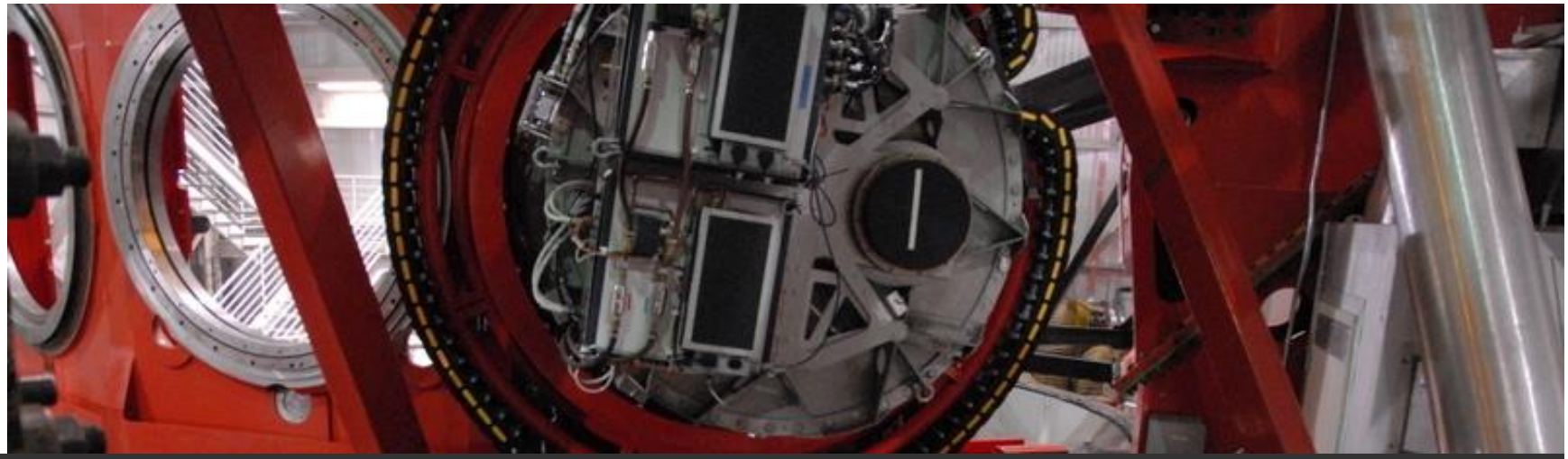


LUCI spectroscopy of distant galaxies

Jaron Kurk (MPE)

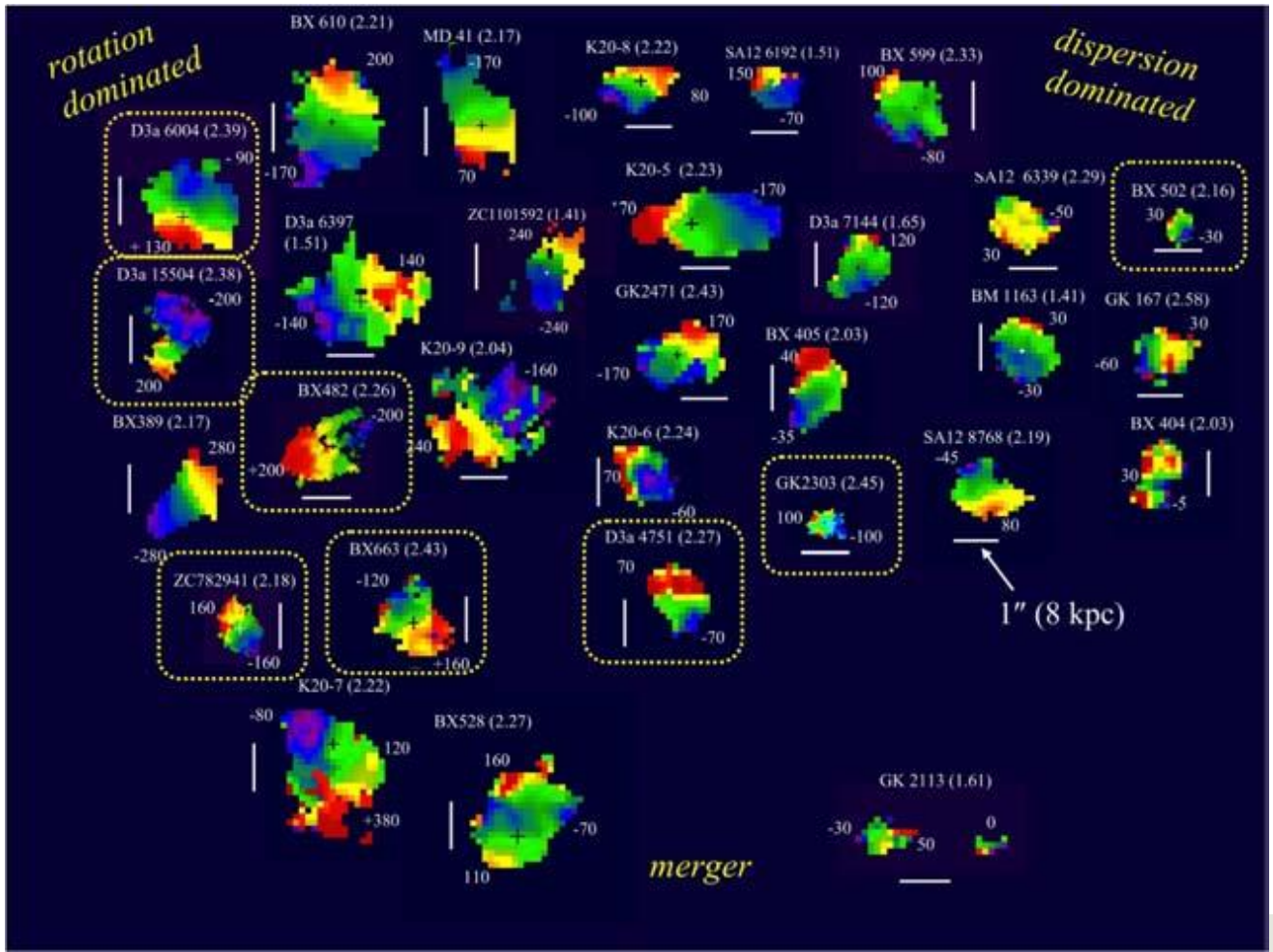
and the SINS and LUCI teams, including

Natascha Foerster Schreiber, Peter Buschkamp
Reinhard Genzel, Linda Tacconi, Dieter Lutz, Ric Davies
Eva Wuyts, Stijn Wuyts, Raanan Nordon, David Rosario, and others

High redshift science at MPE IR/submm

GTO and GO NIR IFU observations of more than 80 z > 1.4 galaxies

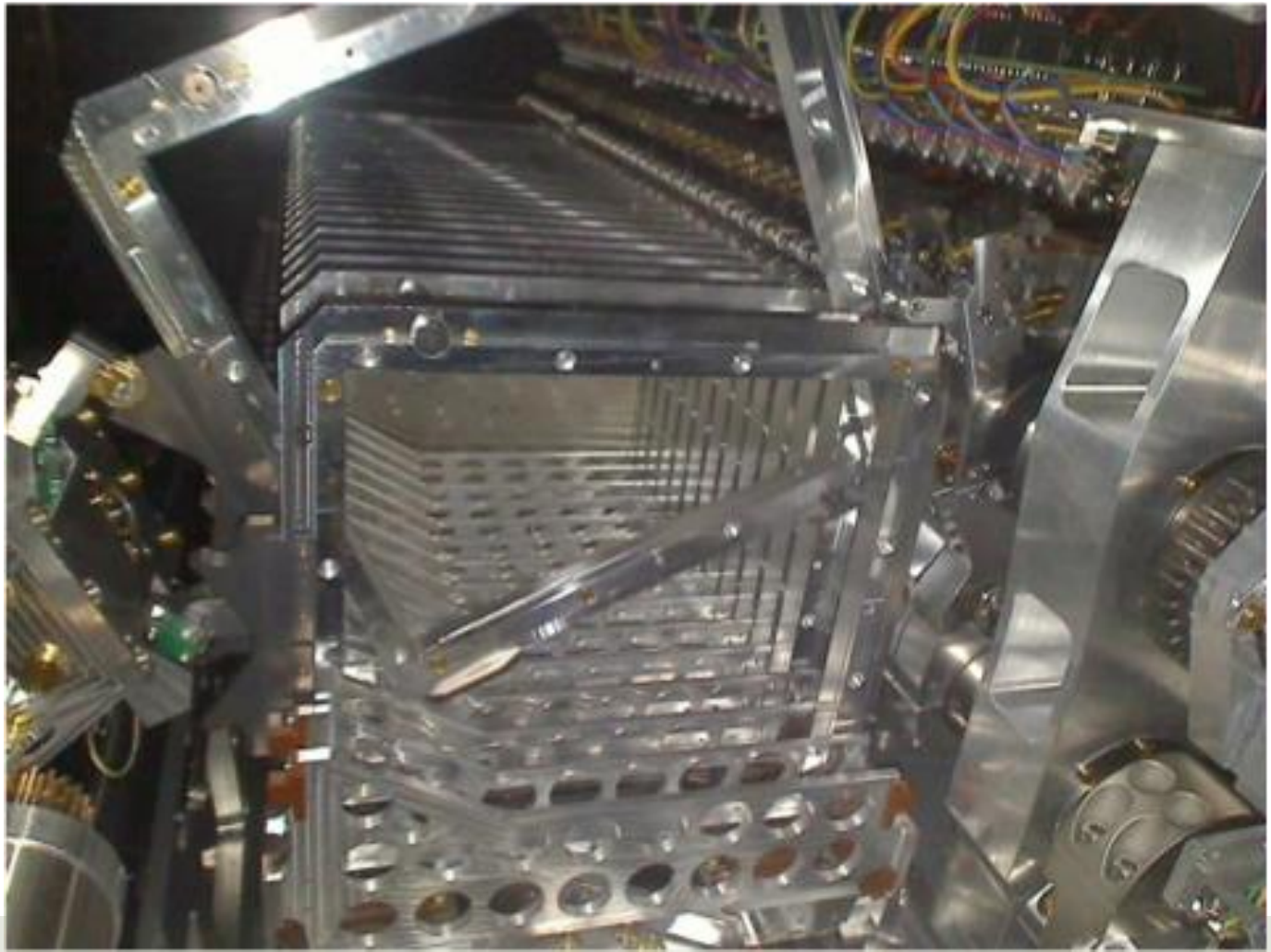
Observed in seeing limited and NGS, LGS modes



Foerster Schreiber et al. 2009

MPE LUCI HW involvement

Cryogenic mask unit contains > 20 laser-cut masks



MPE science with LUCI at the LBT

LBT allows northern hemisphere access: synergy with PdB

LBT allows short lead times (unlike ESO)

All time dedicated to large programmes

Three projects targeting galaxies at z~1.5, 2.3

- High multiplex spectroscopy emission line study of galaxies
- Multi pseudo IFU follow-up of galaxies detected in CO
- Curved slit spectroscopy of lensed galaxies

LUCI survey

Populate BPT and MZ diagrams: OH avoidance for Ha, [NII], Hβ, and [OIII]

Field with high surface density of known z>1.4 galaxies and multi-wavelength coverage (incl. Herschel): GOODS-N

Only selected on known redshift, no constraints on magnitude

Combined with SINFONI (and KMOS) observations

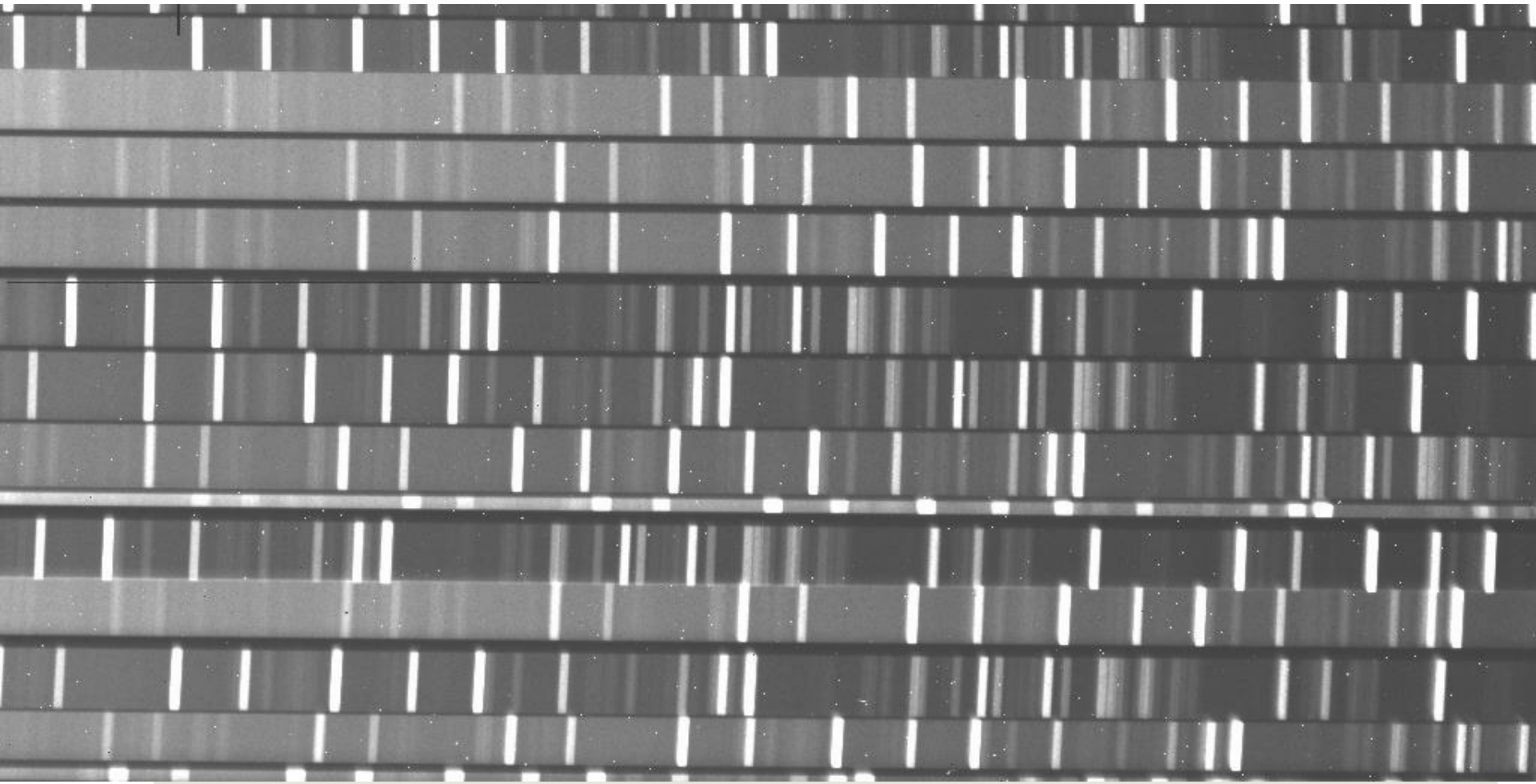
100 hours of 8m NIR multi object spectroscopy in H and K distributed over 10 masks, ~4h integration each

About 10 good targets per mask, 2 with all lines visible

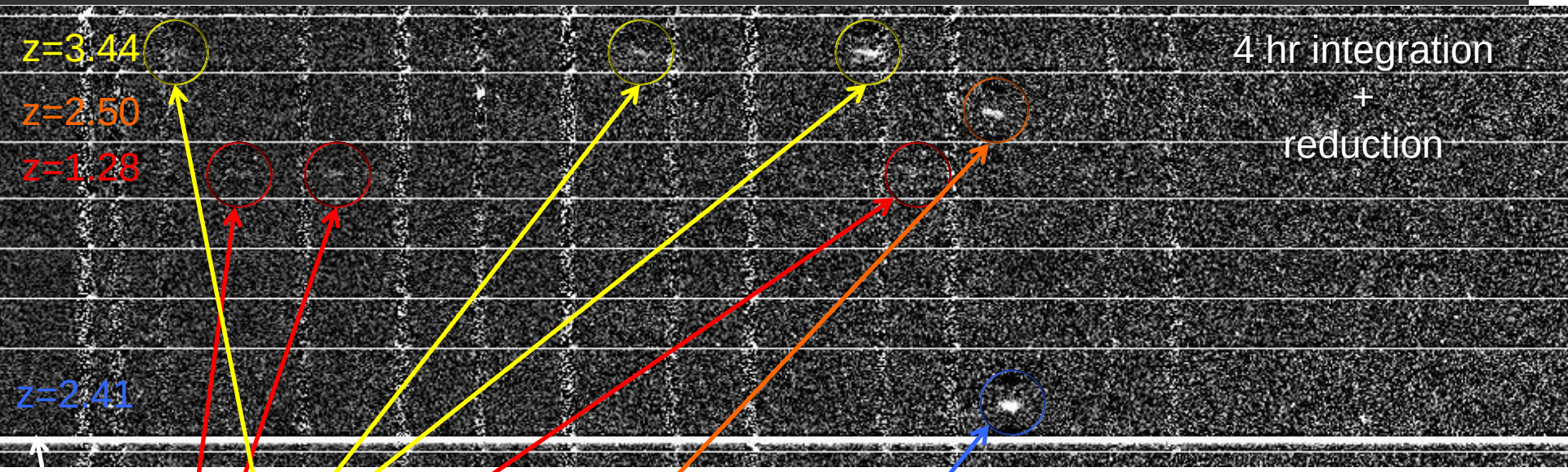
Sample of 100 galaxies observed, 78 detected, also 56 fillers, 16 detected

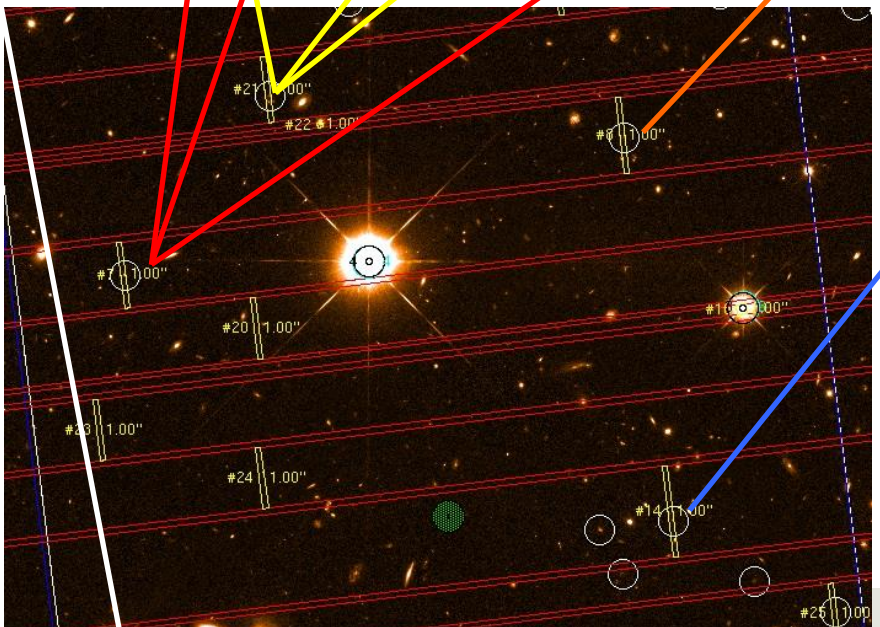
LUCI survey

Dedicated MPE reduction pipeline: Pyroscope (Python/Pyraf)



LUCI survey with LUCI at the LBT

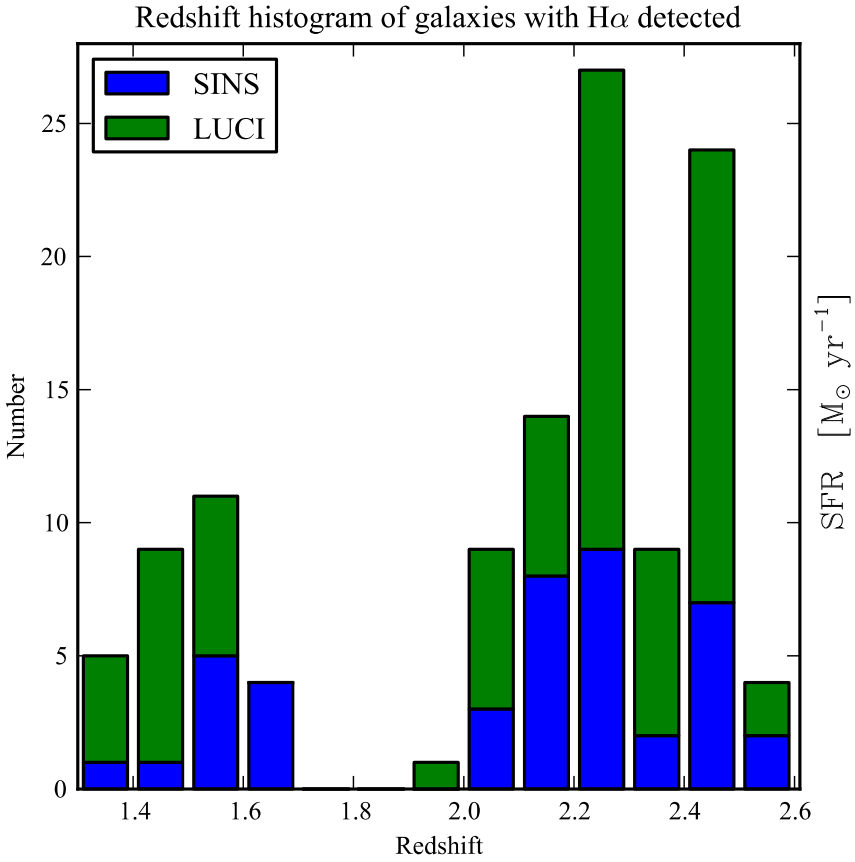


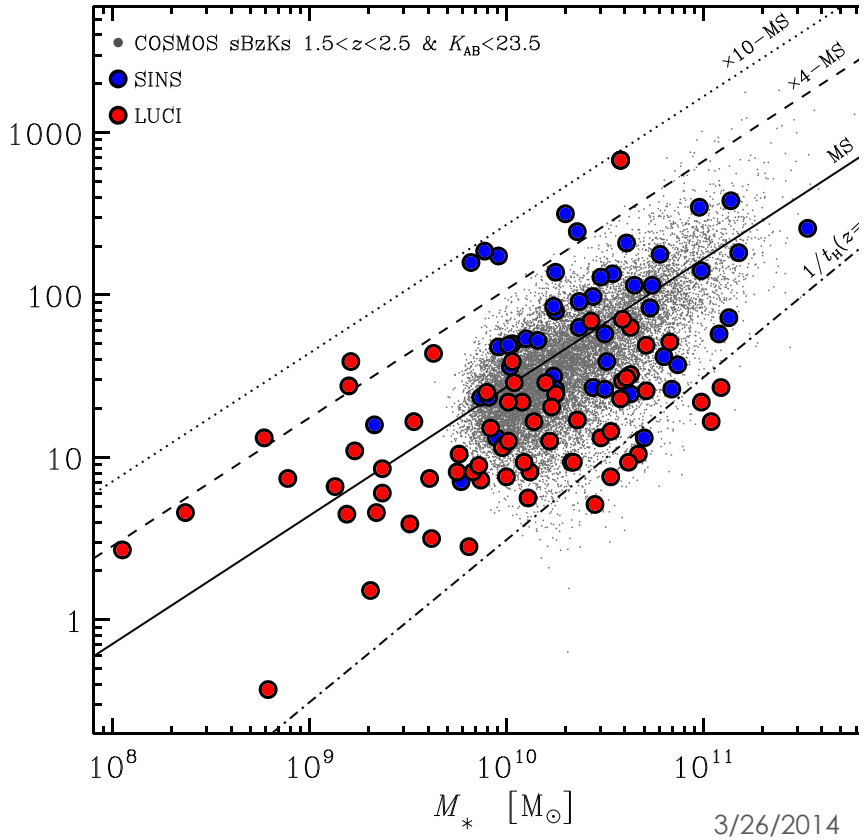


LUCI + SINS sample properties

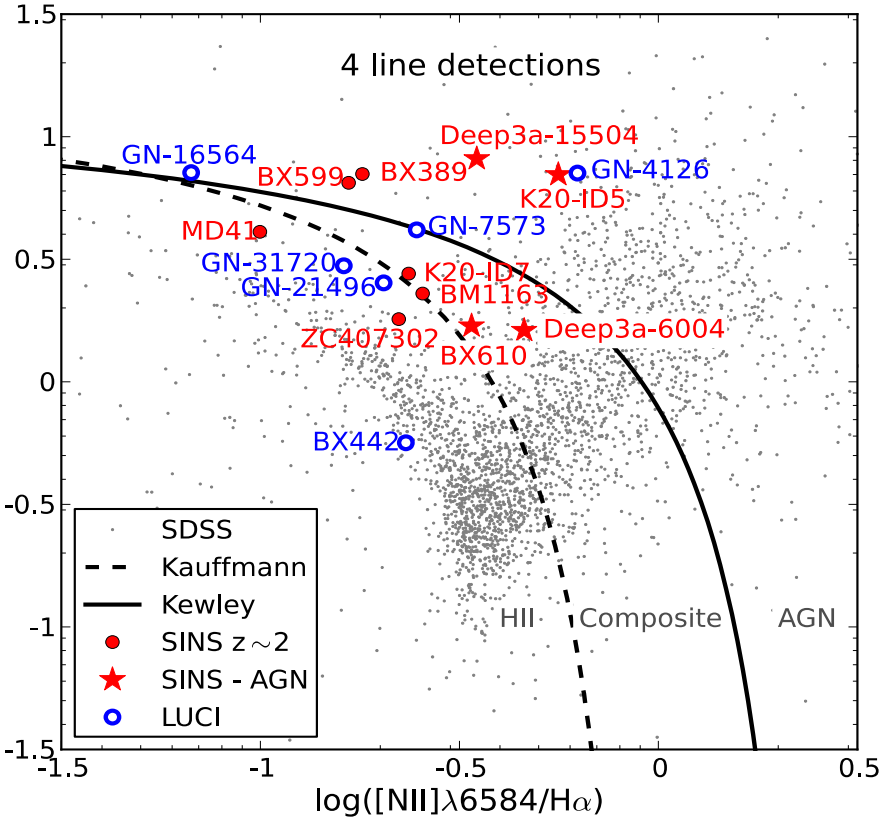
117 1D spectra, ~1/4th at z < 1.9 allows exploration of metallicity as function of several parameters (such as FMR)

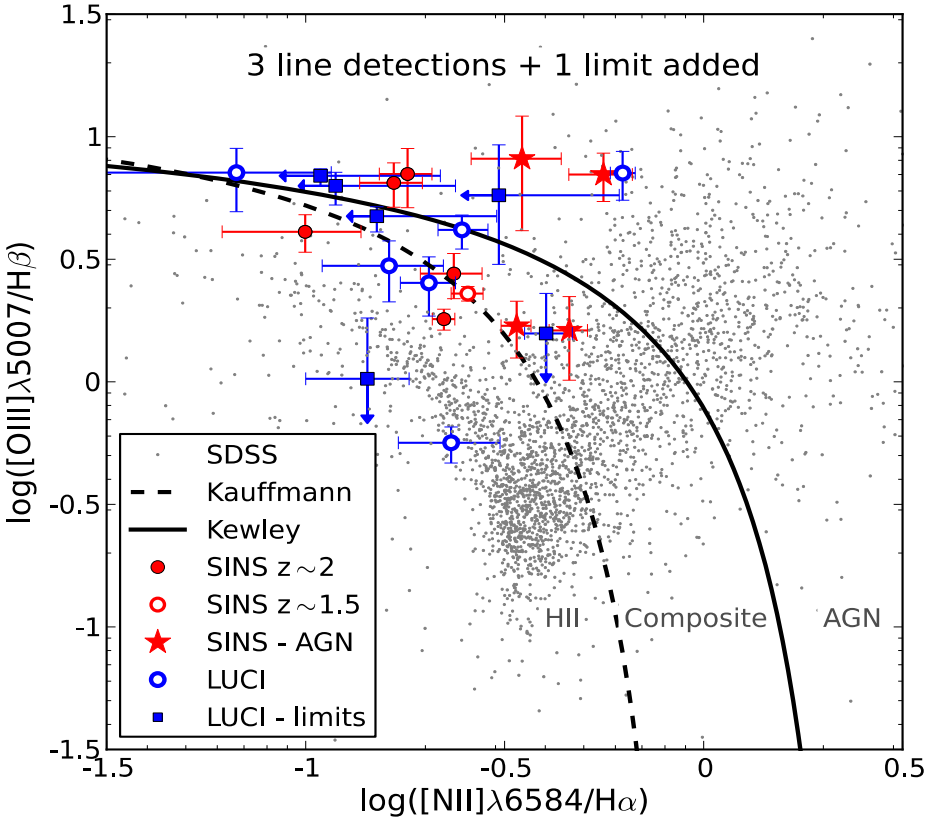
2 dex spread in M* and SFR





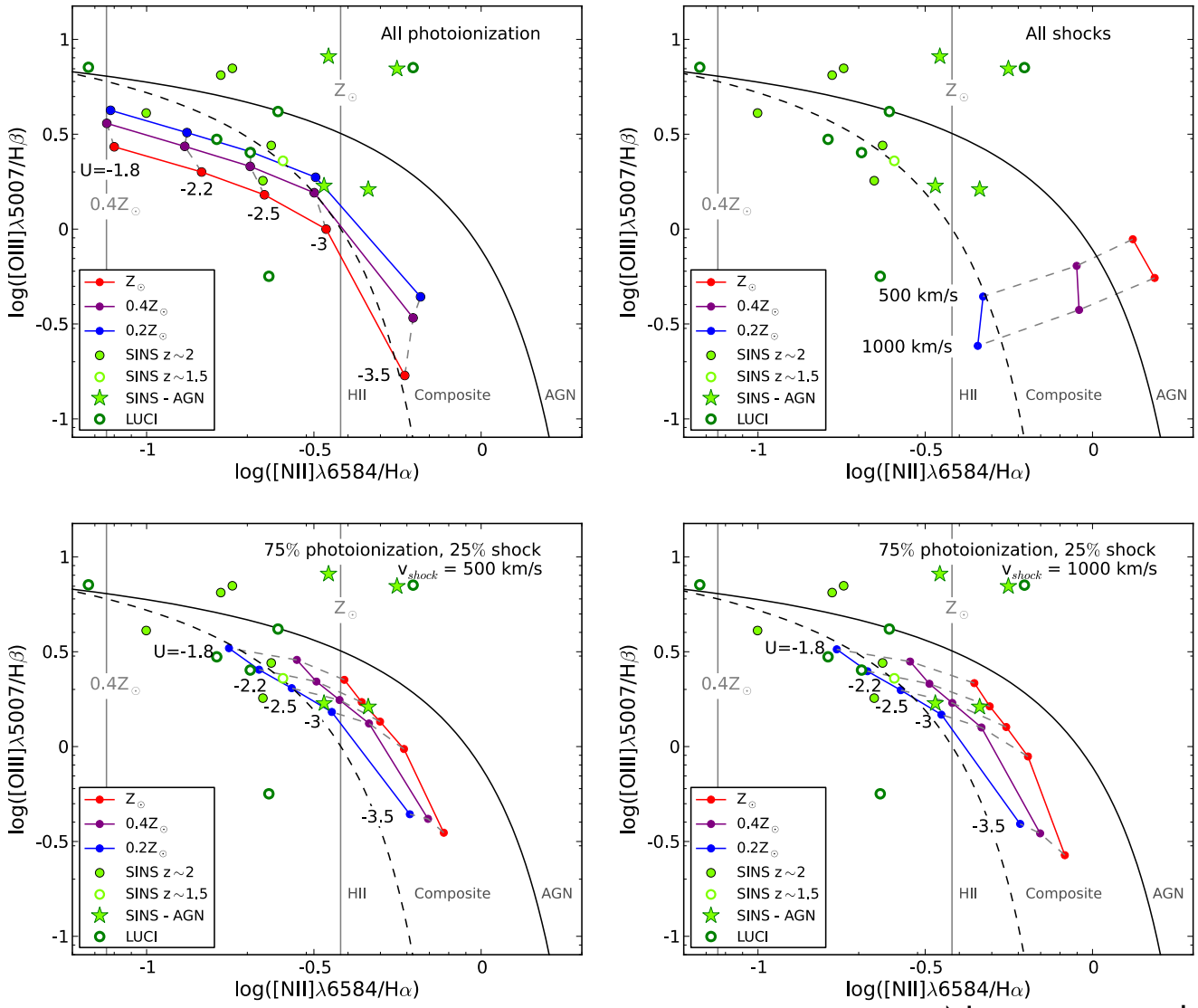
SINS + LUCI results: BPT diagram





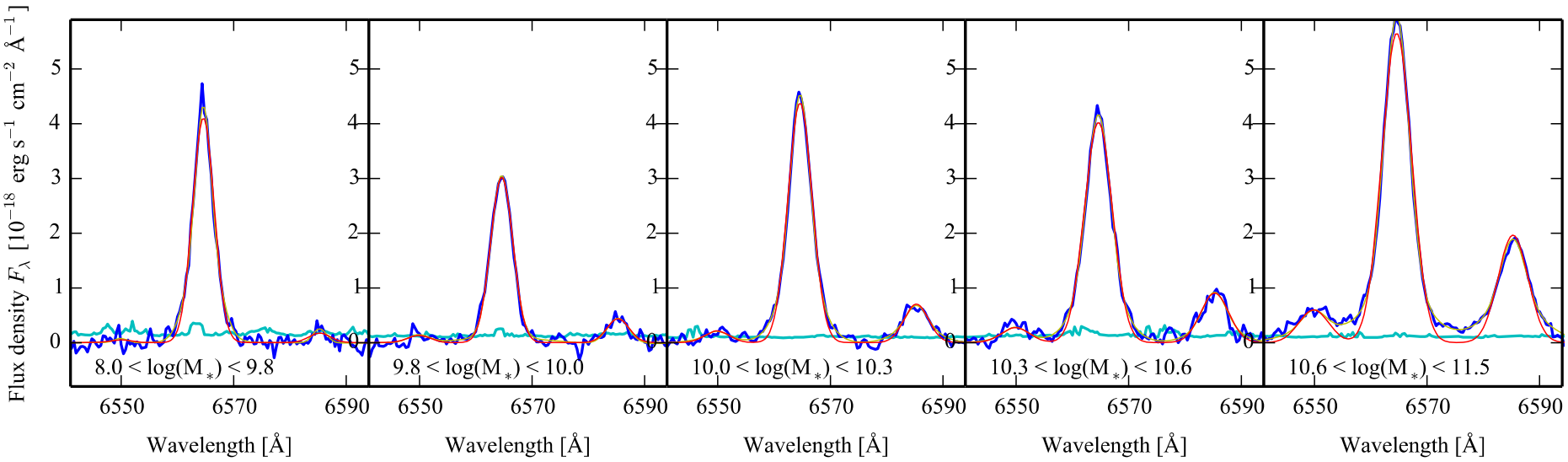
Newman et al. 2014

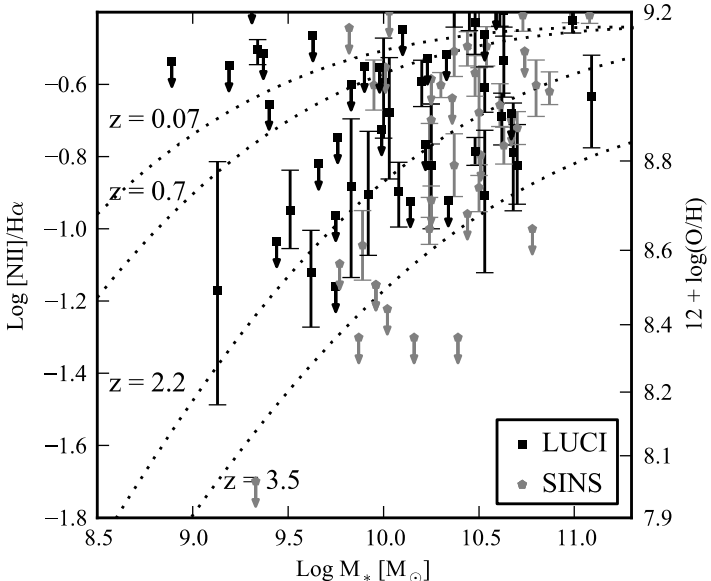
SINS + LUCI results: BPT diagram

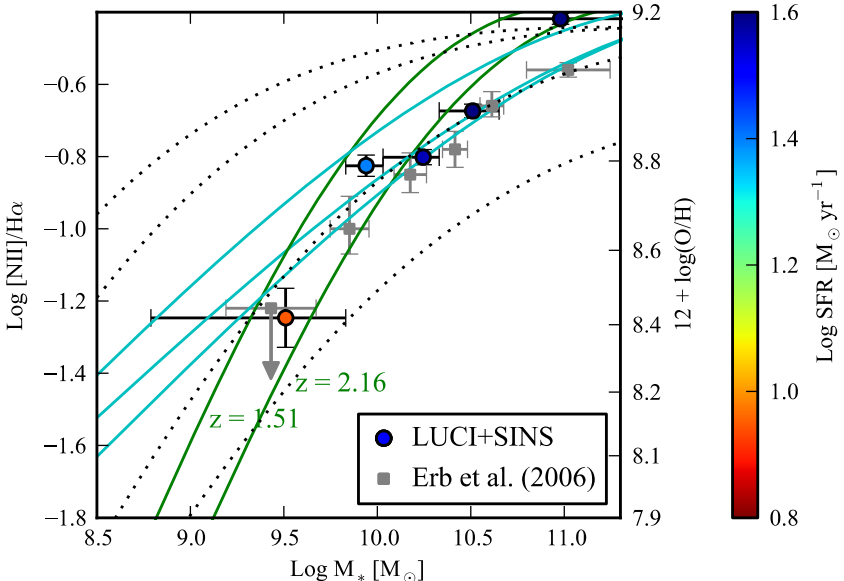


Newman et al. 2014

Stacking – mass bins



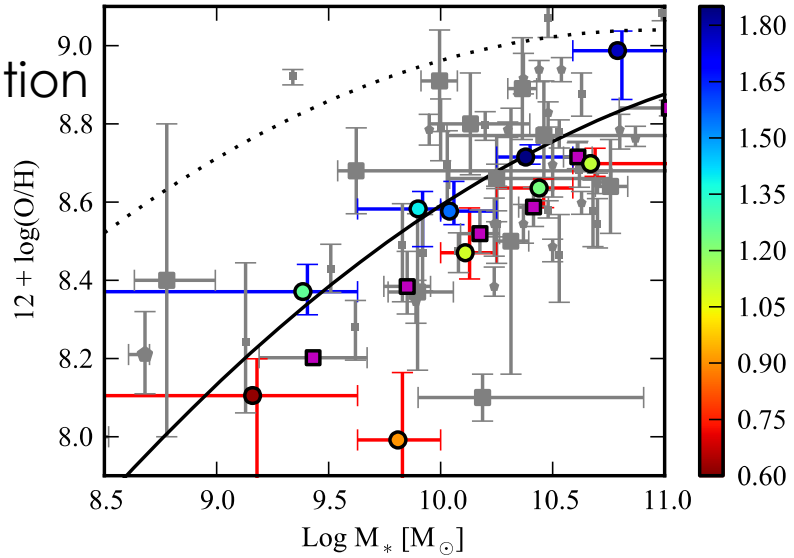


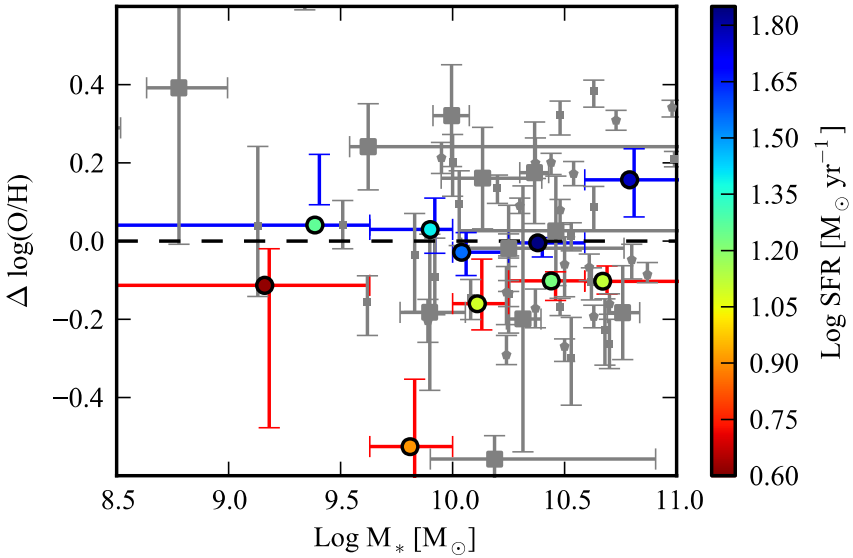


Mass-metallicity relation

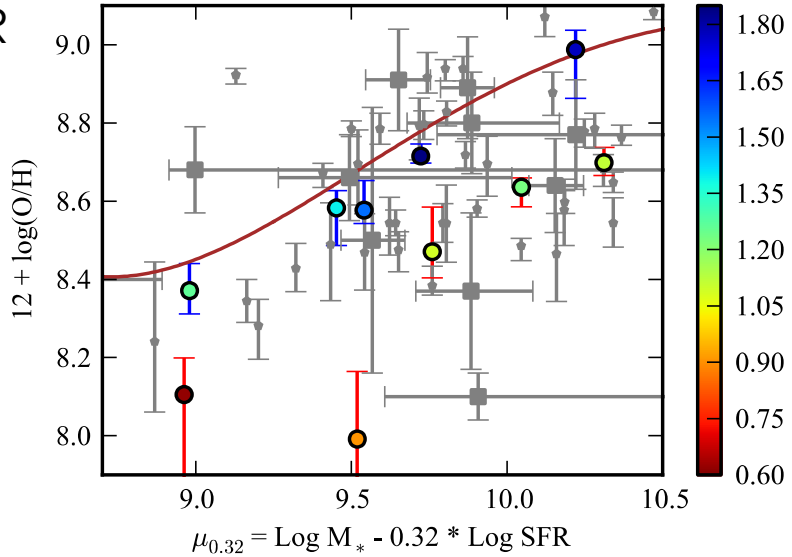
Stacking – mass/SFR bins

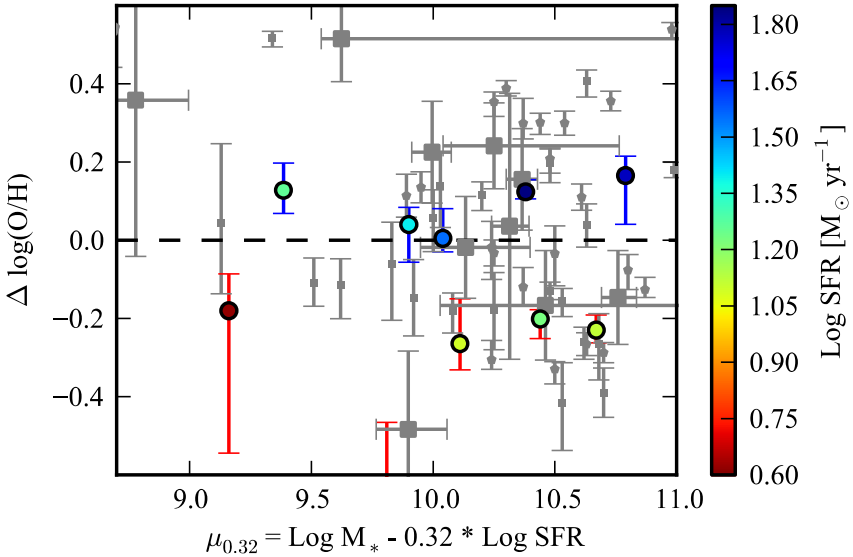
MZ relation





FMR

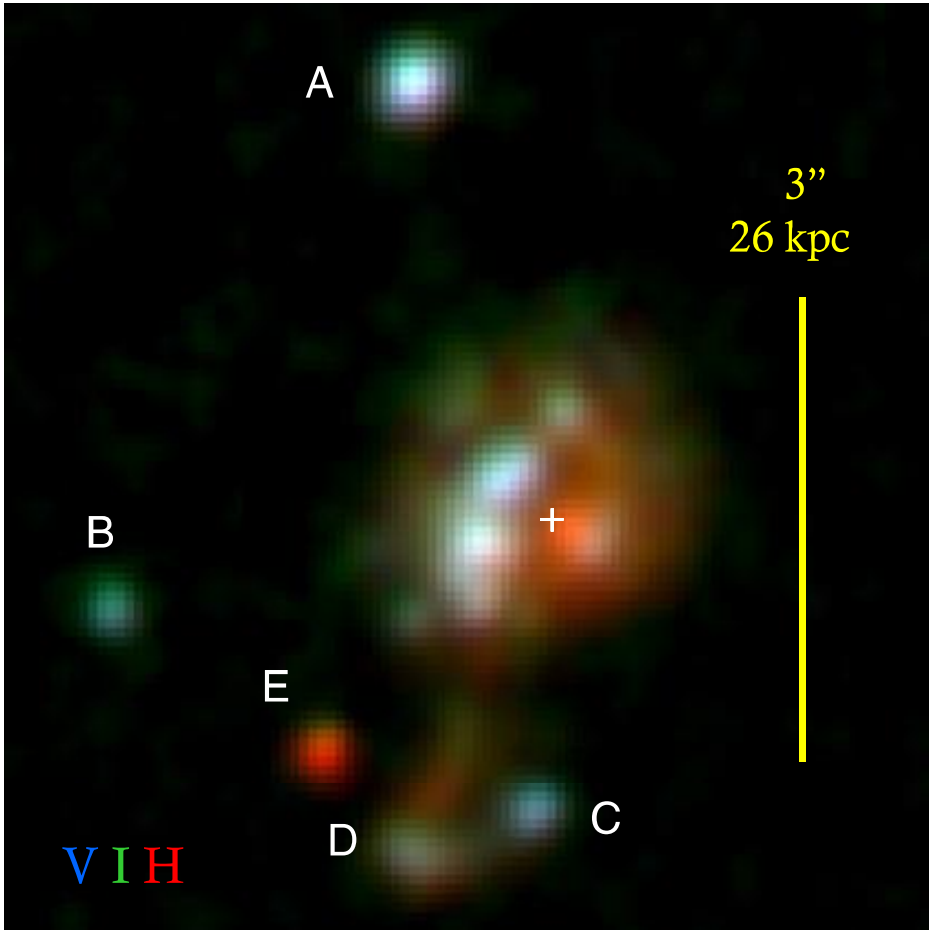




Pseudo IFU – PHIBSS EGS13011166

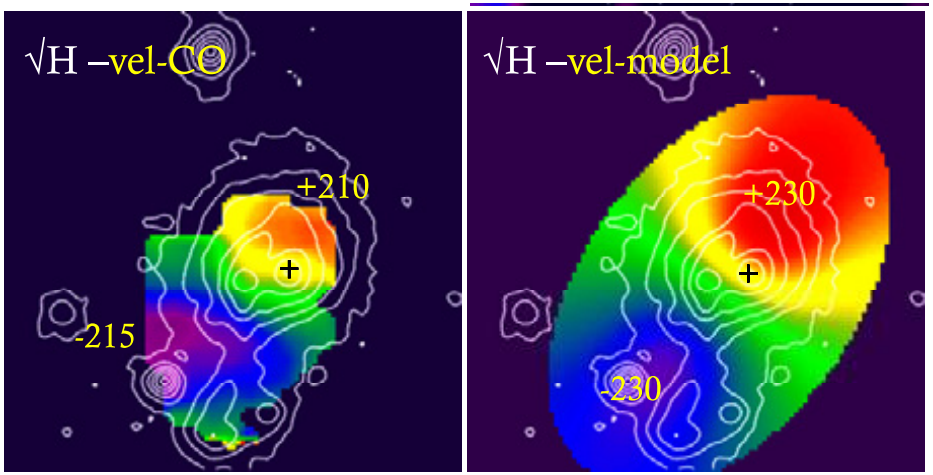
Seven overlapping long slit positions, covering 2.8"

EGS13011166 z=1.53

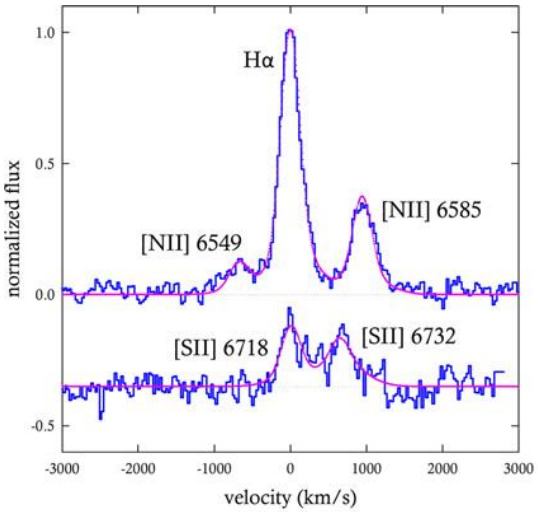


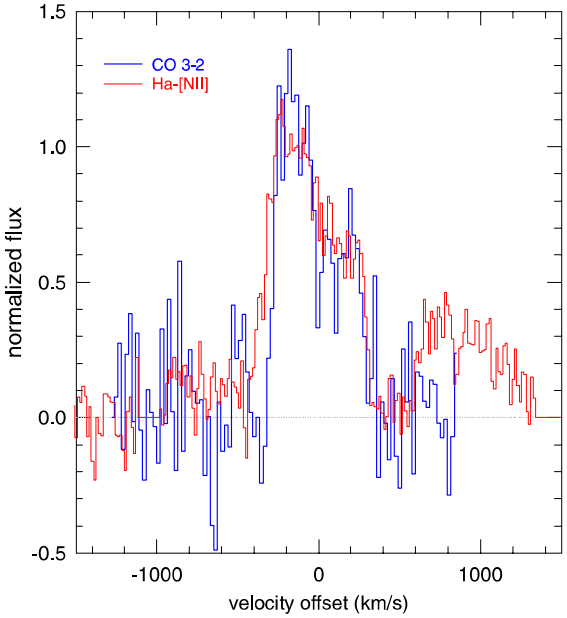
Genzel et al. 2013

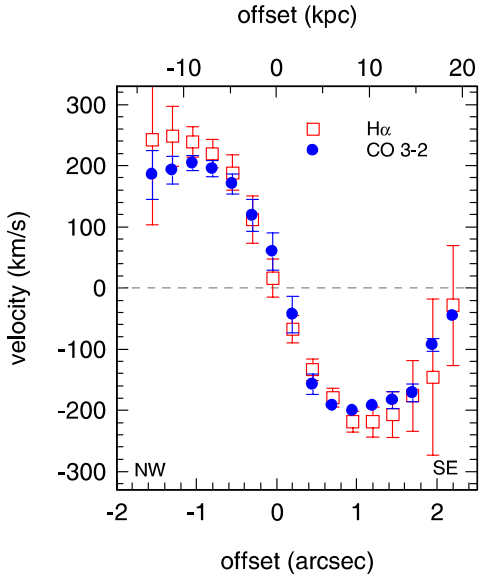
Pseudo-IFU – CO vs Ha kinematics

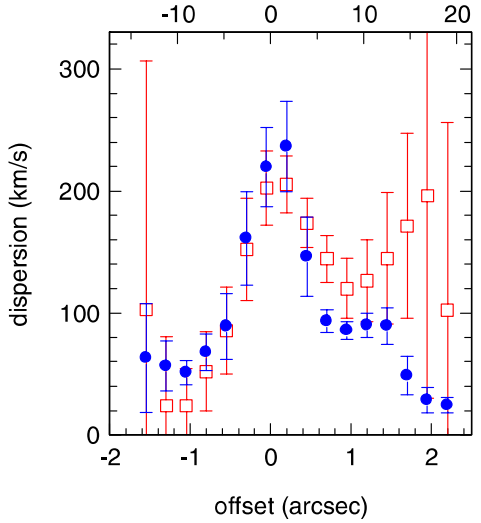


^{12}CO(3-2)









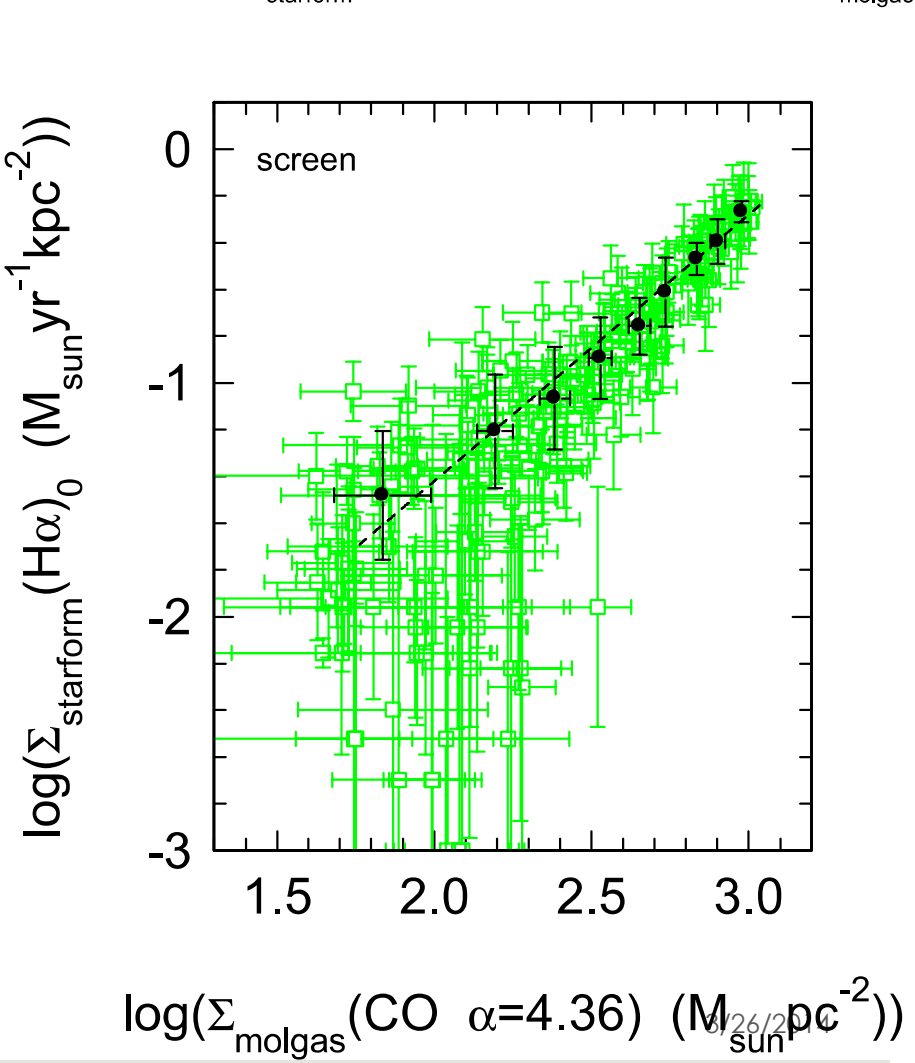
Genzel et al. 2013

Pseudo-IFU – KS relation

KS slope of N=1.14

Spatially resolved KS slope similar to integrated relation of 50 z~1-1.5 galaxies (Tacconi et al. 2013)

Caveats: extinction model and CO conversion factor dependence on gas surface density



Multi pseudo IFU

Pipeline produces multi-extension FITS file with data cubes containing signal and noise -> it's KMOS but not as we know it!

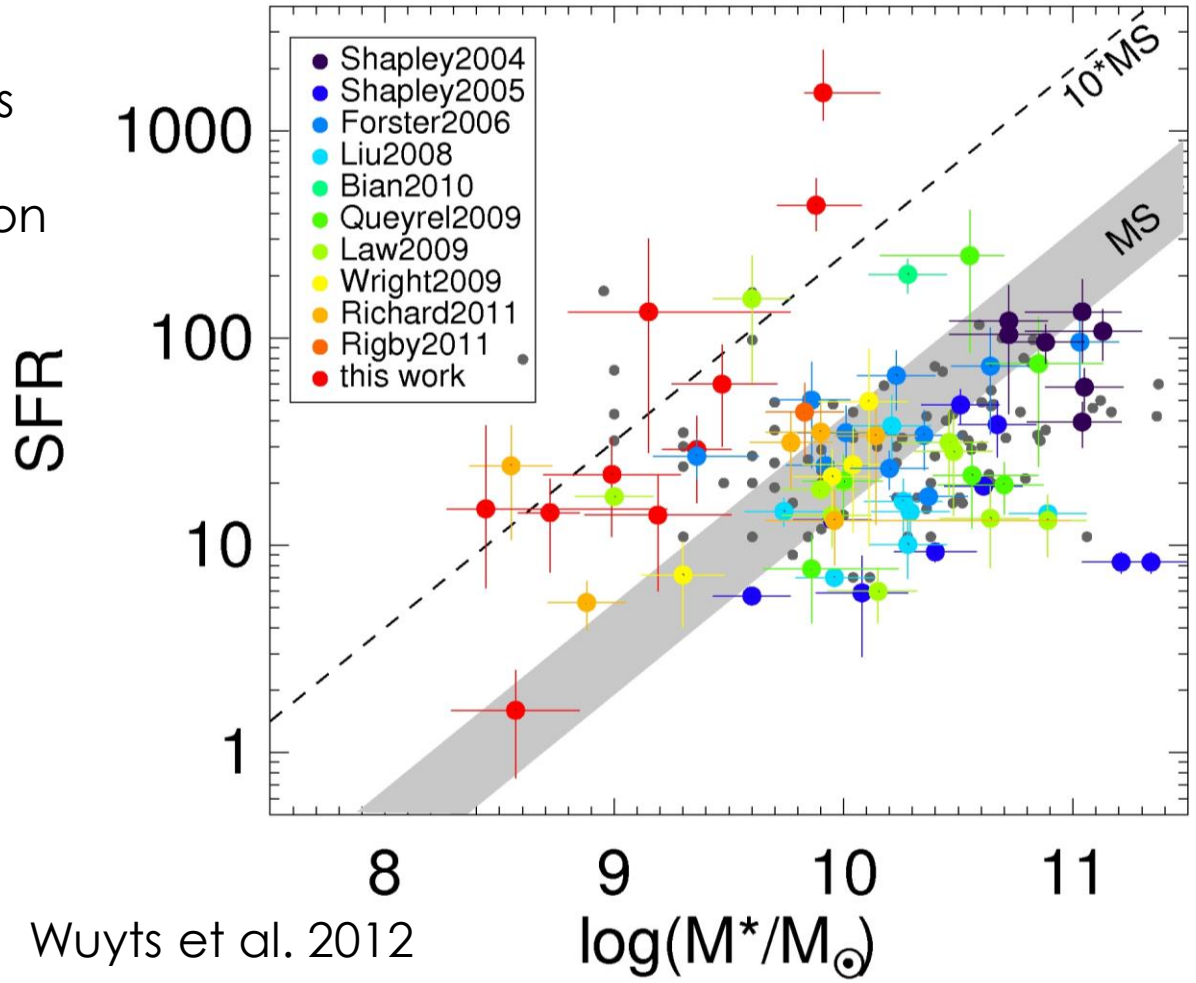
Lensed galaxies

Reach lower masses

High spatial resolution in source plane

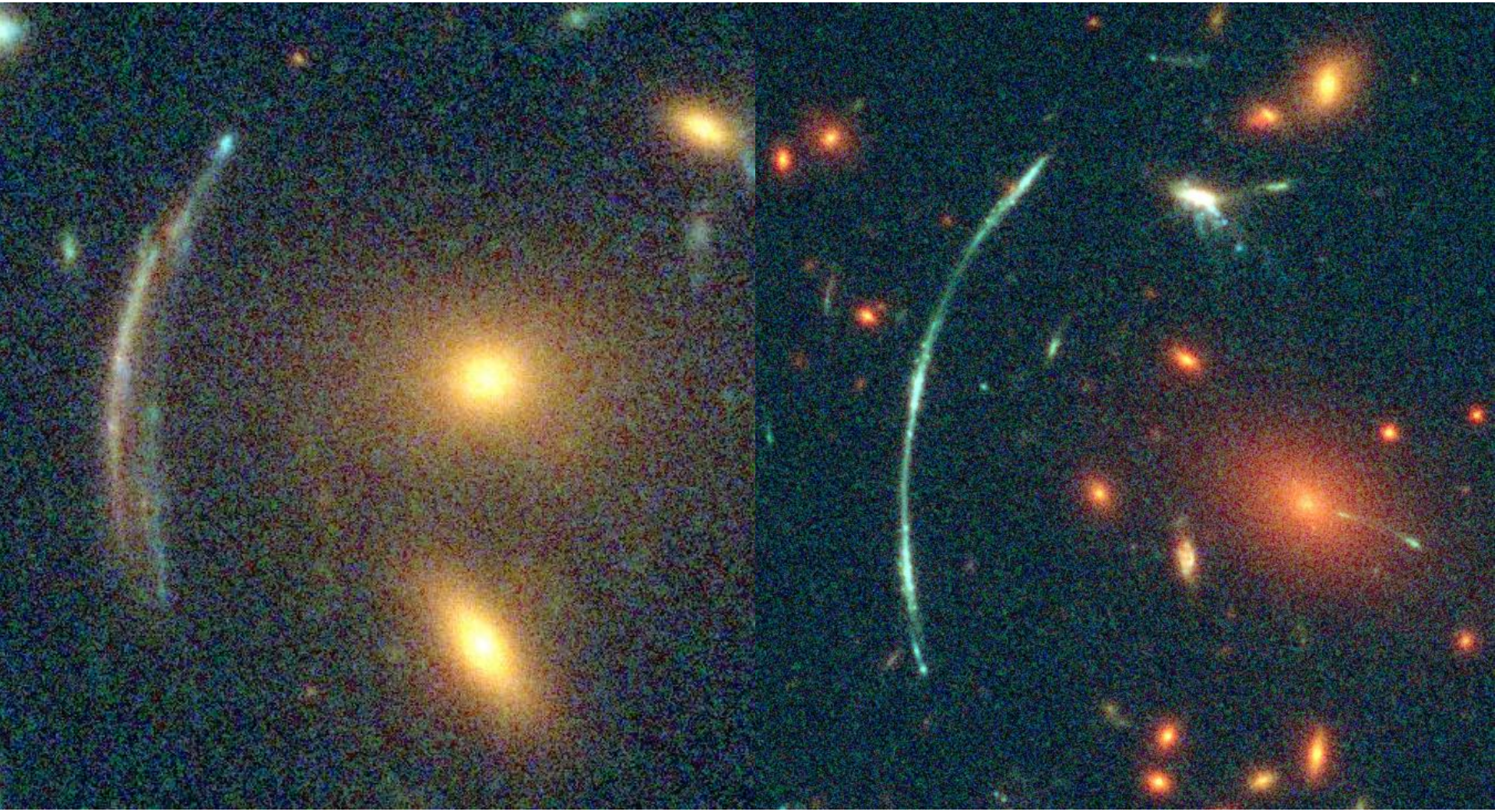
Use LUCI's versatile mask cutting for curved slits

Use medium seeing conditions of 1.0"



Wuyts et al. 2012

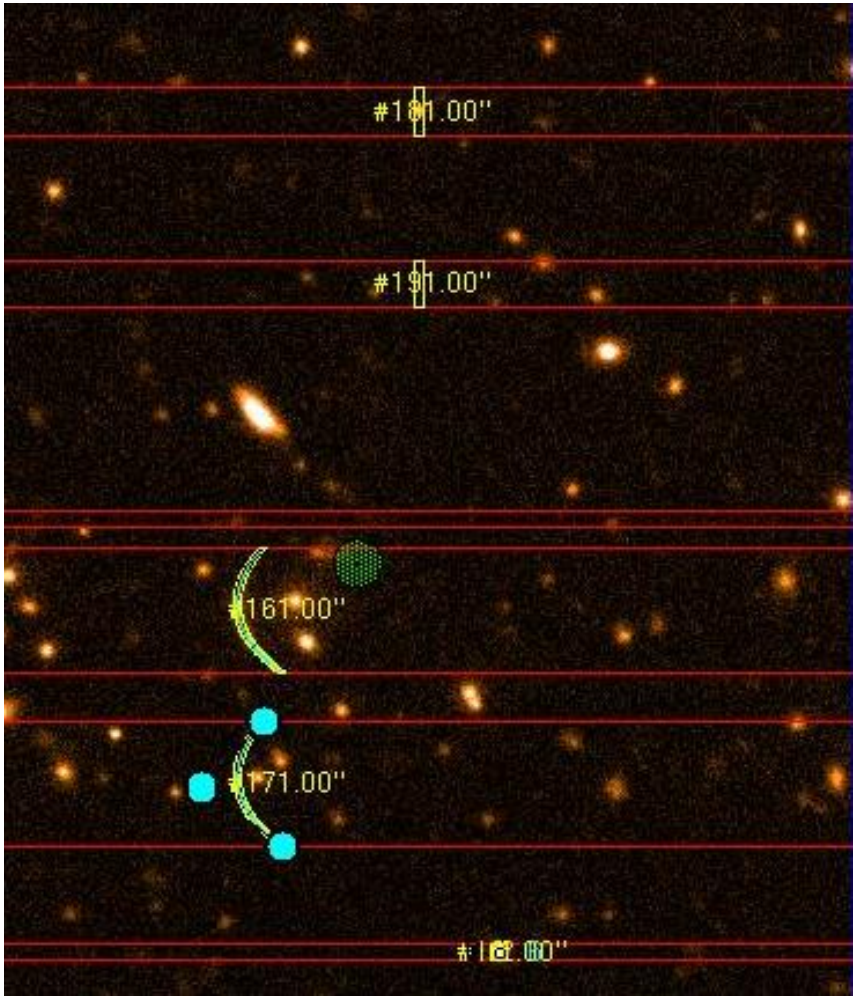
Lensed galaxies – HST images



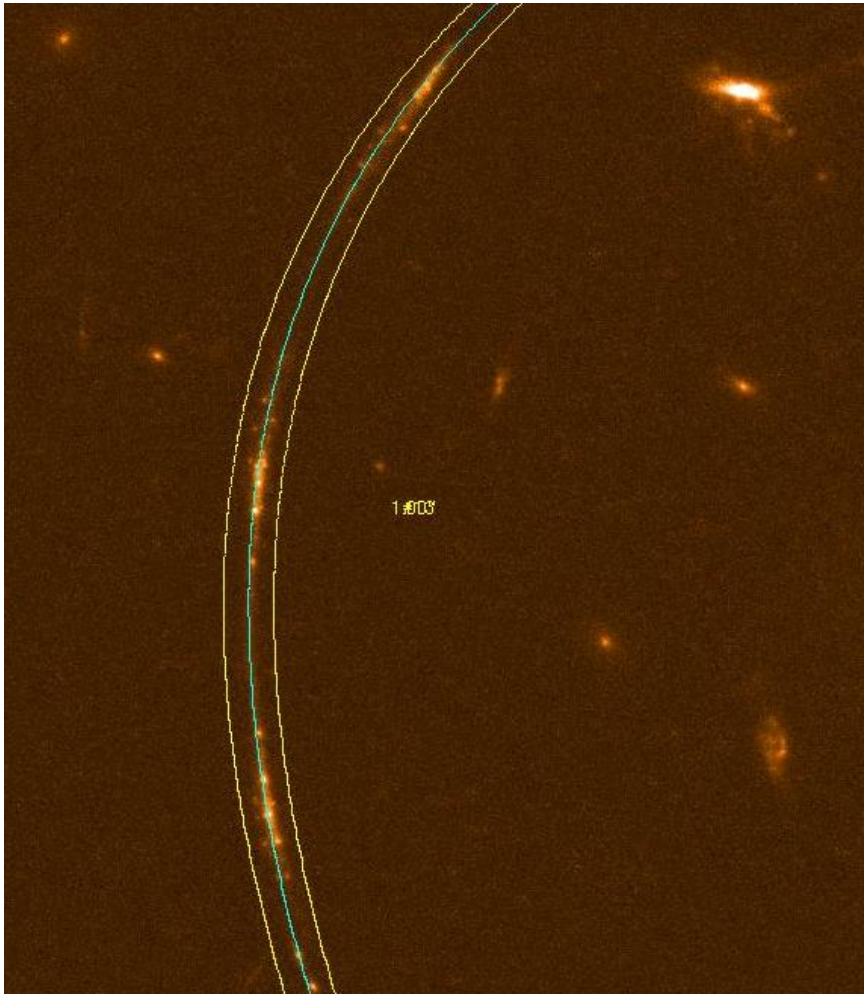
SDSSJ0952

SDSSJ1110

Lensed galaxies – curved slits

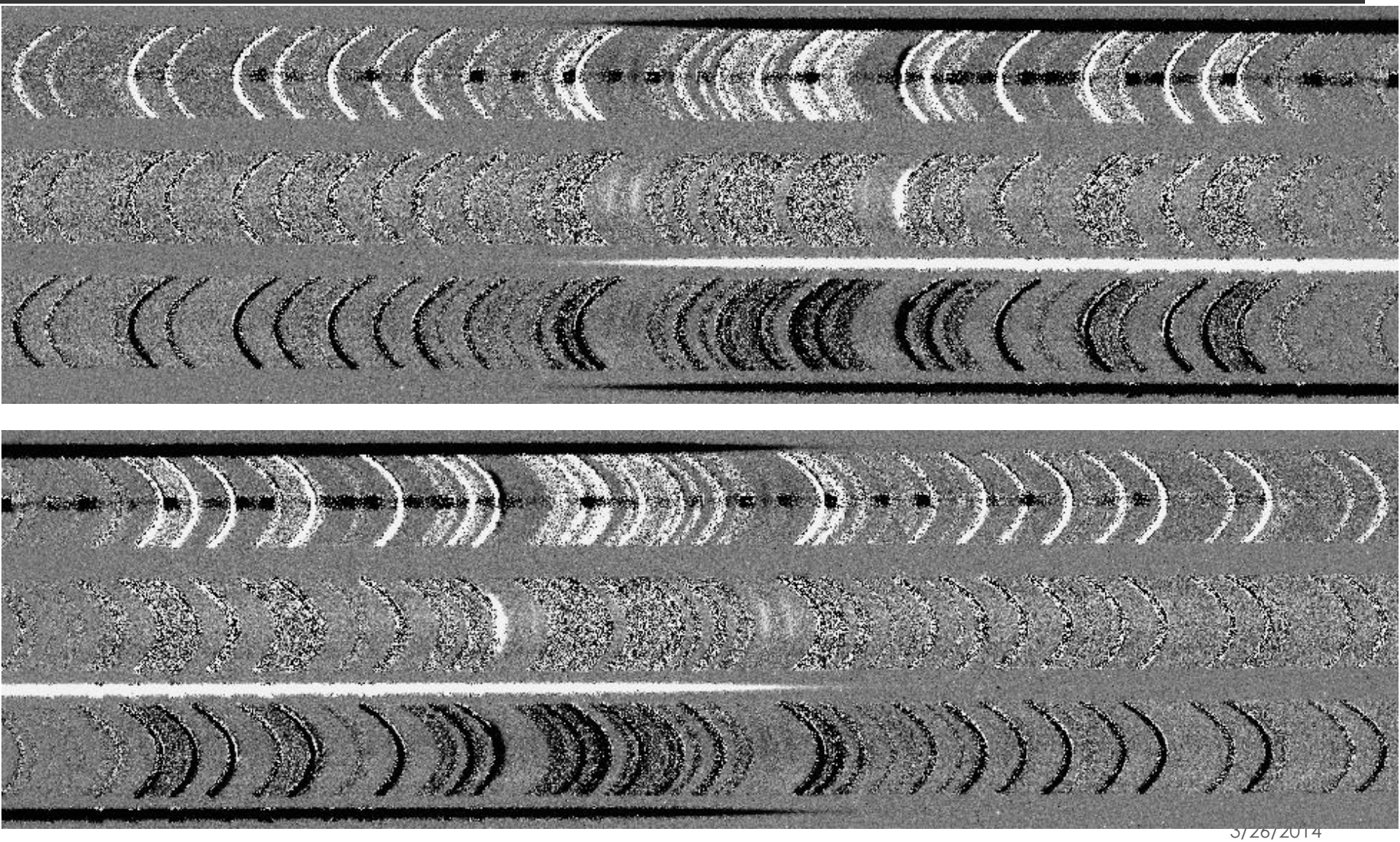


SDSSJ0952

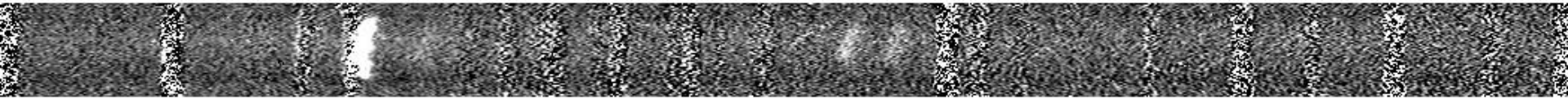


SDSSJ1110

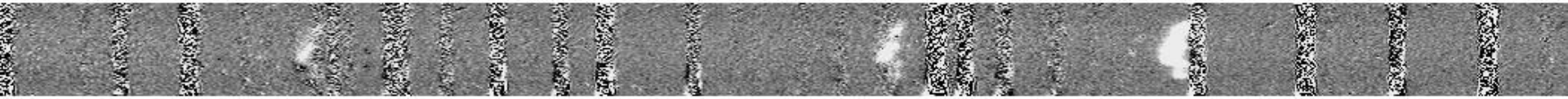
Lensed galaxies – curved slits



Lensed galaxies – curved slits

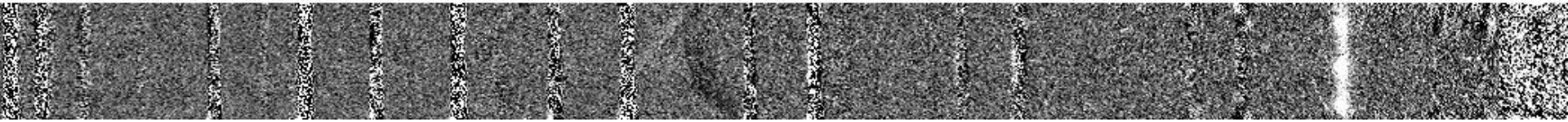


Ha [NII] [SII]



Ha [OIII]4959 [OIII]5007

SDSSJ0952



Ha

SDSSJ1110

Need to convert to source plane
Reduction of curved slit still to be optimised

Summary

- Exciting deep extragalactic observations performed with LUCI
- Multi pseudo IFU mode and synergy with spatially resolved submm imaging allows unique science
- Versatile mask cutting useful for lensed galaxies
- ARGOS will allow us to use narrower slits on a regular basis
  - higher spectroscopic resolution: more discovery space
  - less background: higher s/n
  - higher surface density of targets, more efficient MOS