The Close AGN Reference Survey (CARS)

or: 35 nearby quasars with MUSE

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CLOSE AGN REFERENCE SURVEY

The CARS team

www.cars-survey.org

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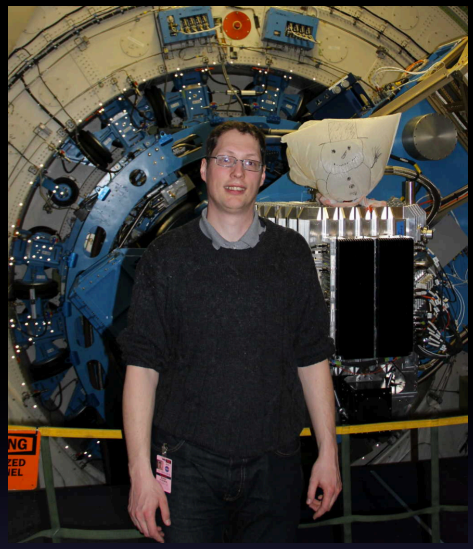

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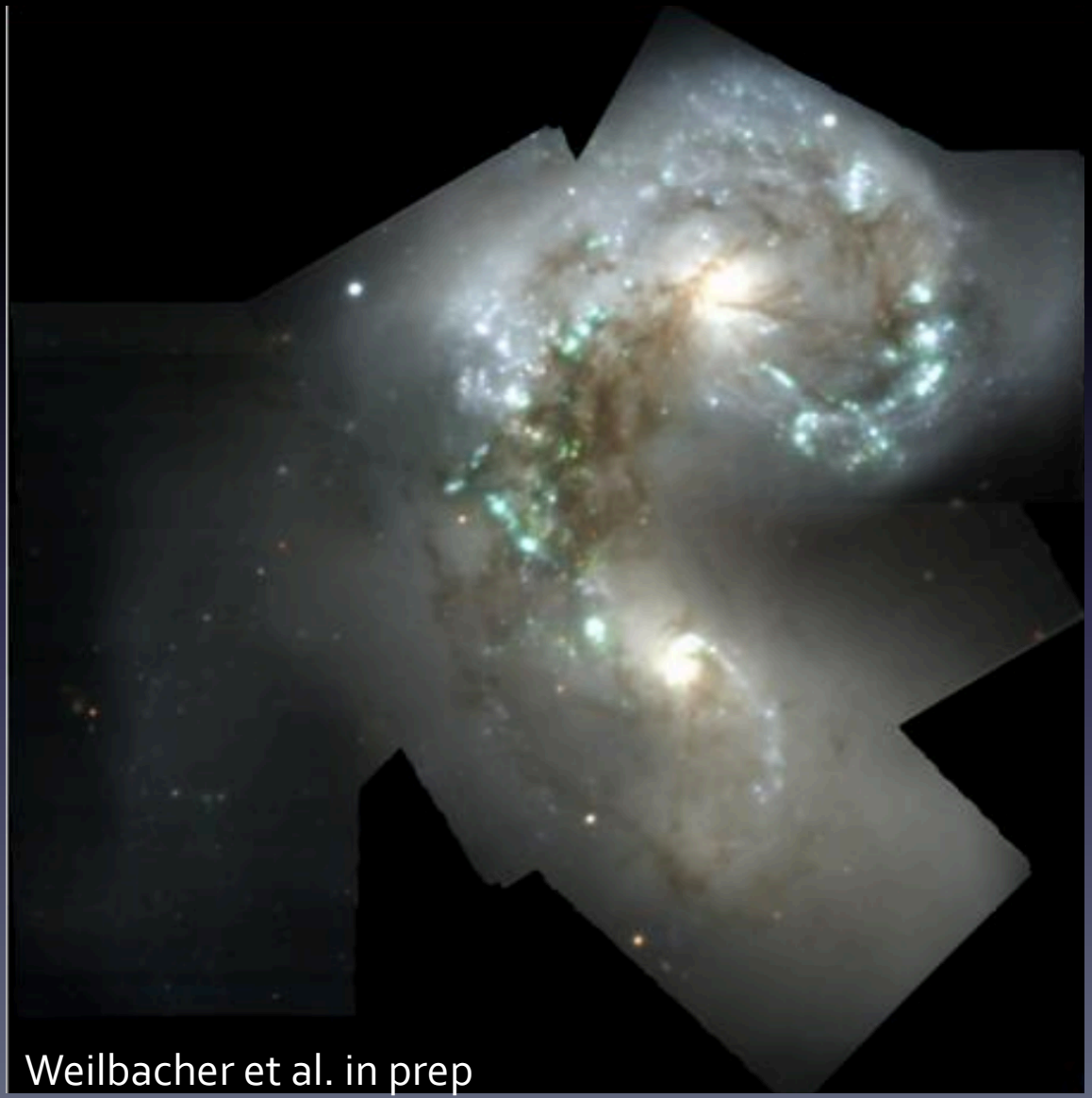
The MUSE instrument on the VLT

- 1'x1' FoV
- 24 IFUs
- 0.2"x0.2"
- 90,000 spectra
- 1.25A (4740-9300A)
- Very high throughput



Weilbacher et al. in prep

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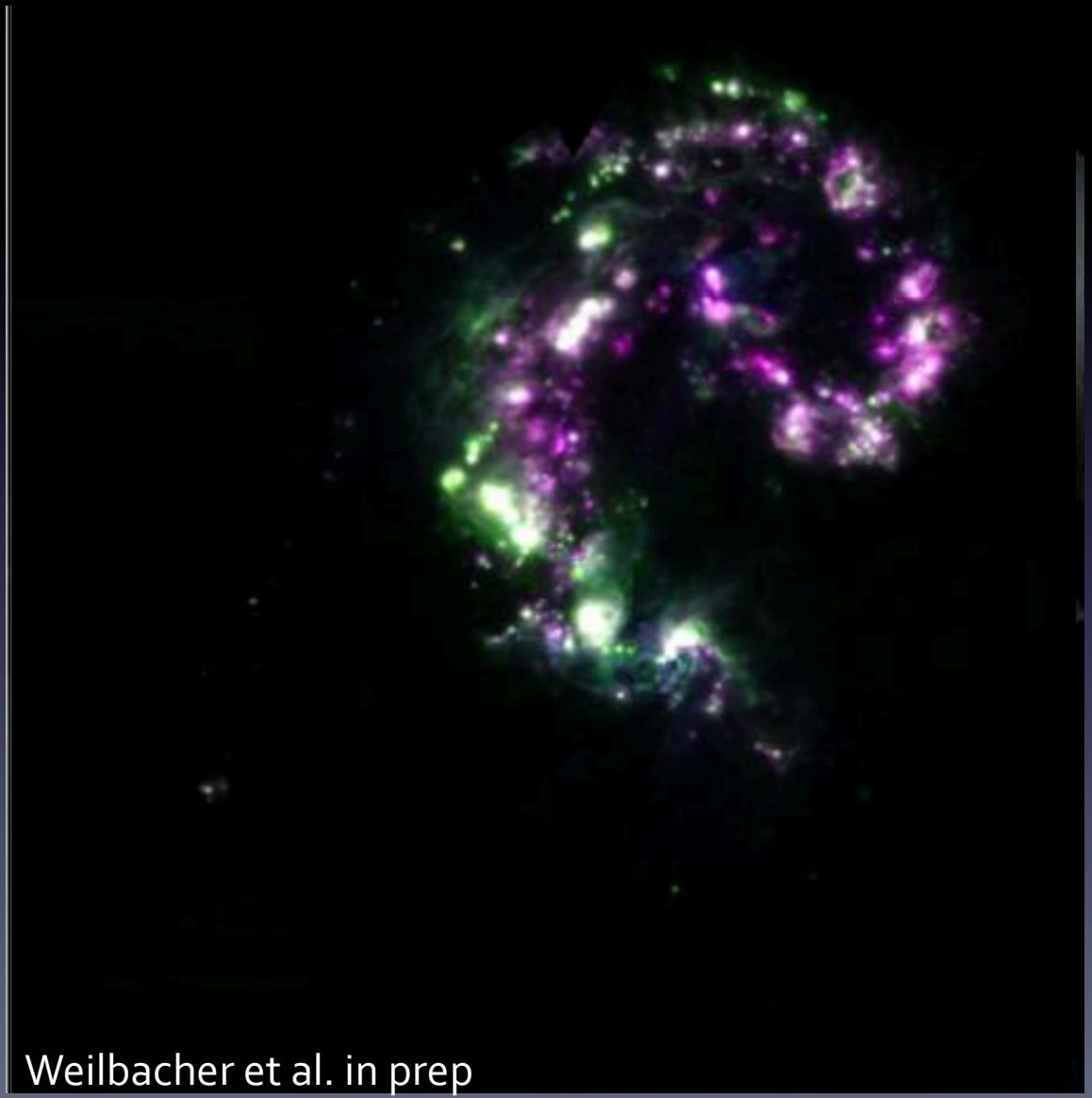

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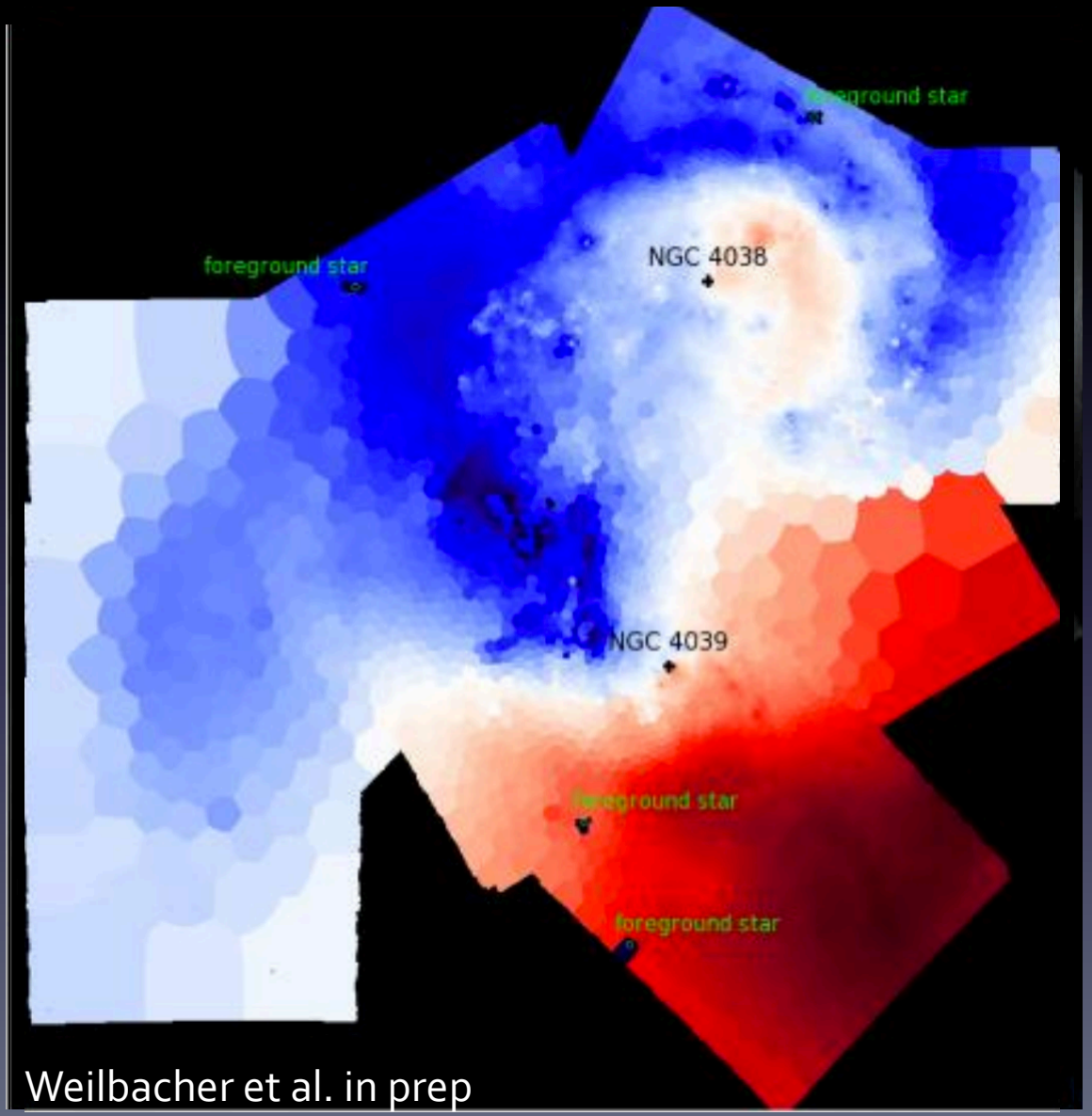
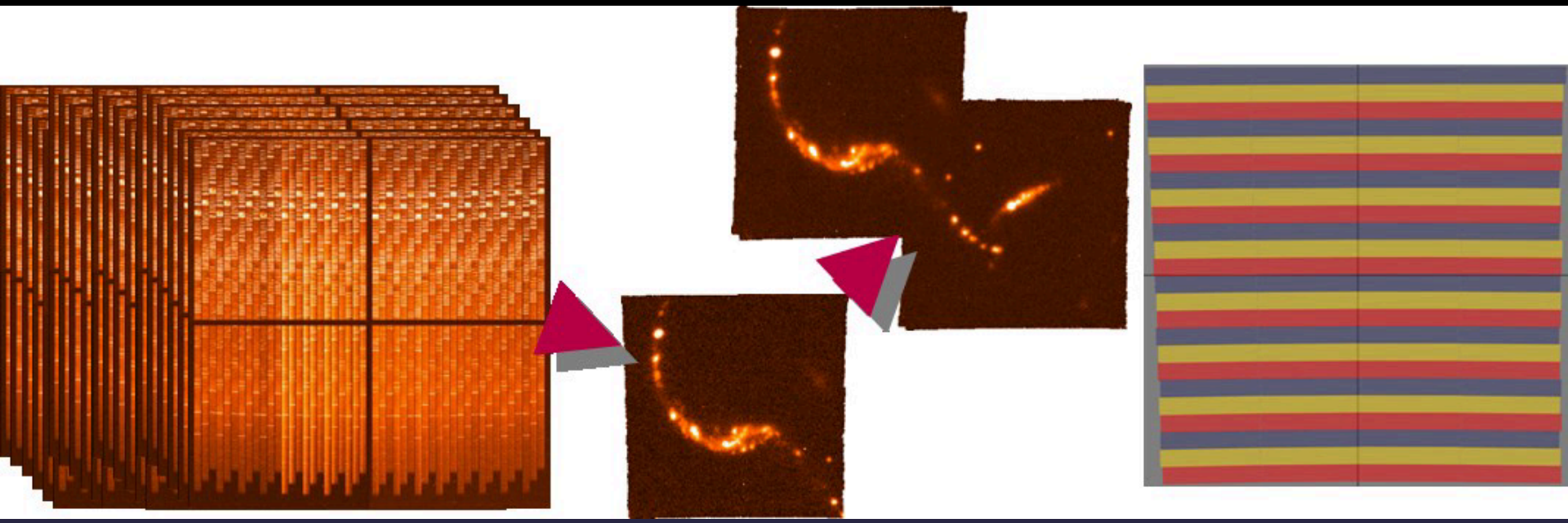


Weilbacher et al. in prep

The MUSE Data Reduction Pipeline

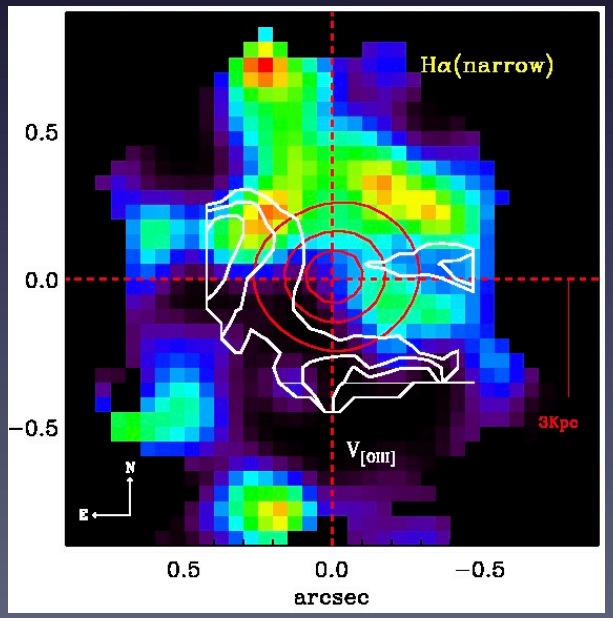


Weilbacher, Streicher & Urrutia

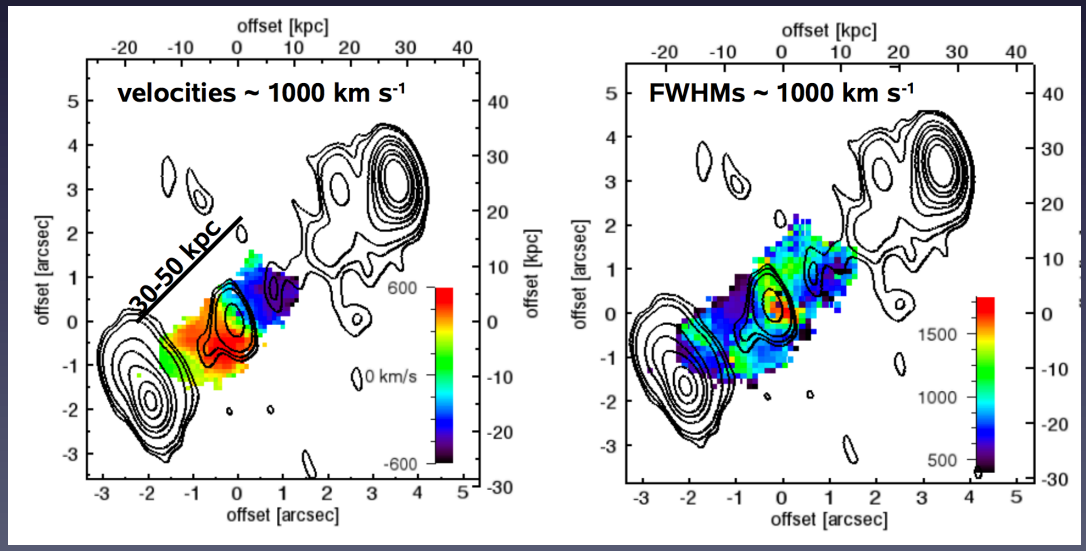
- Through a geometry table assign X_{CCD}, Y_{CCD} to Ra,Dec,λ (PIXTABLE)
- Then drizzle these values in 3D onto a cube (very memory intensive)
- New and improved Sky Subtraction (Soto et al. 2016)

What are the goals of CARS?

- Representative sample of luminous nearby AGN
- Set the reference for any comparison at high z
- Spatially resolved multi-wavelength survey of AGN
- Statistically analyze the link between AGN and hosts



Cano Diaz et al. 2012



Nesvadba et al. 2008

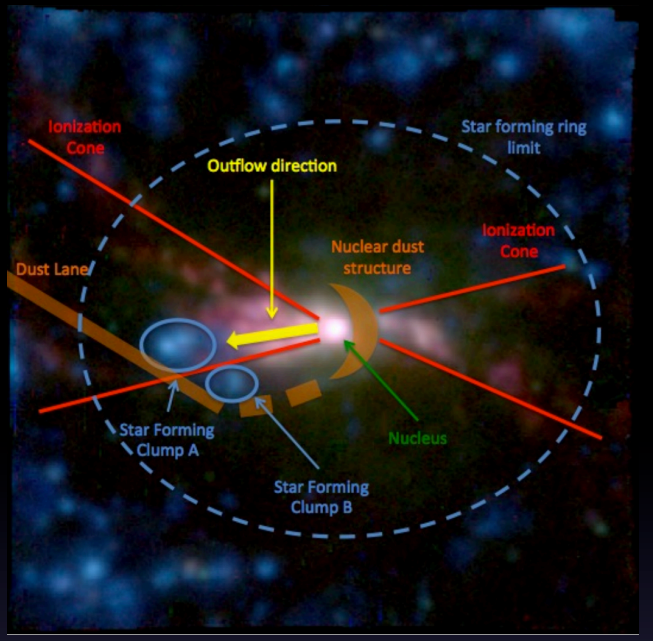
Close AGN Reference Survey

Can AGN get Rid of Star Formation?

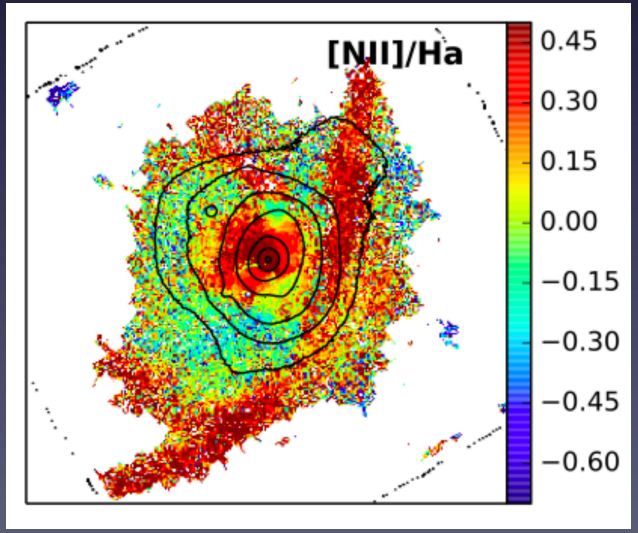
What CARS is not, but cool MUSE AGN science

- MAGNUM (A. Marconi)
- Too low luminosity, mostly Seyfert 2, doesn't act as a reference sample

- ULIRG GTO filler program (GOALS with MUSE)
- Too heterogeneous, hard to pin down AGN properties



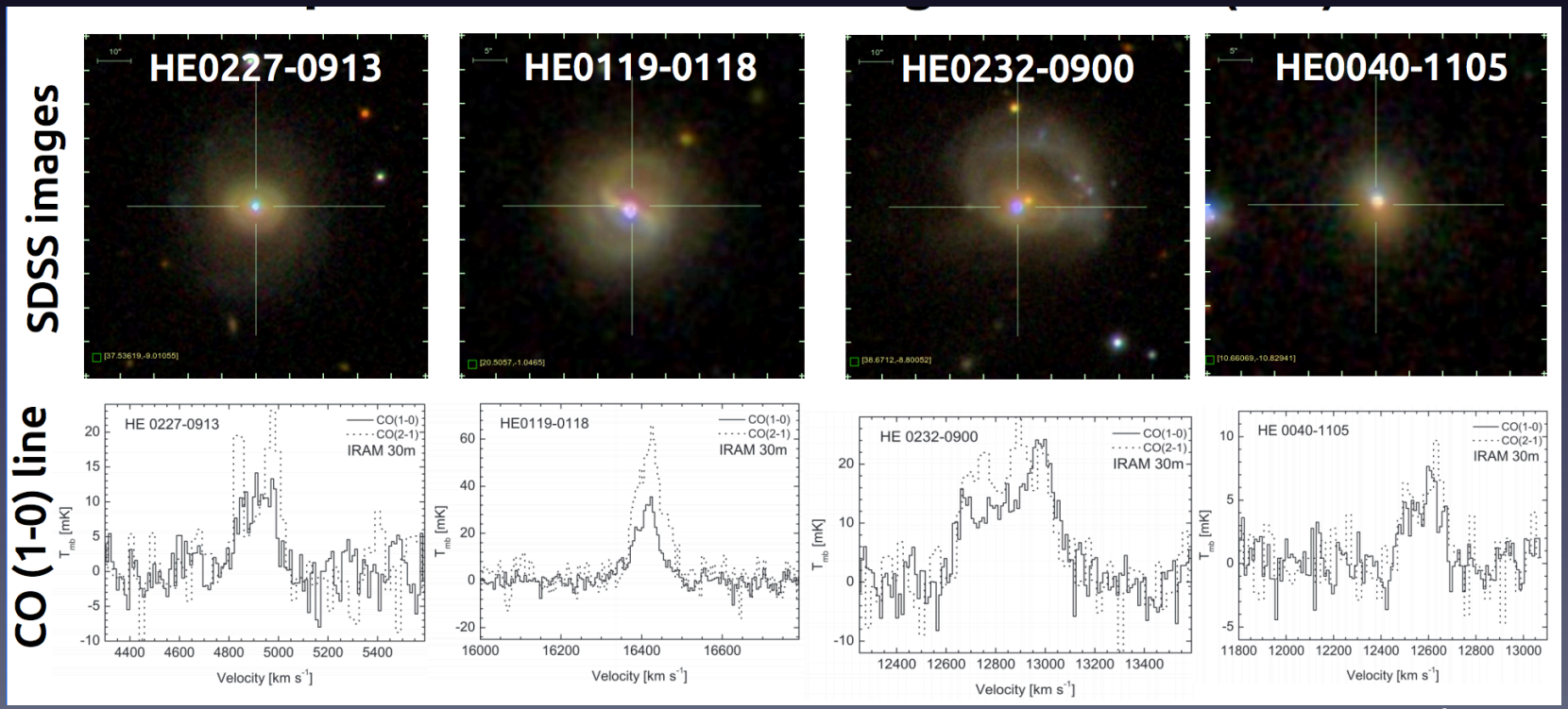
Cresci,...,TU,... 2015 – AGN jet induced star formation



Soto, TU, ... 2016 – Hidden AGN, hidden bow shocks in NGC 34

The CARS sample

- Unobscured AGN from HES, 0.01 < z < 0.06. Subsample of 40 AGN with single dish CO(1-0) data
- More luminous, higher Eddington ratios expected to drive outflows, Type 1 (M_{BH}, L_{edd})



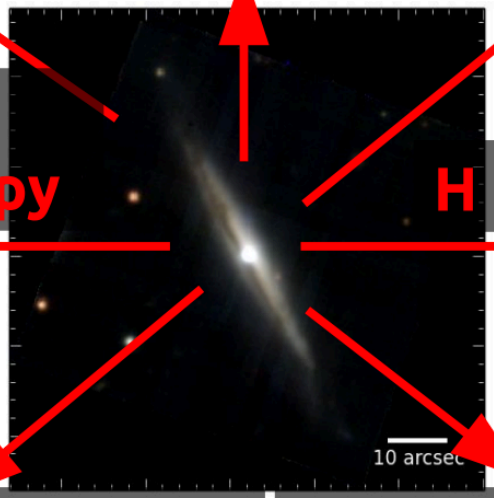
Bertram et al. 2007

deep imaging

3D spectroscopy

[CII] mapping

AO-assisted 3D spectroscopy



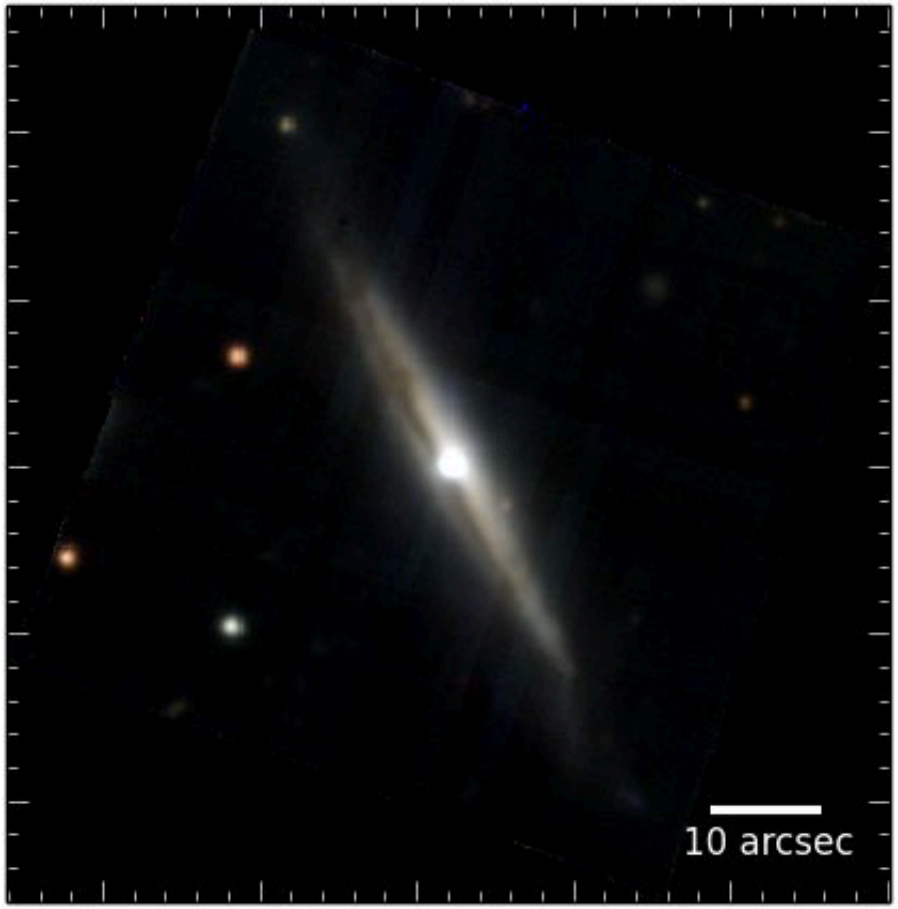
H I maps

deep imaging

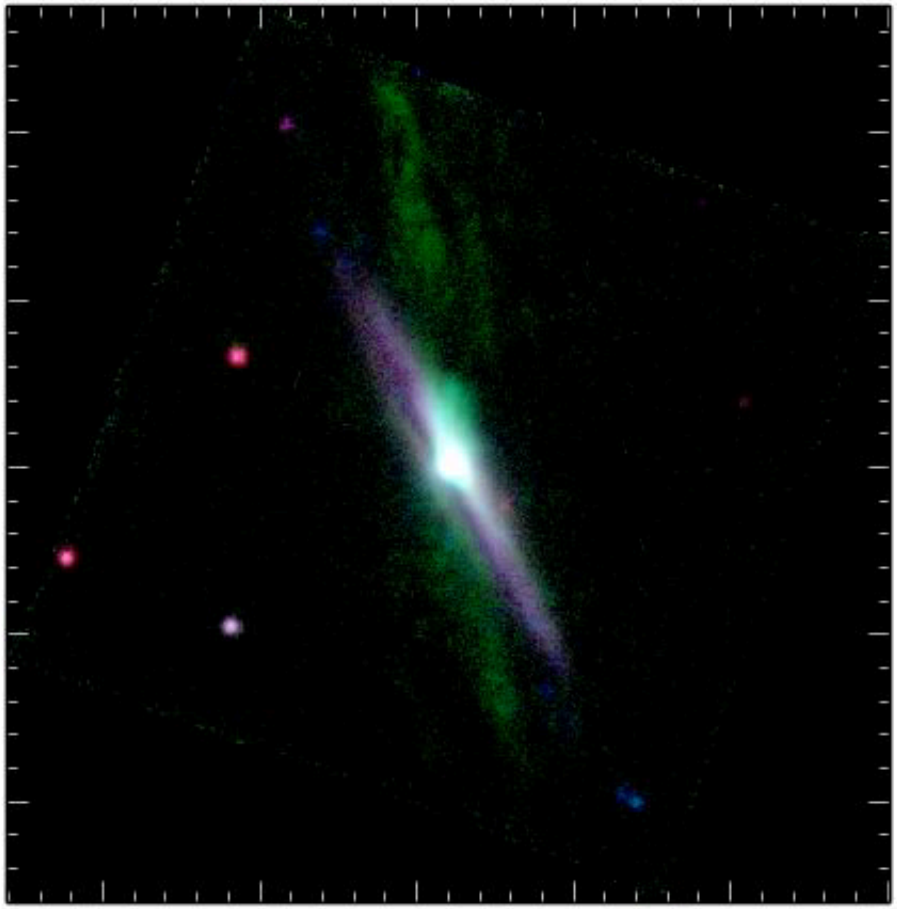
CO(1-0) maps

MUSE – the game changer!

R: I band, G: R band, B: V band



R: Cont band, G: [OIII] 5007, B: Hα



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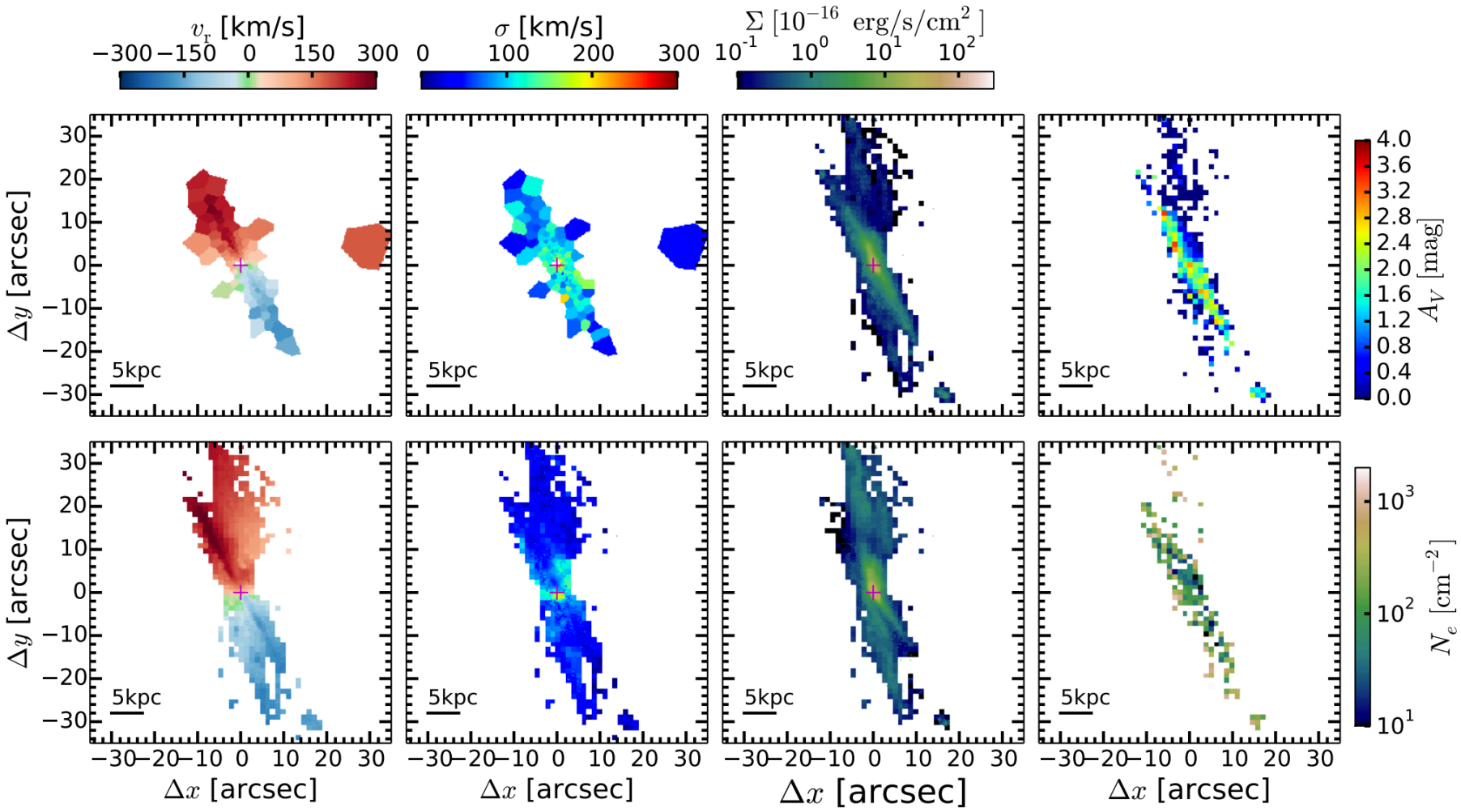
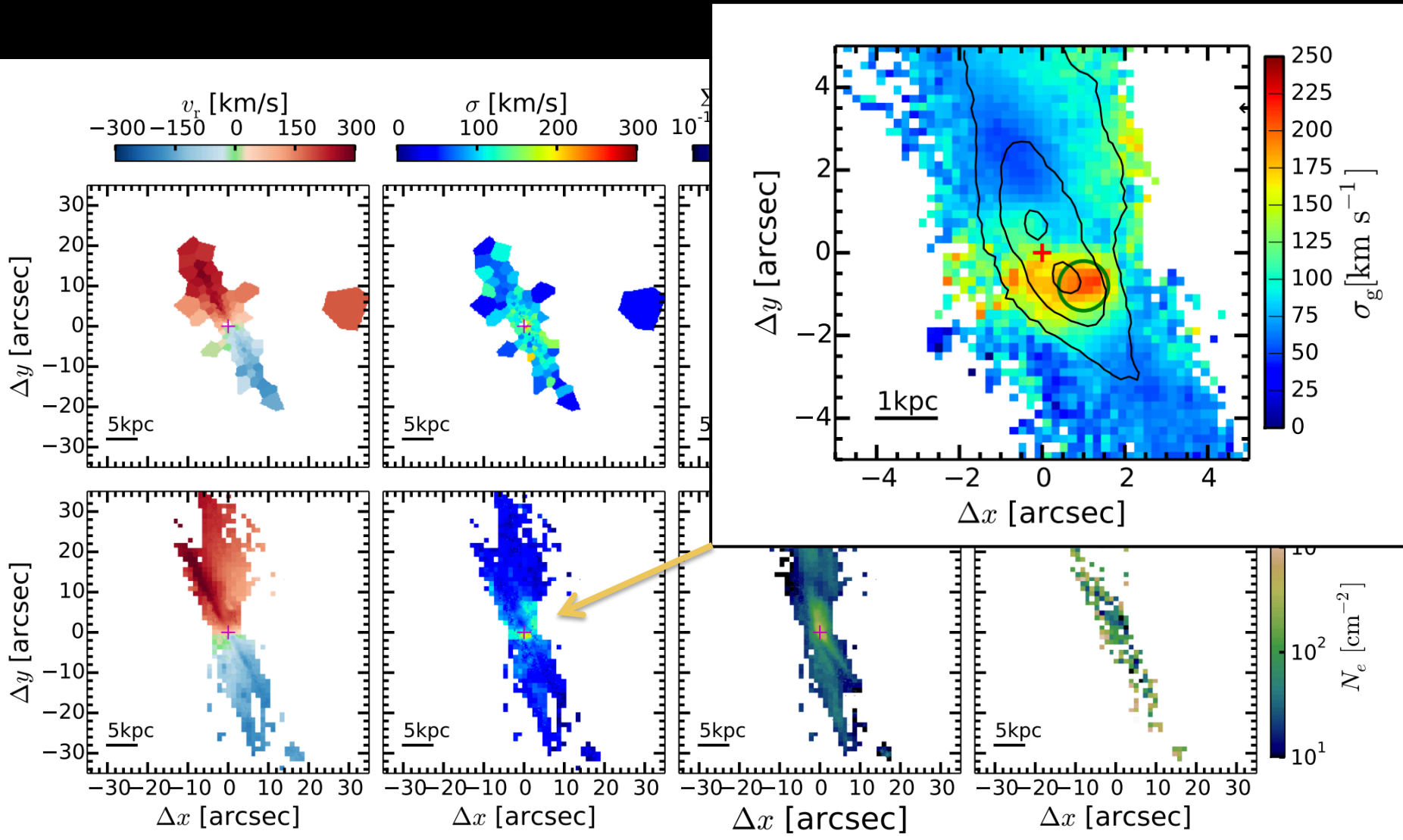
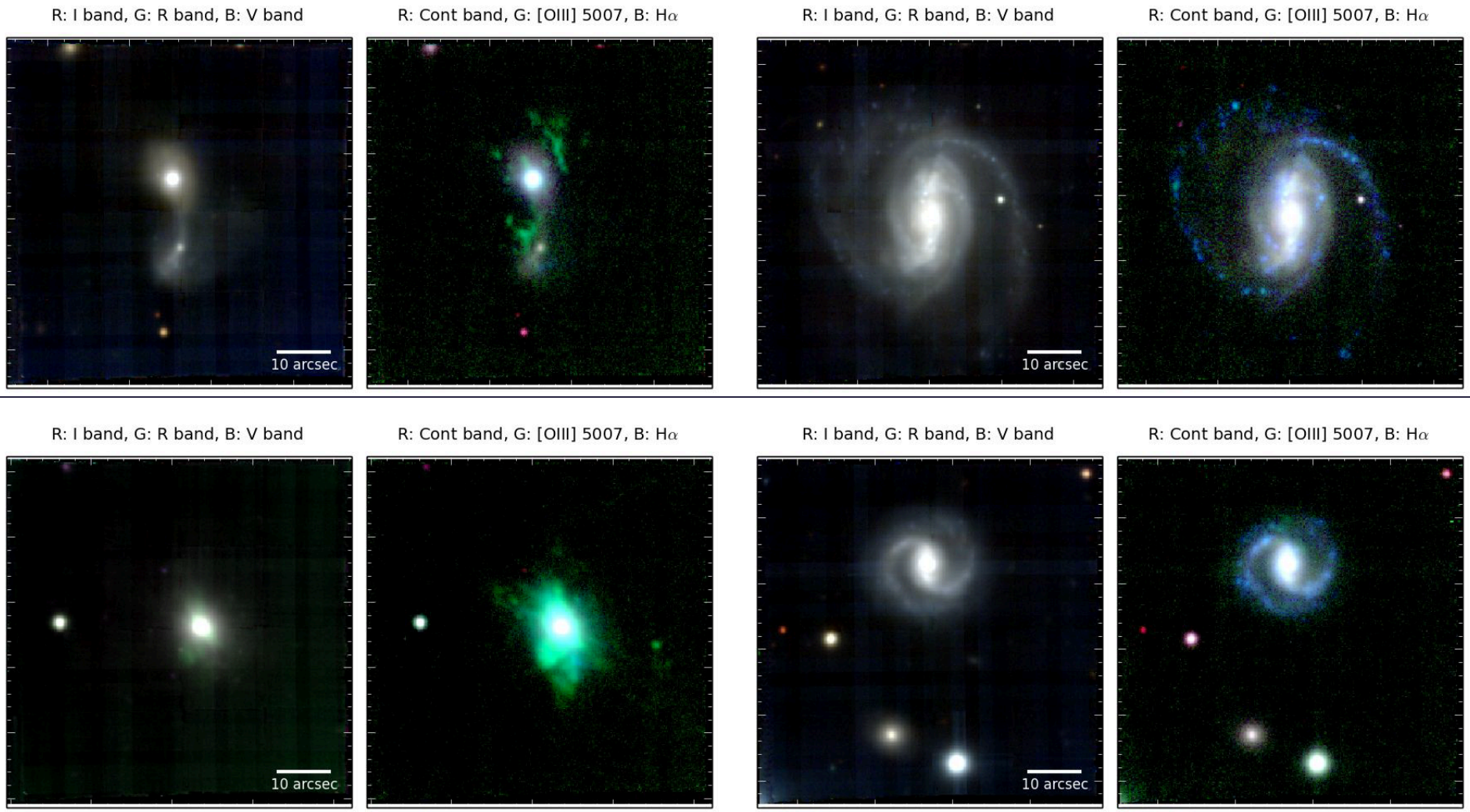


MUSE – the game changer!

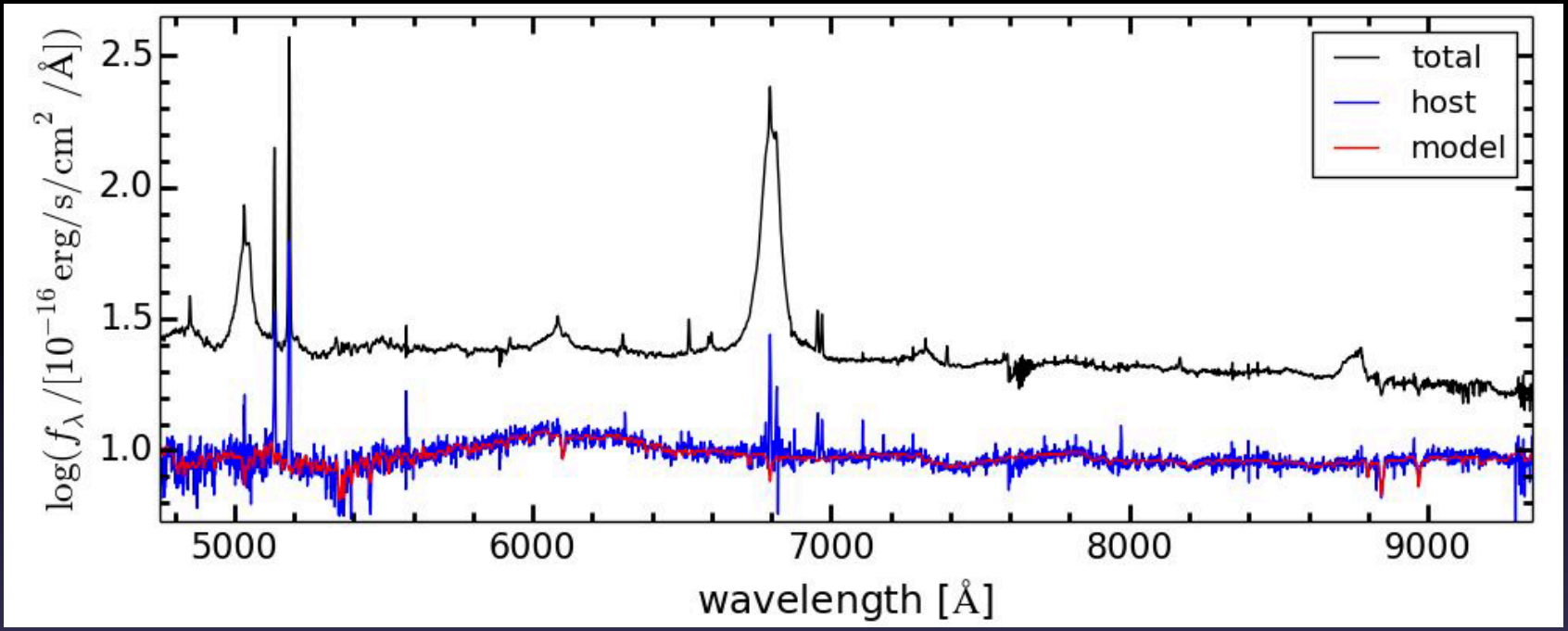


Extended AGN ionization, but also high star formation regions




Corresponds to ~2.4 Million spectra taken
within just ~25 minutes per object

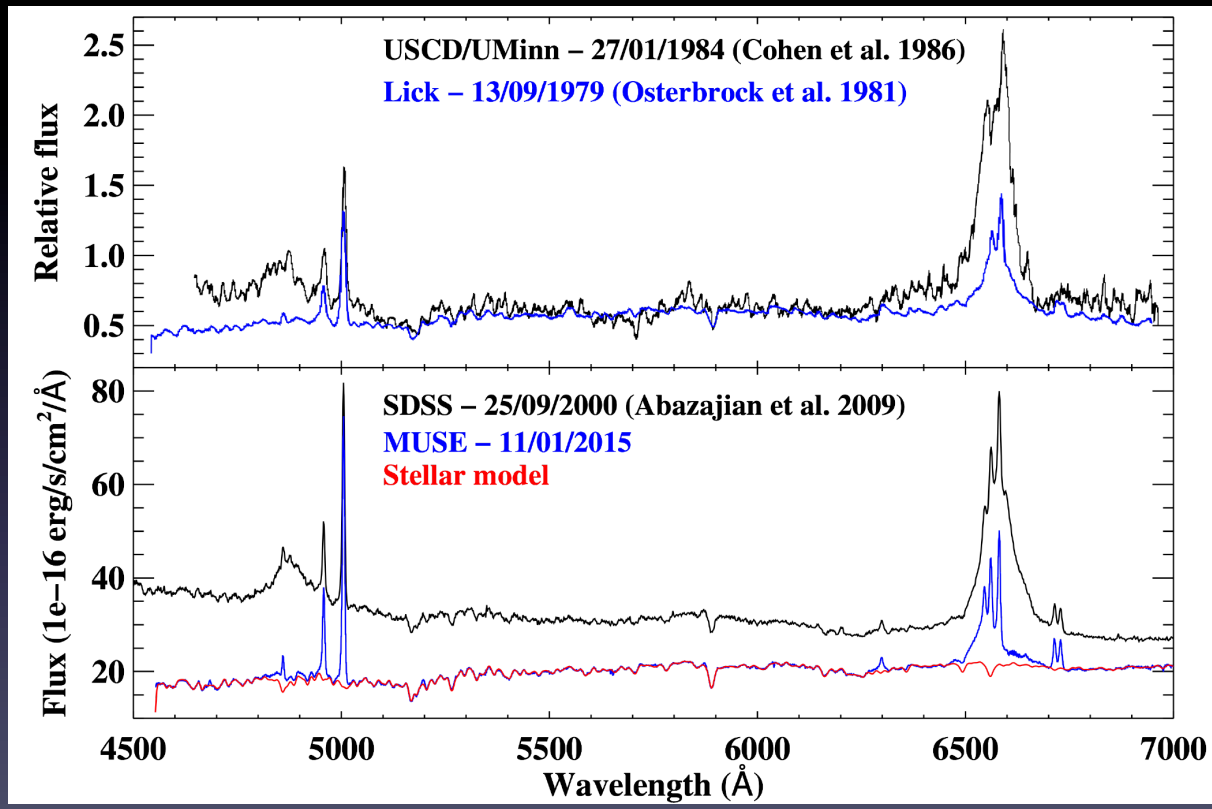
Spatial AGN-host deblending



- Use especially developed software (QDeblend3D) to remove Point Spread Function/Quasar in 3D cubes (Husemann et al. 2014)
- Please do not neglect PSF in 3D data! Its effects go out well beyond its FWHM disk.

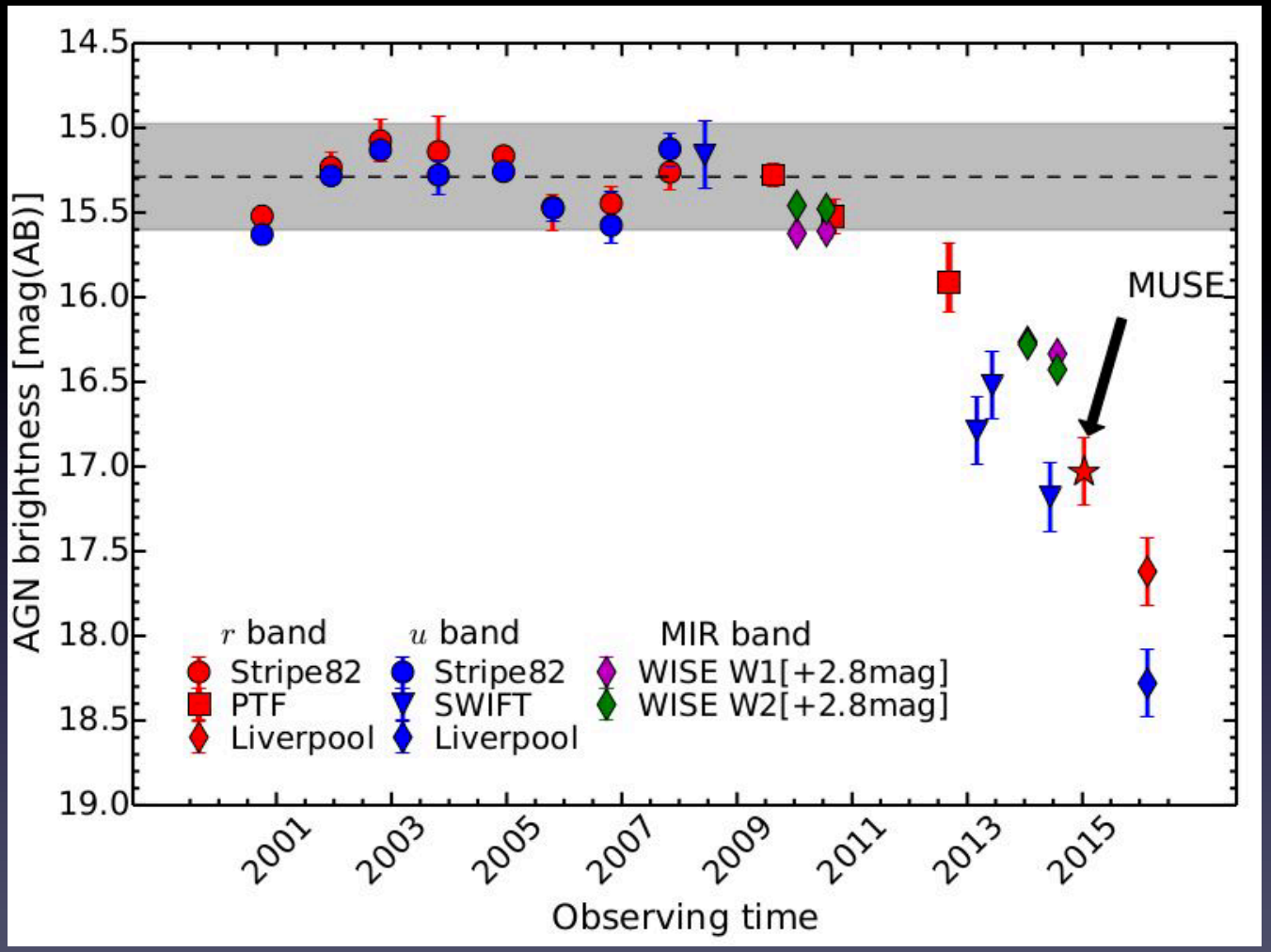
Serendipitous discovery of a Changing look AGN in CARS

McElroy et al. 2016, accepted



Only 2nd/3rd ever "there and back again" changing look AGN on a timescale of 30 years (Mrk 590, Denney et al. 2014)

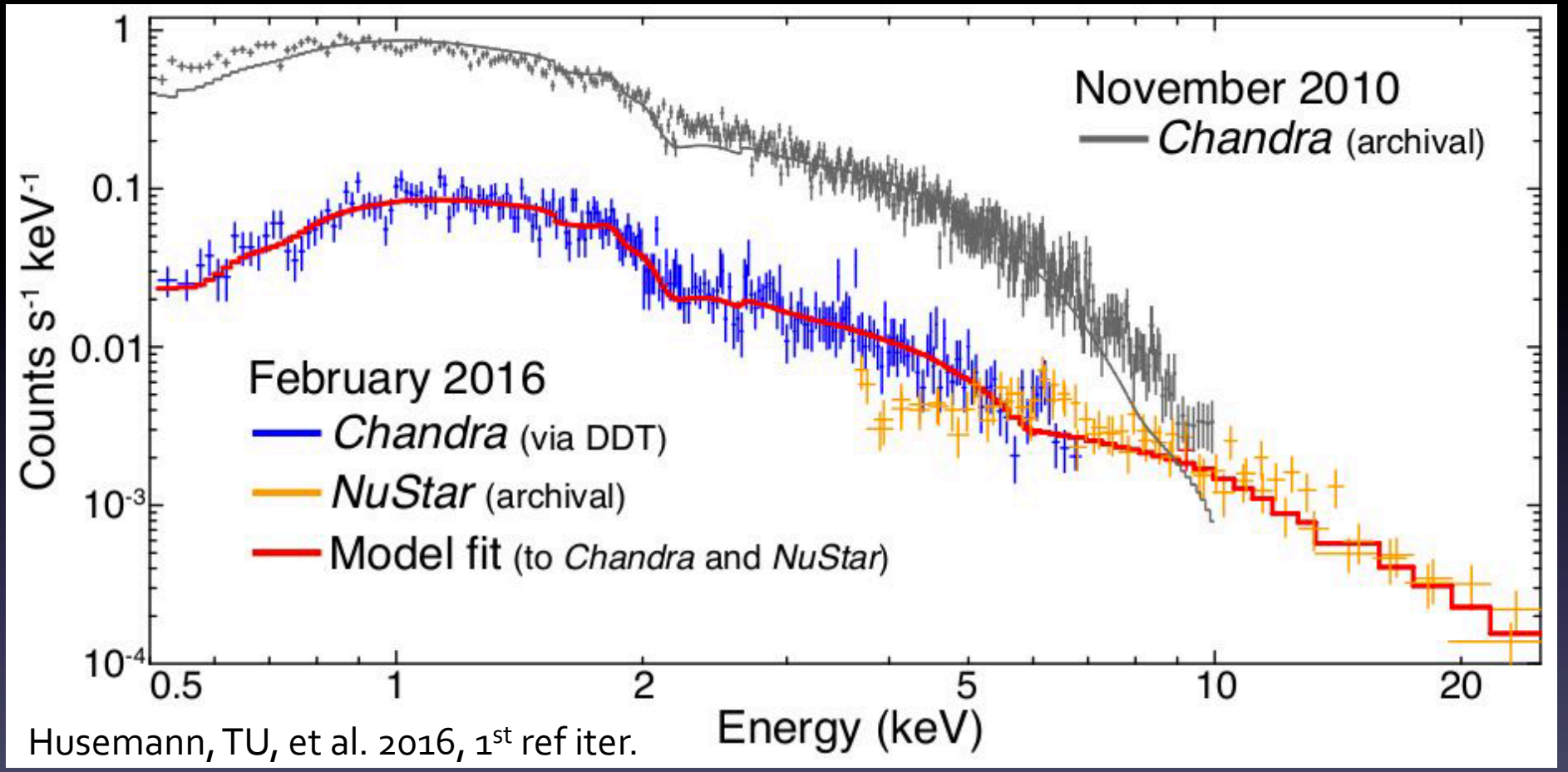
AGN light curve



McElroy et al. 2016

- Still declining!
- Inconsistent with a Tidal Disruption Event

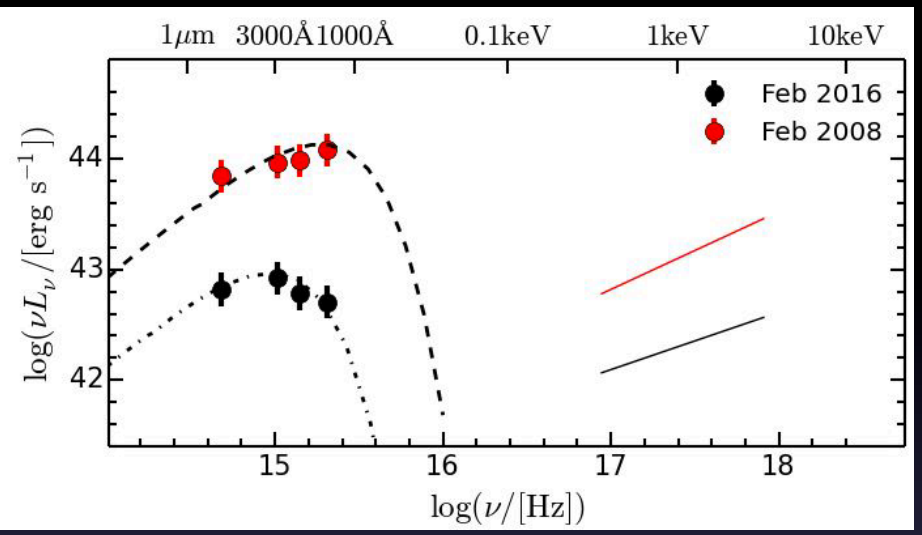
Chandra (DDT) + Nustar



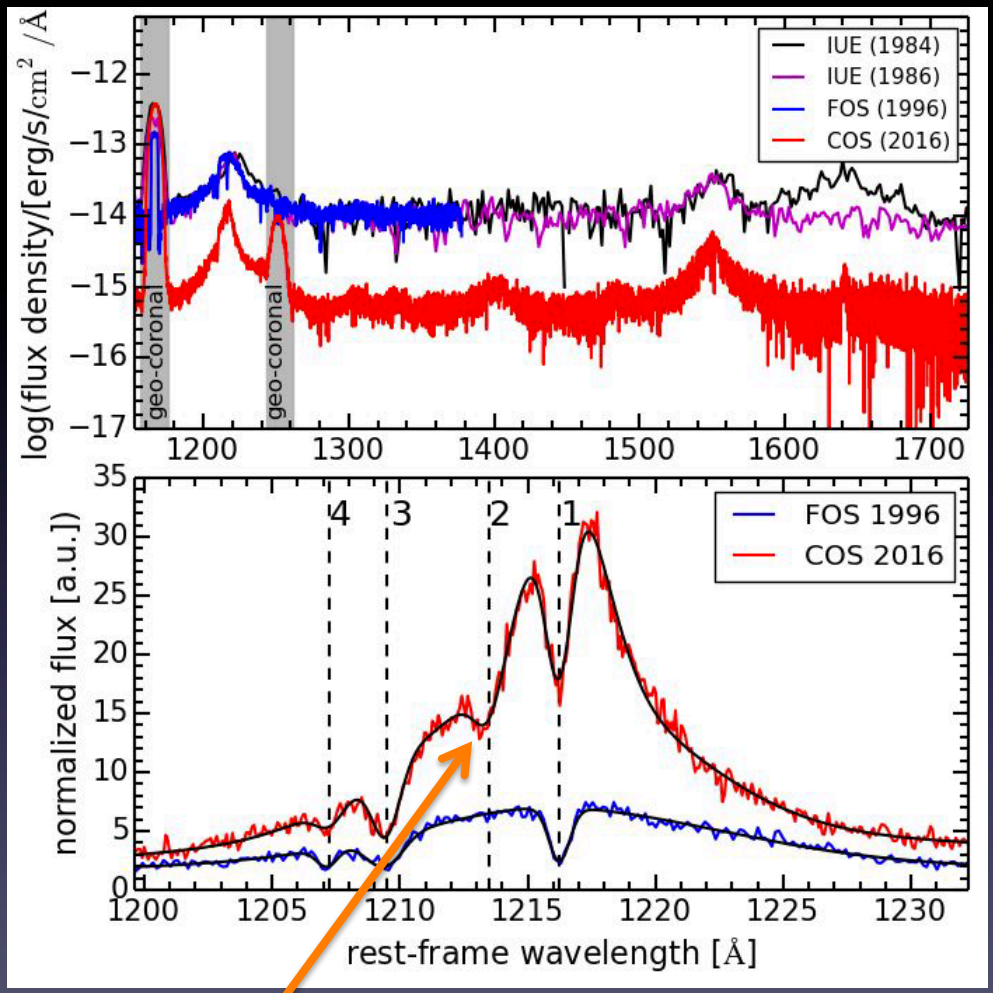
Husemann, TU, et al. 2016, 1st ref iter.

- Spectral models are almost identical, except for the normalization.
- Inconsistent with cloud obscuration

Accretion disk decline and FUV spectroscopy with HST (DDT)



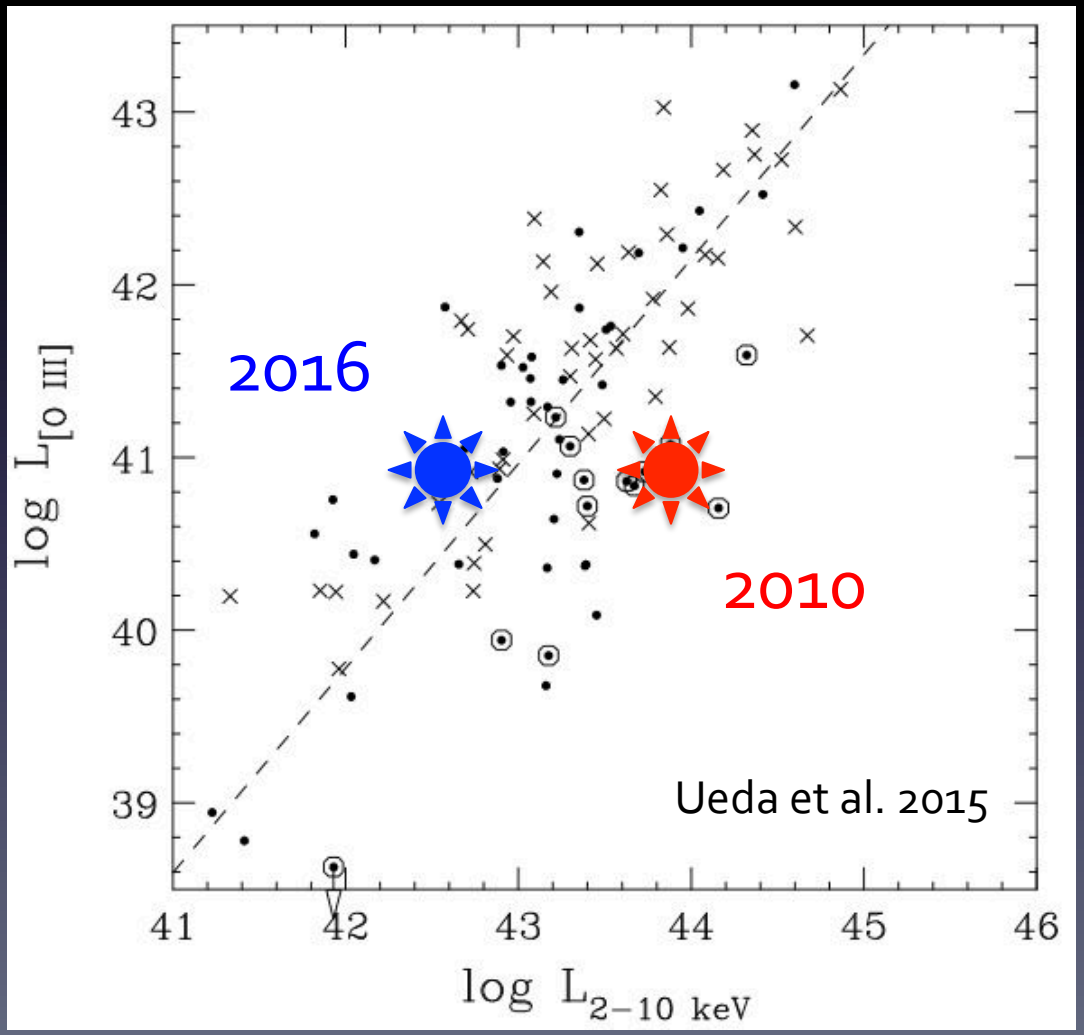
- Peak luminosity shifts by a factor of ~2 in wavelength
- Roughly consistent with L~T⁴ relation
- → support for (thin disc) accretion physics



Husemann, TU, et al. 2016

New narrow Lya absorber. Ignition of an outflow?

Accretion is a process!
AGN are not static objects



CARS is moving fast!

- We are building-up a unique multi-wavelength sample to study the AGN-host galaxy connection
- MUSE provides extraordinary data superior to any ongoing major IFS survey in terms of spatial resolution
- All data will be made public as reduced and high-level data products to the community *at some time*
- Collaboration is still open to new members!

➔ Check www.cars-survey.org and send us a mail