



**The UPER survey:**

**characterization of AGN  
radiative feedback at  $z \sim 2$**

**Chiara Circosta, ESO (Garching, Germany)**

**[ccircost@eso.org](mailto:ccircost@eso.org)**

**On behalf of the SUPER team**

**Energetics**

**Mode: mechanical, radiative**

**Link with the host/BH  
properties**

# **AGN feedback**

**Geometry**

**Properties over  
different scales**

**Role in AGN/galaxy  
evolution**

**Impact on the SF in  
the host galaxy**



# The SUPER survey

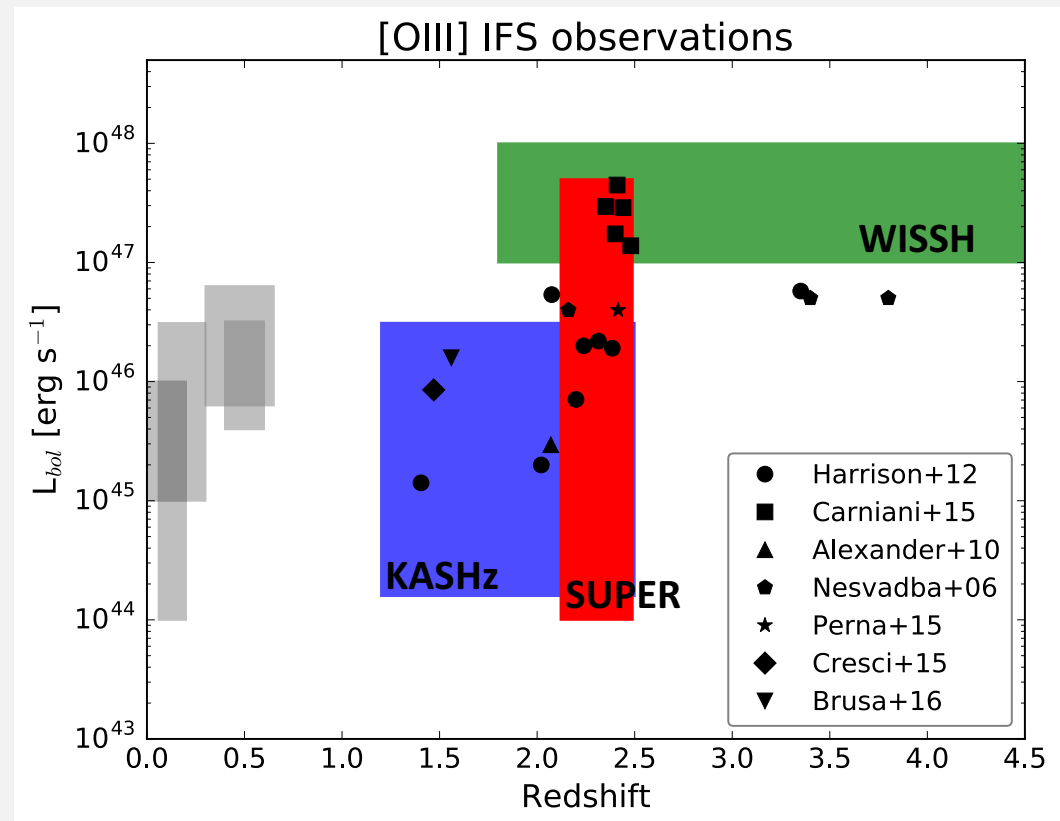
SINFONI Survey for Unveiling the Physics and Effect of Radiative feedback

PI: V. Mainieri

Co-Is: Fiore, Marconi, Balmaverde, Bongiorno, Brusa, Carniani, Cicone, Circosta, Civano, Comastri, Cresci, Feruglio, Georgakakis, Husemann, Kakkad, Lamastra, Lanzuisi, Liu, Mannucci, Menci, Menzel, Merloni, Netzer, Padovani, Perna, Piconcelli, Popesso, Puglisi, Salvato, Schramm, Schulze, Silverman, Vietri, Vignali, Zamorani, Zappacosta

<https://sites.google.com/site/supersinfonisurvey/>

- 280 hours @ VLT/SINFONI (IFS) with AO
- PSF FWHM  $\approx 0.2''$ - $0.3''$   
 $\approx 1$  kpc spatial resolution
- **Blind survey**,  $\sim 40$  AGN at  $z=[2.12-2.49]$
- - Ionized outflows  $\rightarrow$  **[OIII] $\lambda$ 5007** (H band)  
- Star formation  $\rightarrow$  **H $\alpha$**  (K band)

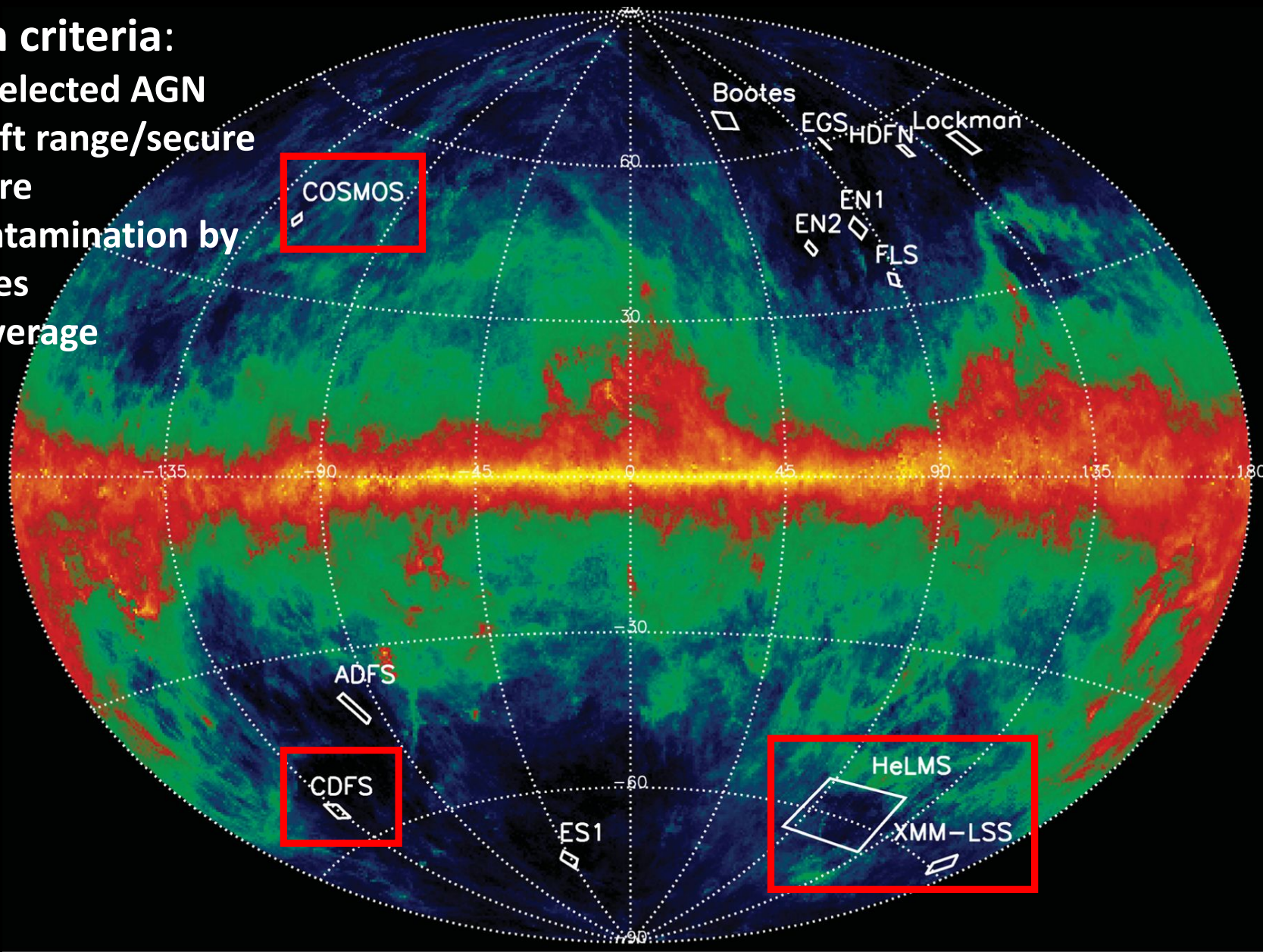




# Sample selection

## Selection criteria:

- ✓ X-ray selected AGN
- ✓ Redshift range/secure measure
- ✓ No contamination by sky lines
- ✓ FIR coverage

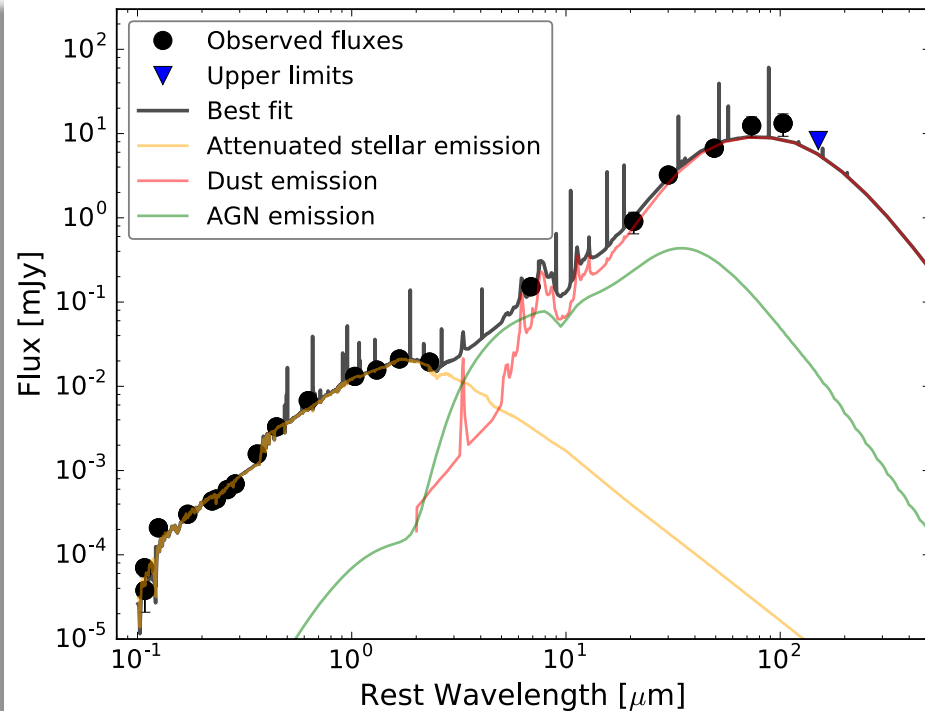


# Target sample characterization

**CIGALE** (e.g. Noll+09, Ciesla+15):

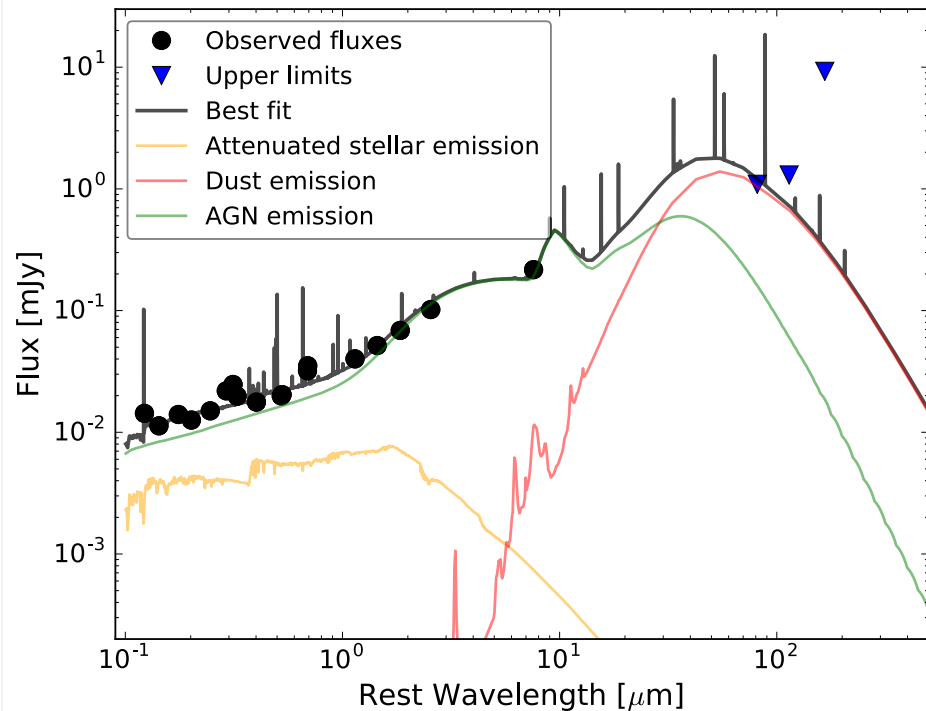
- Stellar emission: BC03 (Chabrier IMF, modified Calzetti attenuation law)
- Nebular emission
- Dust emission: Dale+14
- AGN emission: Fritz+06

**TYPE 2**



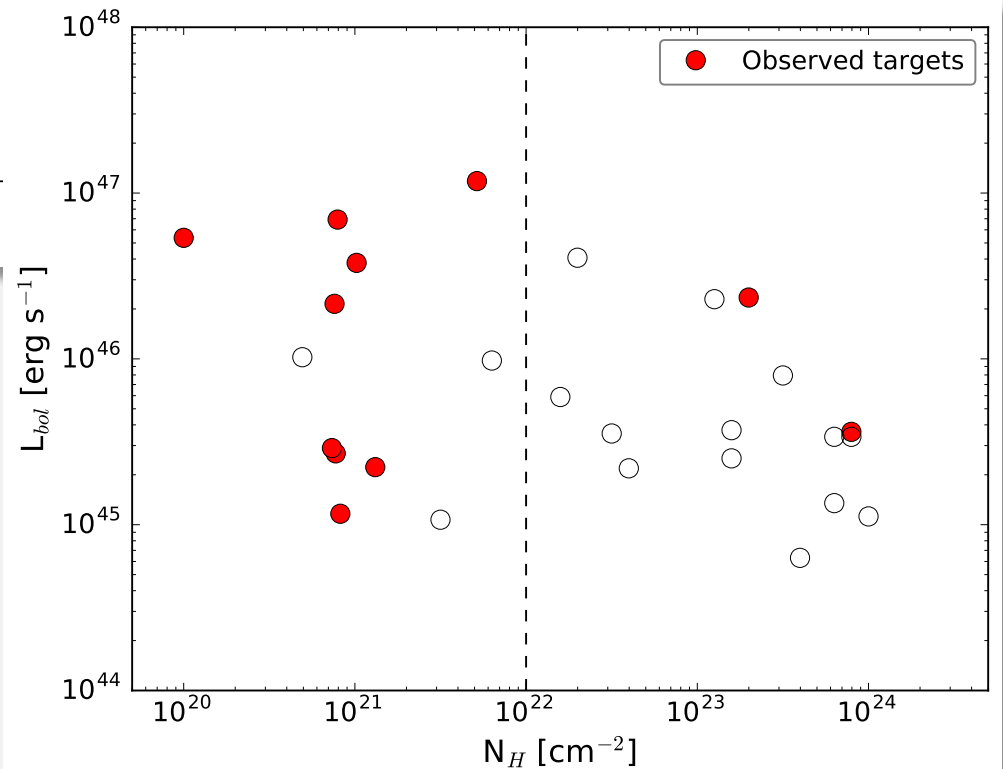
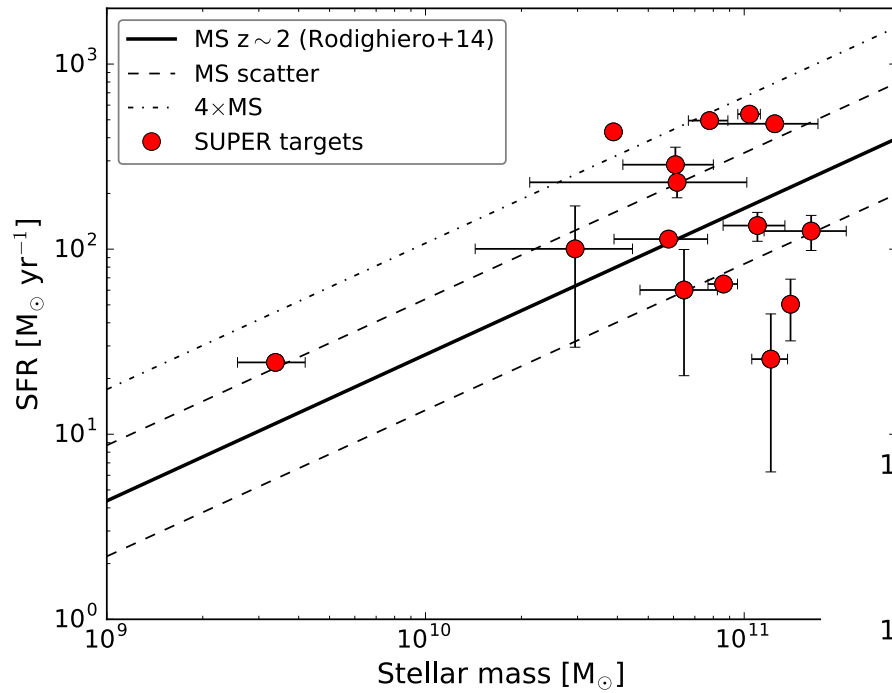
- $M_* = 6.1 \pm 1.9 e10 M_{\odot}$
- $SFR = 286 \pm 70 M_{\odot}/yr$
- $L_{bol} = 1.1 \pm 0.6 e45 \text{ erg/s}$
- $f_{AGN} \sim 0.1$

**TYPE 1**

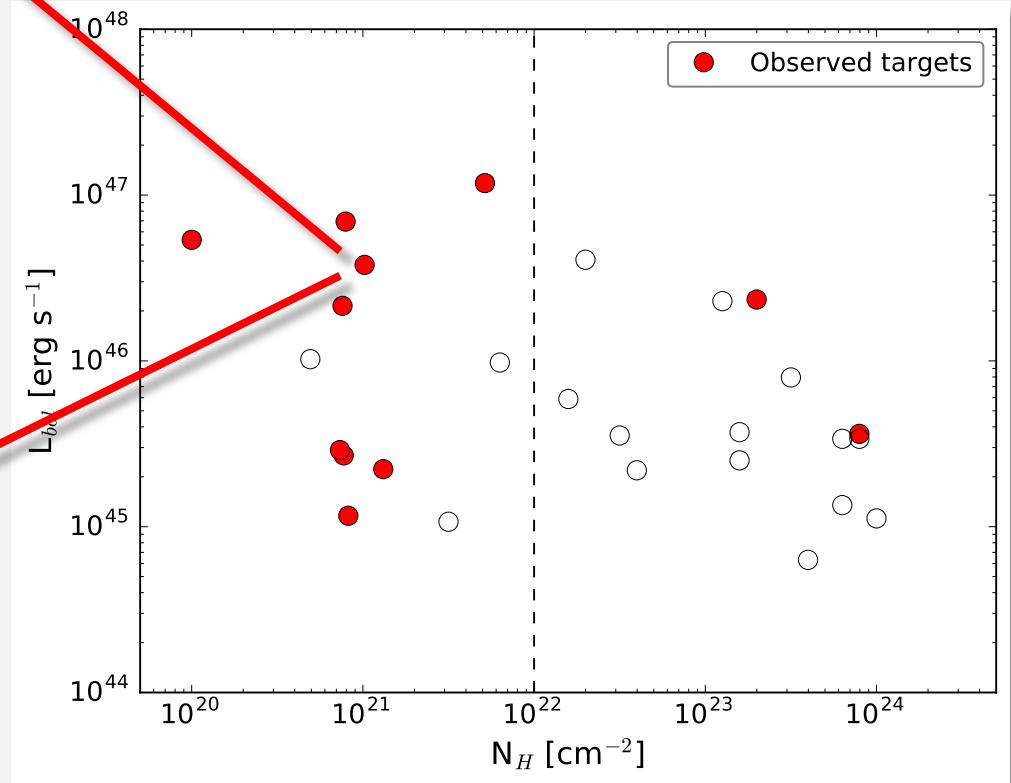
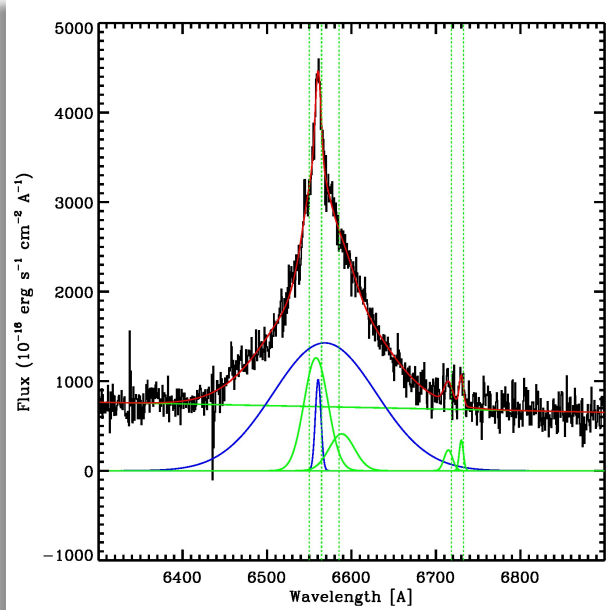
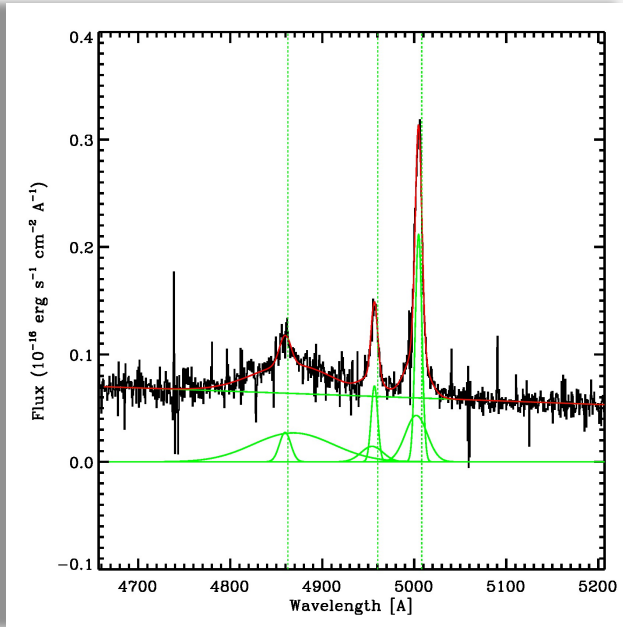


- $M_* = 1.1 \pm 1.0 e10 M_{\odot}$
- $SFR = 40 \pm 25 M_{\odot}/yr$
- $L_{bol} = 9.8 \pm 0.9 e45 \text{ erg/s}$
- $f_{AGN} \sim 0.8$

# Target sample properties

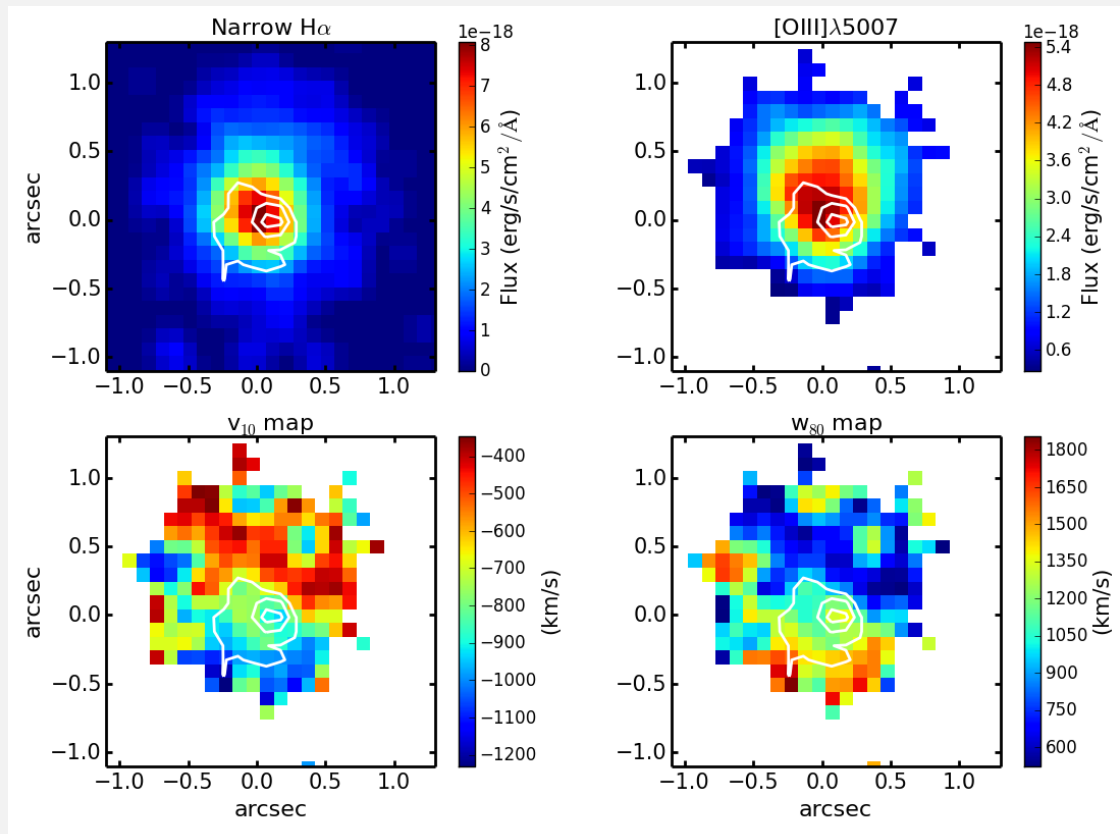
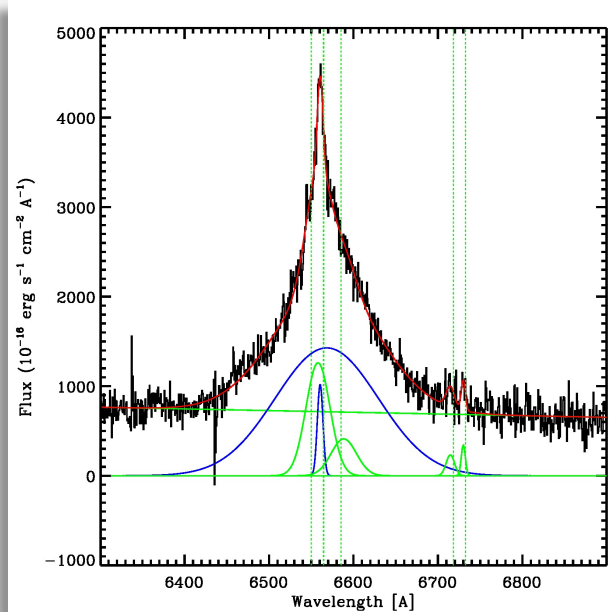
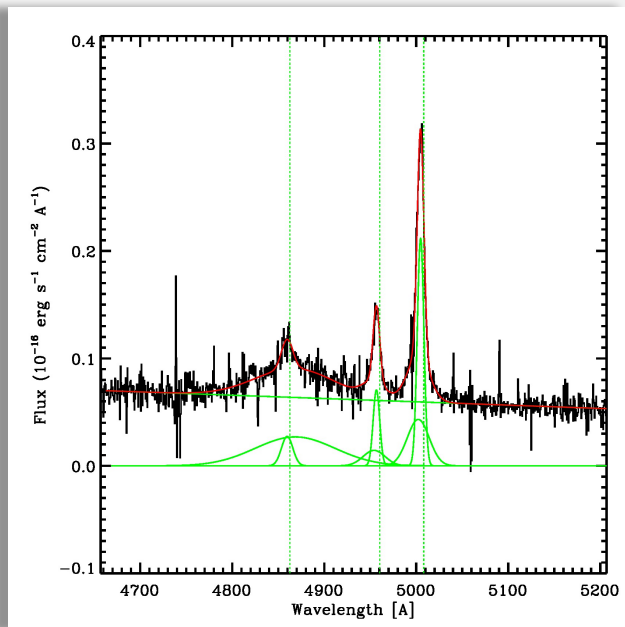


# SINFONI spectra: preliminary results





# SINFONI spectra: preliminary results

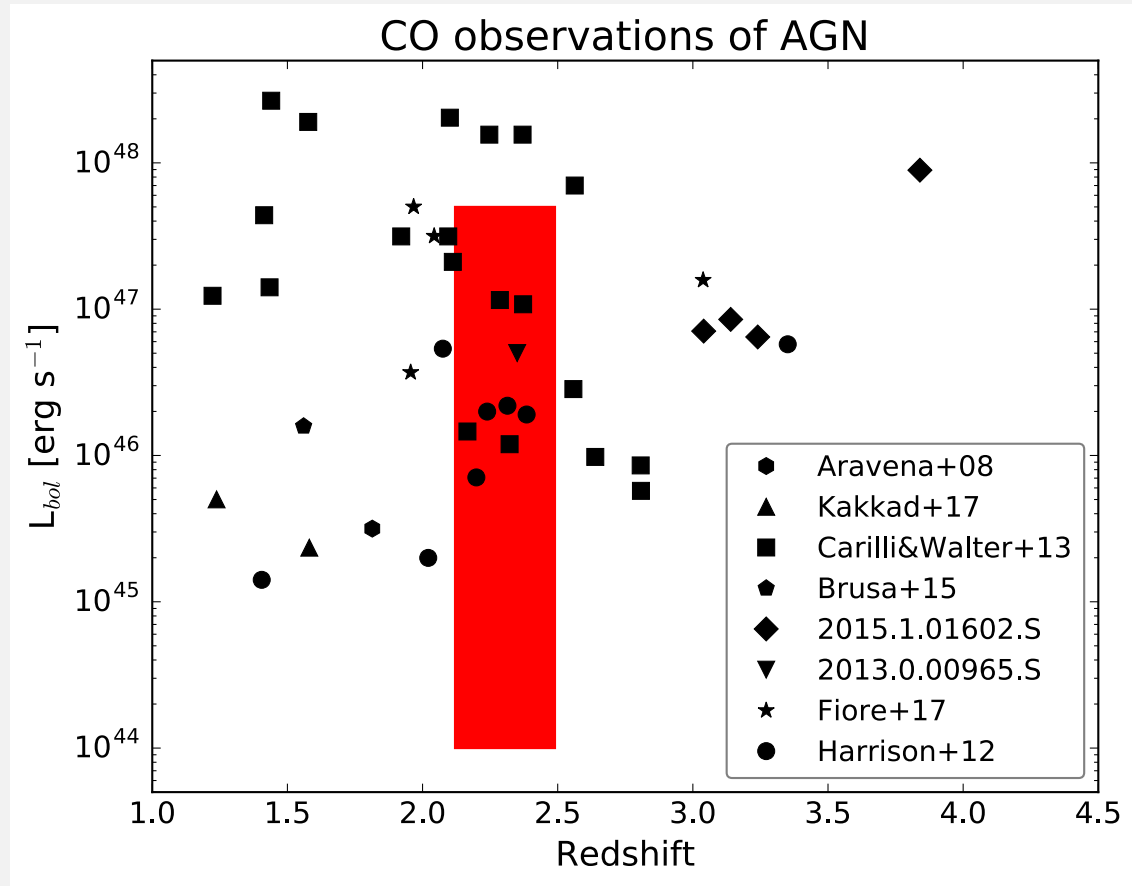


# SUPER-ALMA:

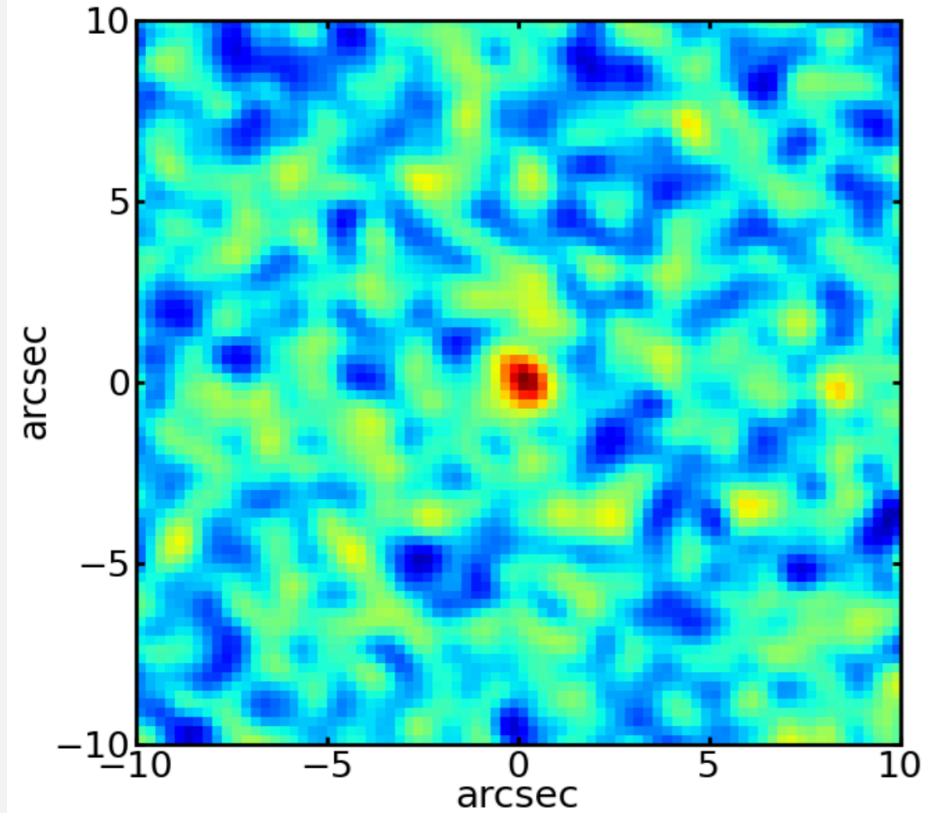
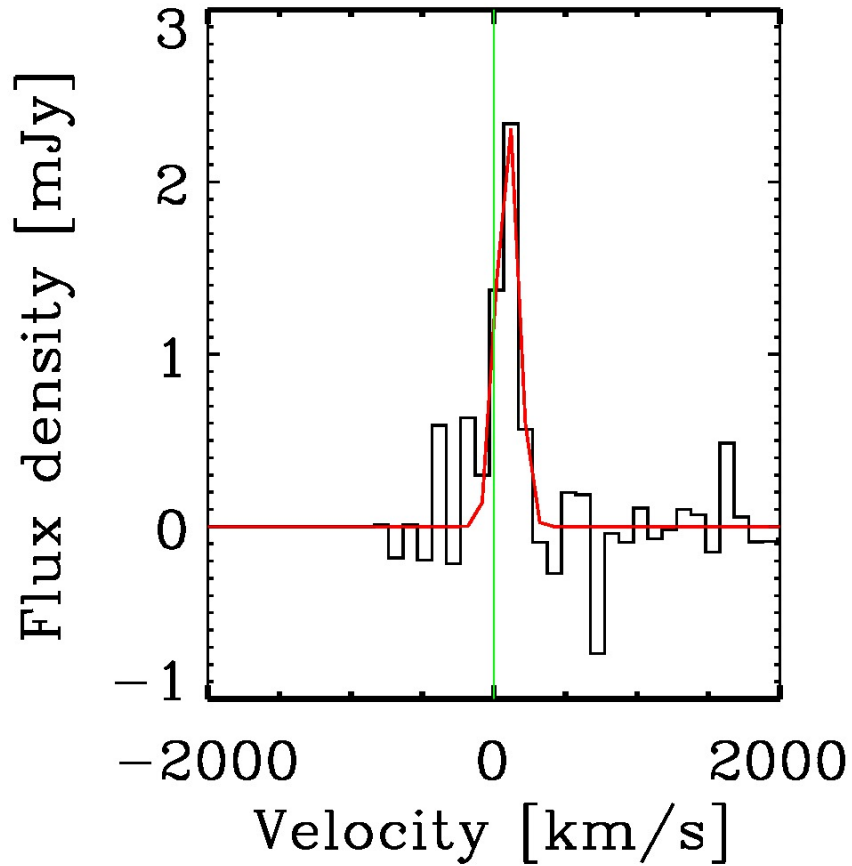
## gas fraction and depletion time

PI: V. Mainieri

- 12.6 hours ALMA on-going observations in Cycle 4 [CO(3-2)], 1" resolution
- Completion of the ALMA follow-up submitted in Cycle 5
- **Impact** of the outflow on the molecular gas content



# SUPER-ALMA: preliminary results



$$S_{\text{peak}} = 2.43 \pm 0.24 \text{ mJy}$$
$$\text{FWHM} = 175 \pm 10 \text{ km/s}$$

# Stay tuned... for “**SUPER**” results!

## Goals:

- Outflow **demography** and energy
- Outflow **morphology** and **impact** on the on-going star formation in the host galaxy
- **Link** between the outflow properties and those of AGN and host galaxies
- Comparison with the parent population of normal star forming galaxies (e.g. SINS/zC-SINF survey, Förster Schreiber+14, PHIBSS/PHIBSS2 survey, Tacconi+13)

## Work in progress...

- On-going observations: **SINFONI**, **ALMA**, **APEX** ([Cl](2-1) -> molecular gas content)
- ~15 targets observed so far
- Survey paper in preparation -> Circosta+2017