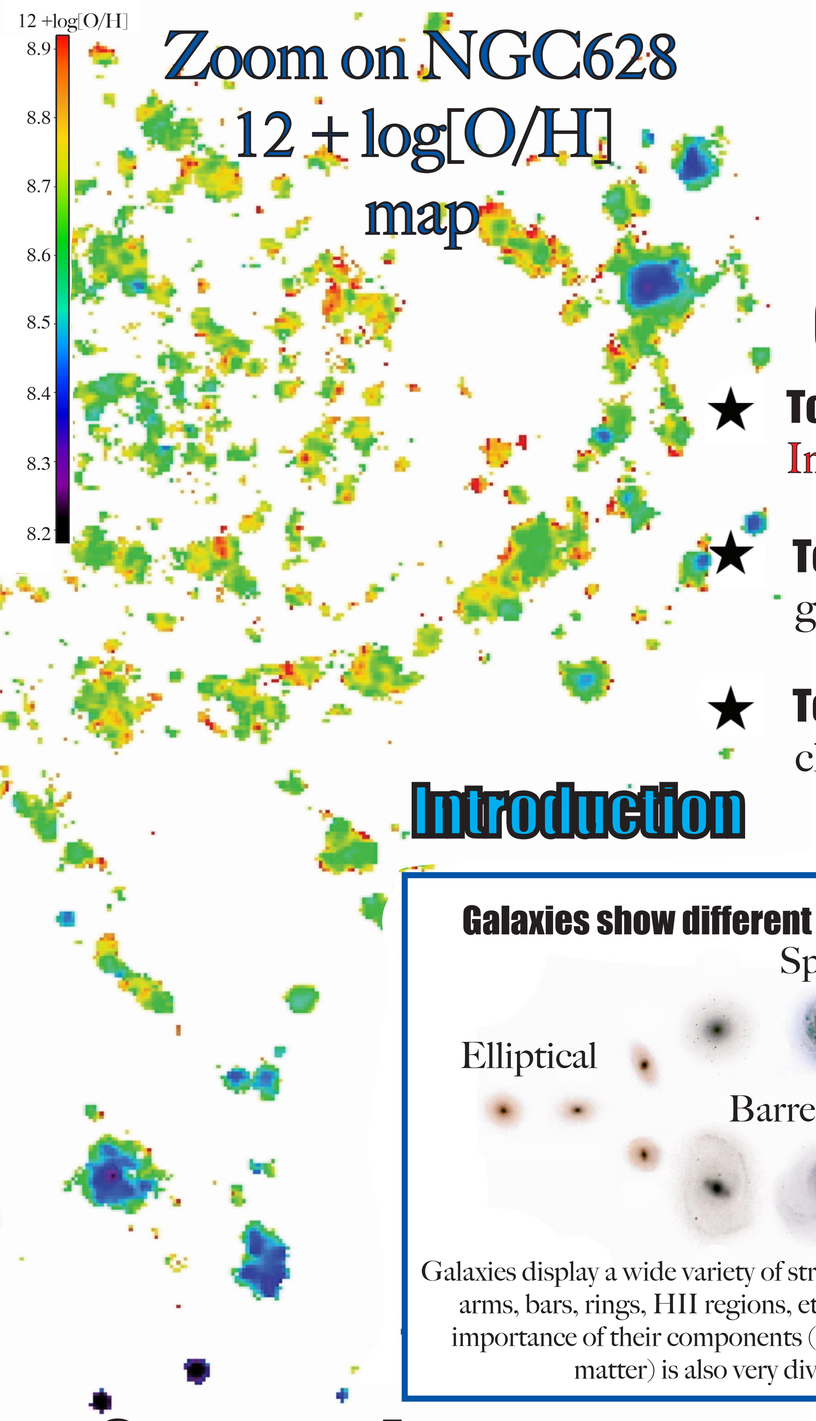


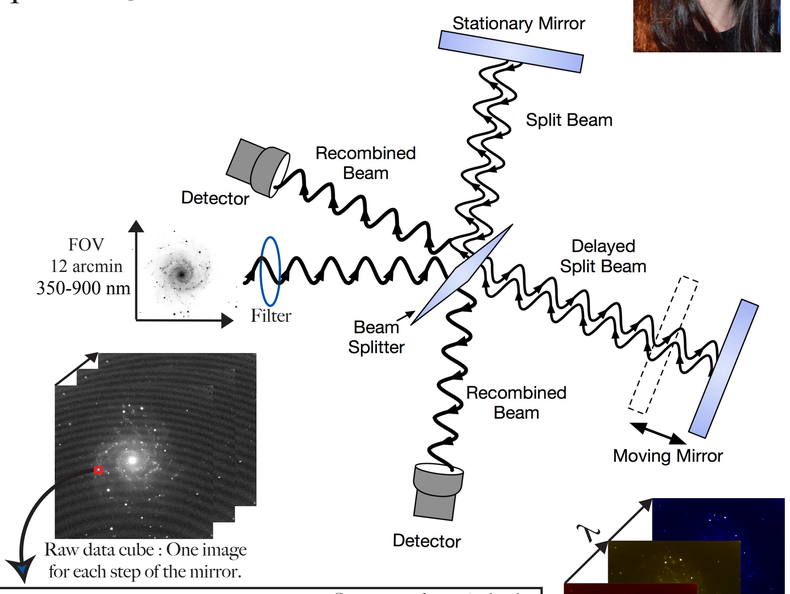
Zoom on NGC628
12 + log[O/H]
map

Goals

★ **To test SpIOMM,** an Optical Fourier Transform Spectro-Imager for the observation of extended objects.

★ **To study** the proprieties of **star forming regions** in 7 spiral galaxies.

★ **To understand galaxy evolution** using stellar population characteristics and the chemical enrichment of the gas.

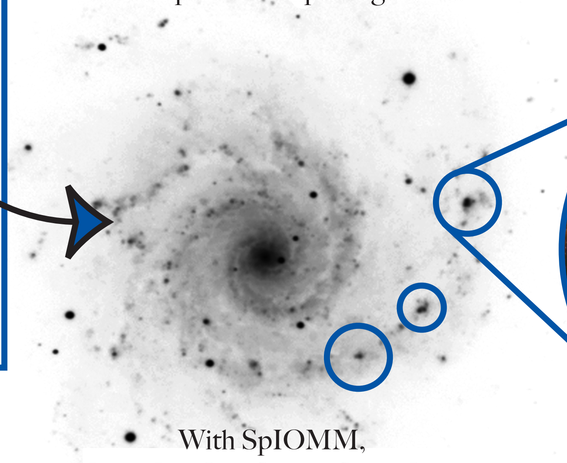


Introduction

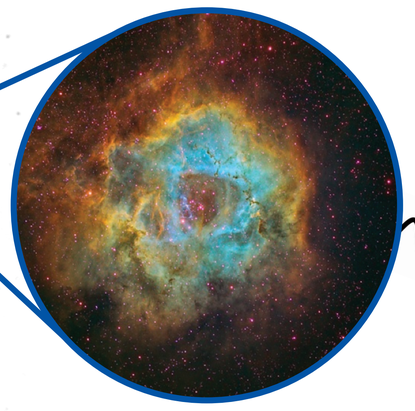
Galaxies show different morphologies

Galaxies display a wide variety of structures (bulges, spiral arms, bars, rings, HII regions, etc.) and the relative importance of their components (stars, gas, and dark matter) is also very diversified.

Spiral galaxies have a larger gas reservoir and present an enhanced star formation rate compared to elliptical galaxies.



With SpIOMM,
hundreds of star forming regions can be observed simultaneously within a galaxy.



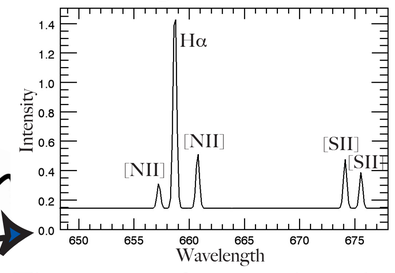
HII Regions

★ UV photons from hot and massive young stars ionize the surrounding gas.

★ Electron recombinations and collisions with ions are responsible for emission lines.

★ Emission lines analysis reveals the young stellar population characteristics and gas properties.

HII Region Spectrum



The intensity of emission lines depends on[1]:

★ Gas abundances (12 + log[O/H])
★ Gas electron temperature (T_e)
★ Gas electron density (n_e)
★ UV flux (from their ionization potential)
★ Electron energy distribution.

The continuum shape and intensity depend on :

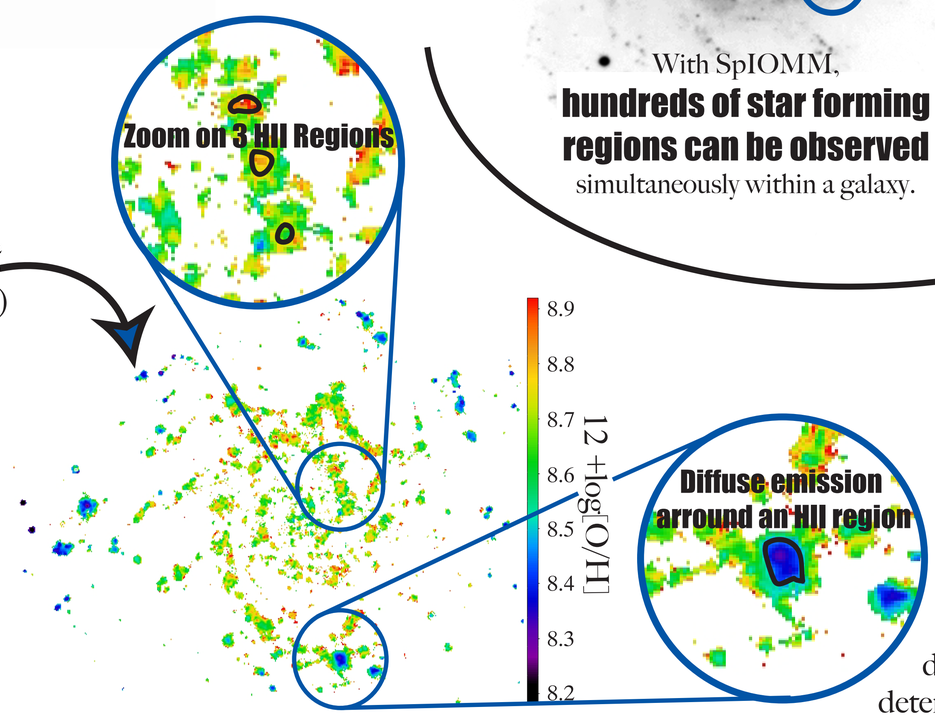
★ Young stellar population mass and age.

Some results

We have studied proprieties of star forming regions :

★ Gas bundances (using O3N2 indicator)[2]
★ Dust extinction (Av using Hα/Hβ ratio)
★ Young populations ages (EW[Hα]), masses (continuum + age) and star formation rate[3]
★ Distribution of the regions within the structure of the galaxy
★ Contamination by diffuse ionized gas.[4]

SpIOMM has allowed us to produce maps of these proprieties with a very good spatial resolution



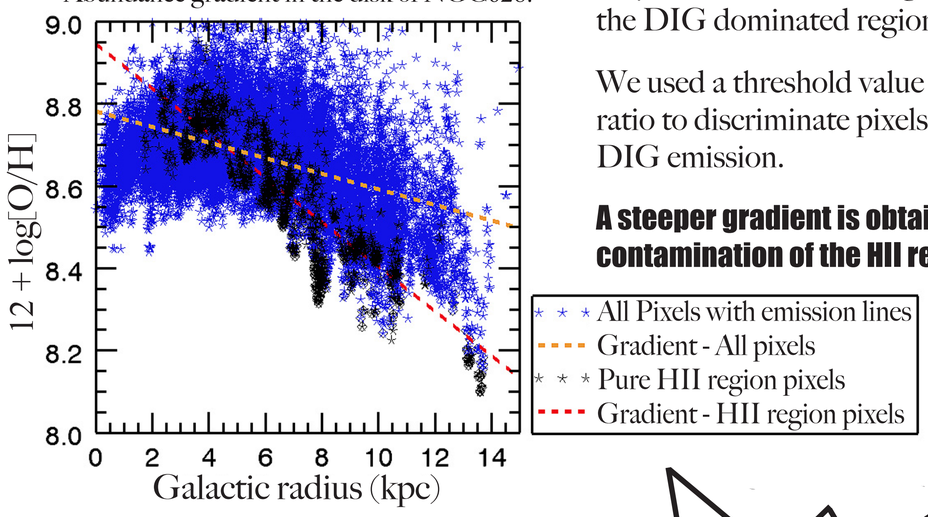
Diffuse Ionized Gas

Traditionnal emission line diagnostic developed to determine gas abundances should only be use in the HII region regime of ionization, not in the DIG dominated region.

We used a threshold value for L[Hα] and [SII]/Hα] ratio to discriminate pixels that are too contaminated by DIG emission.

A steeper gradient is obtained if the diffuse ionized gas contamination of the HII regions is considered.

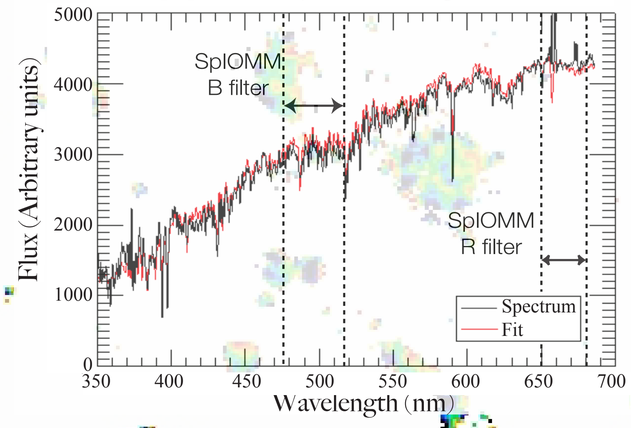
Abundance gradient in the disk of NGC628.



Absorption and dust extinction

All SpIOMM spectra have been corrected for old stellar populations absorptions (synthesis code GANDALF) using long slit data oriented along the radius of the galaxy. Dust extinction has been evaluated using Hα/Hβ ratio.

Stellar populations synthesis : Bulge of NGC5055.

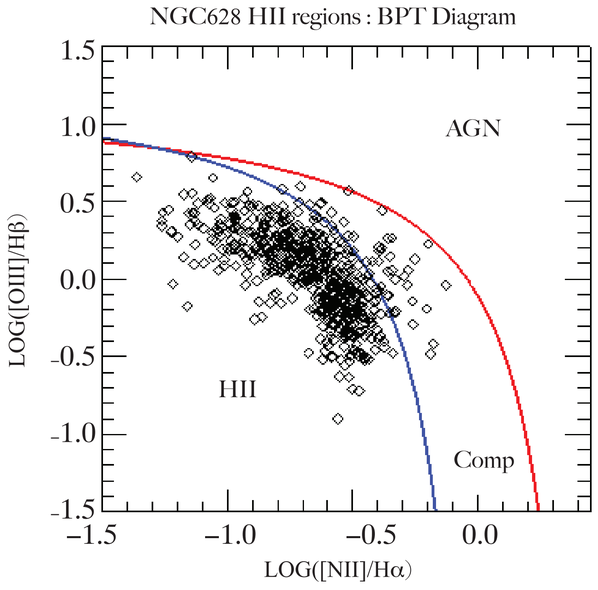


Sources of ionization : BPT analysis

Most of HII regions are in the HII regime of ionization as expected

Some regions show signature of shocks / low ionization species excess

NGC628 HII regions : BPT Diagram



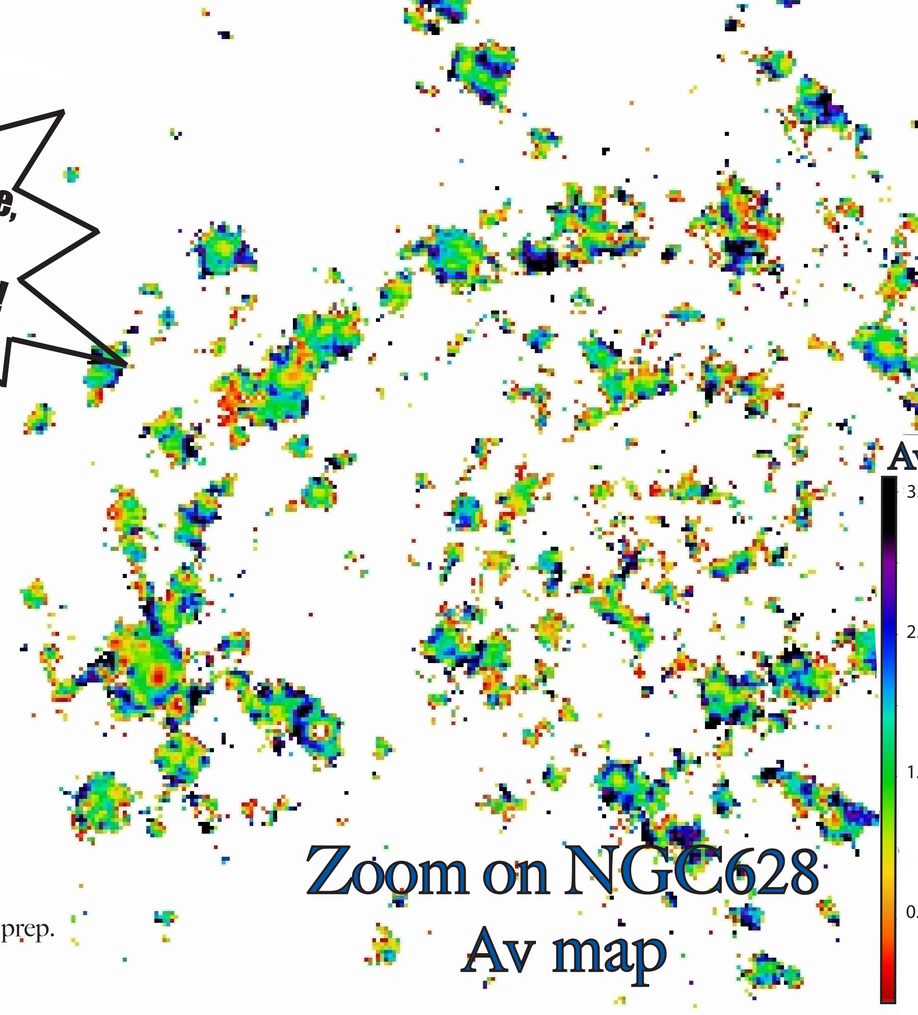
SpIOMM is a prototype, SITELLE will be soon at the CFHT!

Conclusions

★ The gas and stellar properties obtained with SpIOMM are in good agreement with previews studies.

★ The high spatial resolution and large field of view of SpIOMM are unique to separate stellar populations and study the details around HII regions.

★ Using SpIOMM, it is just impossible to present all your results in a single poster!



Zoom on NGC628
Av map

References

1 : Nicholls, D. et al. 2013, ApJS, 207, 21
2 : Pettini, M., Pagel, B. E. J. 2004, MNRAS, 348, L59
3 : Leitherer, C. 1999, ApJ, 123, 3
4 : Rousseau-Nepton et al. 2014, in prep.

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