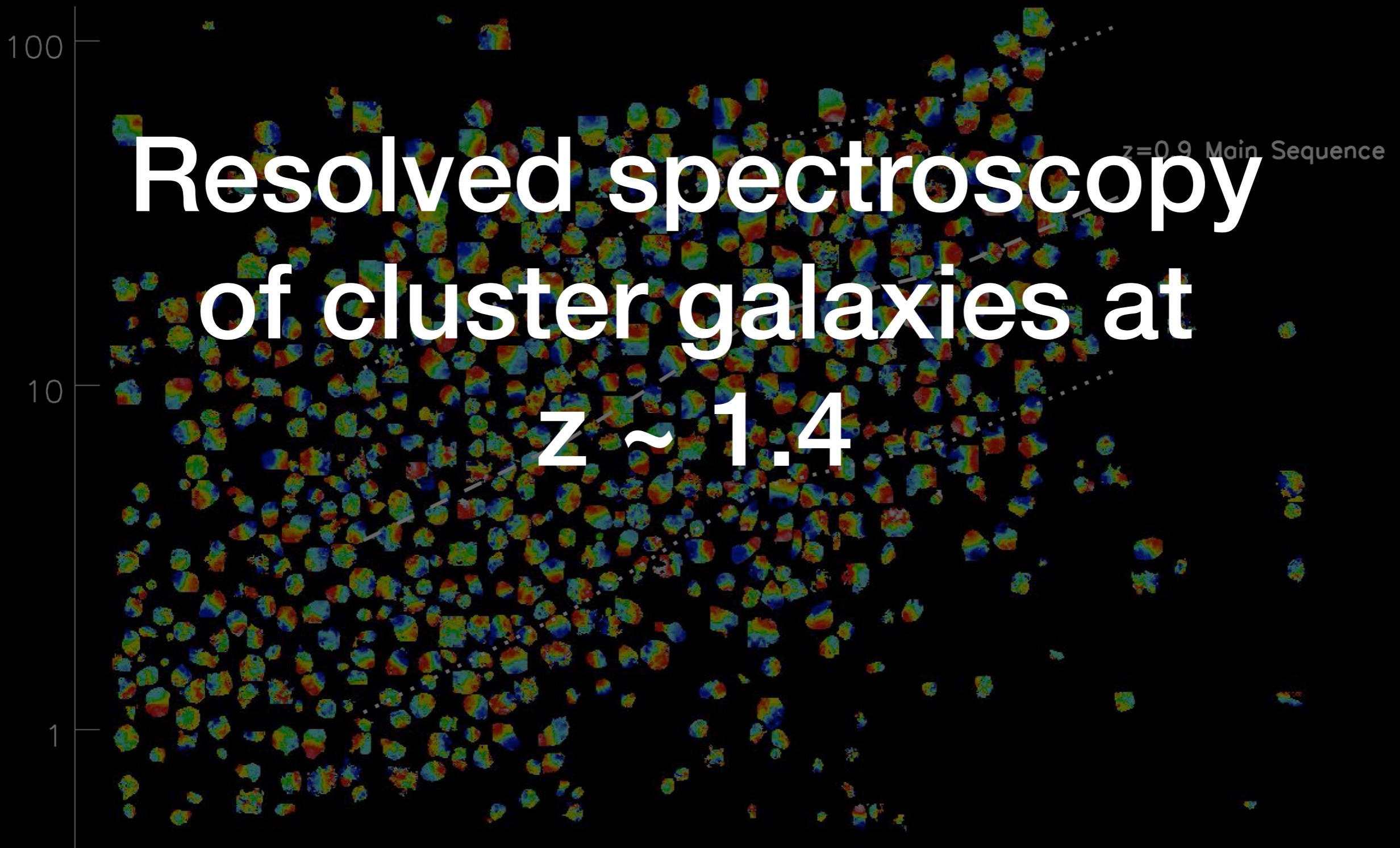


Resolved spectroscopy of cluster galaxies at $z \sim 1.4$

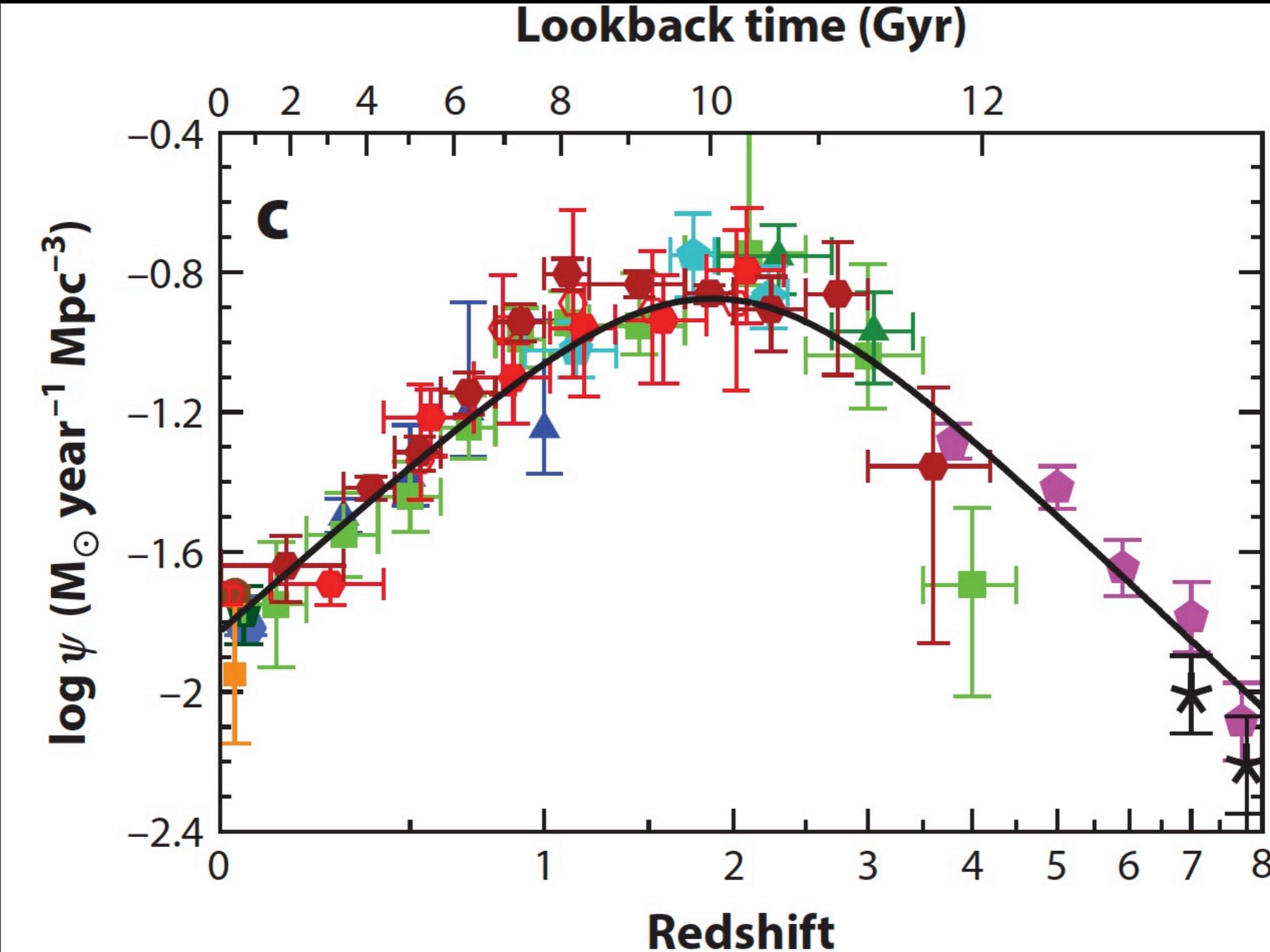
SFR [$M_{\odot} \text{ yr}^{-1}$]



Lancaster
University



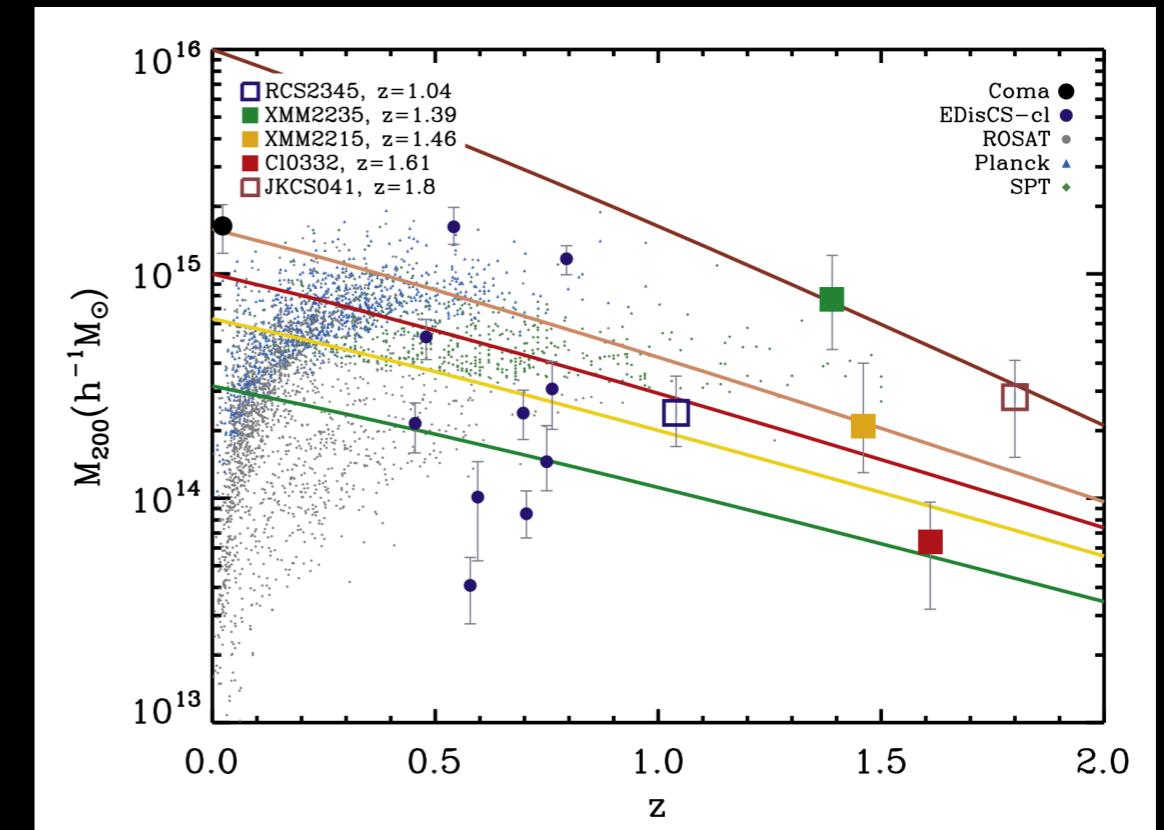
Nick Amos
Supervisor: John Stott



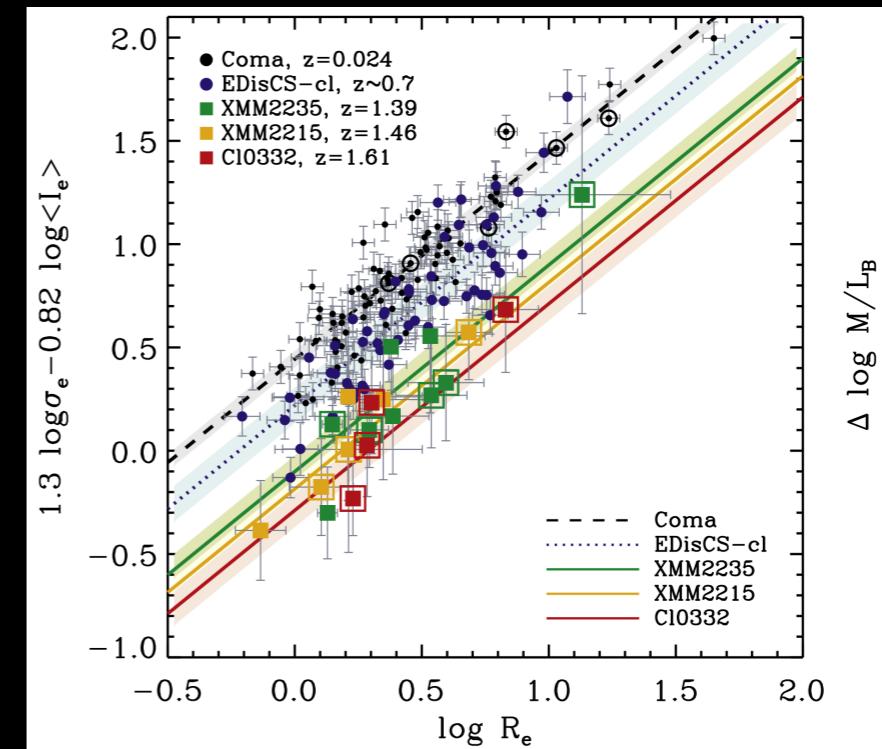
Star formation rate vs Lookback time/redshift
Madau, P., Dickinson, M., 2014

KMOS Cluster Survey (KCS)

- 30-night KMOS GTO program
- Deep absorption-line spectroscopy of five overdensities
 >20 galaxies in each field
- Evolution of kinematics and stellar populations
- Fundamental plane

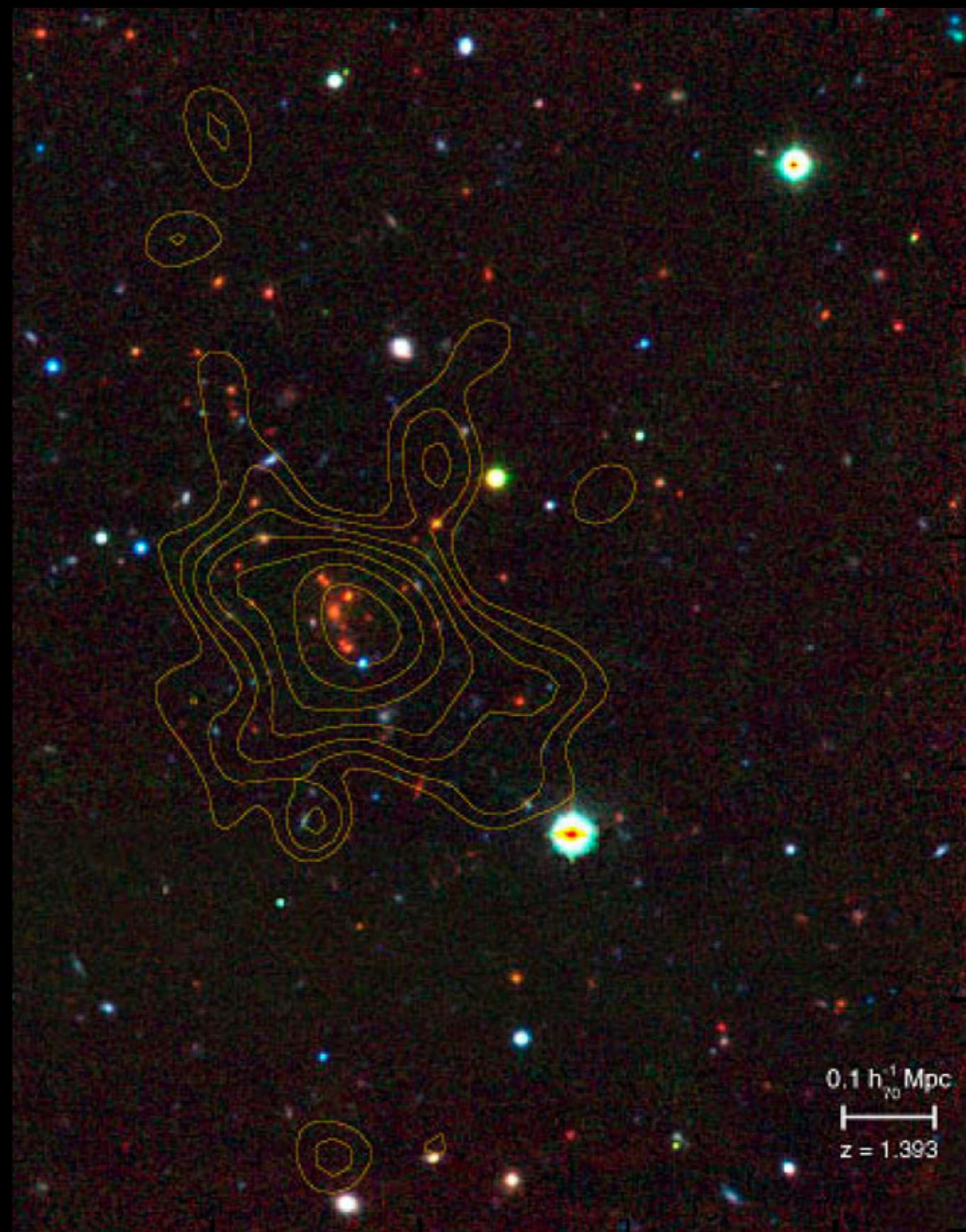


Beifiori et al., 2017

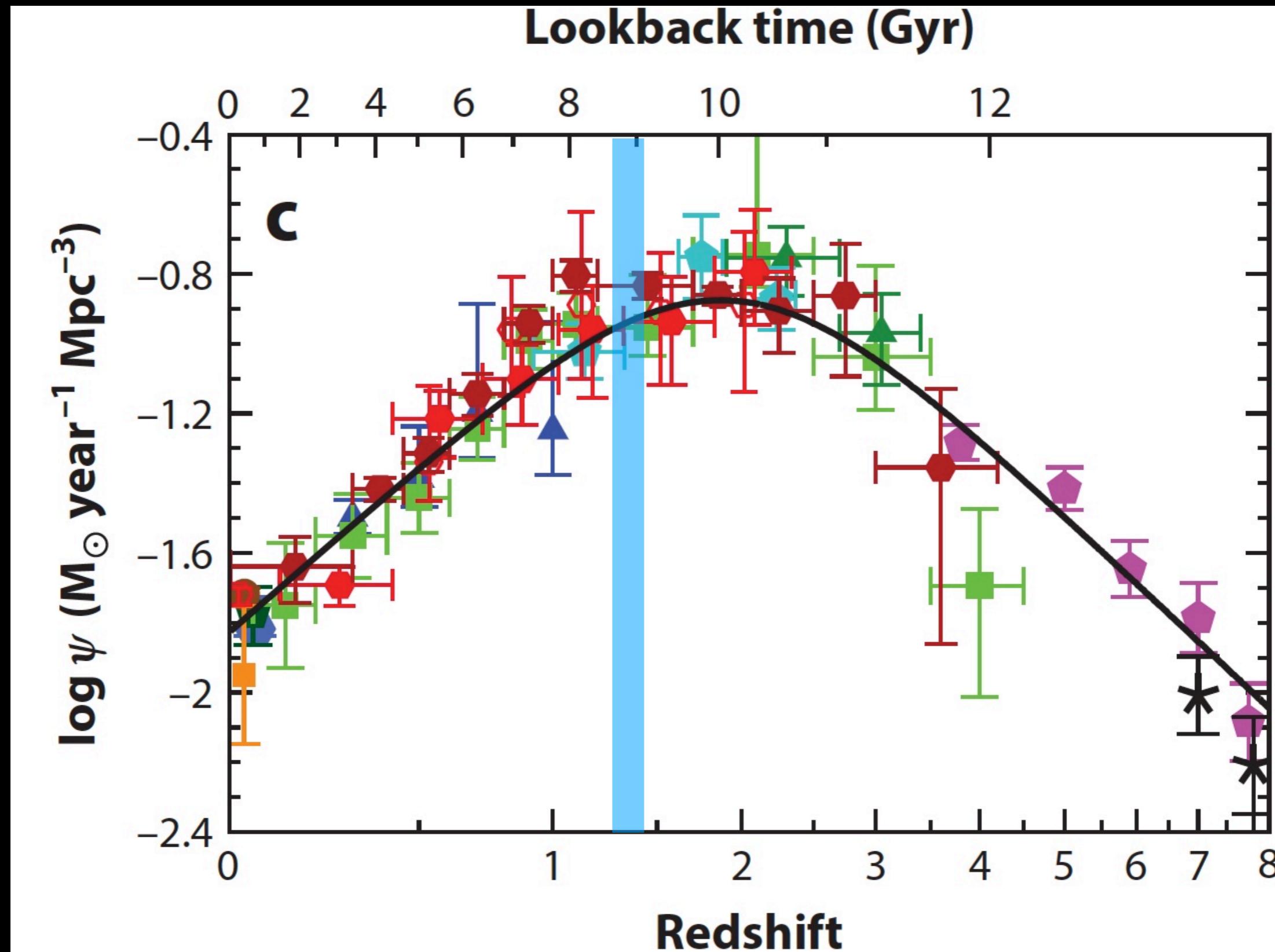




XMMXCS J2215.9-1738 $z \sim 1.46$



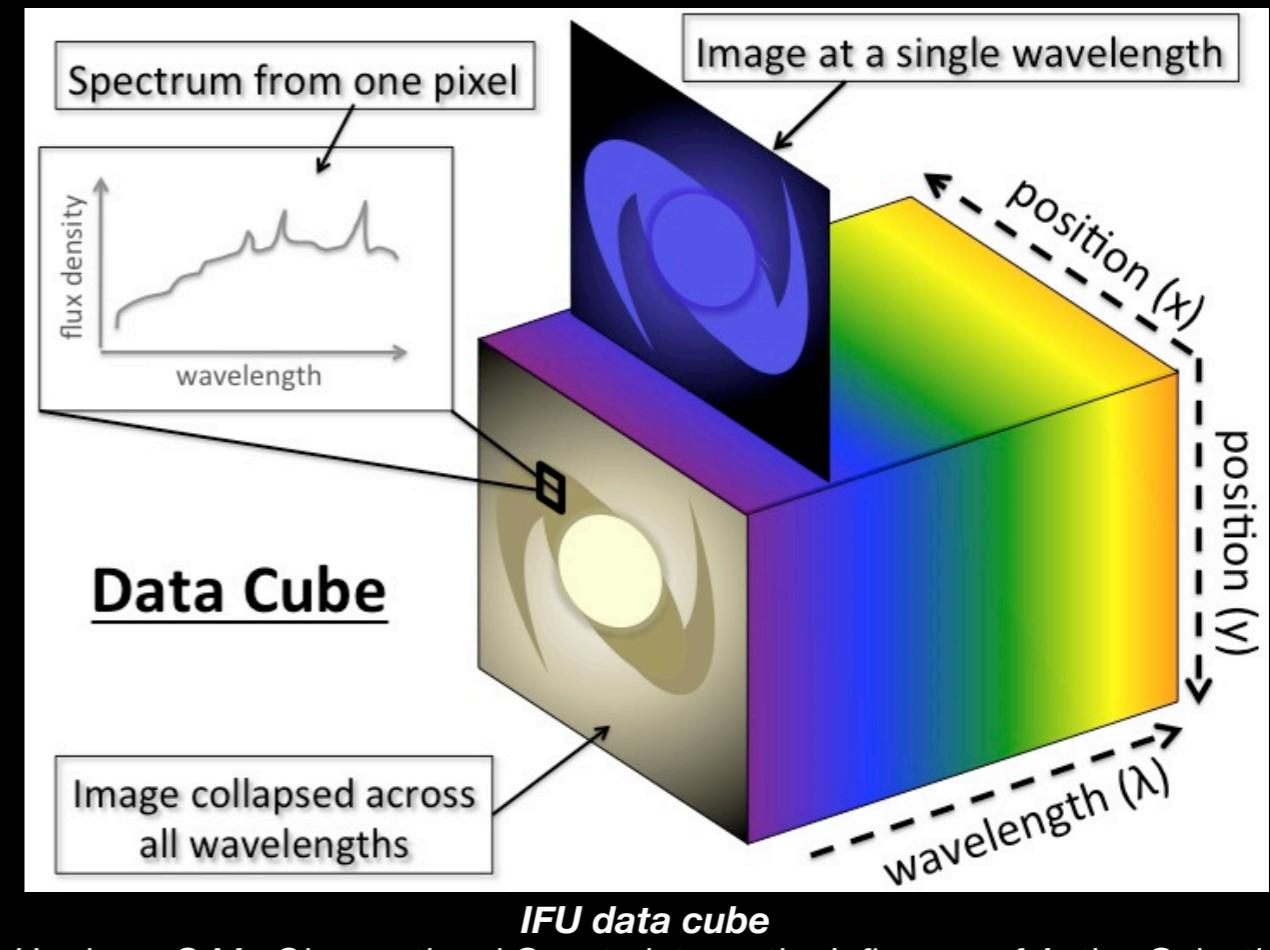
XMMU J2235.3-2557 $z \sim 1.39$



Star formation rate vs Lookback time/redshift
Madau, P., Dickinson, M., 2014

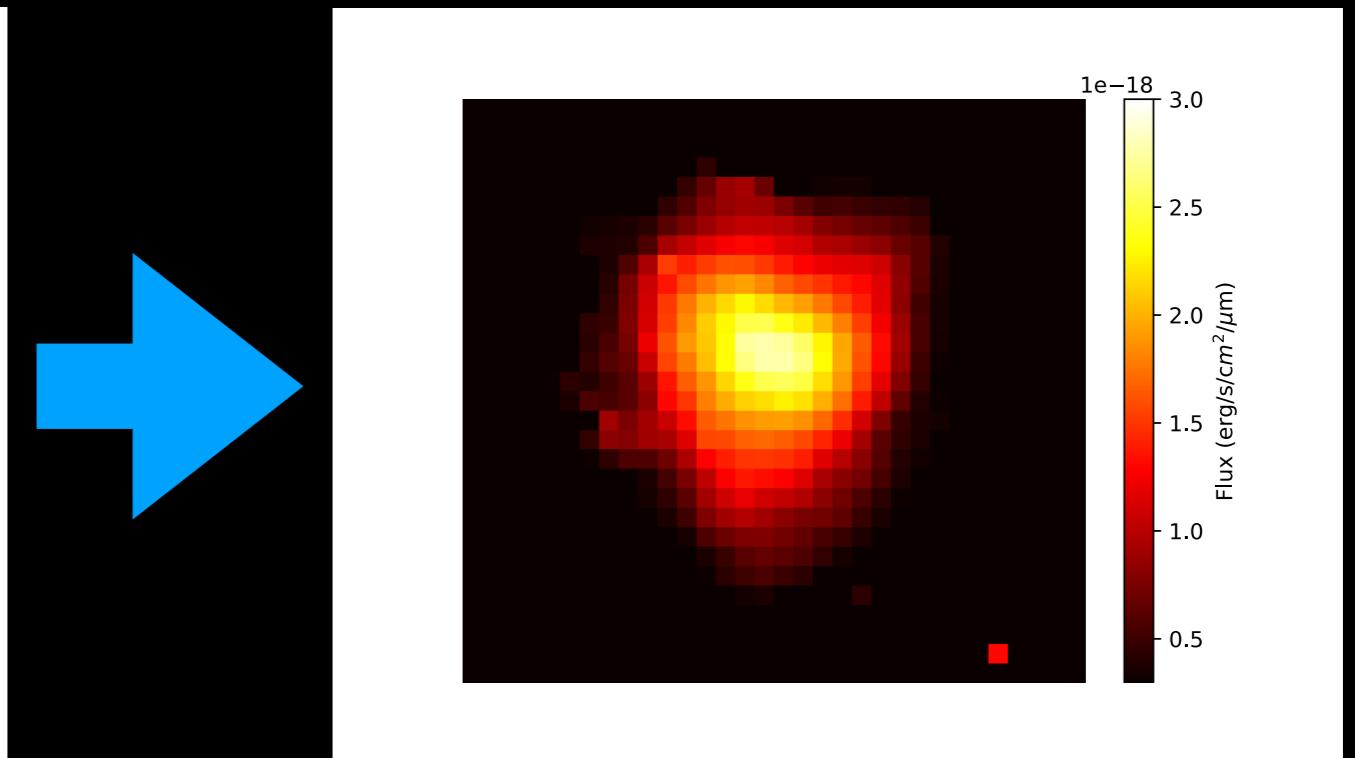
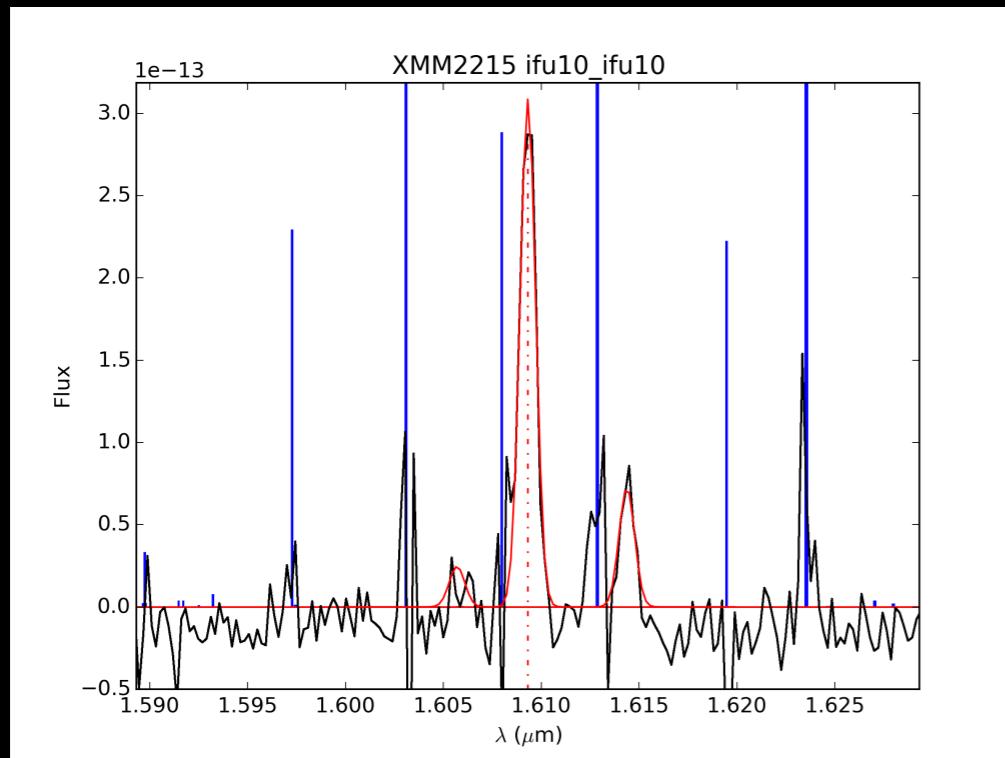
Why IFU data?

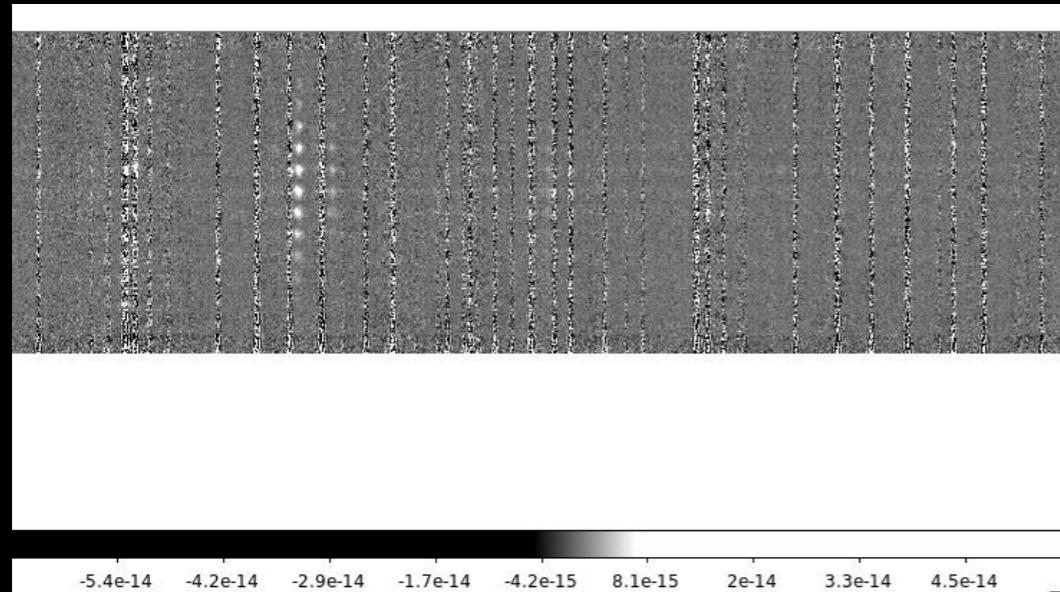
- **Spatially resolved spectra**
- **Image for each wavelength**



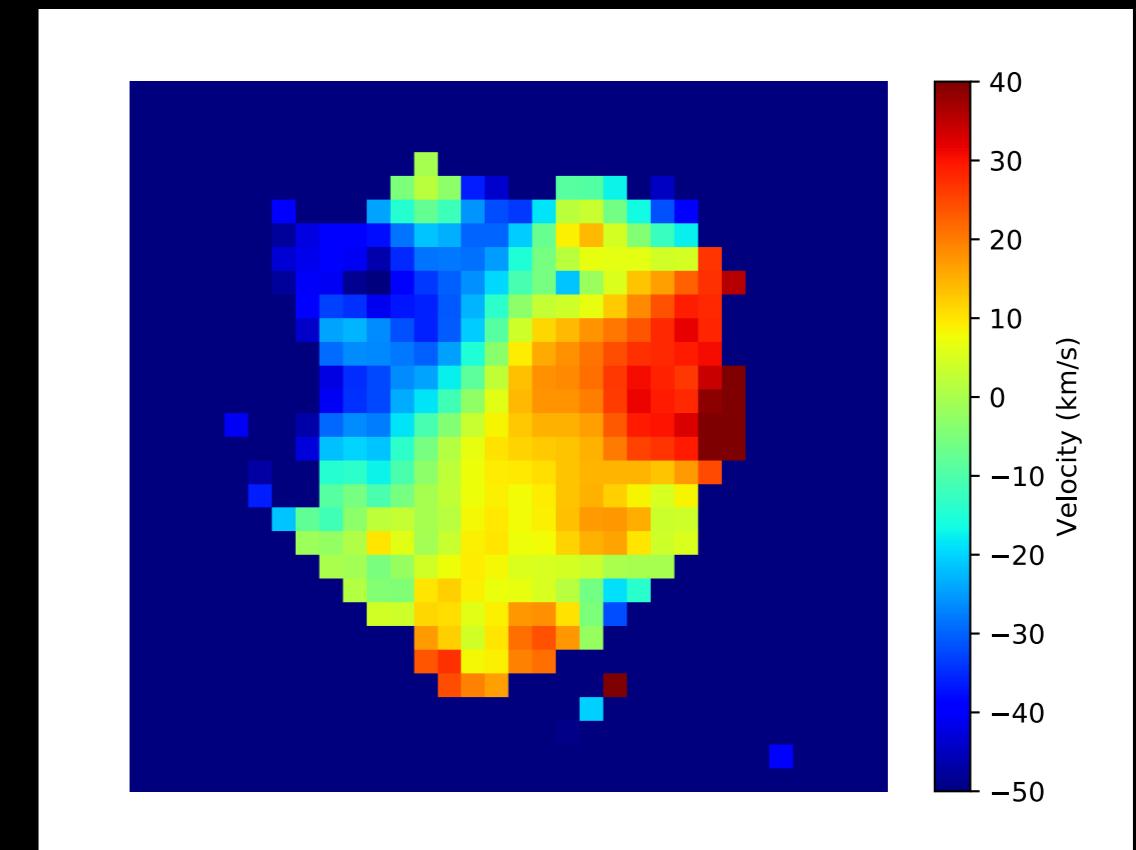
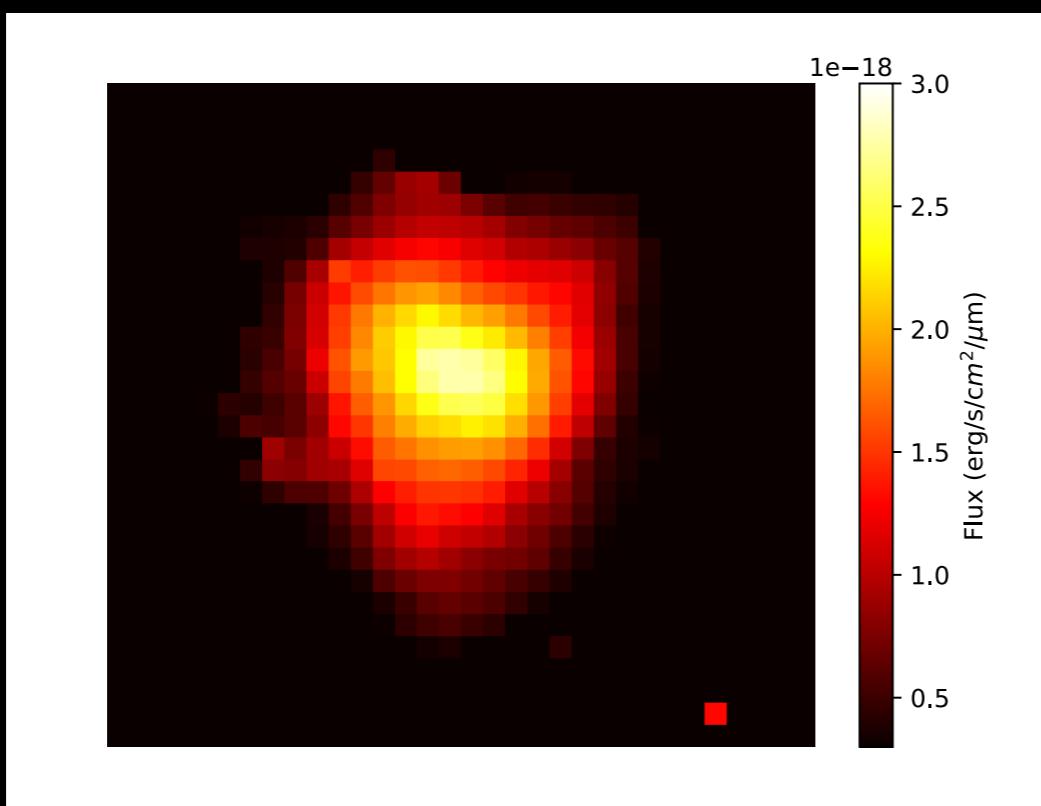
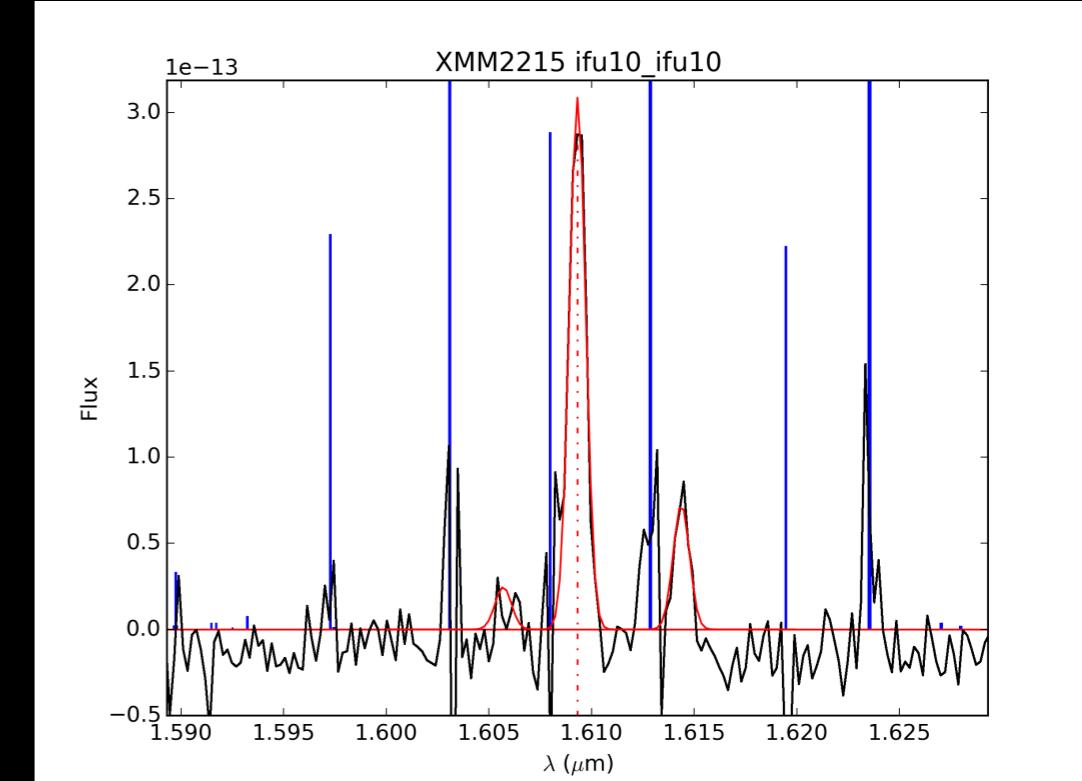
IFU data cube

Harrison, C.M., *Observational Constraints on the Influence of Active Galactic Nuclei*

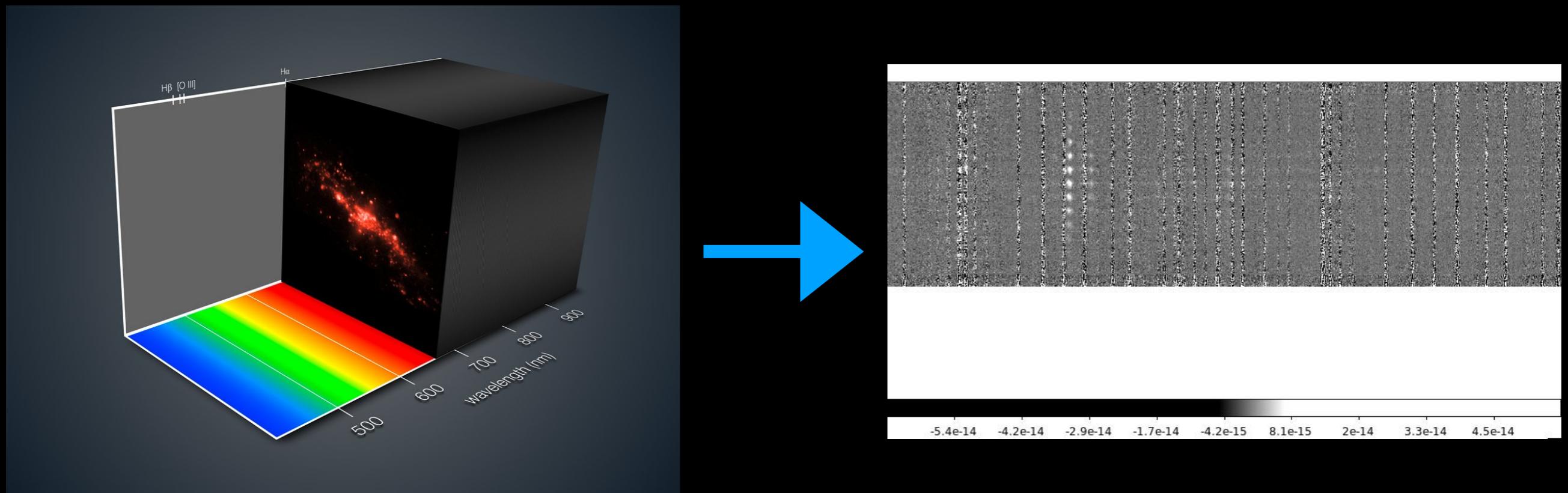




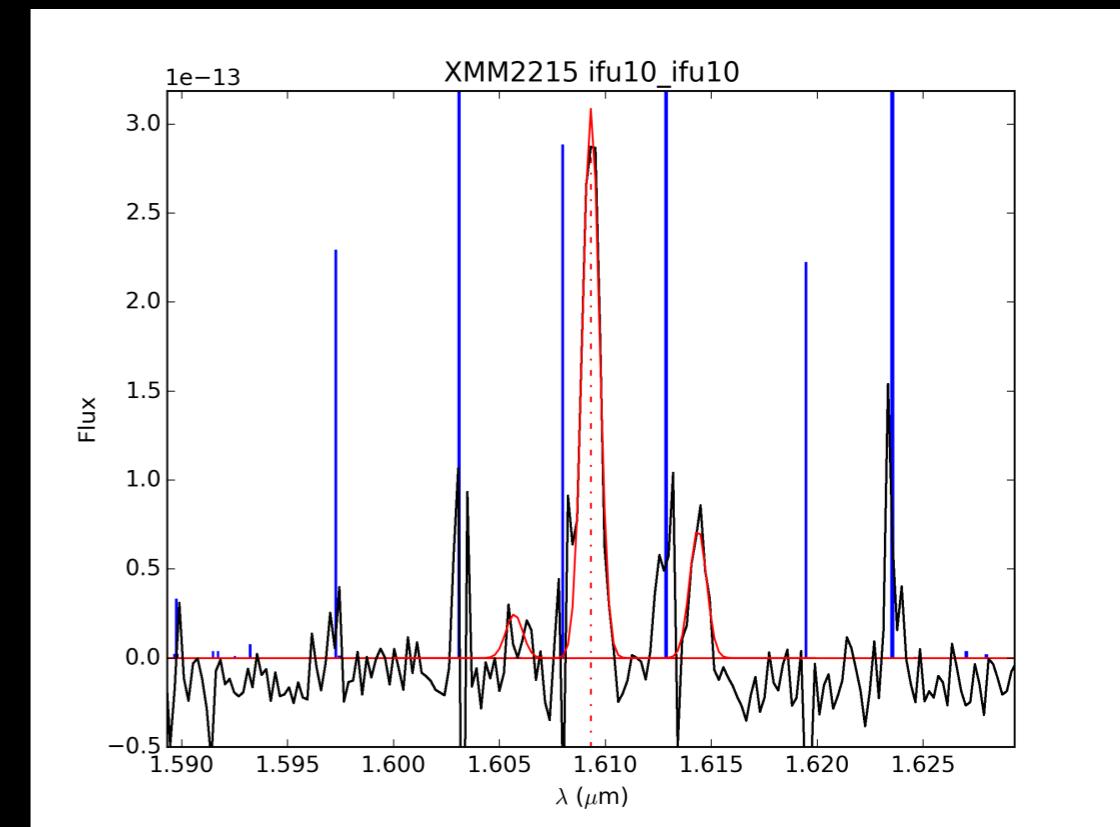
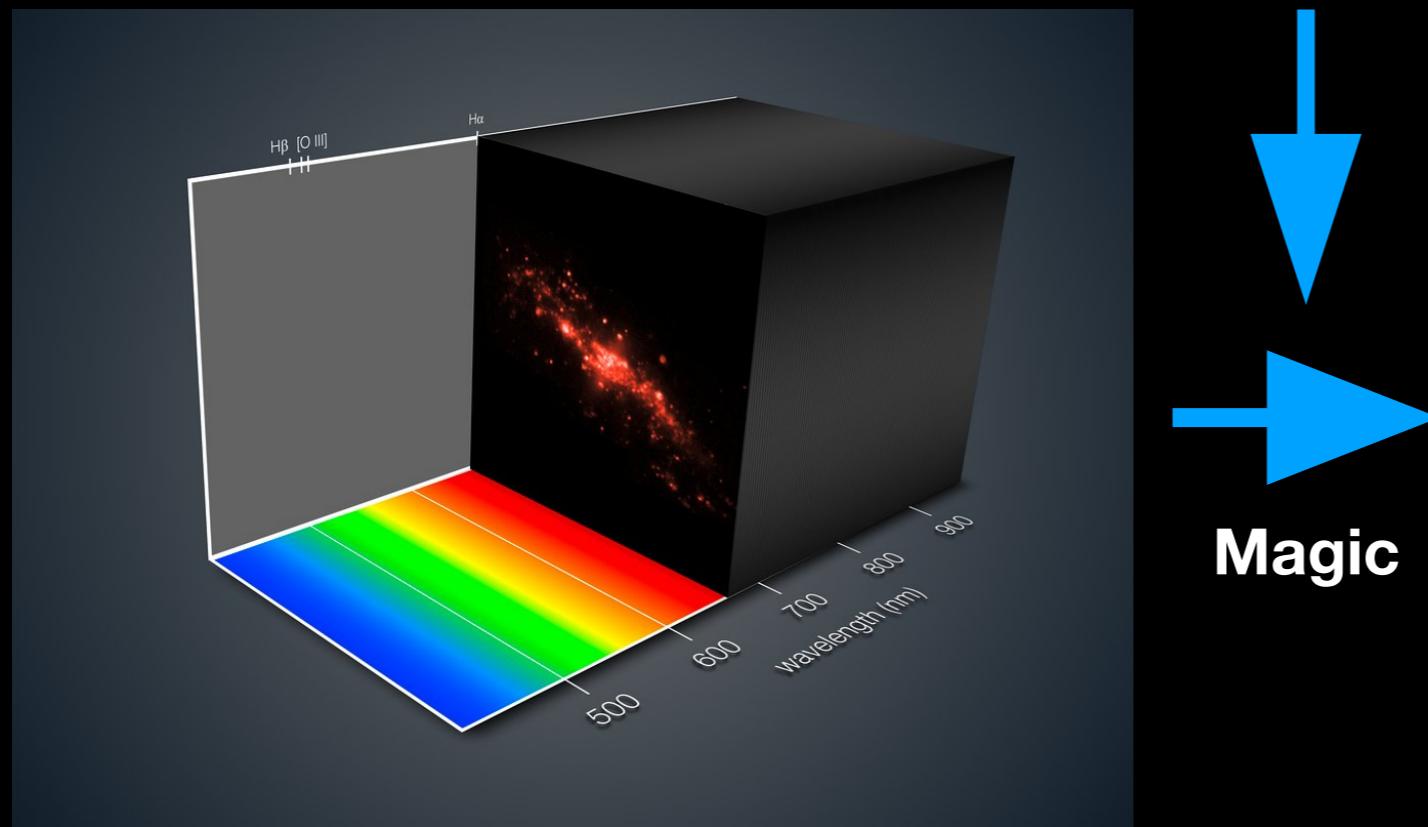
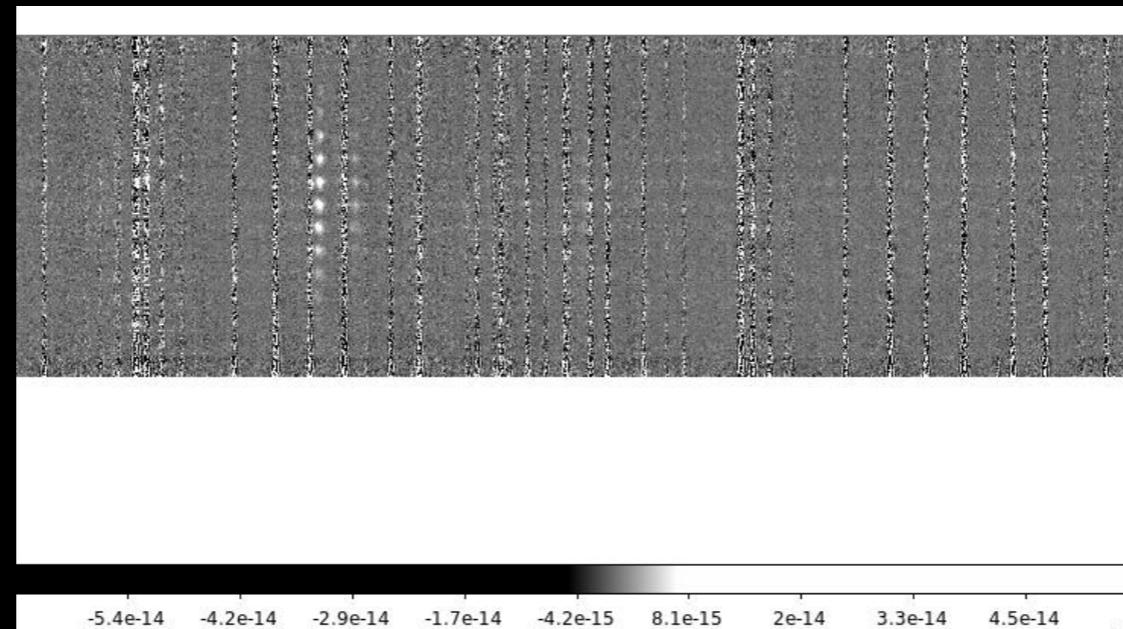
IFU Analysis



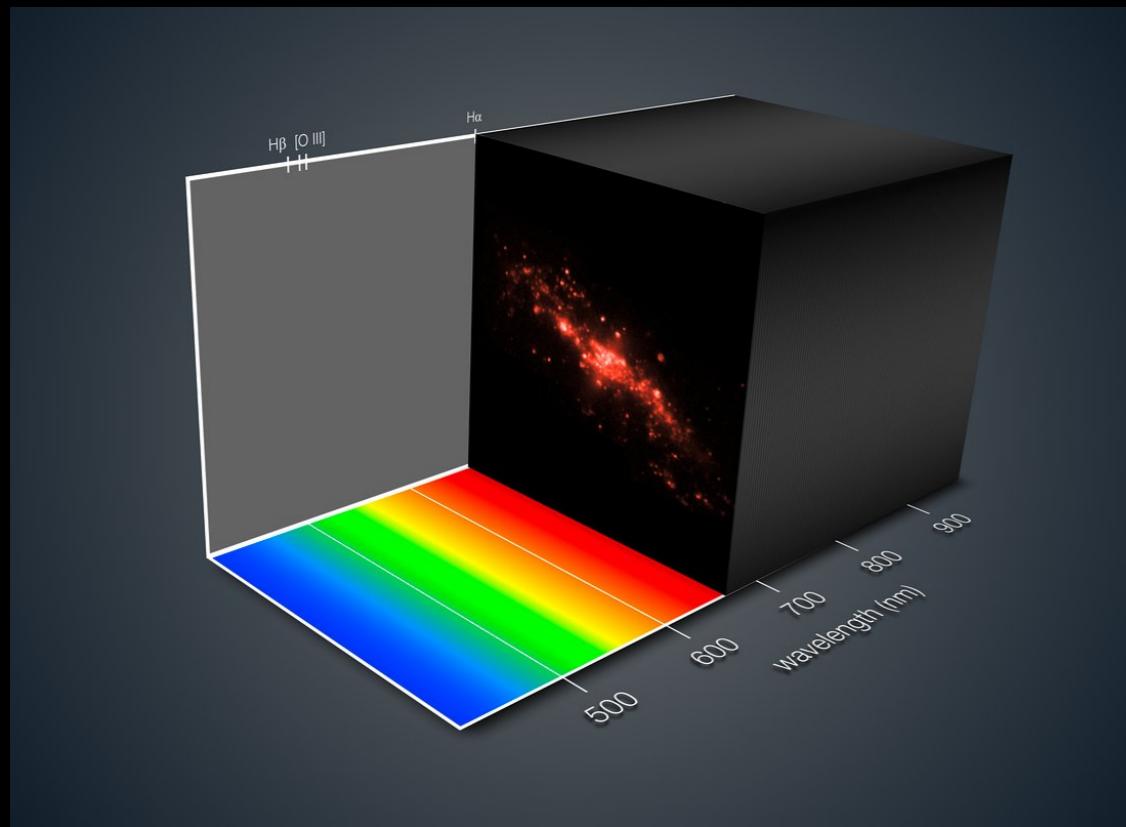
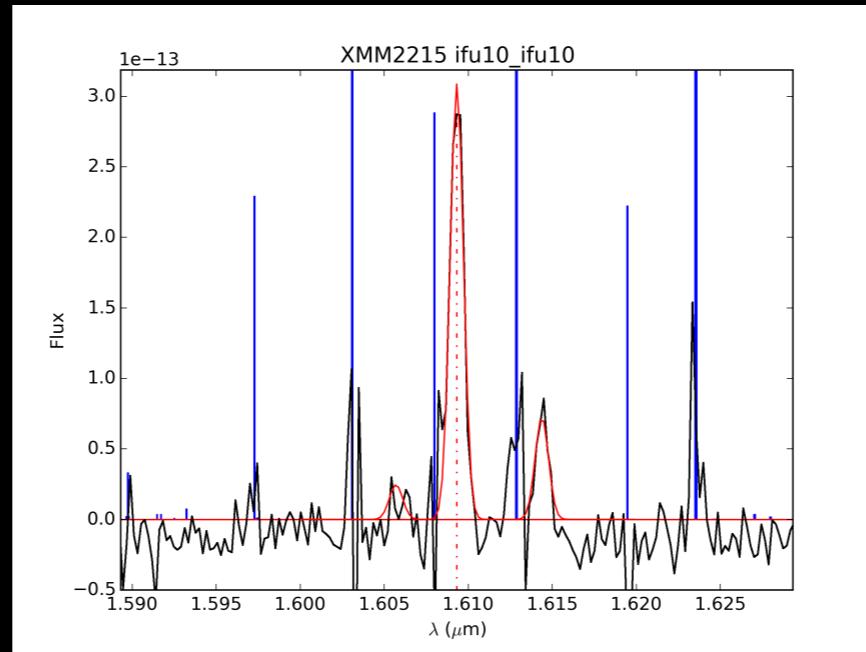
Unwrapping the Cube



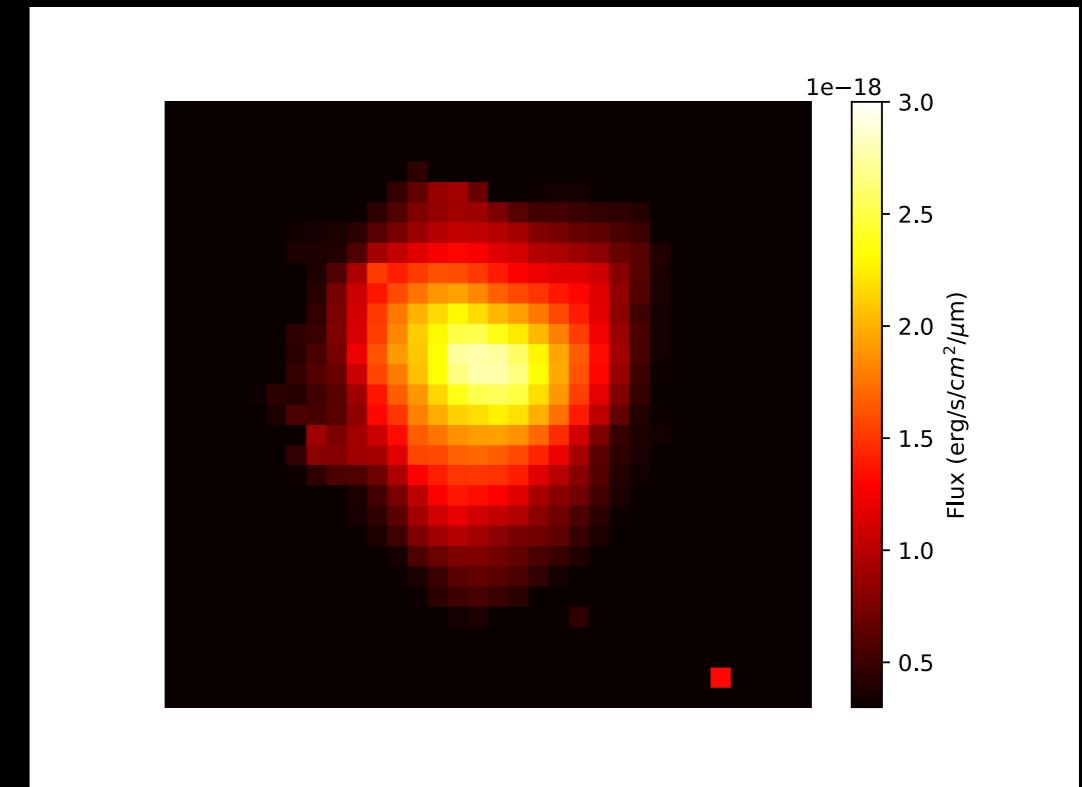
Building (and fitting) a 1D spectrum



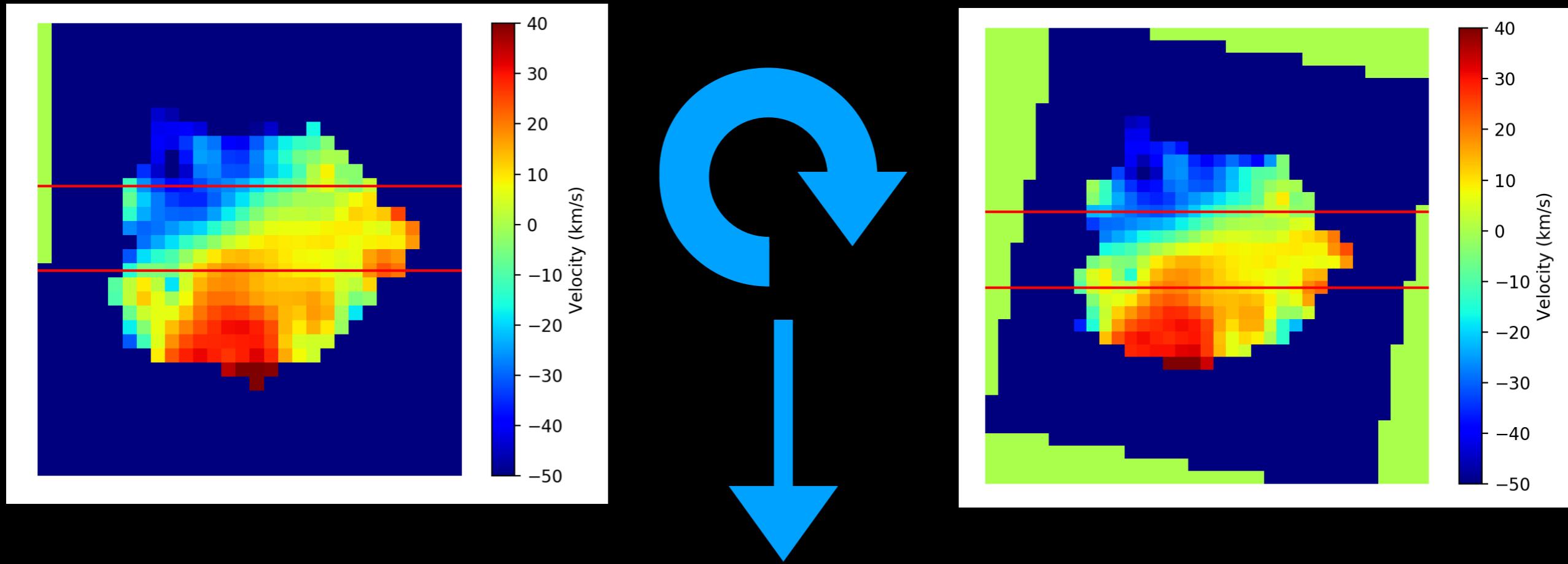
Mapping the galaxy



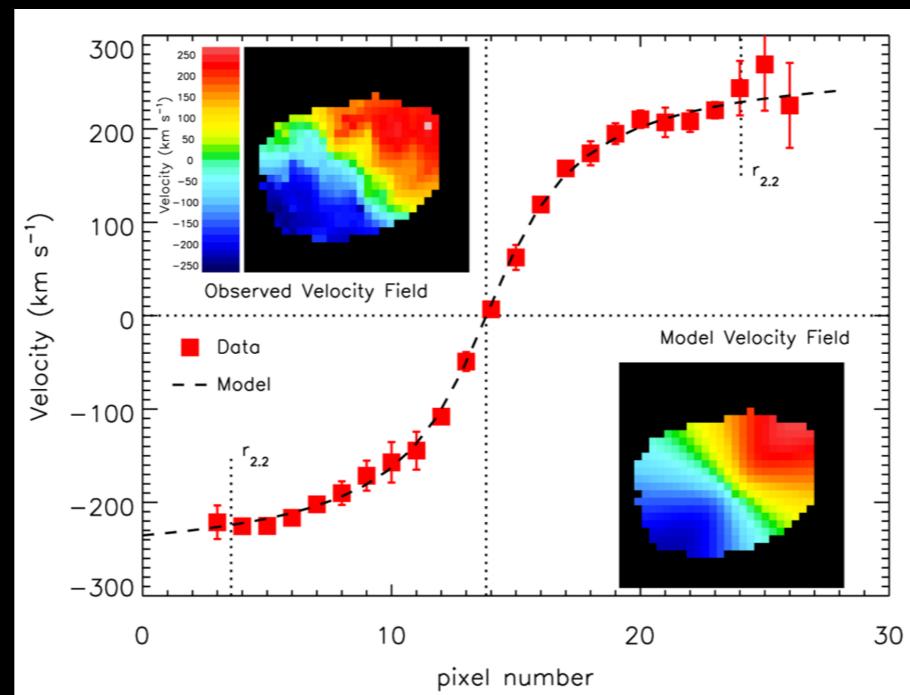
Advanced
Sorcery



Mapping the galaxy



- Rotate through 180°
- Apply slit through galaxy center
- Fit arctangent function
- Find maximum to produce 1-D rotation curve



Example 1-D rotation curve - Stott et al. 2016

What next?



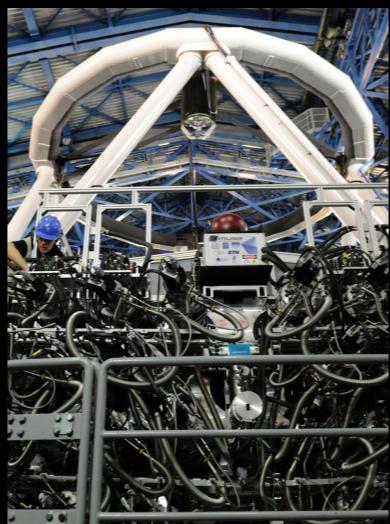
- Dynamics -> DM content
- Metallicity maps -> Gradient
- AGN content
- Comparison of Cluster environment to field
 - i.e KROSS/KGES/K3D

Past

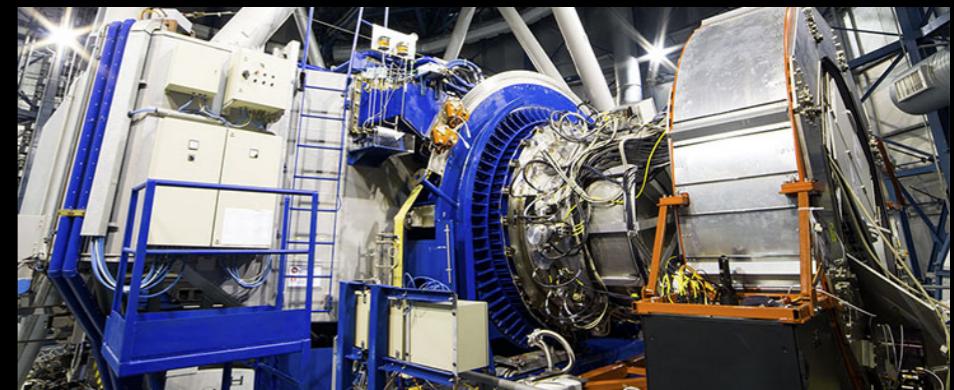


Spectrograph for Integral Field Observations in the Near Infrared - SINFONI
ESO

Present

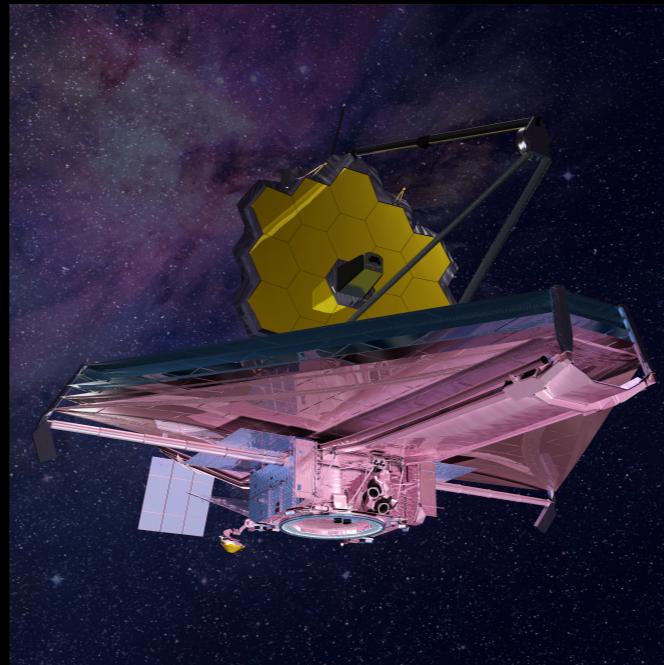


Multi Unit Spectroscopic Explorer - MUSE
ESO

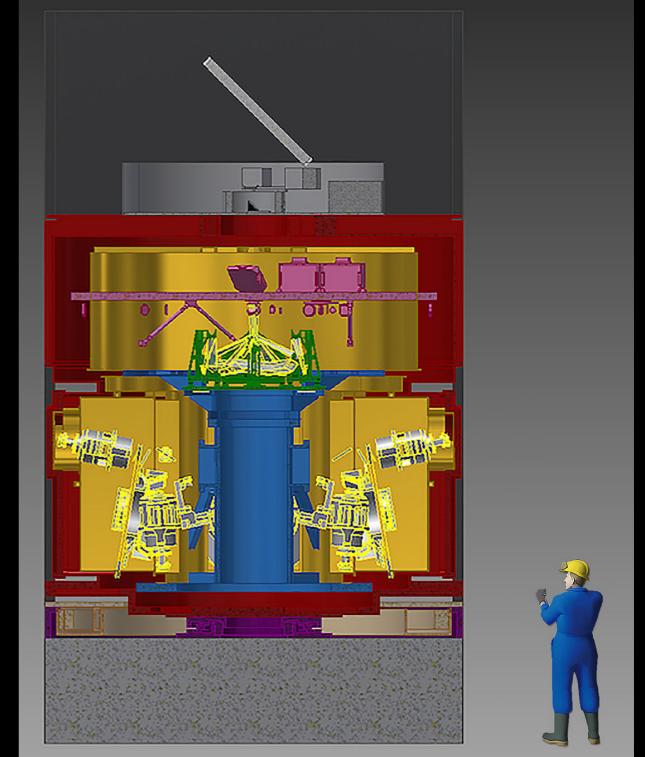


K-band Multi-Object Spectrograph - KMOS
ESO

Future

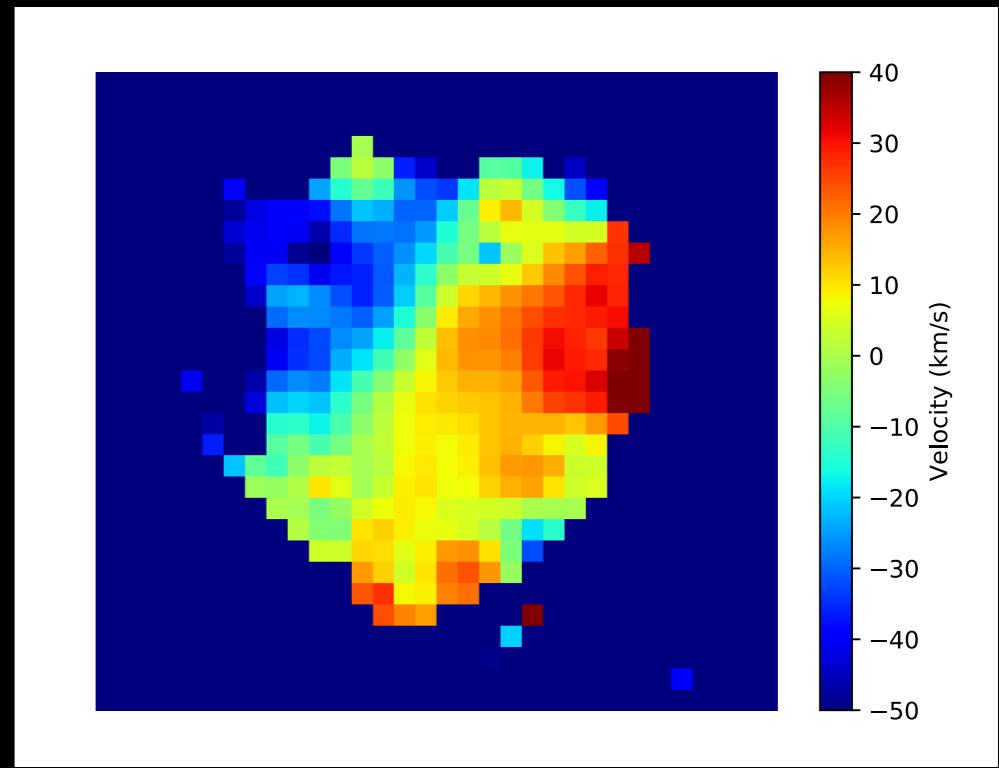
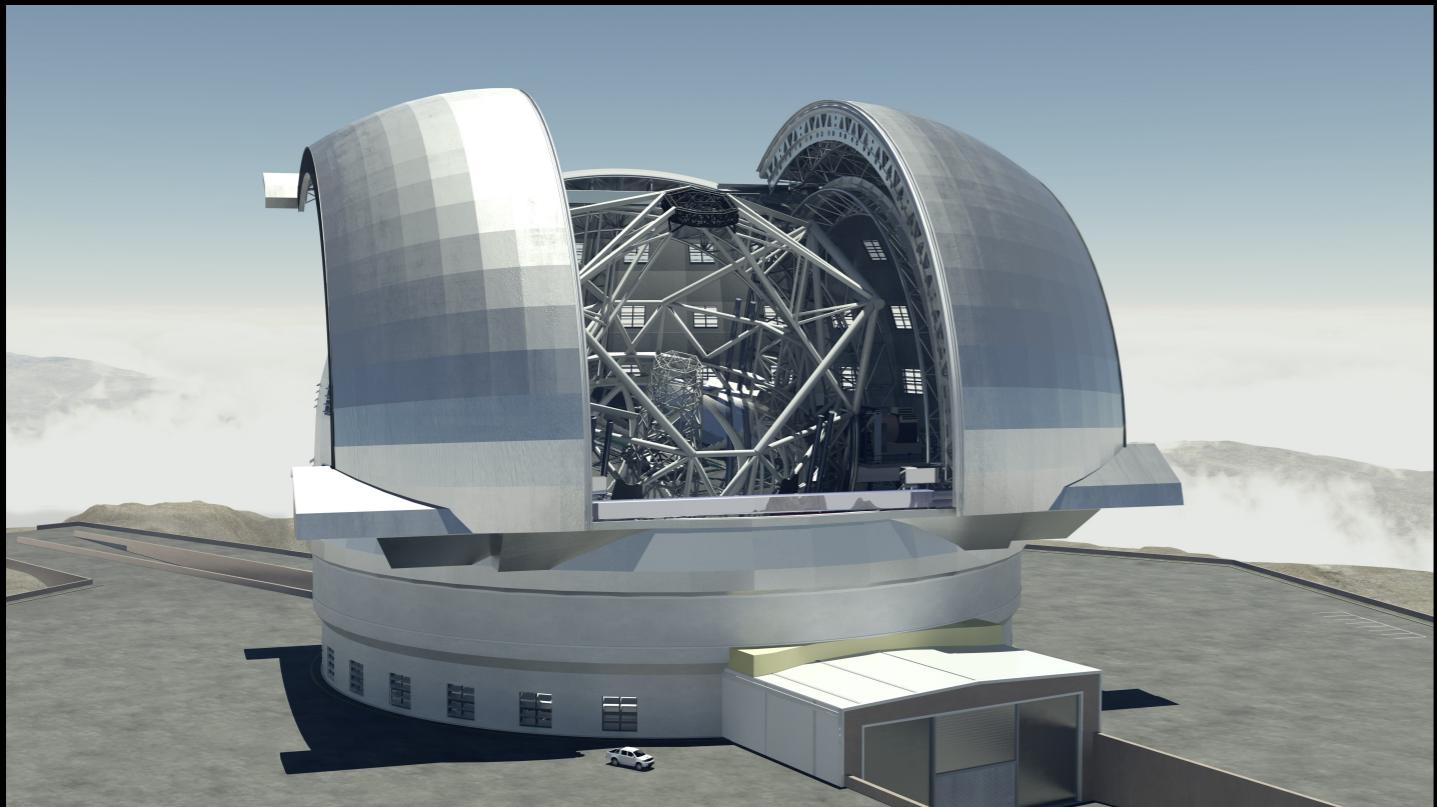


Near Infrared Spectrograph - NIRSpec
NASA/ESA



High Angular Resolution Monolithic Optical and Near-infrared Integral field spectrograph - HARMONI
ESO

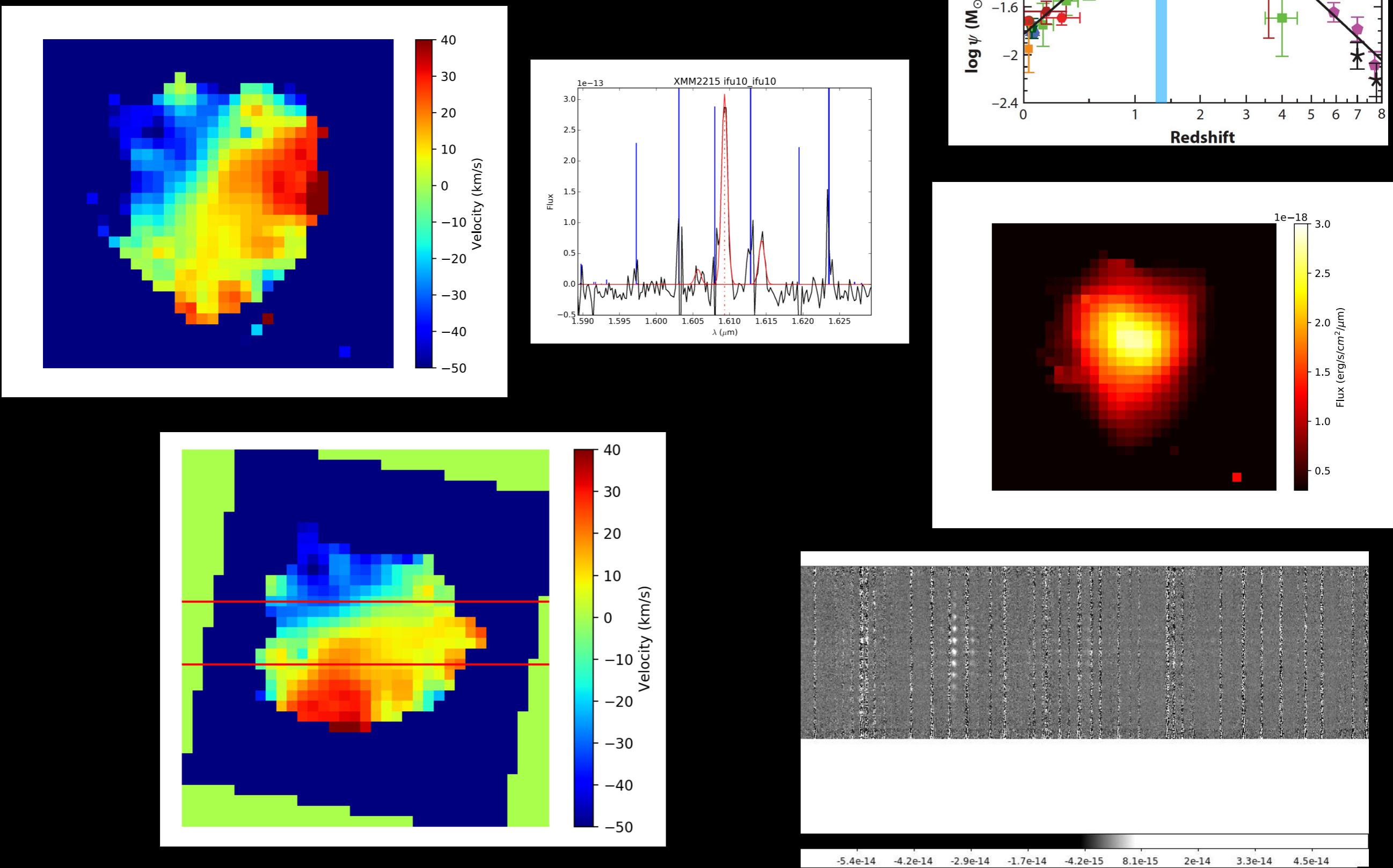
HARMONI (ELT)



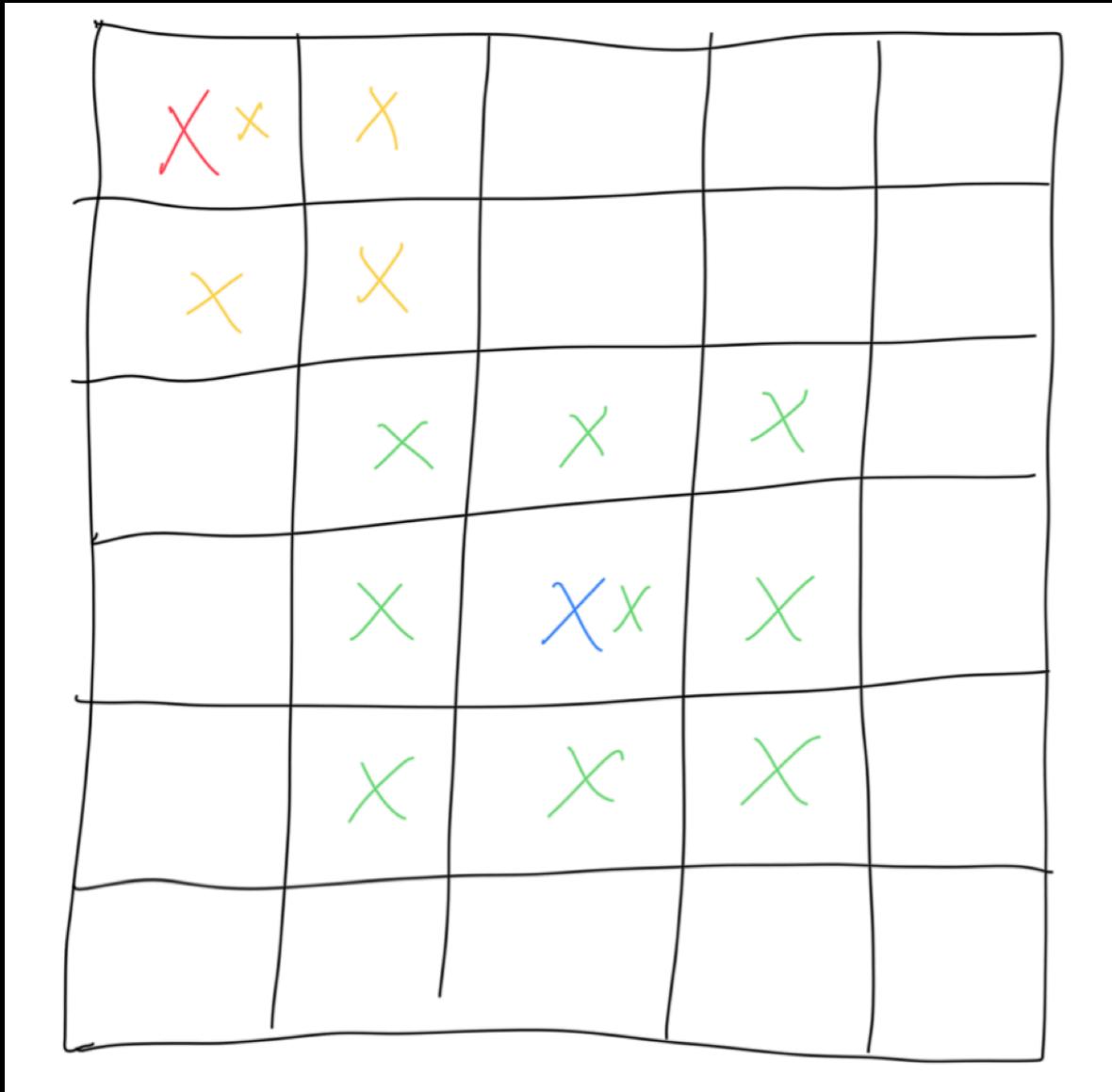
- Spectral resolution $R \sim 500 - 20000$
- Range of spaxels scales:
 - $0.03'' \times 0.06''$ to $0.004''$
- FOV - $6'' \times 9''$

This, but with stars!

Conclusions



Advanced Sorcery



- S/N ≥ 5
 - Fit to continuum away from lines
 - Sum of three gauss fit
 - Calculate the difference in the χ^2 and S/N
- Allow circular expansion to nearby pixels
- Repeat

NIRSpec (JWST)

- Spectral resolution $R \sim 100 - 2700$
- - Spatial resolution $0.1'' \times 0.1''$
- FOV - $3'' \times 3''$



Maximum wavelength range: 0.6 - 5.3 μm !