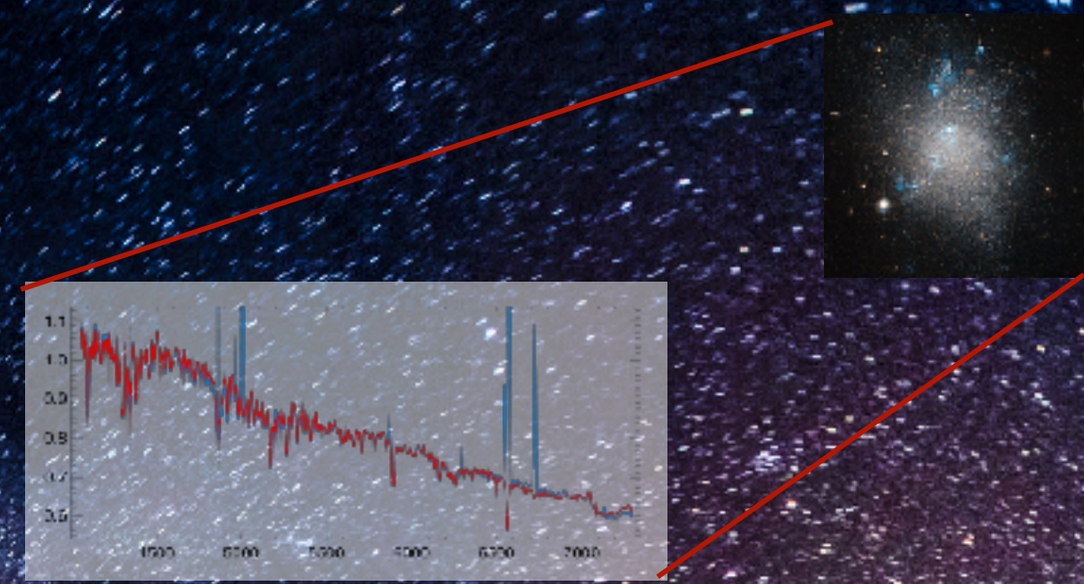
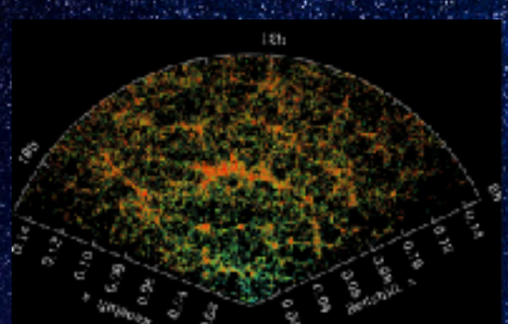
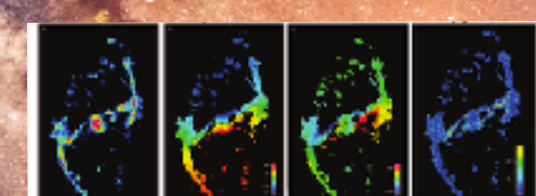


Galaxy Evolution with Spectroscopic Surveys at UCL

Guido Roberts-Borsani





6th February 2019, UCL

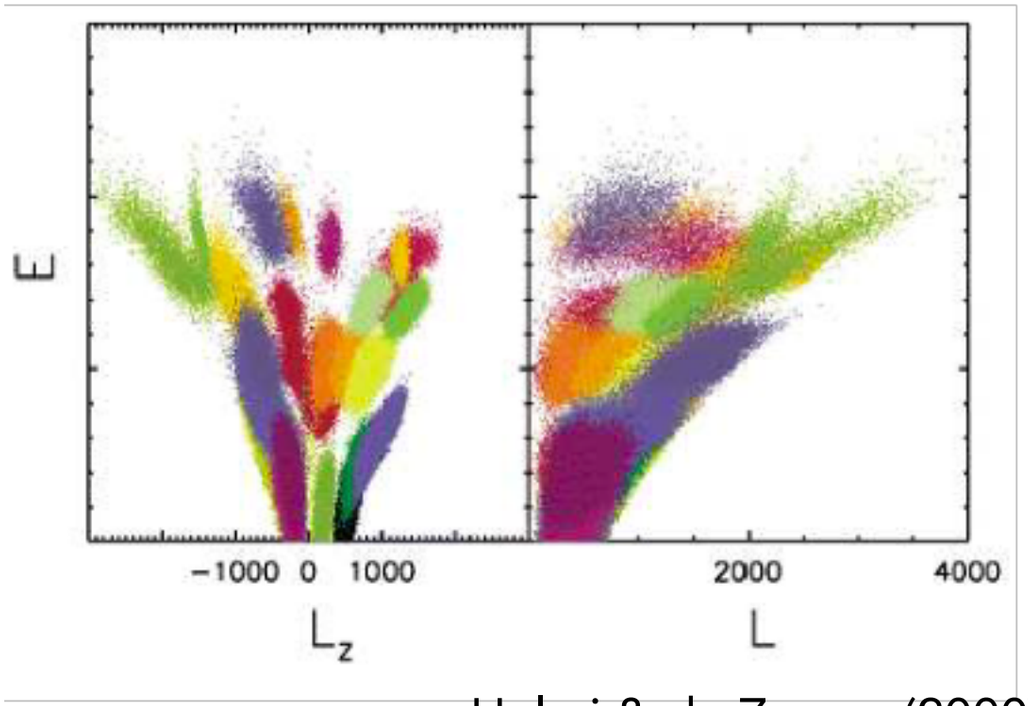
https://www.hawaiiscape.com/2018/05/night-sky-leds-landscape-lighting/#!prettyPhoto

Testing CDM assembly processes with Subaru/PFS

Subaru/PFS' multi-object nature will provide ***millions of stellar spectra*** to understand the kinematics and chemical abundances of the stellar populations.

Perfect synergy with:

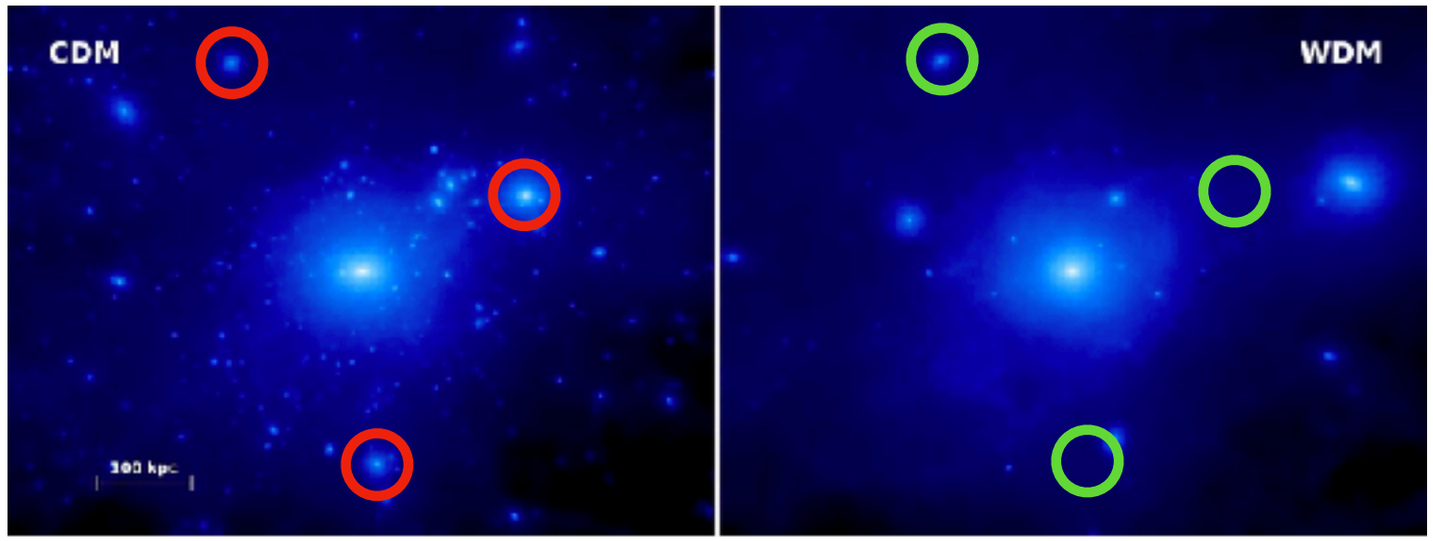
- GAIA → stellar distances
- Hyper Suprime-Cam → imaging data for large FOV



Helmi & de Zeeuw (2000)

Is dwarf galaxy formation not understood?

Is dark matter assembly weird?

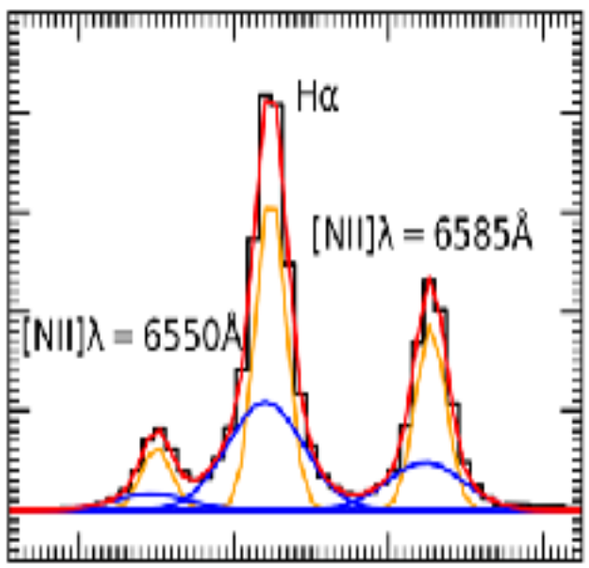


Credit: Durham University

Looking at galaxy evolution with Subaru/PFS

Great news! Optical spectra out to z~2 with diagnostic lines such as Hα+[NII], [OIII], Hβ. Large wavelength coverage across redshifts and high resolution (~2x SDSS resolution) allows for ***characterisation of galaxy ISM.*** ESO-MOONS will extend this range:

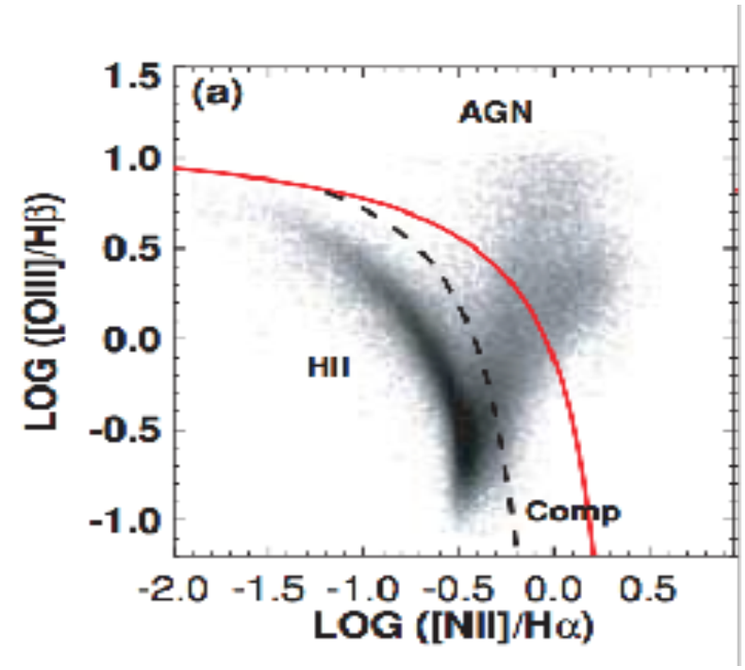
Gallagher et al. (2018)



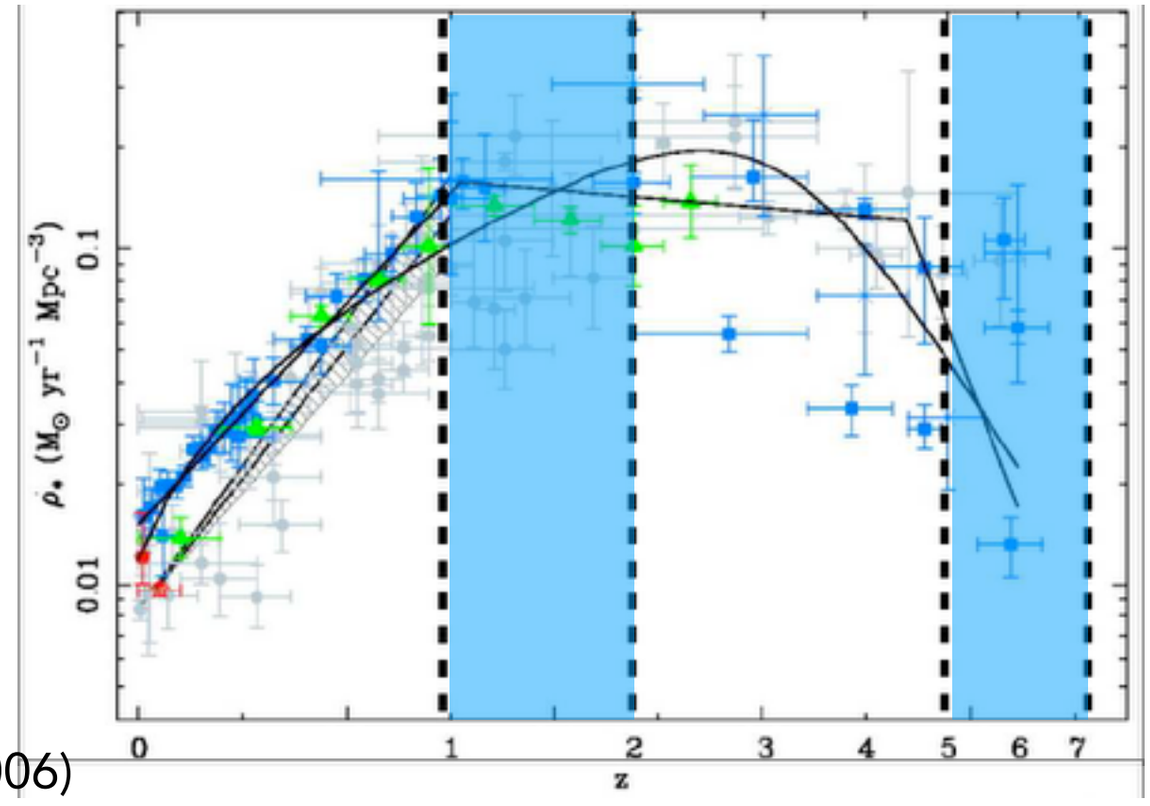
High wavelength resolution allows for detection and mapping of outflows and accretion

Kewley et al. (2006)

BPT diagnostics lines can determine ionisation source of gas



Study peak epoch of SF and BH growth over LARGE area

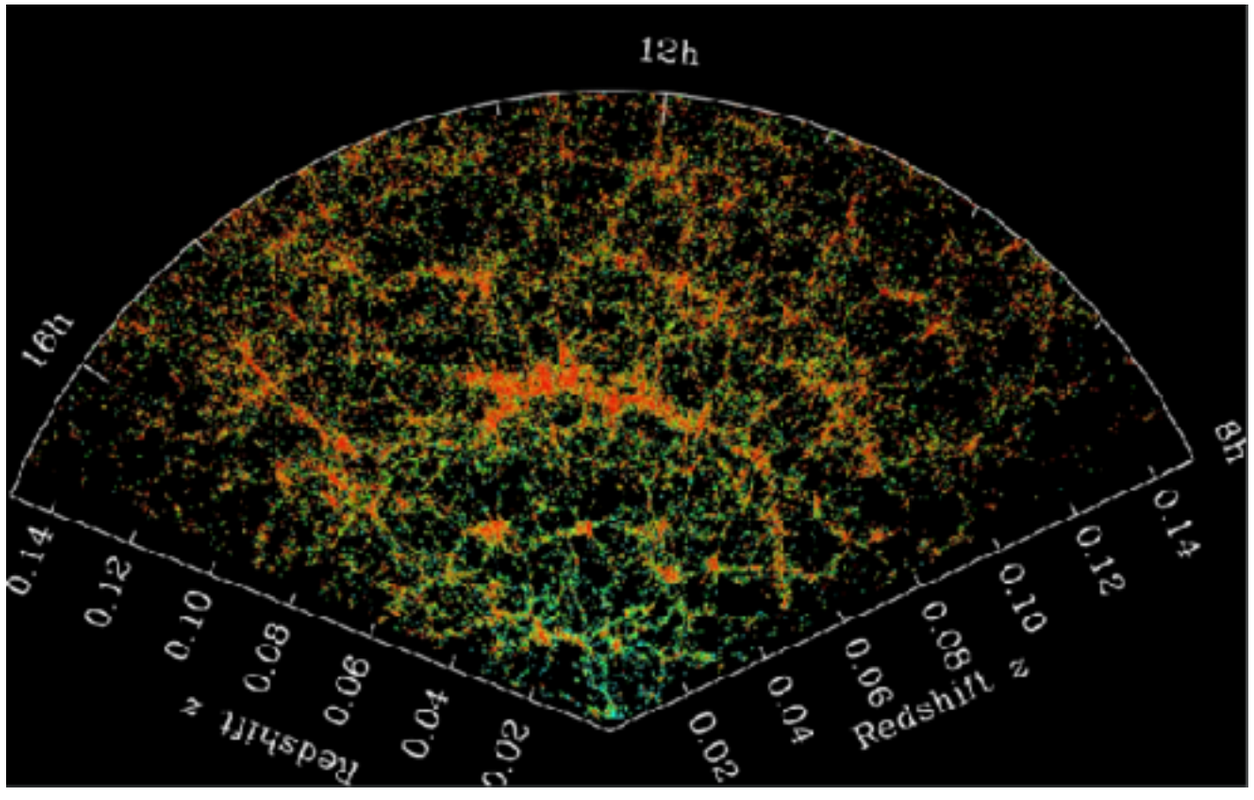


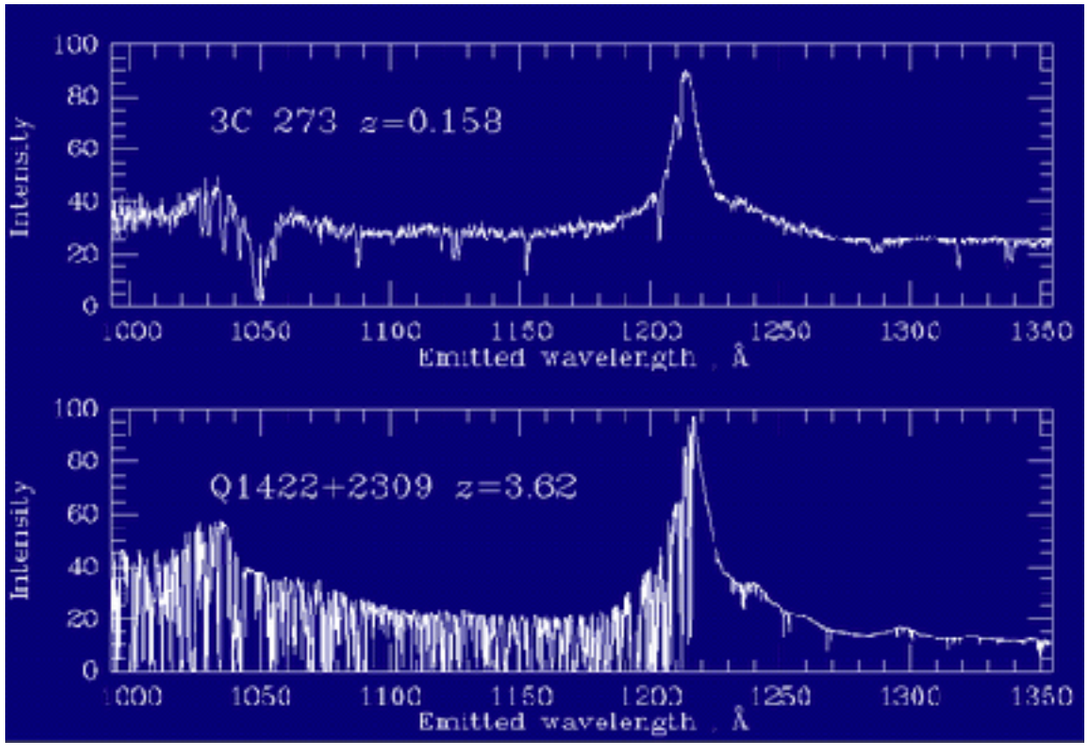
Hopkins & Beacom (2006)

Mapping the observable Universe with DESI

~30,000,000 optical spectra covering 1/3 of the night sky, ~x10 larger than SDSS. Complimented by spectra/imaging with Euclid/WFIRST.

→ Redshifts, distributions and optical properties of ***SOOOOO many galaxies***!!
→ Growth of structure and clustering of galaxies: observational constraints for DM models and…… dark energy! How does this evolve as a function of redshift of galaxy type?
→ Lyman alpha studies to determine neutral fractions along the line of sight and clustering…





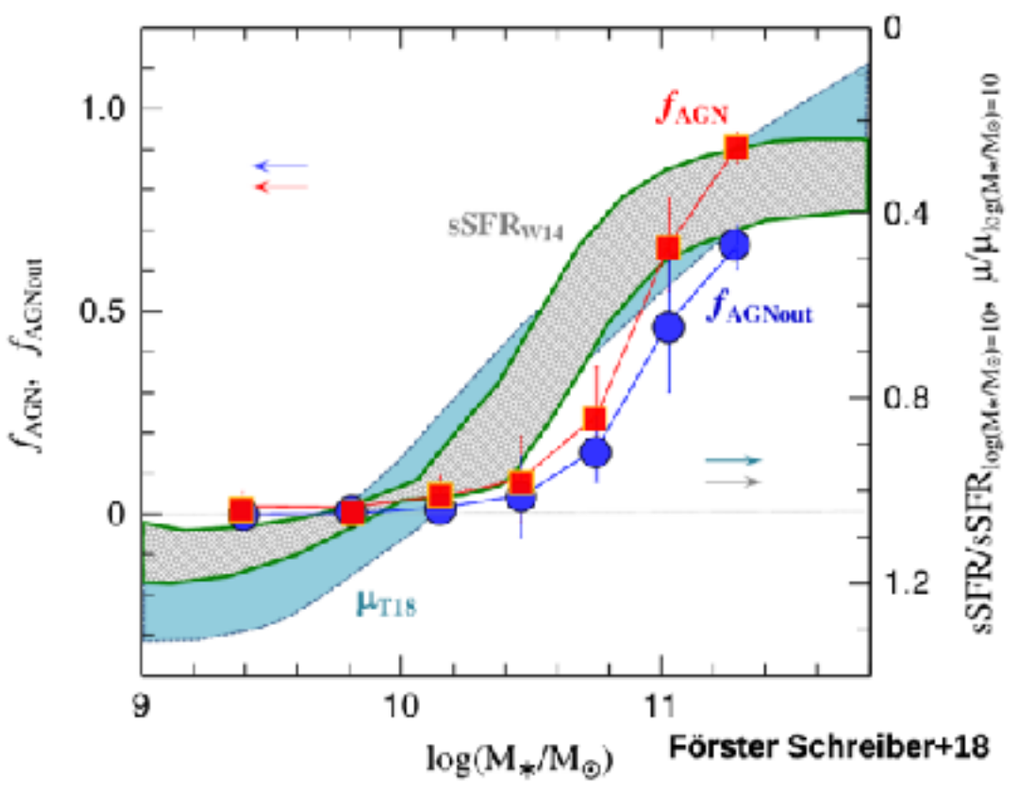
Credit: William C. Keel

AGN surveys with 4MOST

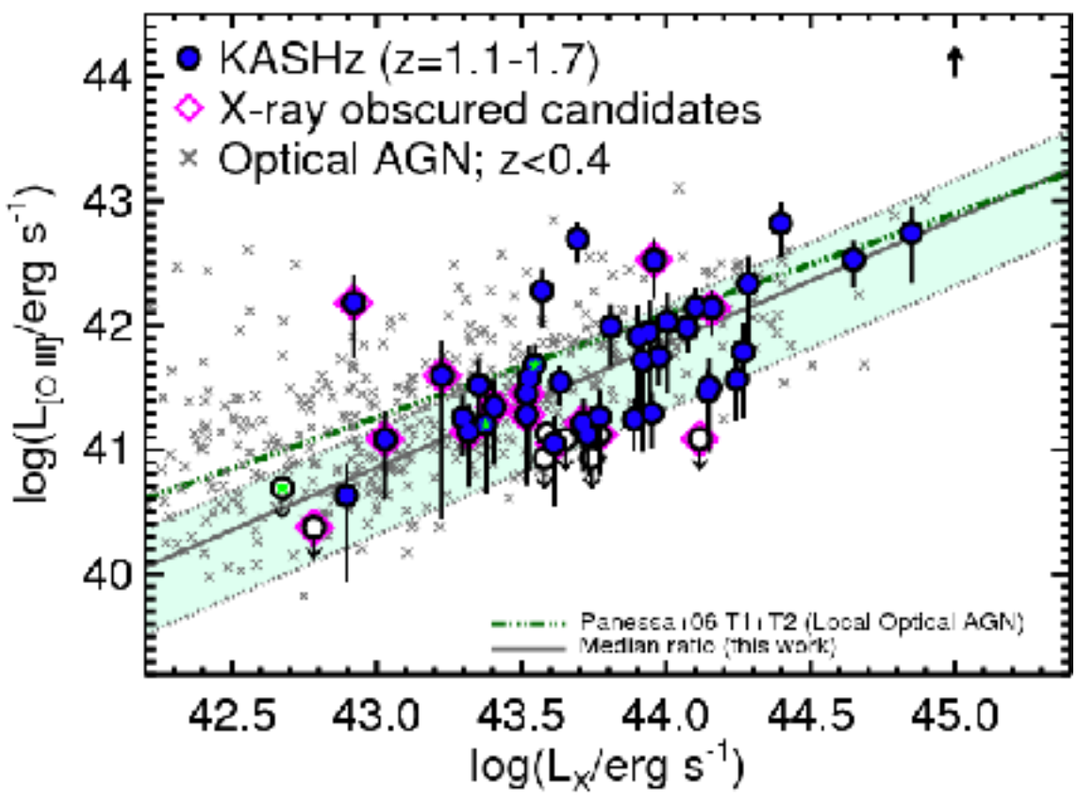
AGN are very difficult to characterise - not always obvious, can contaminate studies of galaxies, and duty cycles of AGN are unknown.

- eROSITA provides x-ray data, WISE provides mid-IR data, and 4MOST optical data with high resolution
- ***>1,000,000 AGN over the range 0<z<6.5*** with 90% completeness
- Compare scaling relations of AGN across wavelengths and epochs, and improved color selection techniques:

AGN feedback and influence on SFRs



Black hole accretion and evolution from optical-to-X-ray SED and emission line studies

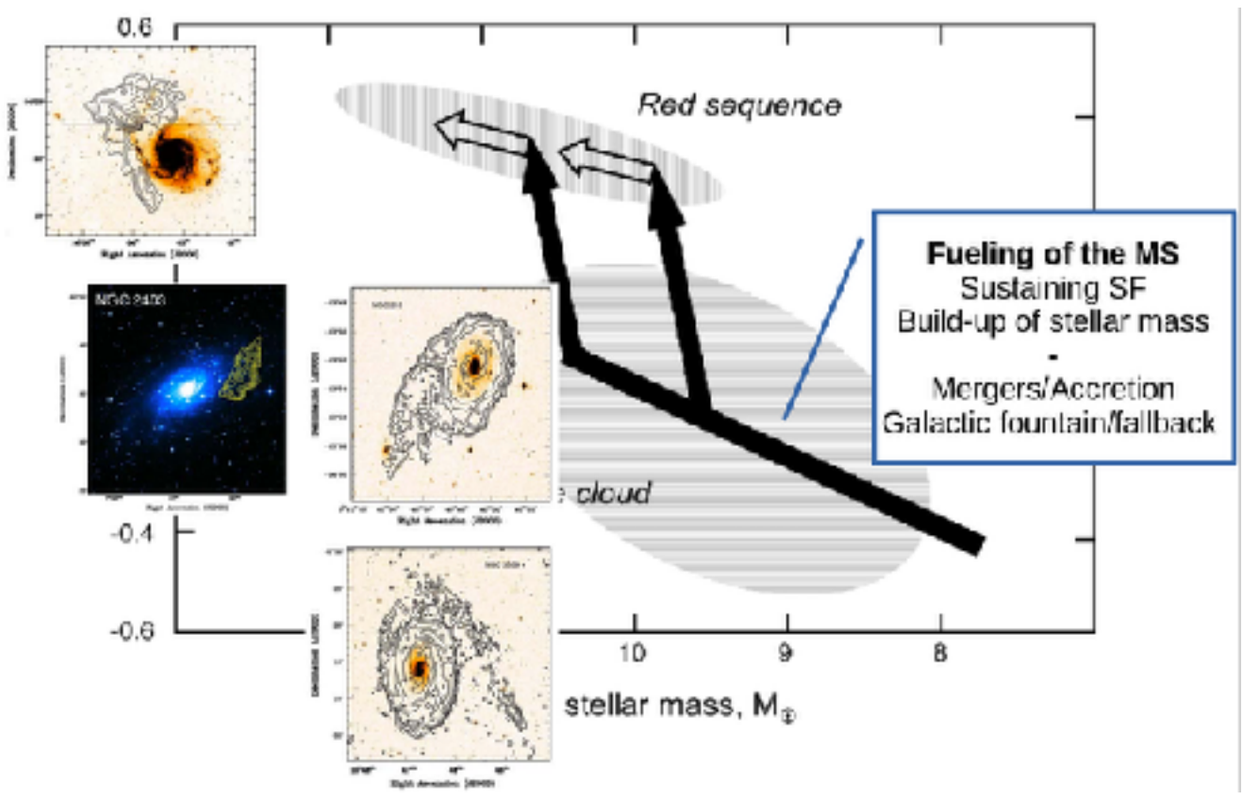


KASHz; Harrison+2018

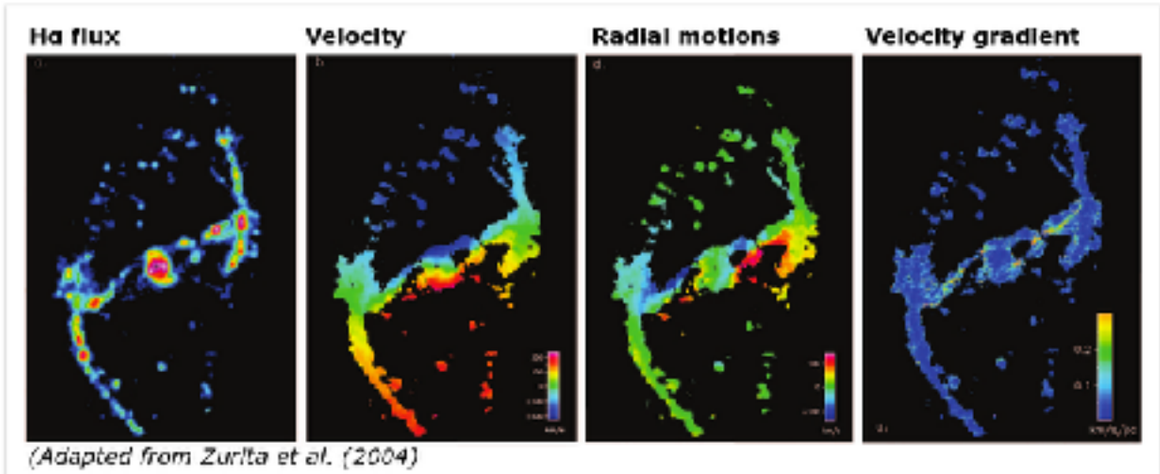
IFU and multiwavelength studies with WEAVE-Apertif

IFU data is extremely valuable in ***linking together the ISM, CGM, and cyclic nature of gas in galaxies***, thereby helping to determine the powering source and fates of the gas…
Westerbork radio telescope (Apertif) provides the COLD gas tracer for the fuel for star formation…

~100,000 galaxies out to z~0.2 with optical IFU and HI:



- IFU allows for absorption (and emission) signatures of the ISM, CGM, outflows, and accretion so can link all stages.
- HI provides cold gas information so can determine whether quenching mechanisms have an impact on the fuel and ultimately the position of the galaxy on the main-sequence.

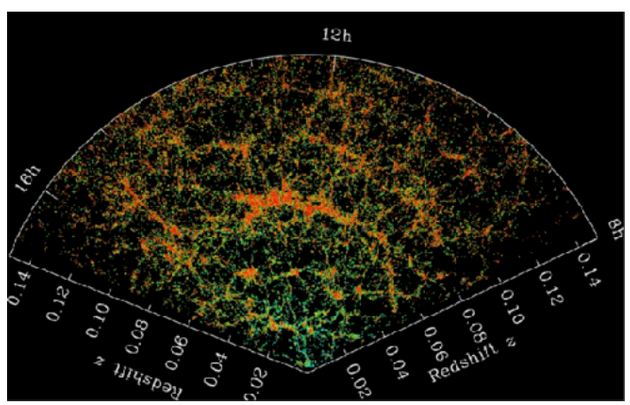


https://ingconfluence.ing.iac.es:8444/confluence//display/WEAV/WEAVE-APERTIF

Conclusions

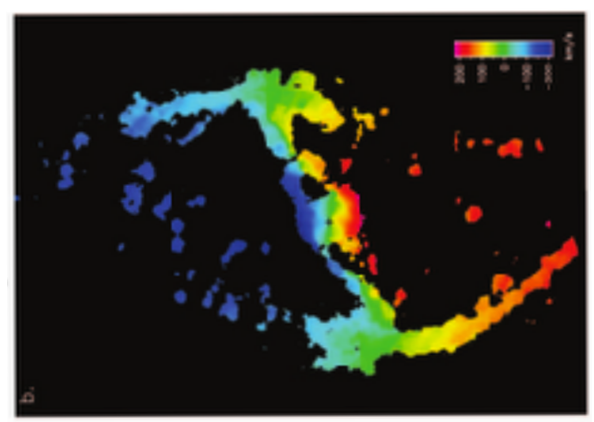
1

Optical spectra allow for redshift determine, studies of stellar populations and state of the ISM gas. Upcoming surveys offer an ***unprecedented view*** on the galaxy populations over all epochs…



2

The advent of multi wavelength and IFU studies will allow us to ***connect different gas and light phases*** to reveal connections between different processes from integrated to kpc scales…



3

The unprecedented number of spectra allows us to do detailed statistics and determine conclusions over ***general galaxy populations*** rather than small number samples…