KASHz:
The prevalence and properties of ionised outflows

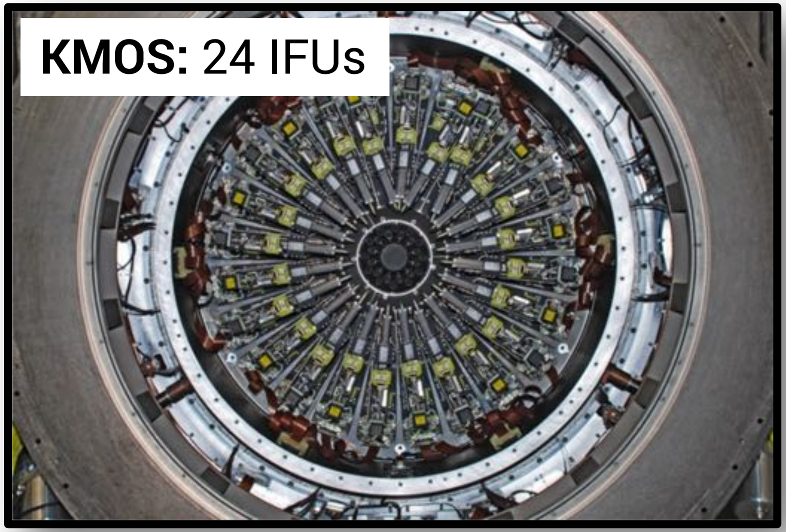
Chris Harrison (ESO); Jan Scholtz
Dave Alexander; Chen-Chou Chen; David Rosario; Alfie Tiley

SUPER- KASHz:
The prevalence and properties of ionised outflows

Chris Harrison (ESO); Jan Scholtz
Dave Alexander; Chen-Chou Chen; David Rosario; Alfie Tiley

Chiara Circosta; Darshan Kakkad;
Vincenzo Mainieri; Giustina Vietri ***+ SUPER team***

KASHz Project



~50 nights GTO (P92-P100) for Galaxy Surveys & KASHz:

KROSS & KGES (e.g., Stott+16; Harrison+17; Tiley+sub.)

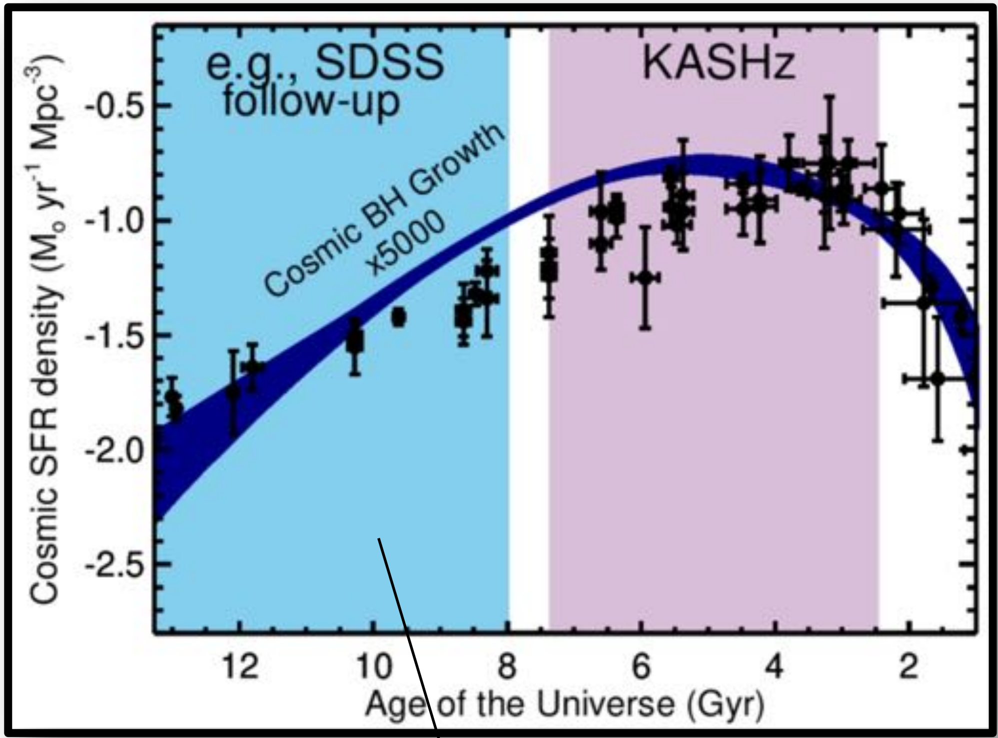
Supplemented with SINFONI archive

Primary Sample: X-ray AGN, z=0.5-2.6, from deep fields

Targeted [O III] and/or Hα lines

KASHz Motivation

Statistical sample of distant AGN ionised outflows with IFS data



1. **Prevalence?**
2. **Properties and drivers?**
3. **Impact?**

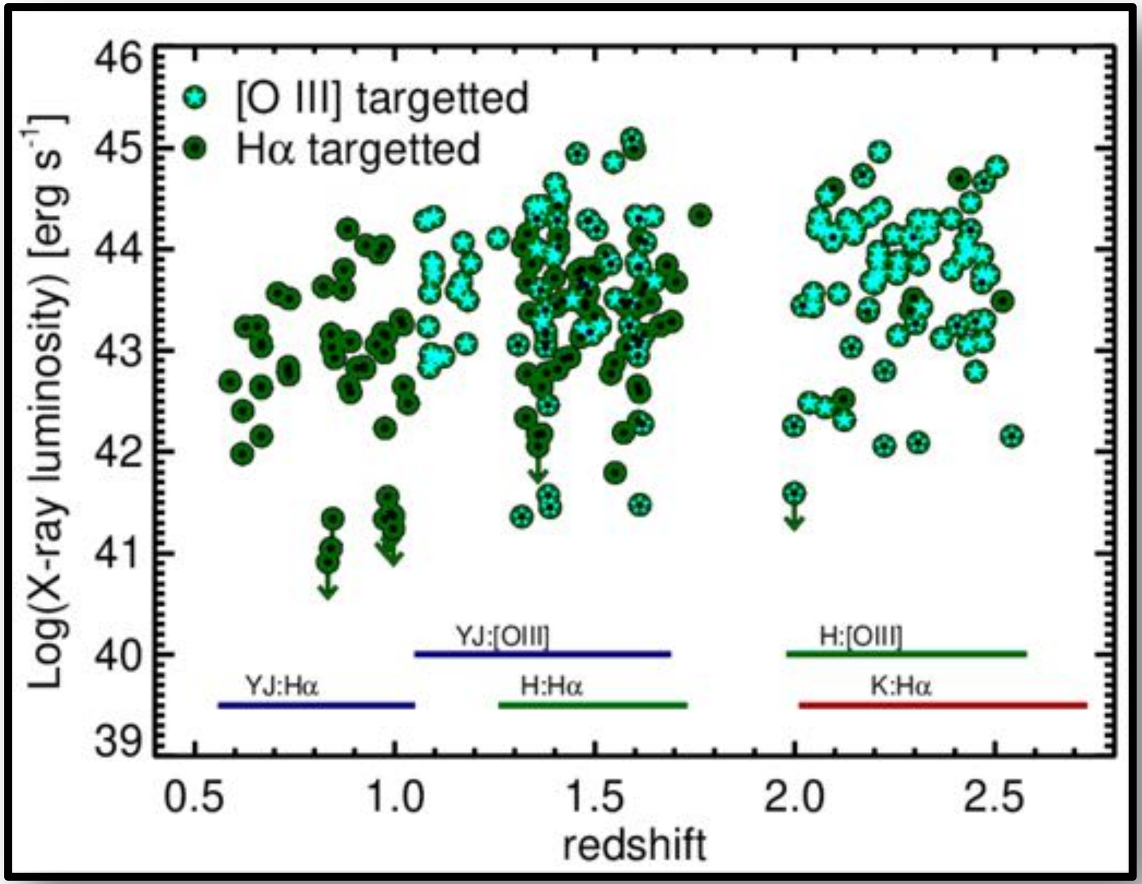
Select for detailed follow-up

Complement Galaxy Surveys
(e.g., KMOS^{3D};KROSS +)
- but mostly only H*α* -

Will use low-z observations to help guide high-z observations

KASHz Sample

The primary sample: 250 X-ray identified AGN



No pre-knowledge on kinematics

4 magnitudes in Lx

141 [O III] covered

163 Ha covered

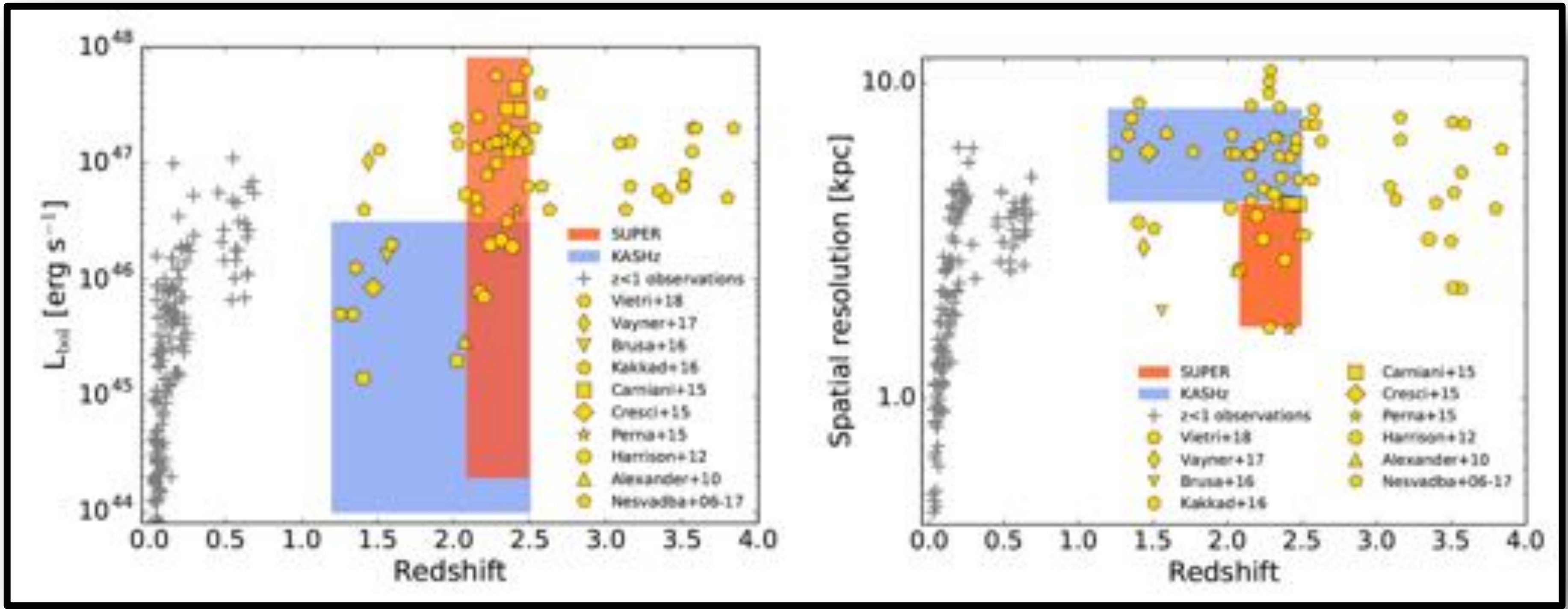
53 with both lines

First third of sample: Harrison+16

SUPER Survey

SINFONI- AO Large Programme: 39 X-ray z~2.3 AGN

[O III] covered IFS Data:



All SUPER targets: IFS in [O III] and Hα (PI: Mainieri)

11 KASHz targets in SUPER (+9 more with AO data)

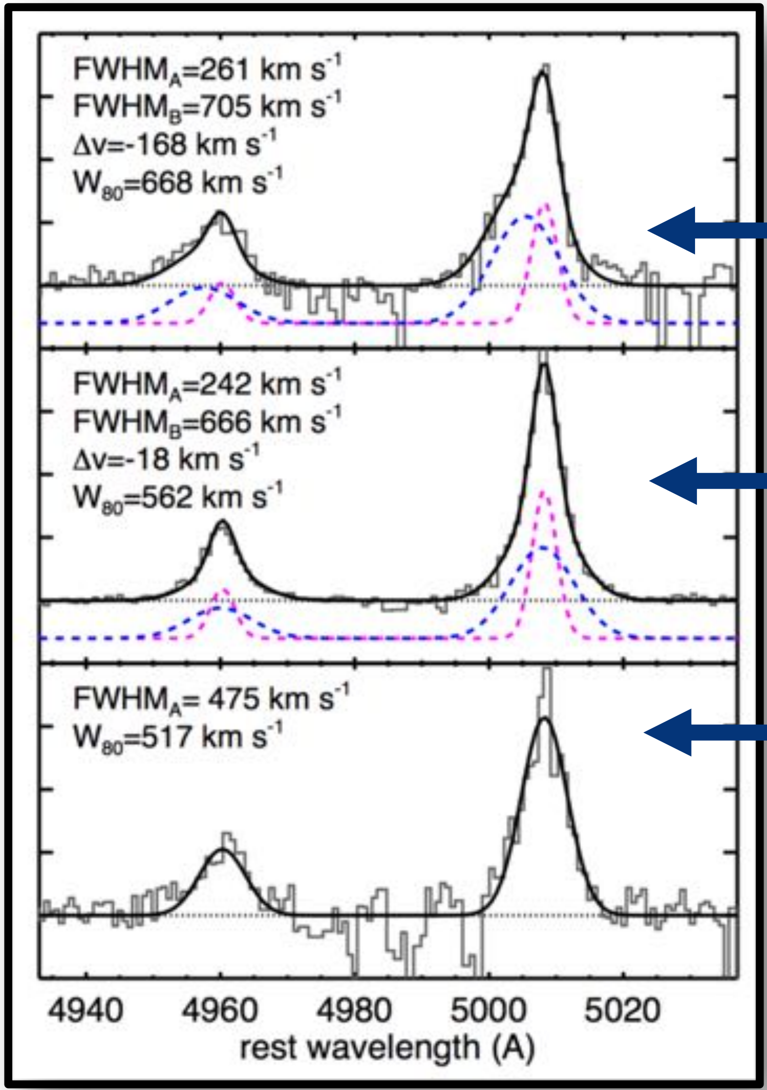
Combine seeing-limited and AO observations

Circosta+18 [sub,]

1. Prevalence?

1. Prevalence

Emission-line profiles are diverse: [O III]4959,5007



`Outflow' component, *velocity offset*

`Outflow' component, *no velocity offset*

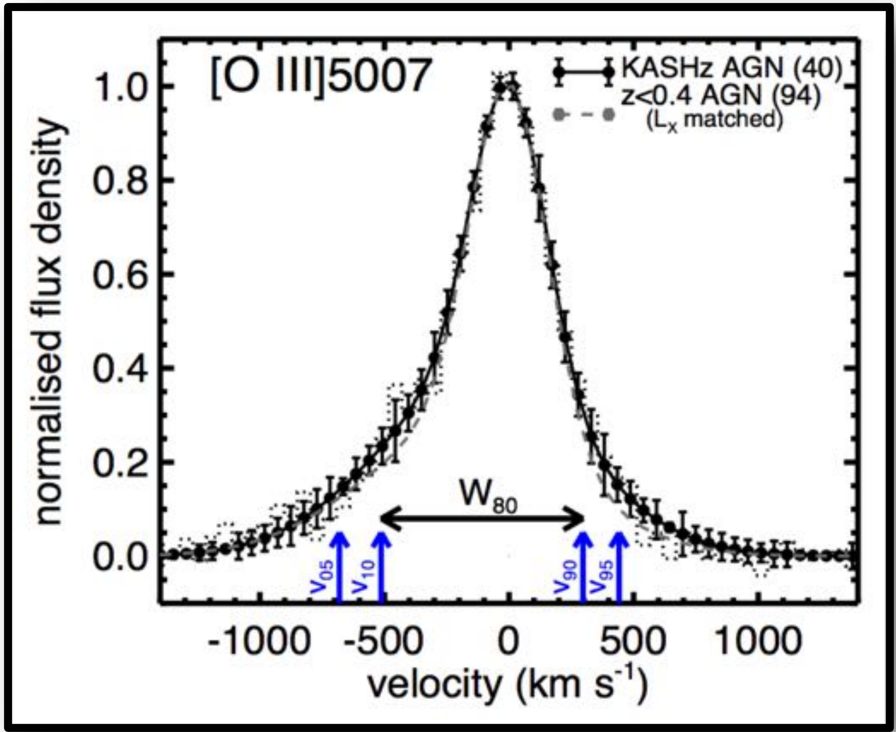
No clear broad component

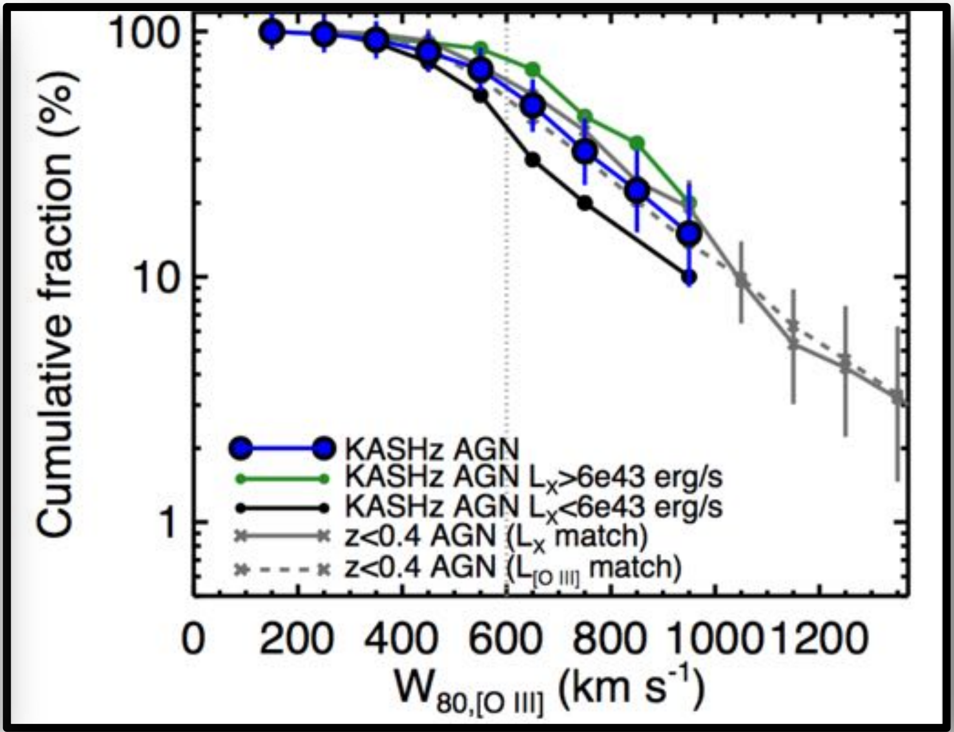
Harrison+16

1. Prevalence

How representative are high velocity components?

Initial Sample:





- **Can assess how representative each object is**
- **Some luminosity trend**
- **For luminosity-matched samples prevalence and line profiles same at z<0.4**

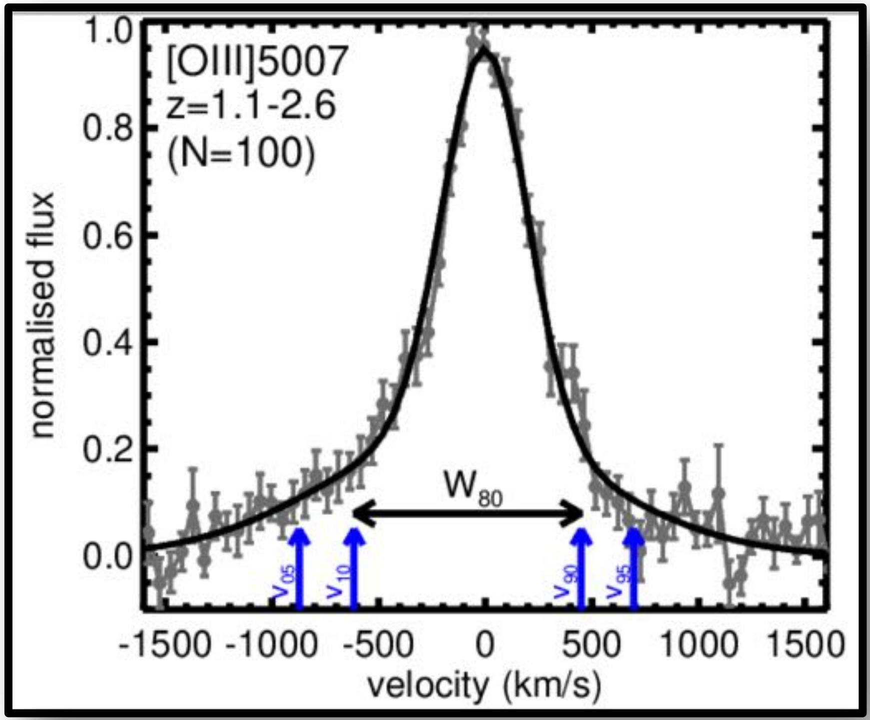
(will use low-z `analogues' to aid interpretation)

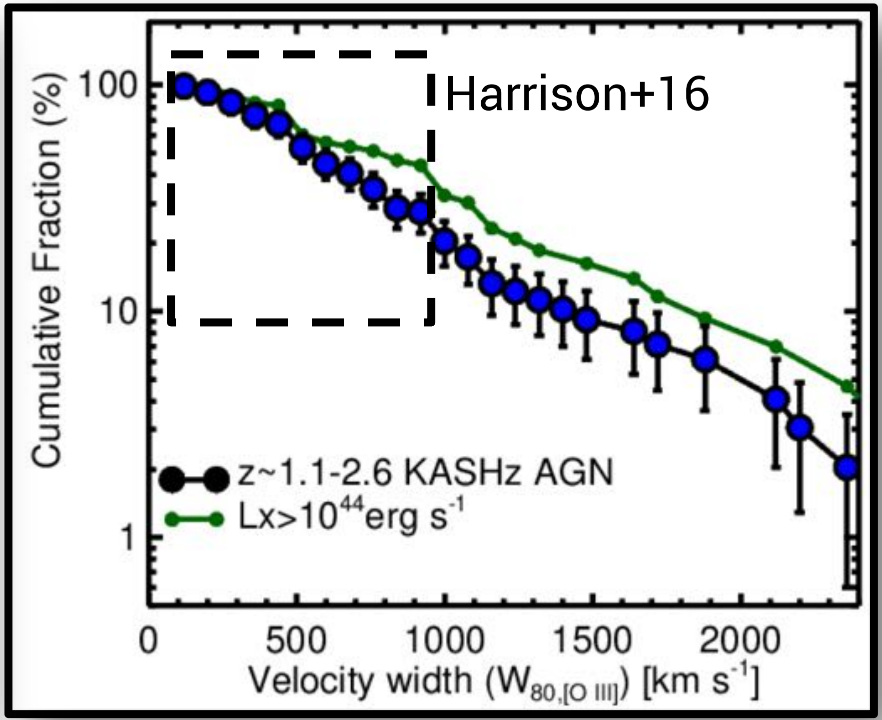
Harrison+16

1. Prevalence

Need large samples to find most extreme objects

Full Sample:





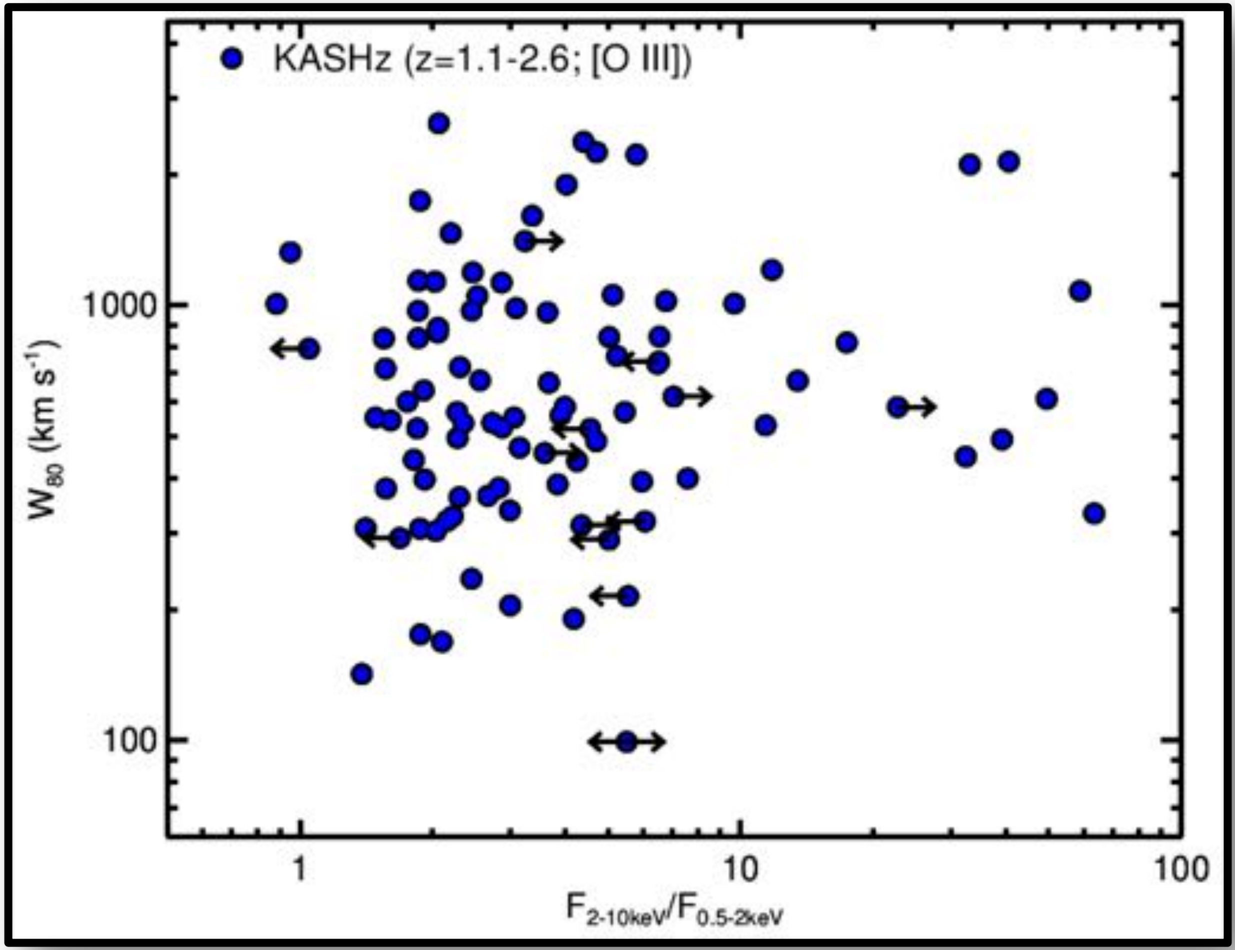
Our survey guides how representative well-studied (extreme?) sources are

Harrison+in prep

1. Prevalence

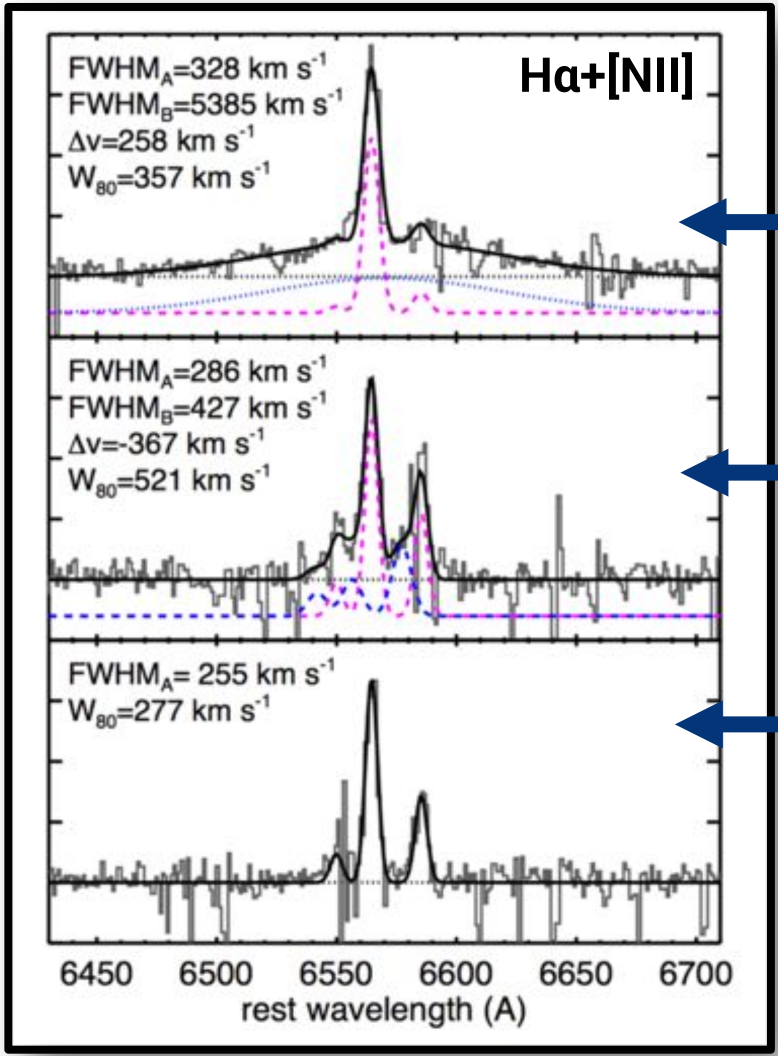
Are X-ray obscured AGN special?

Full Sample:



1. Prevalence

Emission-line profiles are diverse: Hα



Weak BLR + narrow Hα

`Outflow' component, velocity offset

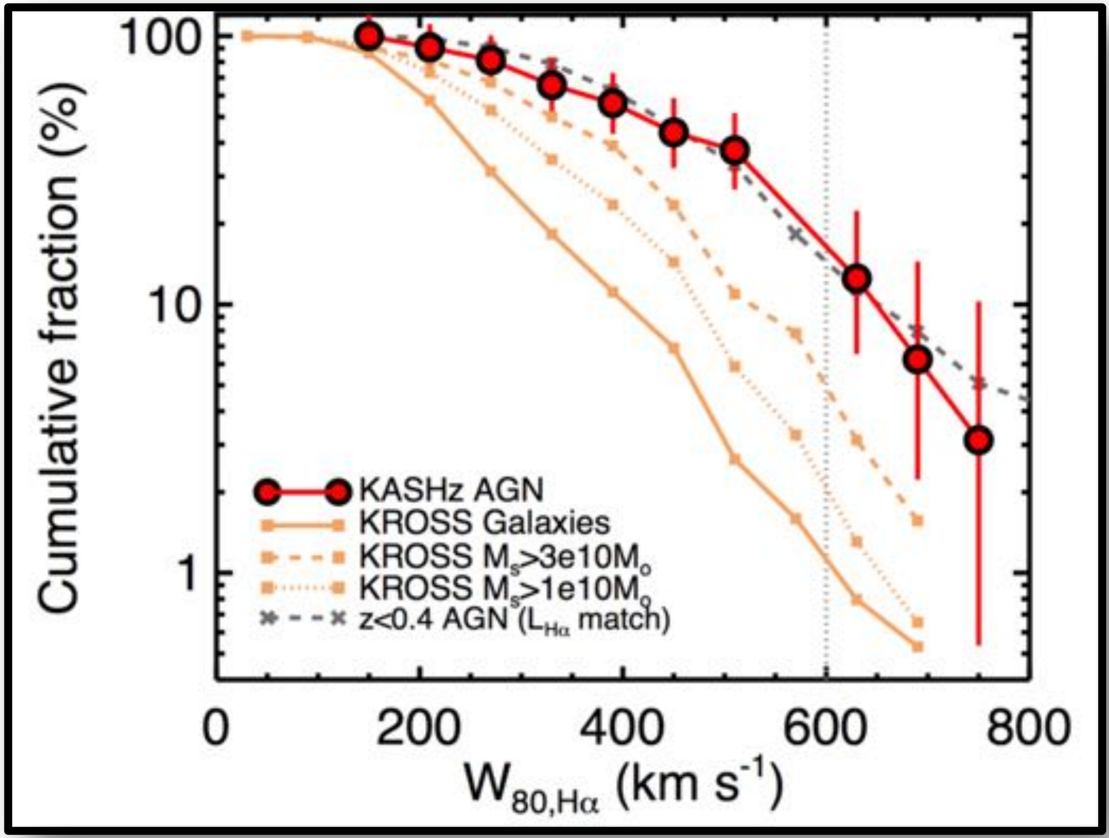
No clear broad component

Harrison+16

1. Prevalence

Broadest lines associated with most massive galaxies and AGN

Initial Sample:



Again, very well matched to luminosity matched z<0.4 AGN

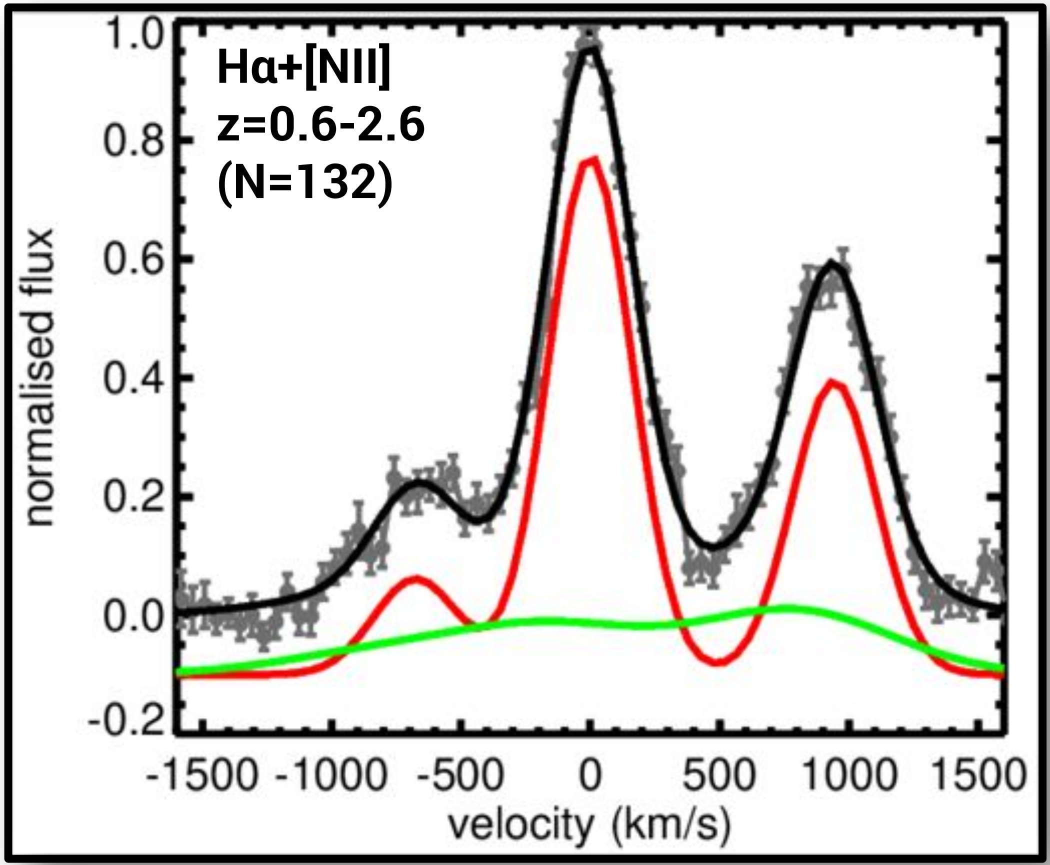
(also see Forster Schreiber+18)

Harrison+16

1. Prevalence

Hα shows weaker wings compared to [NII] and [O III]

Full Sample:



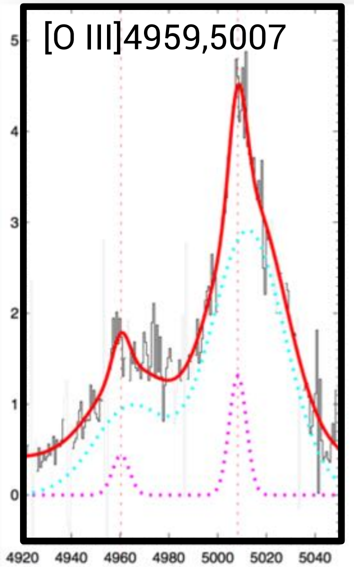
Need to de-couple different emission lines

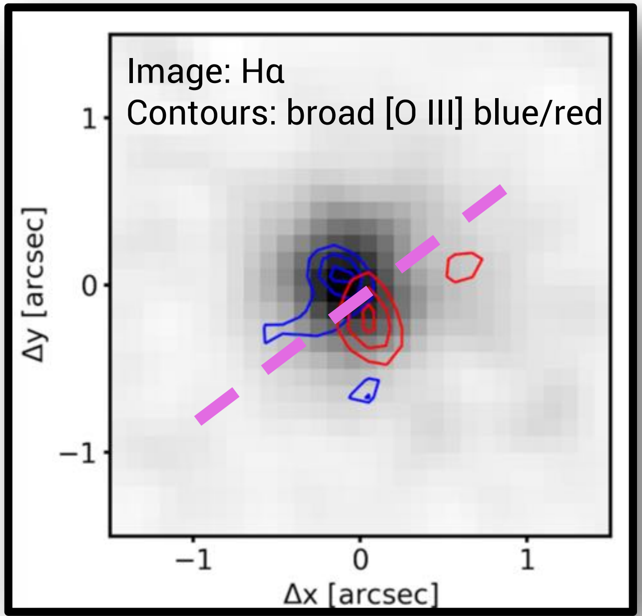
Harrison+in prep

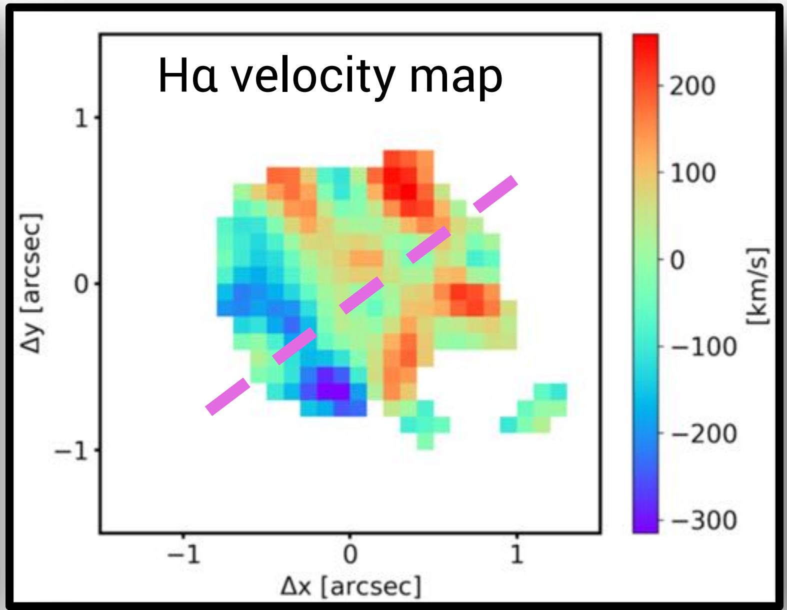
2. Properties and drivers?

2. Properties and drivers

Hα and [OIII] can trace different velocity structures





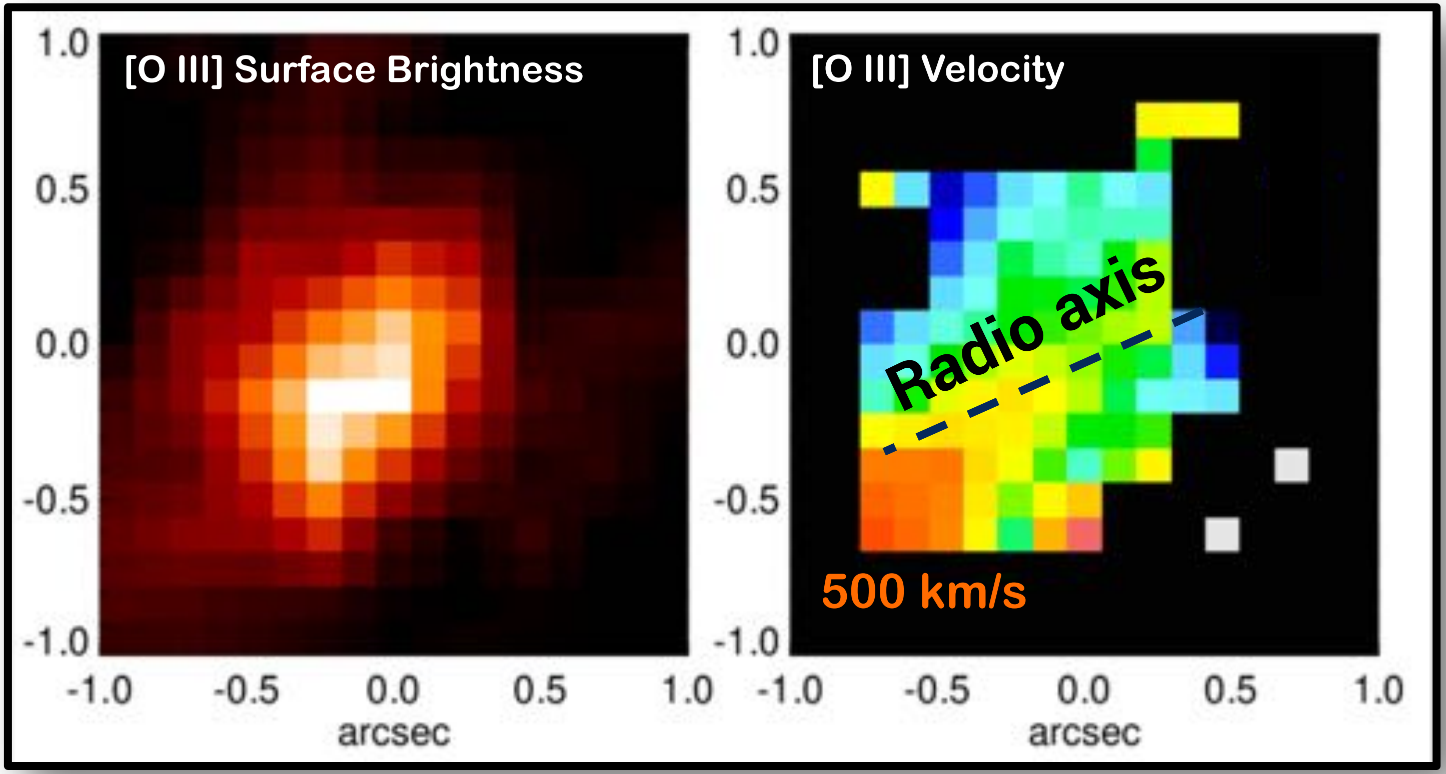


- **SUPER-KASHz target**
- **[O III] outflow perpendicular to narrow Hα gradient axis**

Kakkad+ in prep

2. Properties and drivers

What role do radio jets play in driving the gas kinematics?



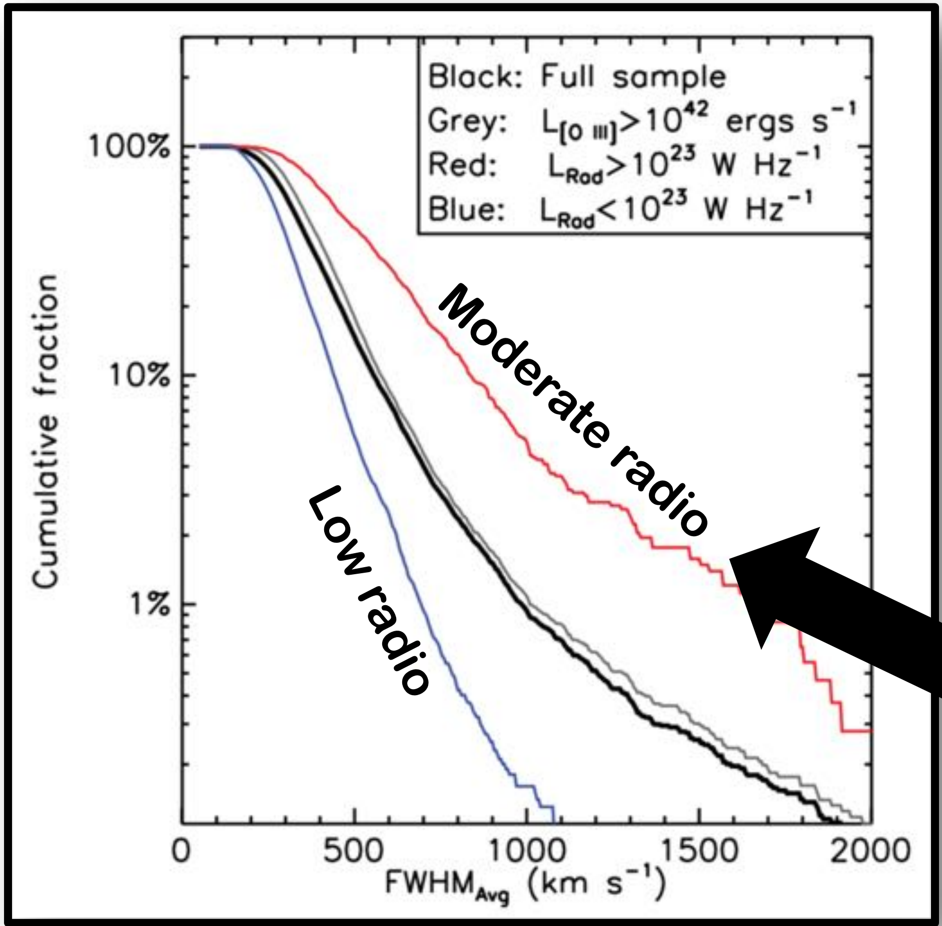
But most sources spatially unresolved in radio maps

Preliminary!

2. Properties and drivers

Can we learn some lessons from the low-z Universe?

z<0.4 AGN (SDSS) [O III]



Moderate luminosity radio = higher prevalence of high velocities

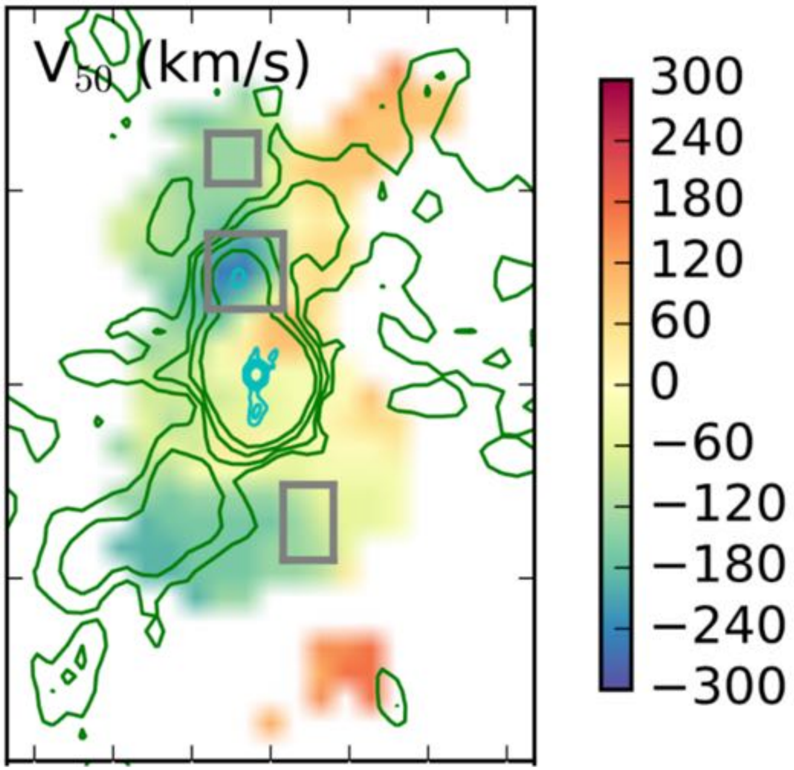
->Spatially-resolved follow up

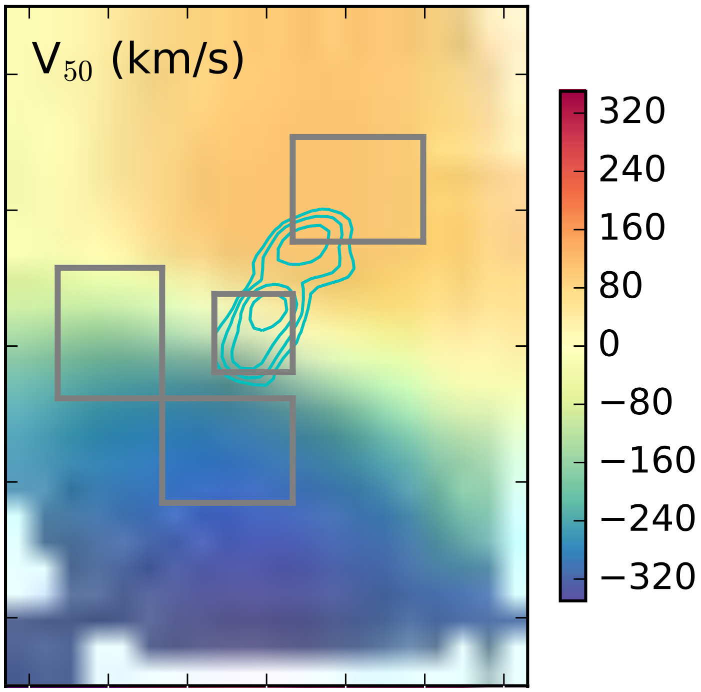
(also see Zakamska & Greene 2014)

Mullaney+13

2. Properties and drivers

~kpc jets may be crucial in radio-weak radiatively luminous AGN





z<0.2 "radio quiet" quasars

Not ``radio" AGN e.g., Best&Heckman)

May be classed as "Non-jetted"

Harrison+15->

M.E. Jarvis+ in prep

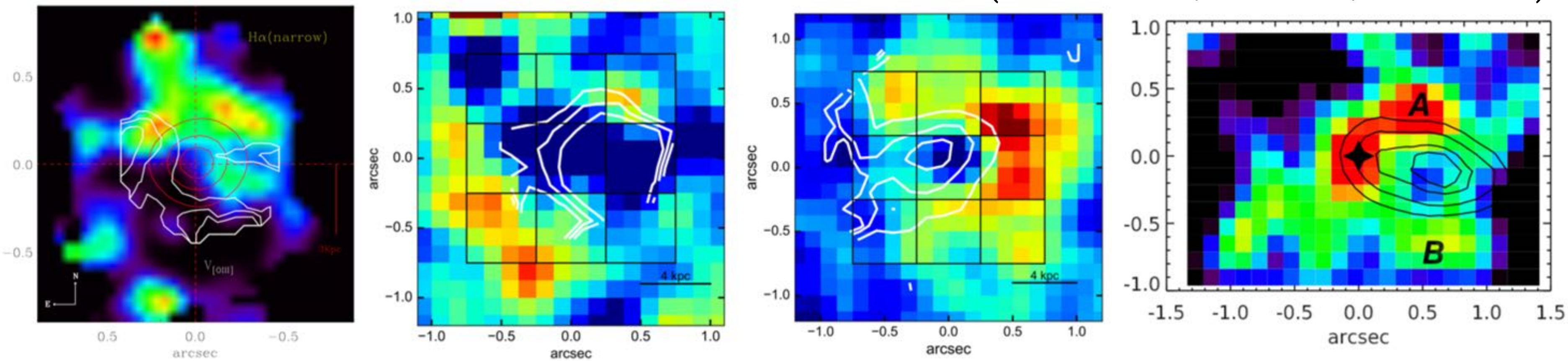
3. Impact?

3. Impact

``Direct" evidence for suppressed star formation

AGN/quasars z=1.5-2.5

(Cano-Diaz+12; Cresci+15; Carniani+16)



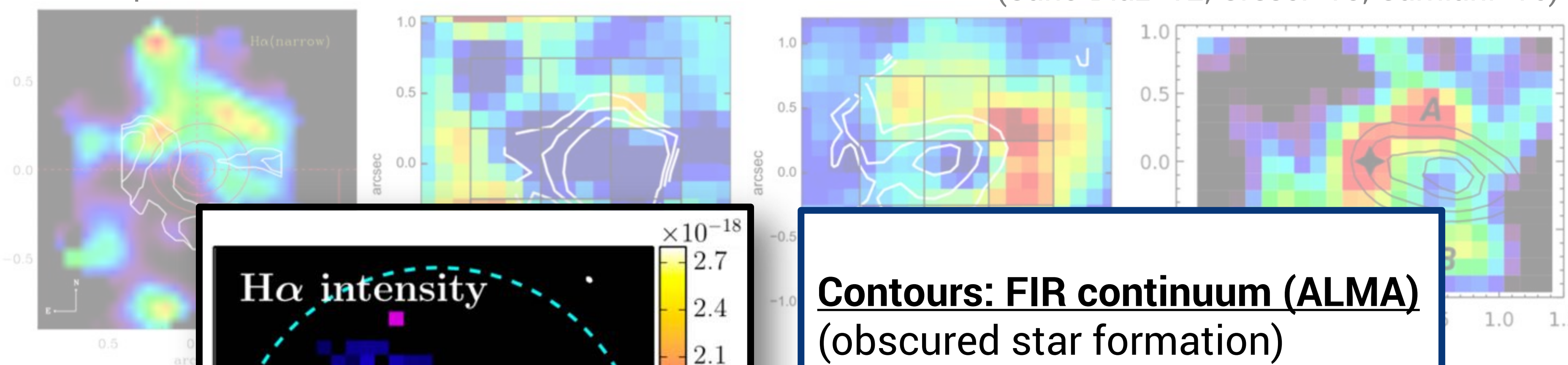
<u>Contours: *[O III] Outflow*</u> **<u>Maps: H-alpha</u>** (star formation)

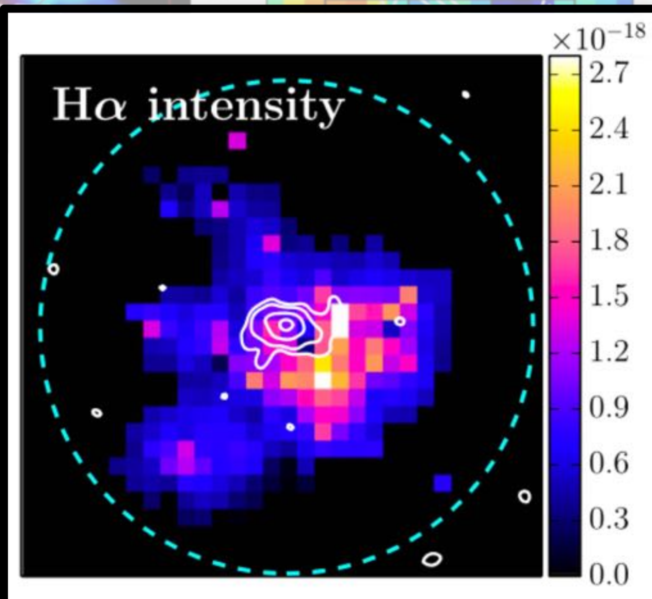
3. Impact

How reliable is H-alpha for tracing all star formation?

AGN/quasars z=1.5-2.5

(Cano-Diaz+12; Cresci+15; Carniani+16)





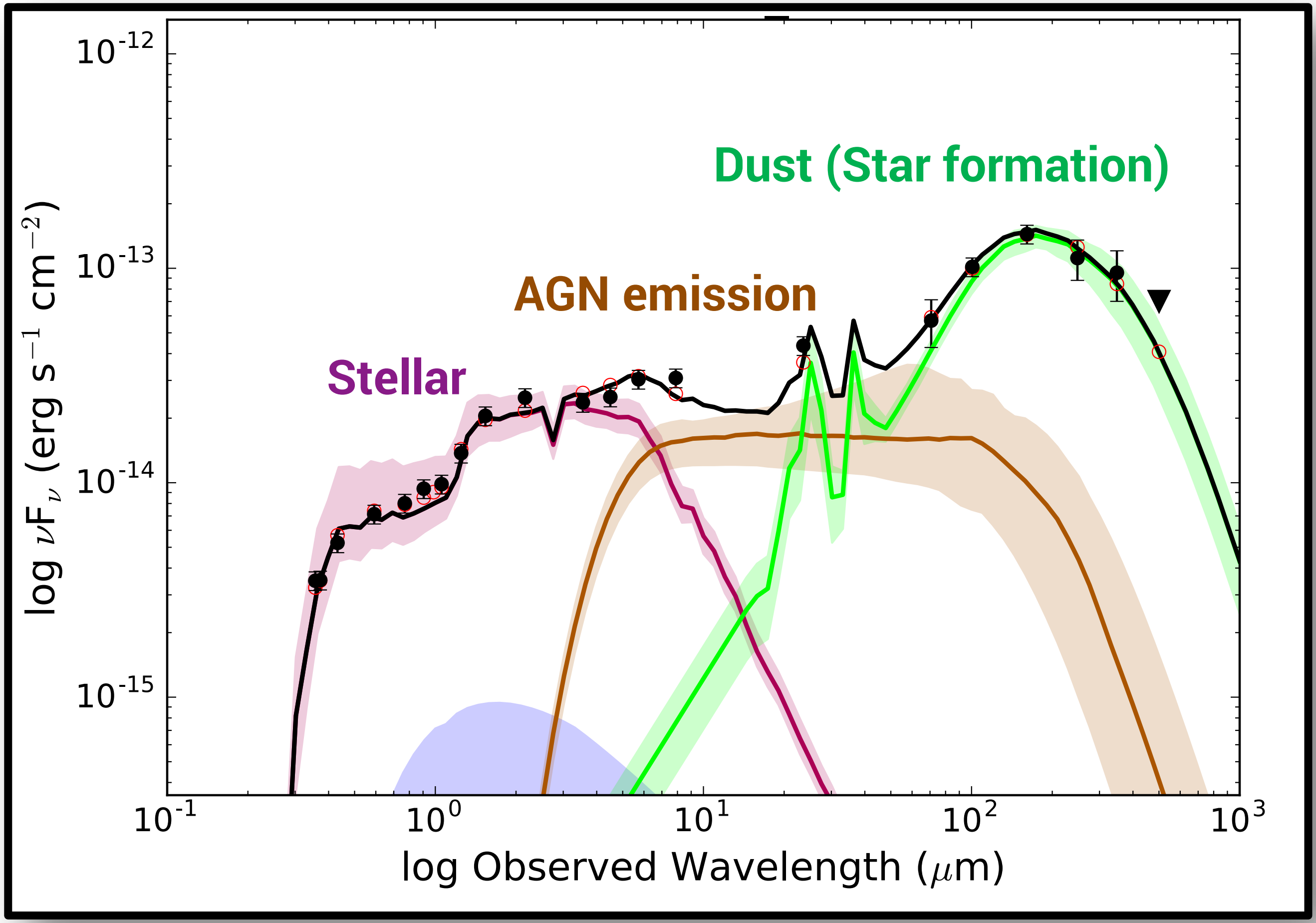
<u>Contours: FIR continuum (ALMA)</u>
(obscured star formation)

<u>Map: H-alpha</u>
(unobscured star formation)

Chen+17

3. Impact

FORTES-AGN: Reliable masses, star formation rates and AGN luminosities



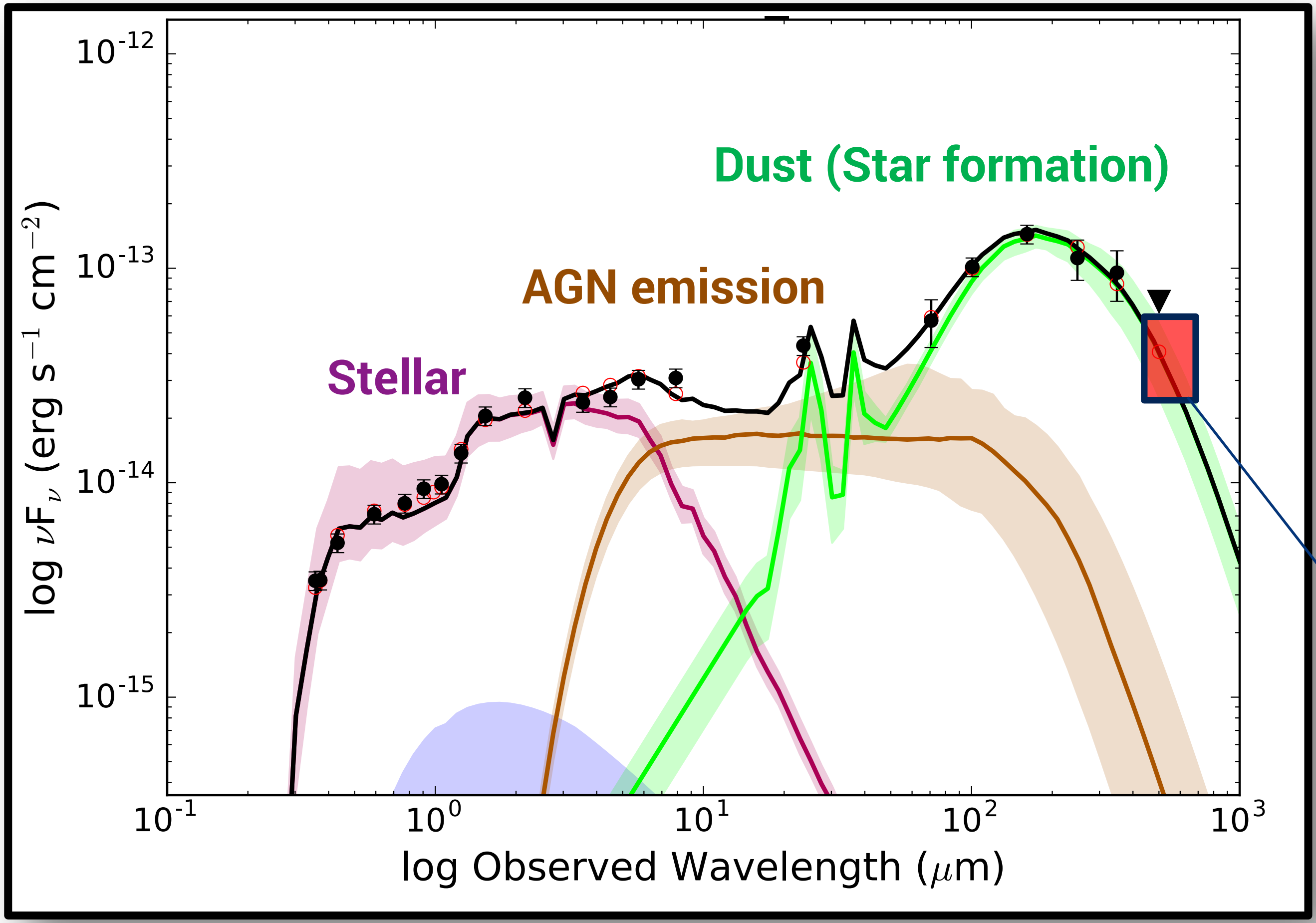
Ongoing: deep ALMA continuum to go up to ~10x deeper than *Herschel (Stanley+18)*

(Scholtz talk)

Rosario+ in prep

3. Impact

FORTES-AGN: Reliable masses, star formation rates and AGN luminosities



Ongoing: deep ALMA continuum to go up to ~10x deeper than *Herschel (Stanley+18)*

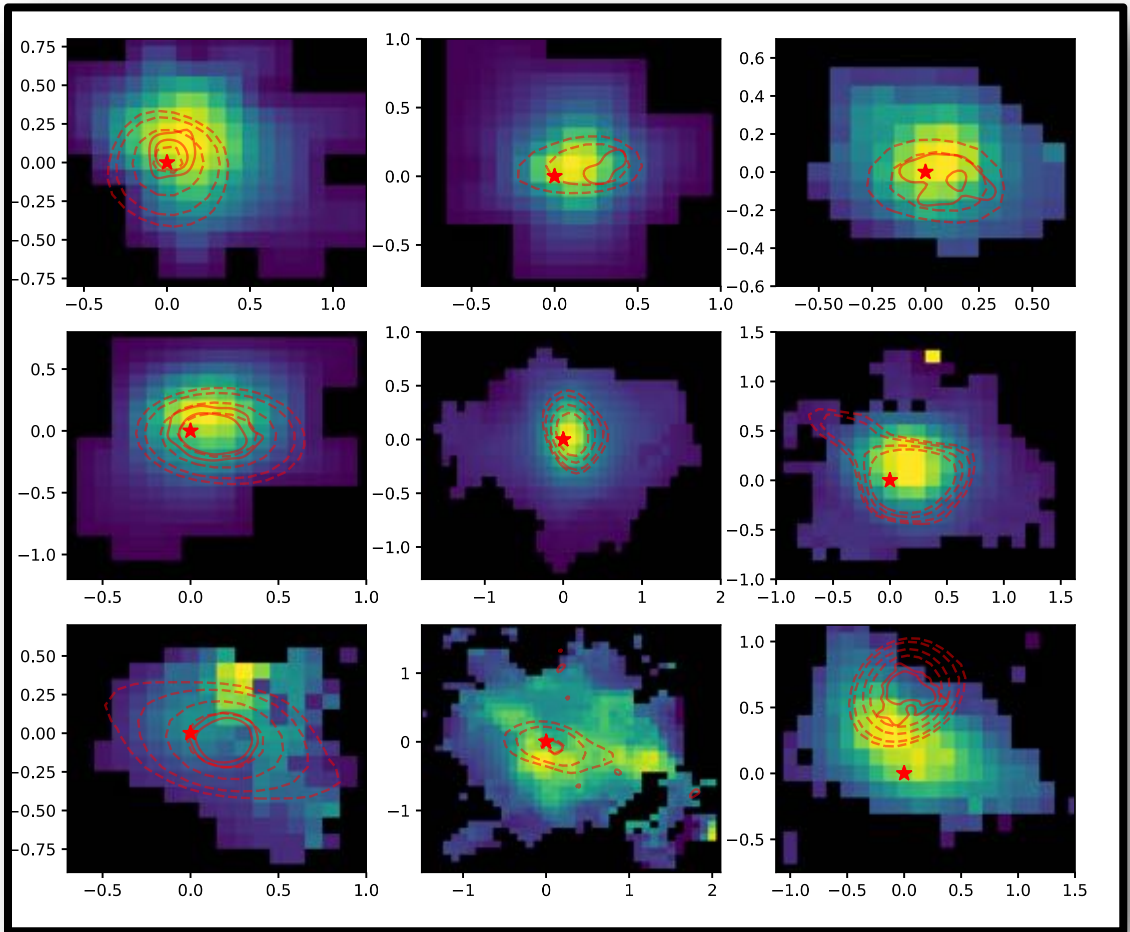
(Jan Scholtz talk)

Where we will be mapping FIR continuum

Rosario+ in prep

3. Impact

KASHz targets show complex FIR vs. Hα geometry



Can be patchy Hα

FIR continuum peak often offset

Need to be careful with interpretation

(astrometry corrected)

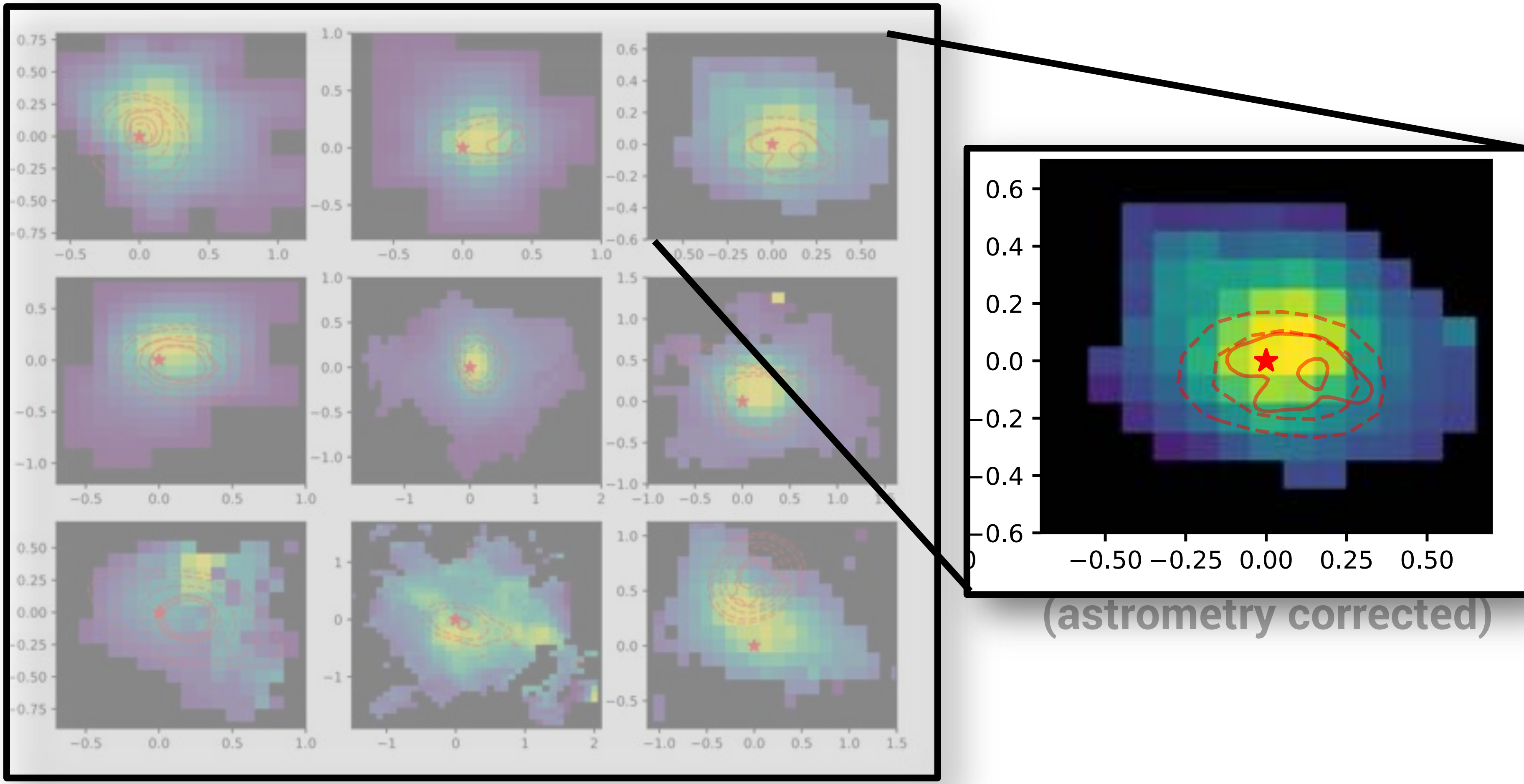
Star: AGN

Contours:
FIR continuum
(High&Low res)

Map: H-alpha

Scholtz+ in prep

KASHz targets show complex FIR vs. Hα geometry



(astrometry corrected)

Star:
continuum centre

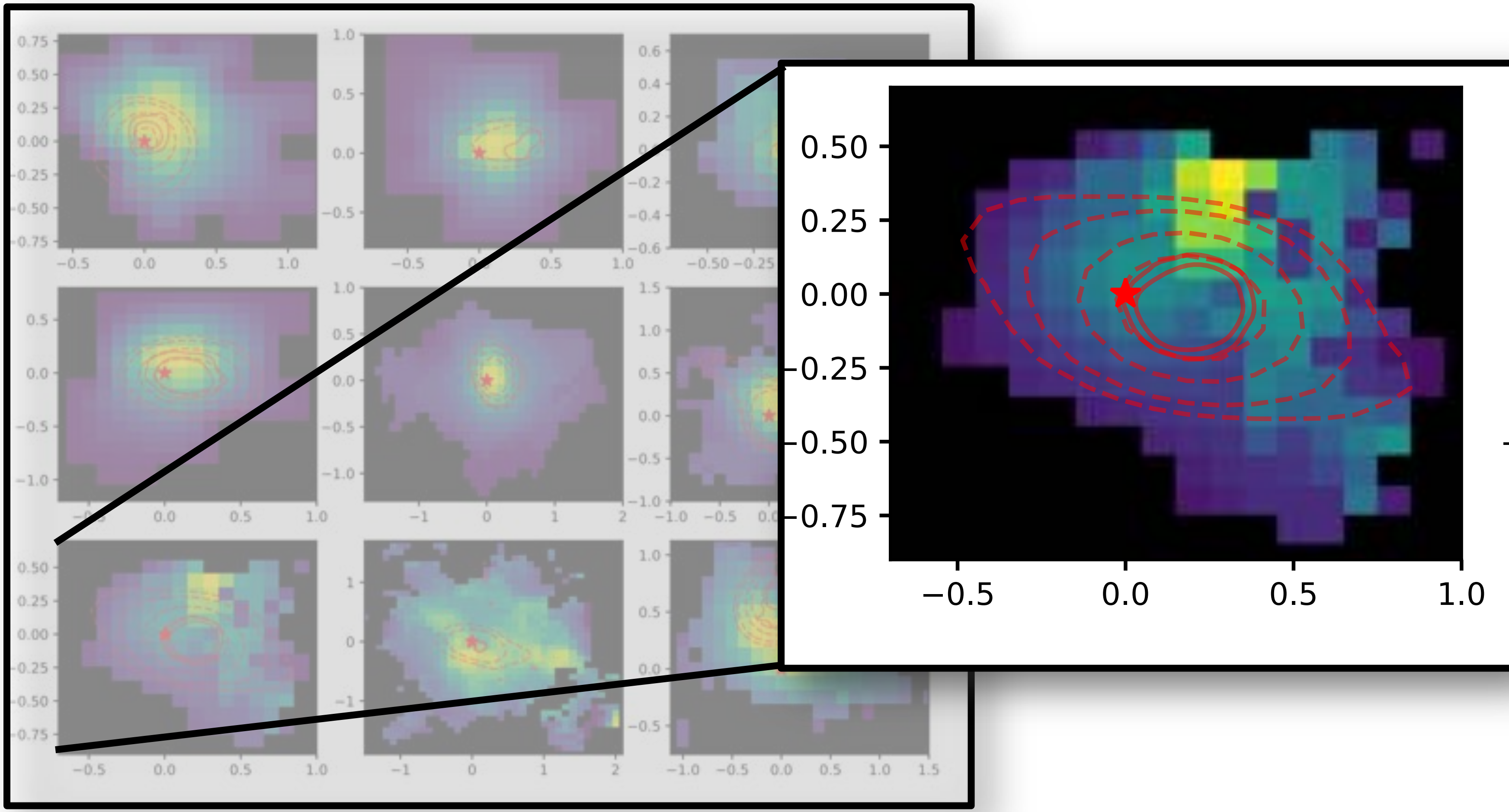
Contours:
FIR continuum
(High&Low res)

Map:
H-alpha

Scholtz+ in prep

3. Impact

KASHz targets show complex FIR vs. Hα geometry



Star:
continuum centre

Contours:
FIR continuum
(High&Low res)

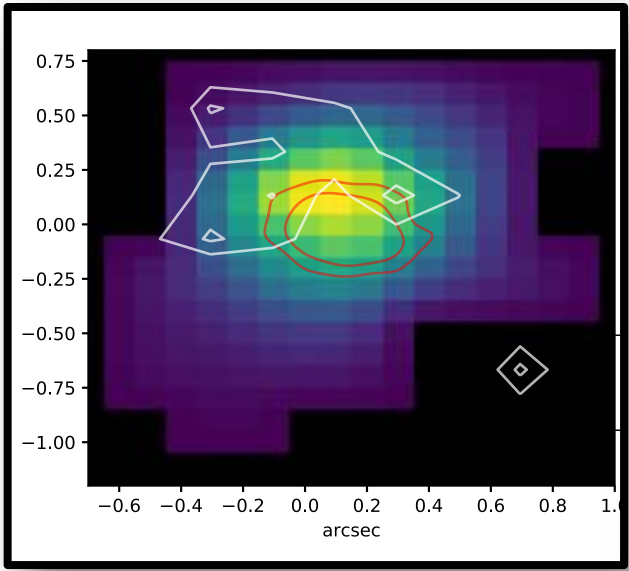
Map:
H-alpha

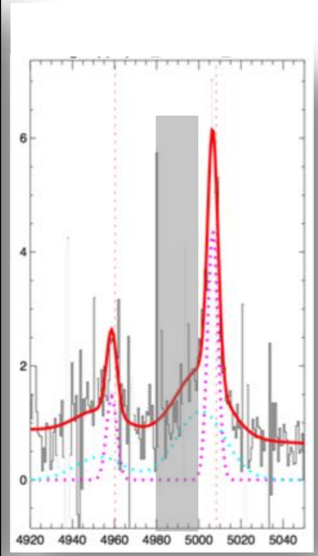
Scholtz+ in prep

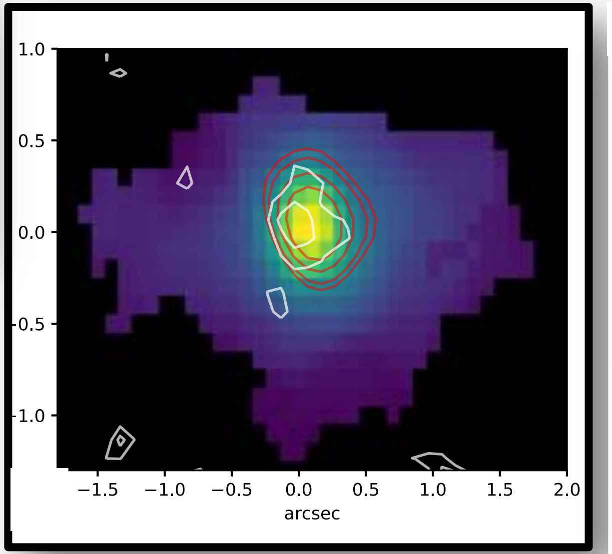
3. Impact

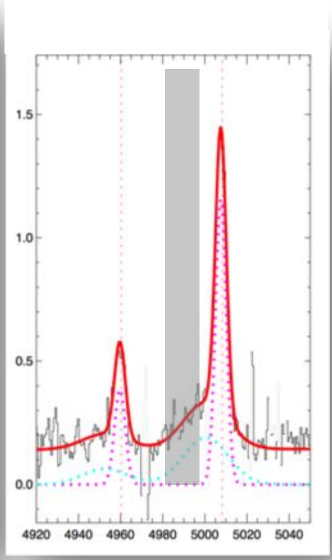
No simple universal ``suppression” of SF by [OIII] outflows

Map: H-alpha **Red Contours:** FIR continuum **White contours:** [O II] outflow









Scholtz+ in prep

Key messages

KASHz: 250 z=0.6-2.6 X-ray AGN with IFS data
Approach: Detailed observations in context of population

- Quantifying the prevalence of ionised outflows
- Most extreme gas kinematics associated with AGN
- We should continue to investigate the role of radio jets in driving outflows for all AGN
- Caution required when using Hα to trace star formation: "suppression" not ubiquitous