

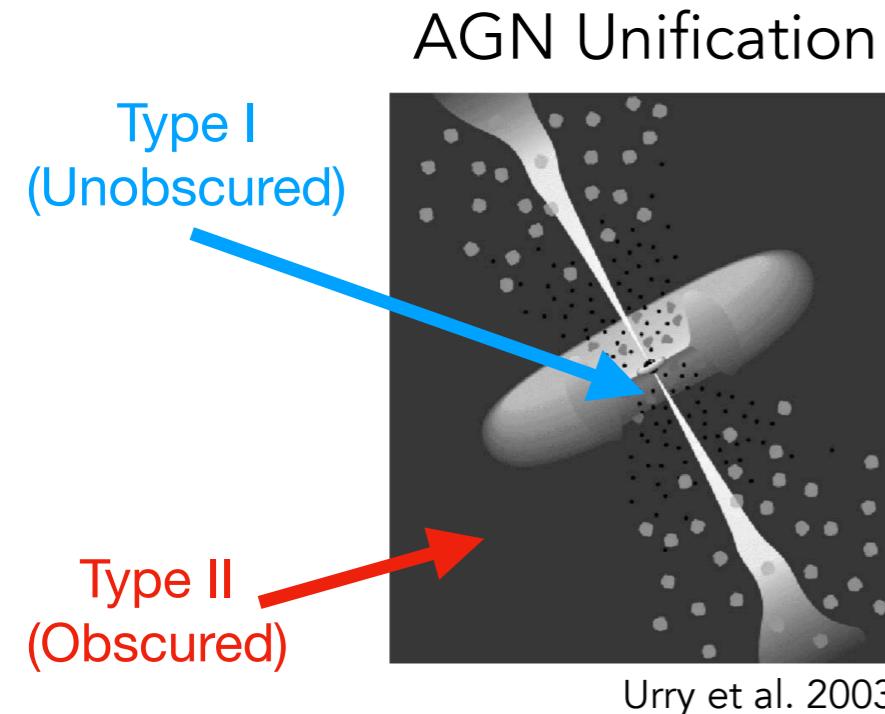


The Galactic Scale Effects of Active Galactic Nuclei

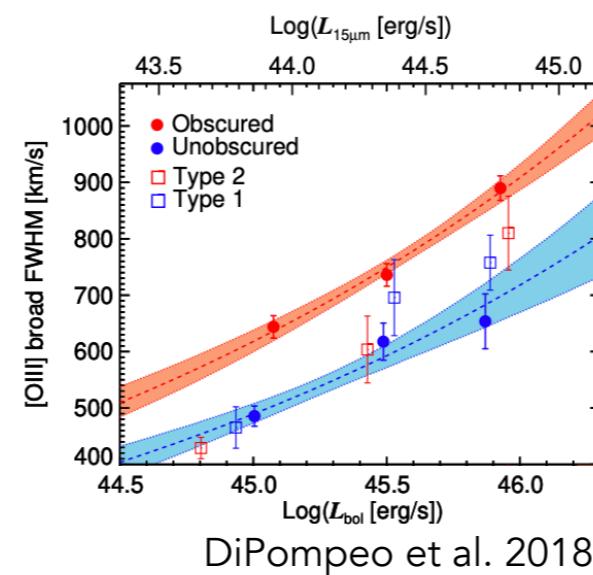
Fabry-Pérot observations of NGC 1068

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Petri Vaisanen(SAAO), Rajin Ramphul (SAAO, UCT)
Carl J. Mitchell (Rutgers)

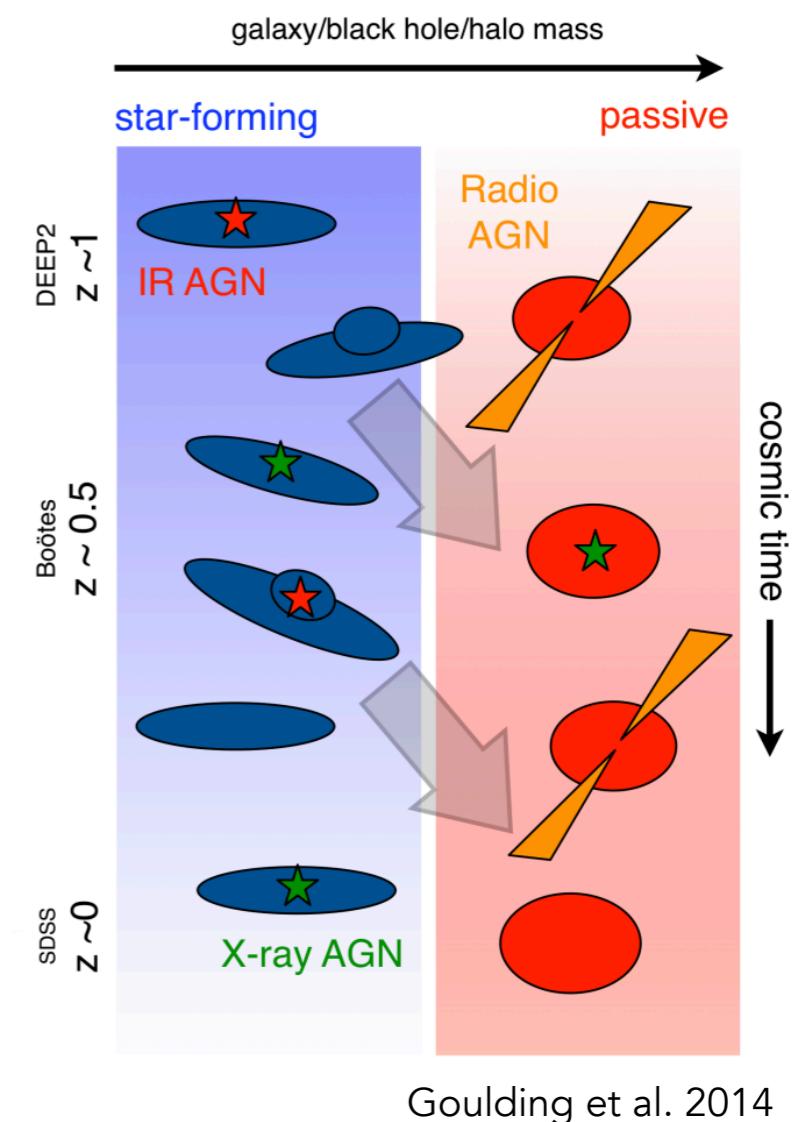
Obscured AGN: Insight into AGN Evolution



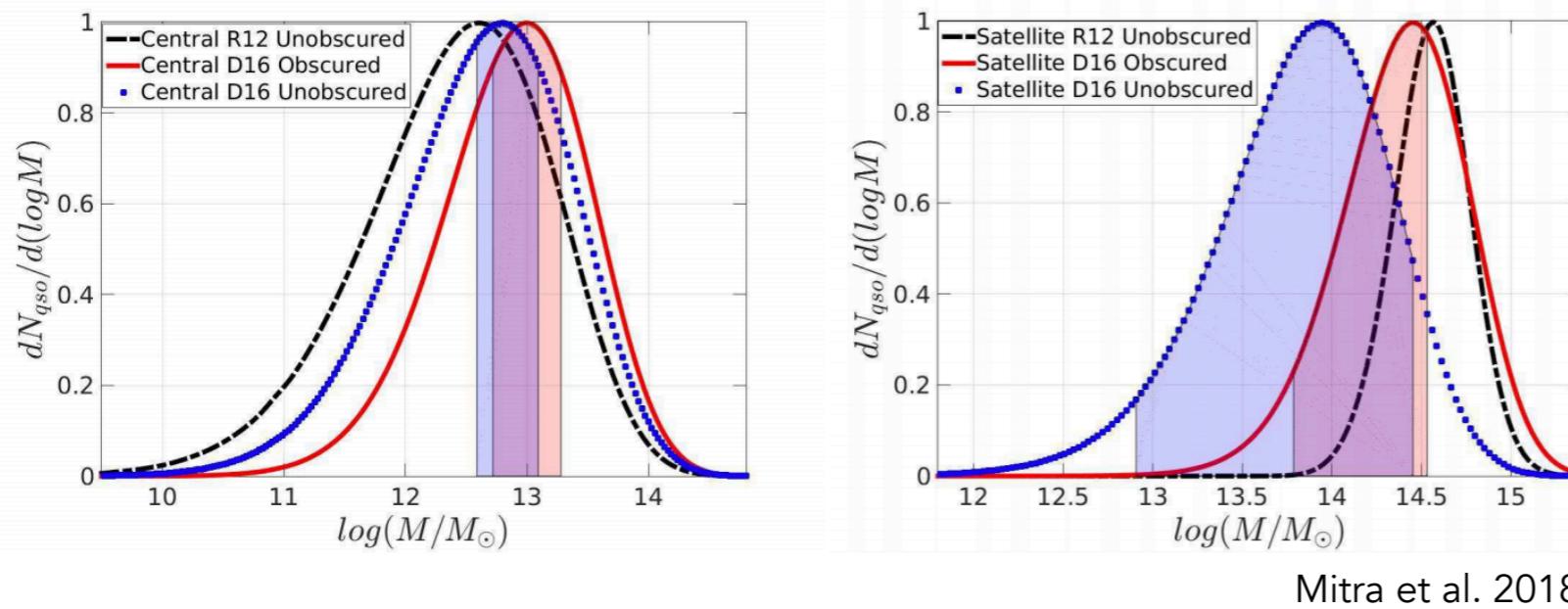
Type II AGN have more powerful outflows



Type II AGN may shed light on a “fueling mode” in the AGN evolutionary picture

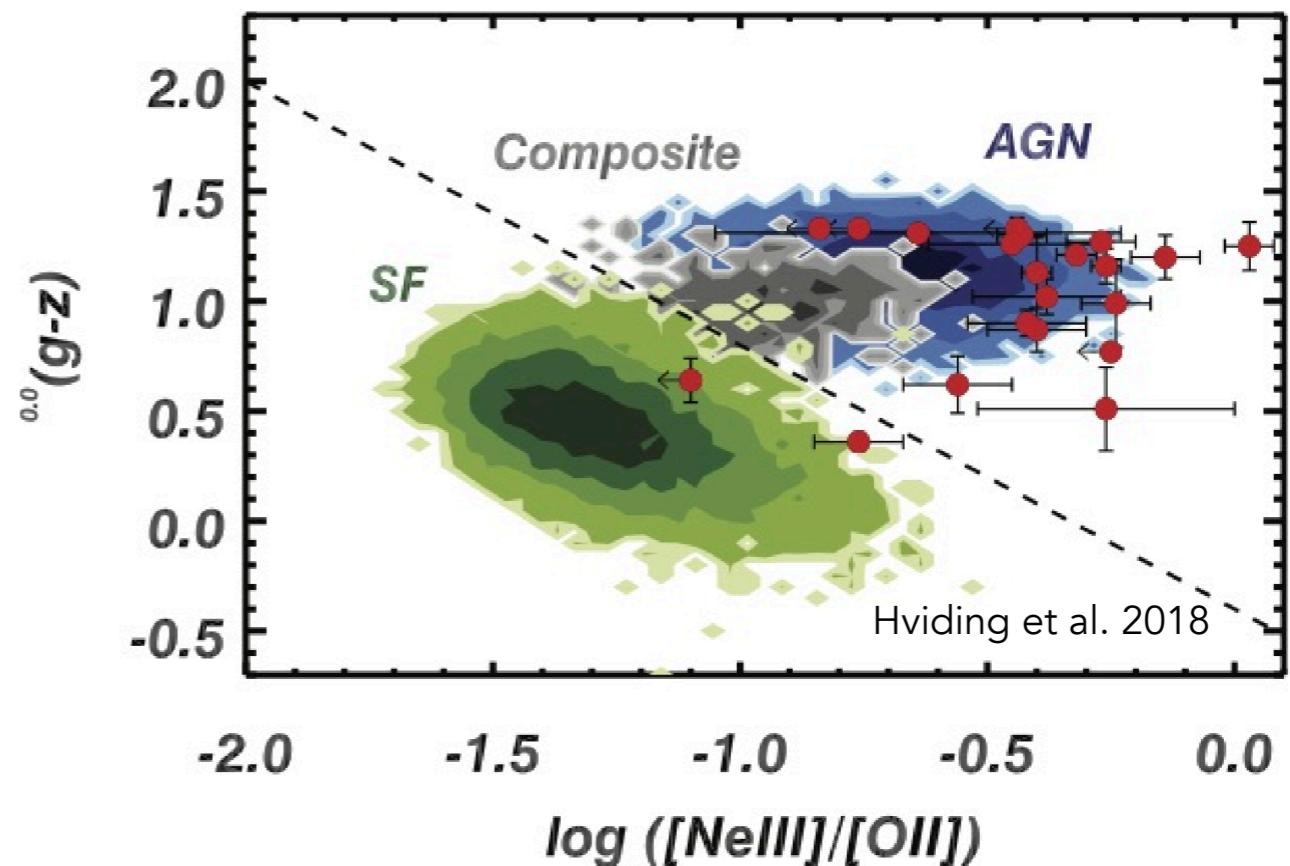


Type II AGN have different DM halo mass distributions



RSS: An Effective Tool to Study Type II AGN

- Study emission line ratios of large samples of AGN. (e.g. Hainline et al. 2014; Hviding et al. 2018)
- Used to characterize a bright subset of the extremely obscured quasar population.



SALT Queue based observing ideal for this study as we primarily wanted to find redshift and strong AGN lines, which can be done in a variety of conditions

RSS Fabry-Pérot on SALT

Advantages:

Large FOV (4' Radius)

Calibrated for use in:

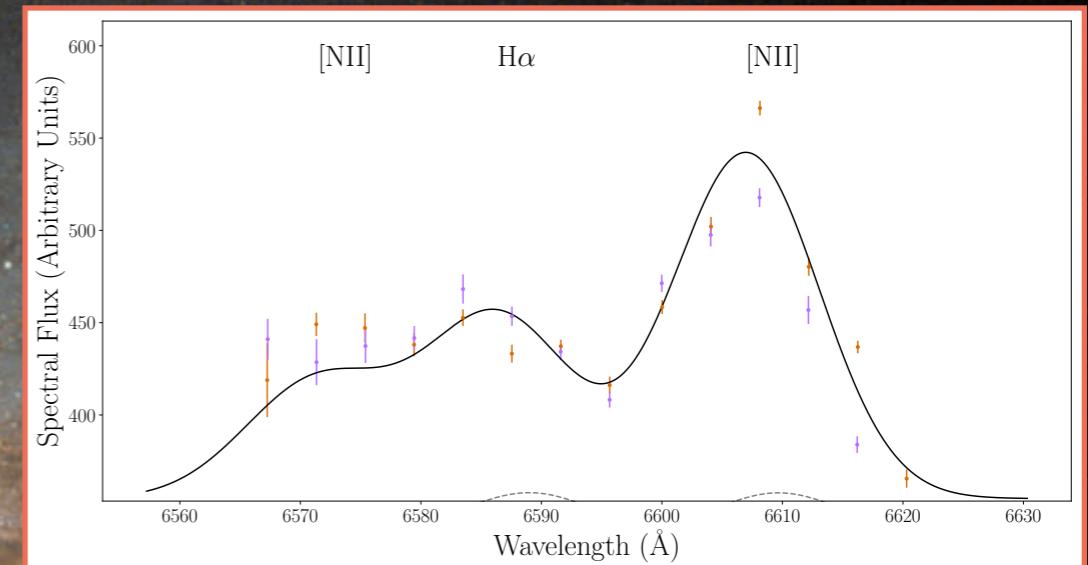
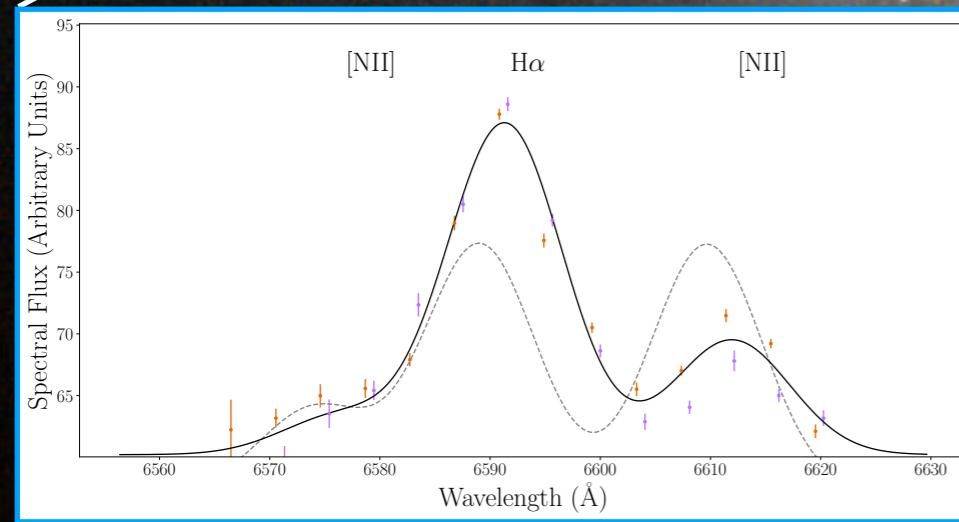
- 480 - 515 nm,
- 530 - 600 nm,
- 650 - 705 nm,
- 730 - 770 nm

LR mode can resolve nearby lines, e.g. [NII] from H α

Challenges & Opportunities:

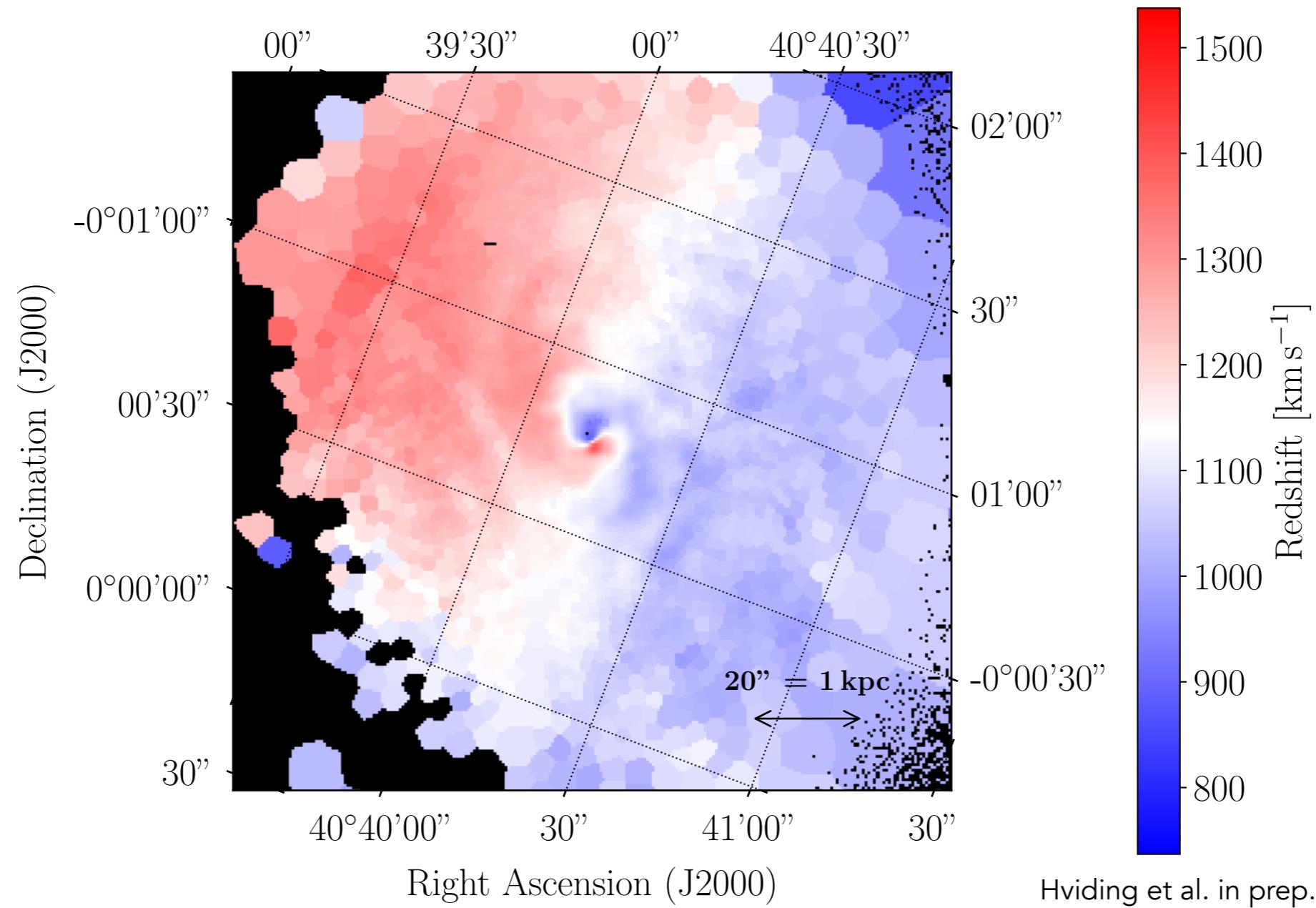
The wavelength solution is difficult to constrain without strong sky features

The available pipeline is incomplete and no longer maintained



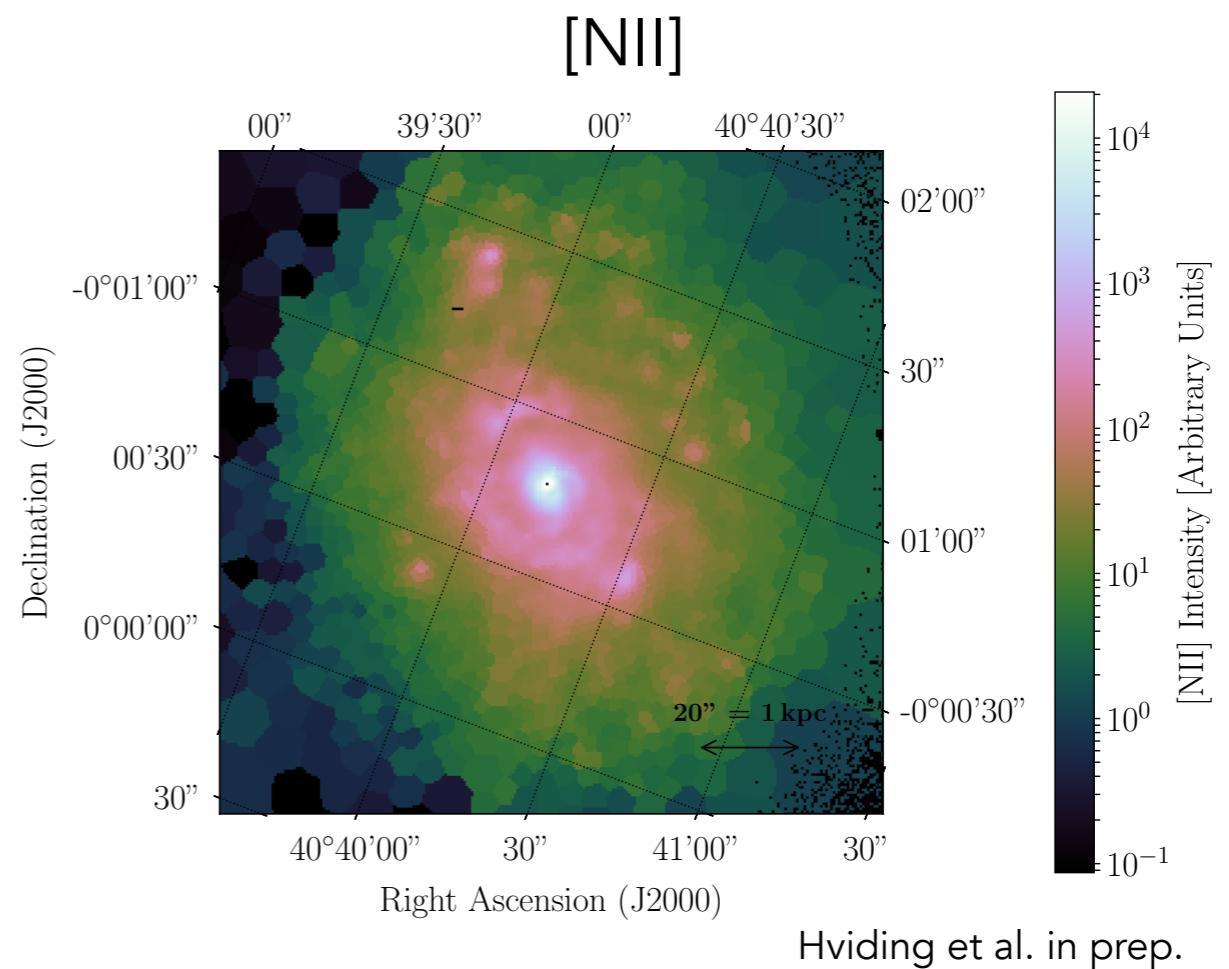
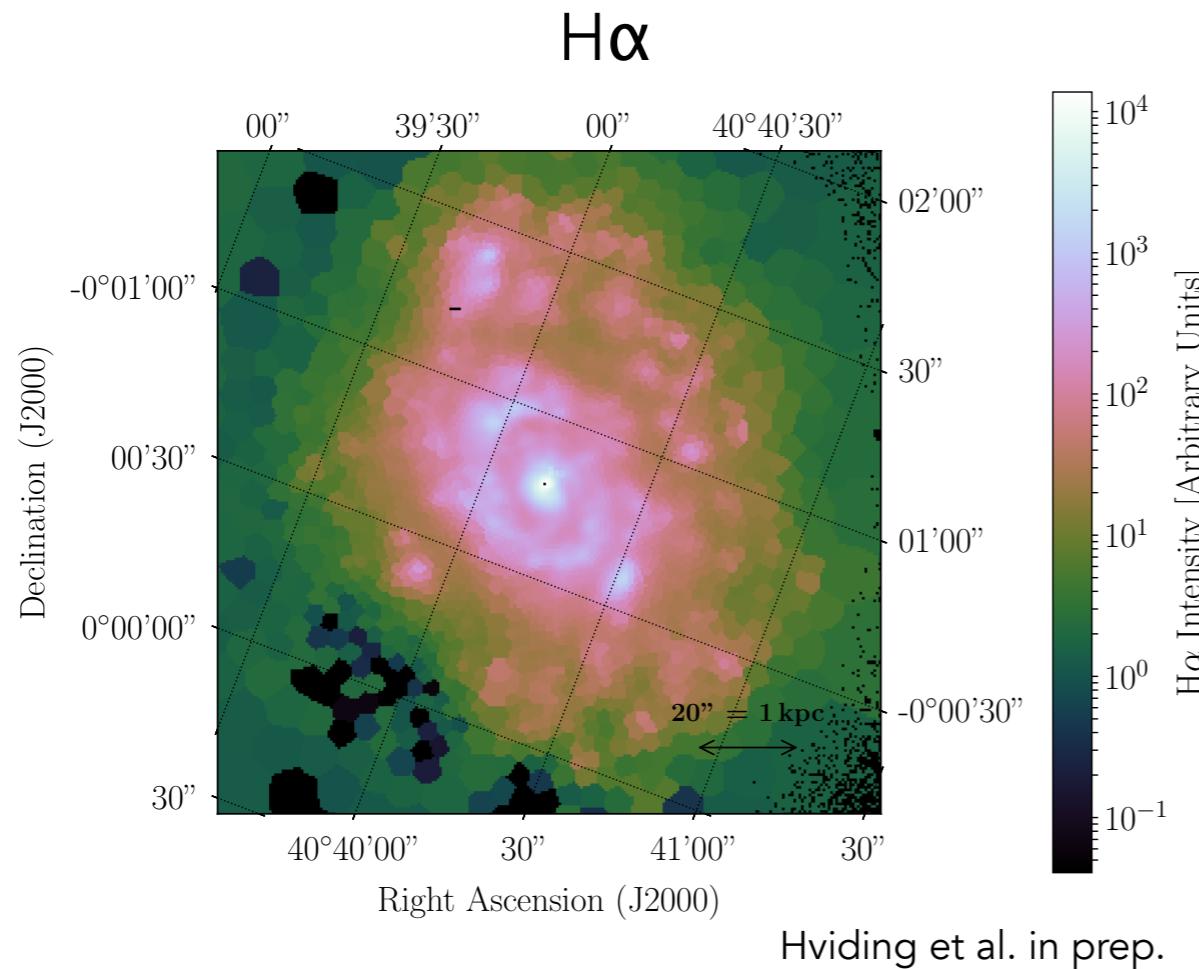
NGC 1068 Fabry-Pérot Results

Velocity Field



NGC 1068 Fabry-Pérot Results

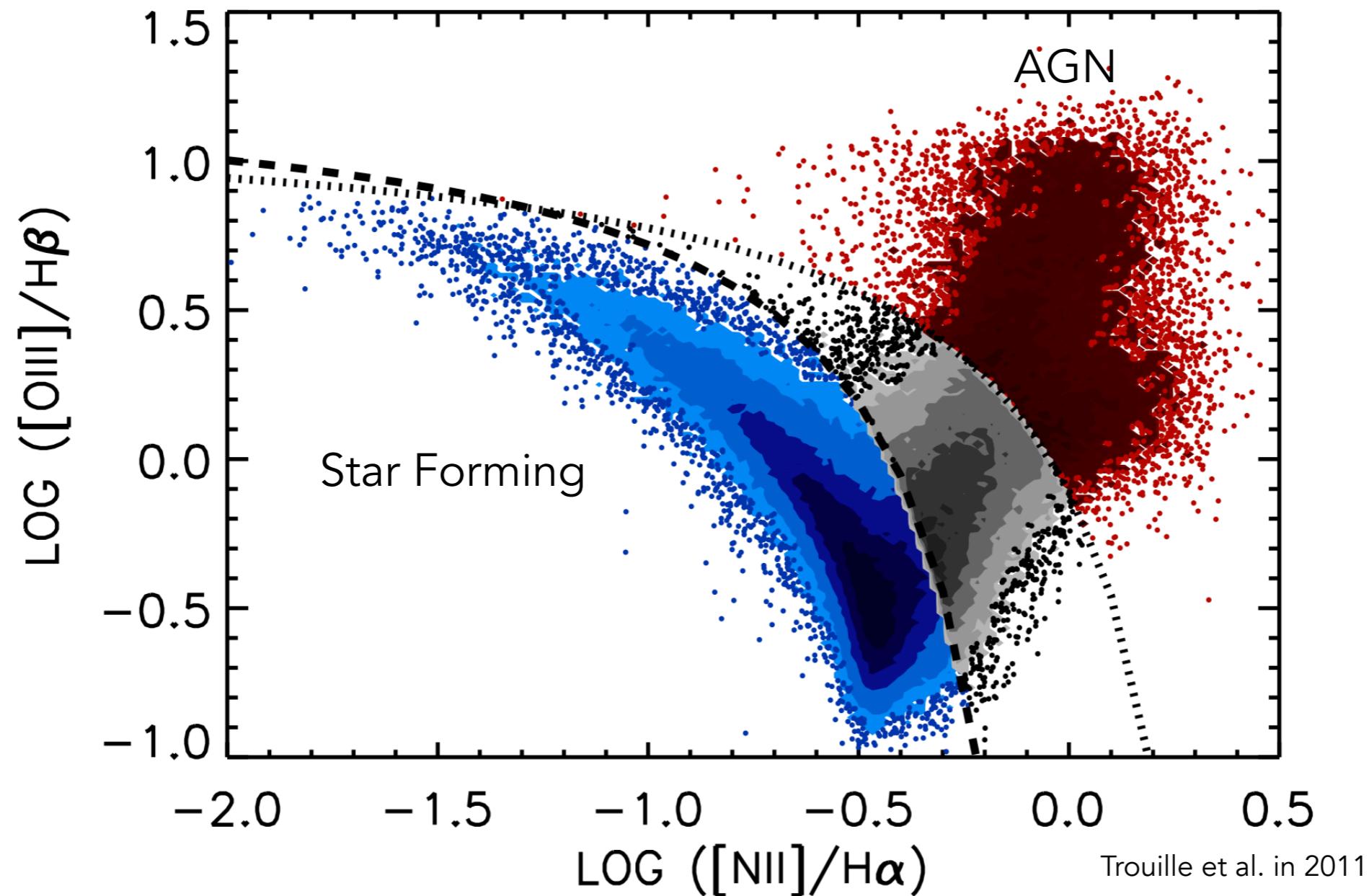
Emission Line Intensity Maps



Largest FOV resolved $\text{H}\alpha$ and [NII] maps of NGC 1068

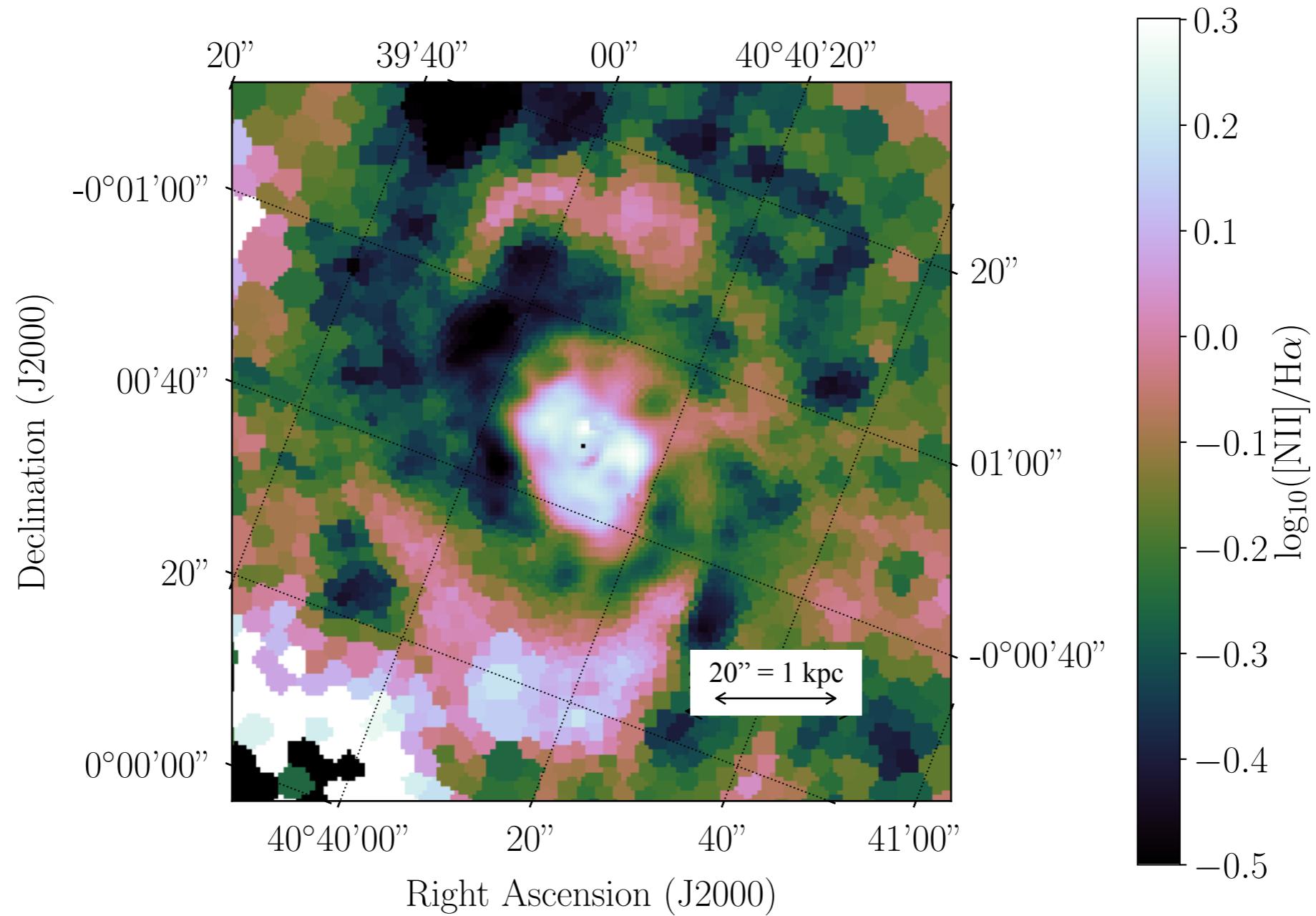
Line Ratios as an AGN diagnostic

Traditionally, AGN are classified using the Baldwin, Phillips & Terlevich (1981) Diagram



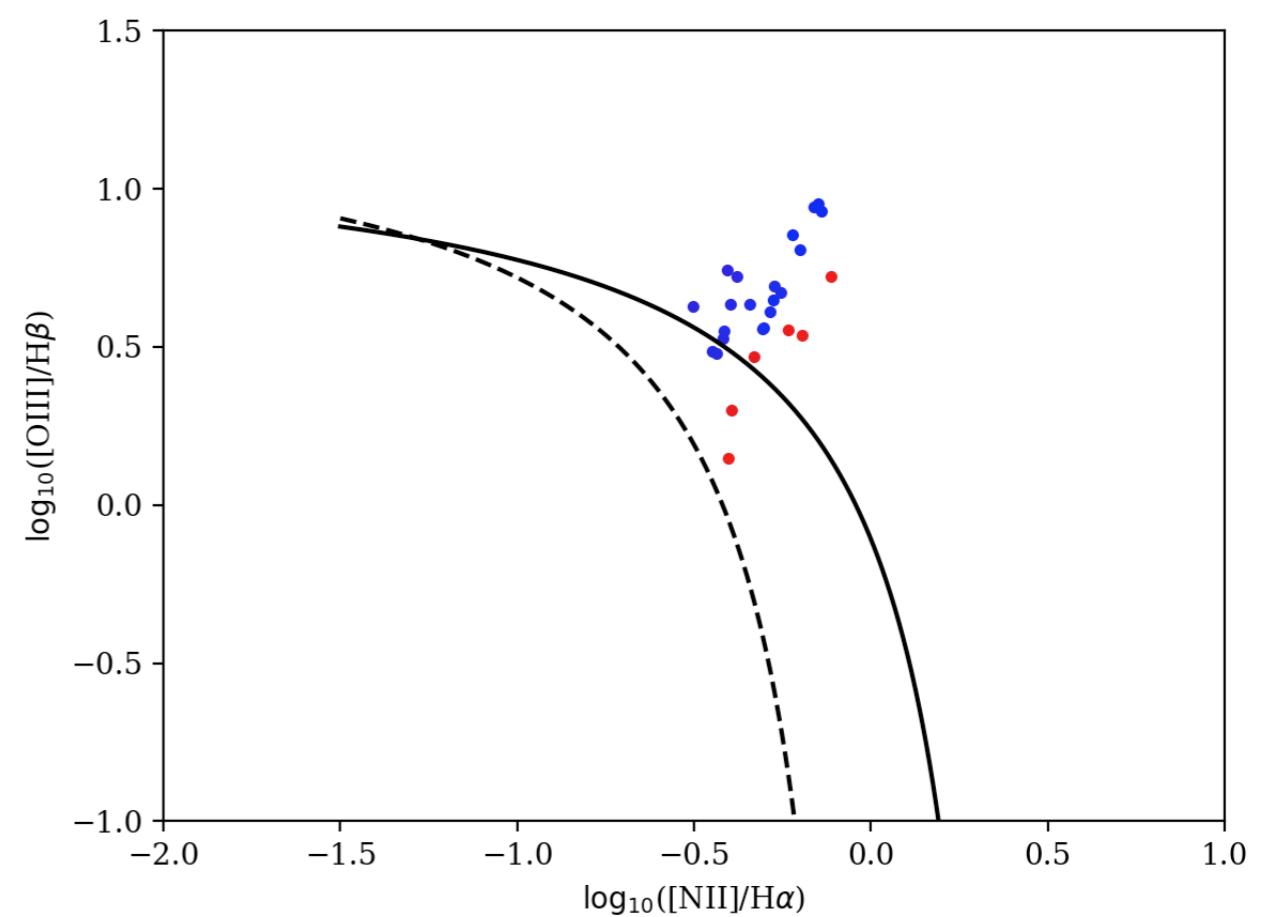
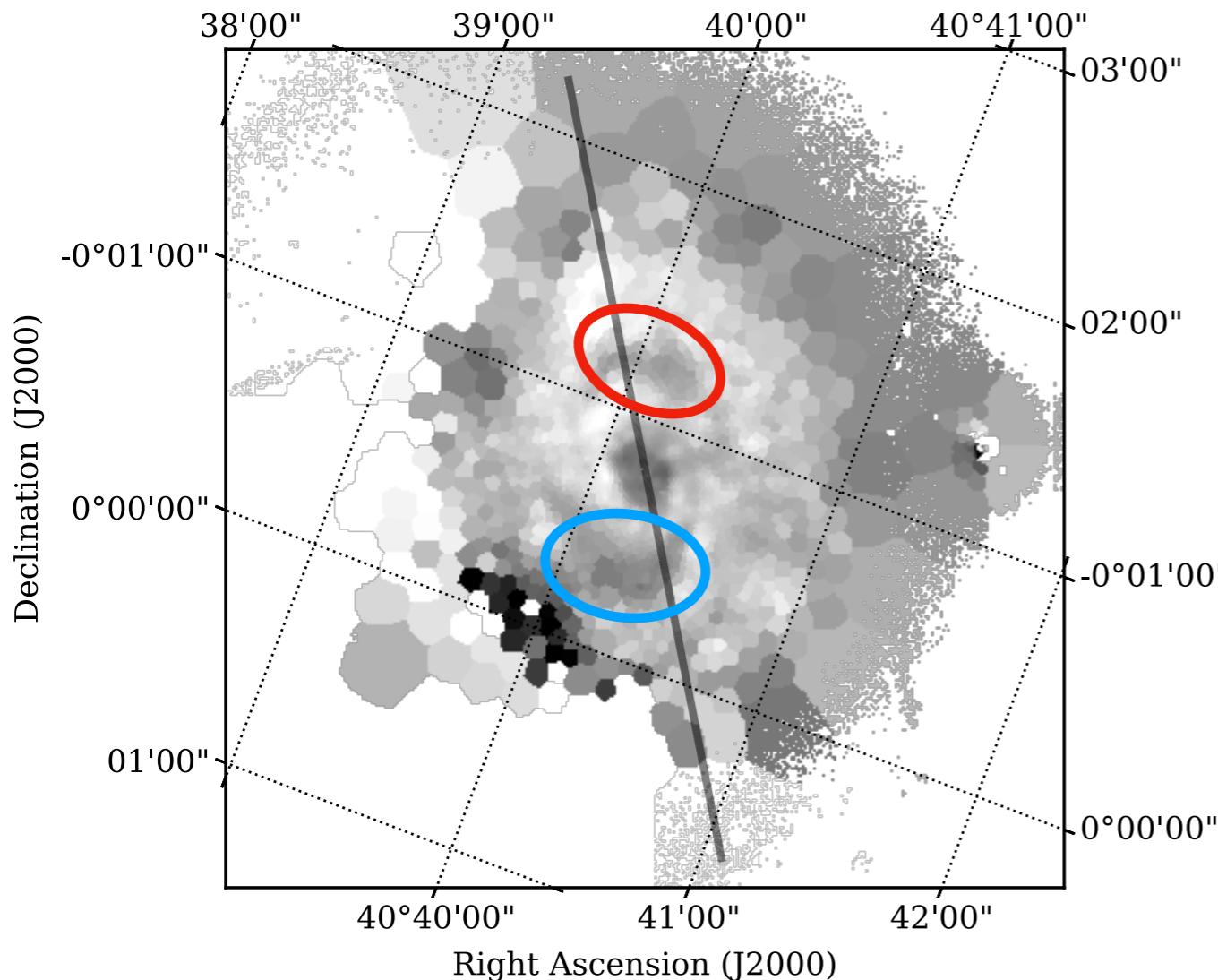
Trouille et al. in 2011

NGC 1068 Fabry-Pérot Results



Hviding et al. in prep.

Longslit Confirmation

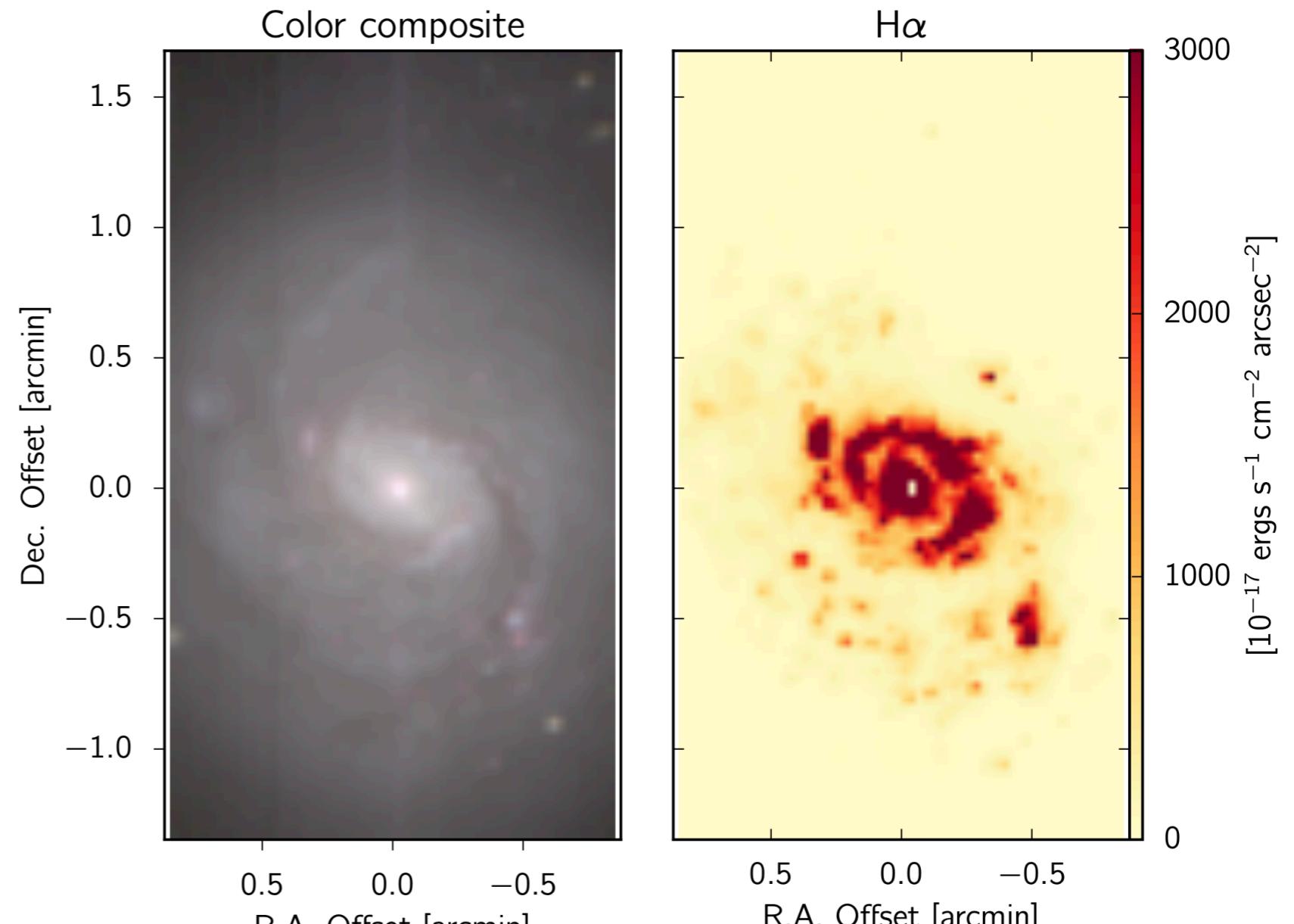


Hviding et al. in prep.

Longslit observations to constrain BPT y-axis ($\log_{10}([\text{OIII}]/\text{H}\beta)$)

TYPHOON PrISM Survey Results

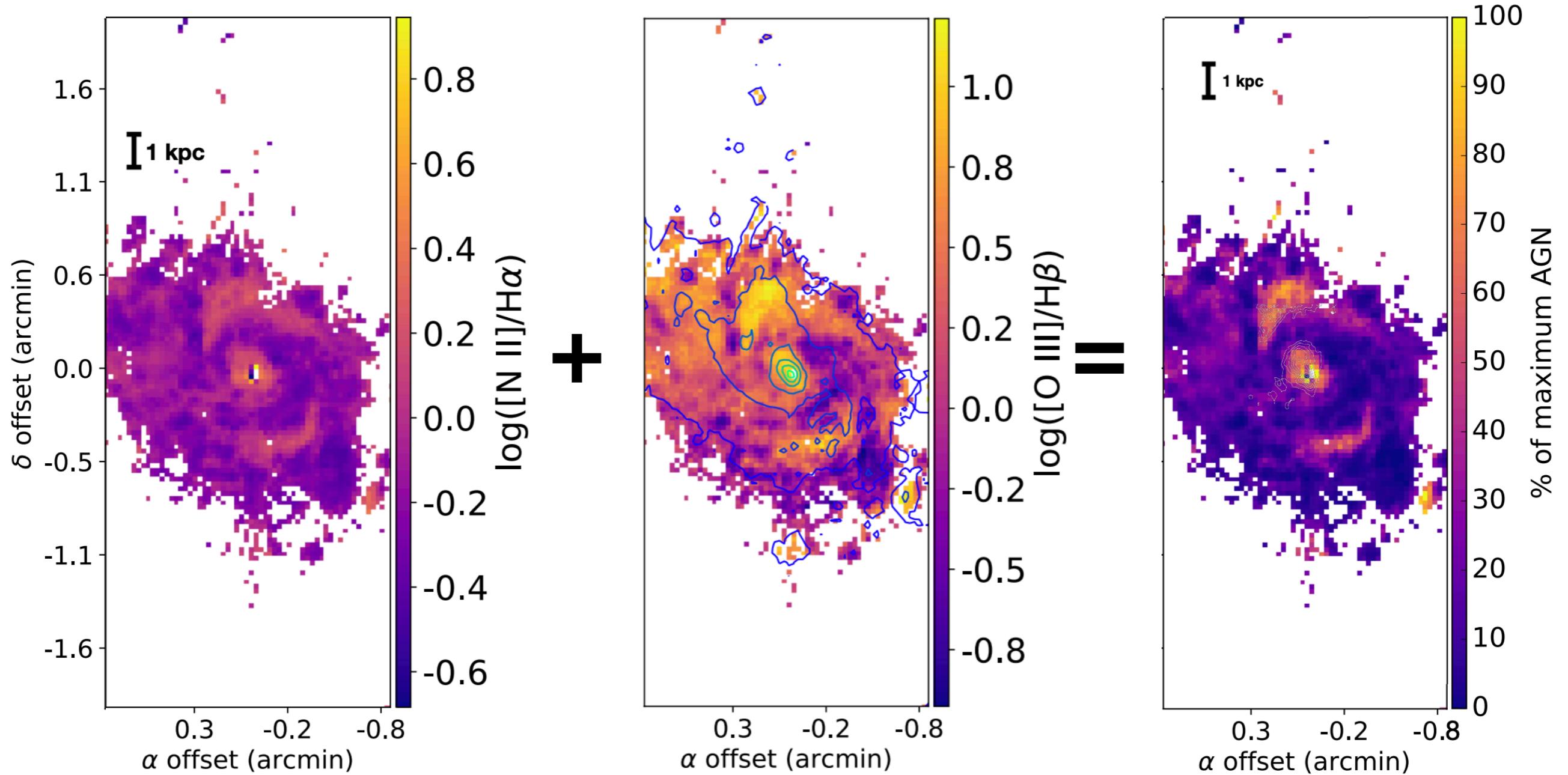
- Progressive Integral Step Method (PrISM)
Observations of the 100 closest and largest galaxies in the Southern Hemisphere
- 2.5m duPont telescope
at Las Campanas Observatory
- These are first results,
further details are forthcoming.



D'Agostino et al. 2018

TYPHOON PrISM Survey Results

The same ionization features are observed

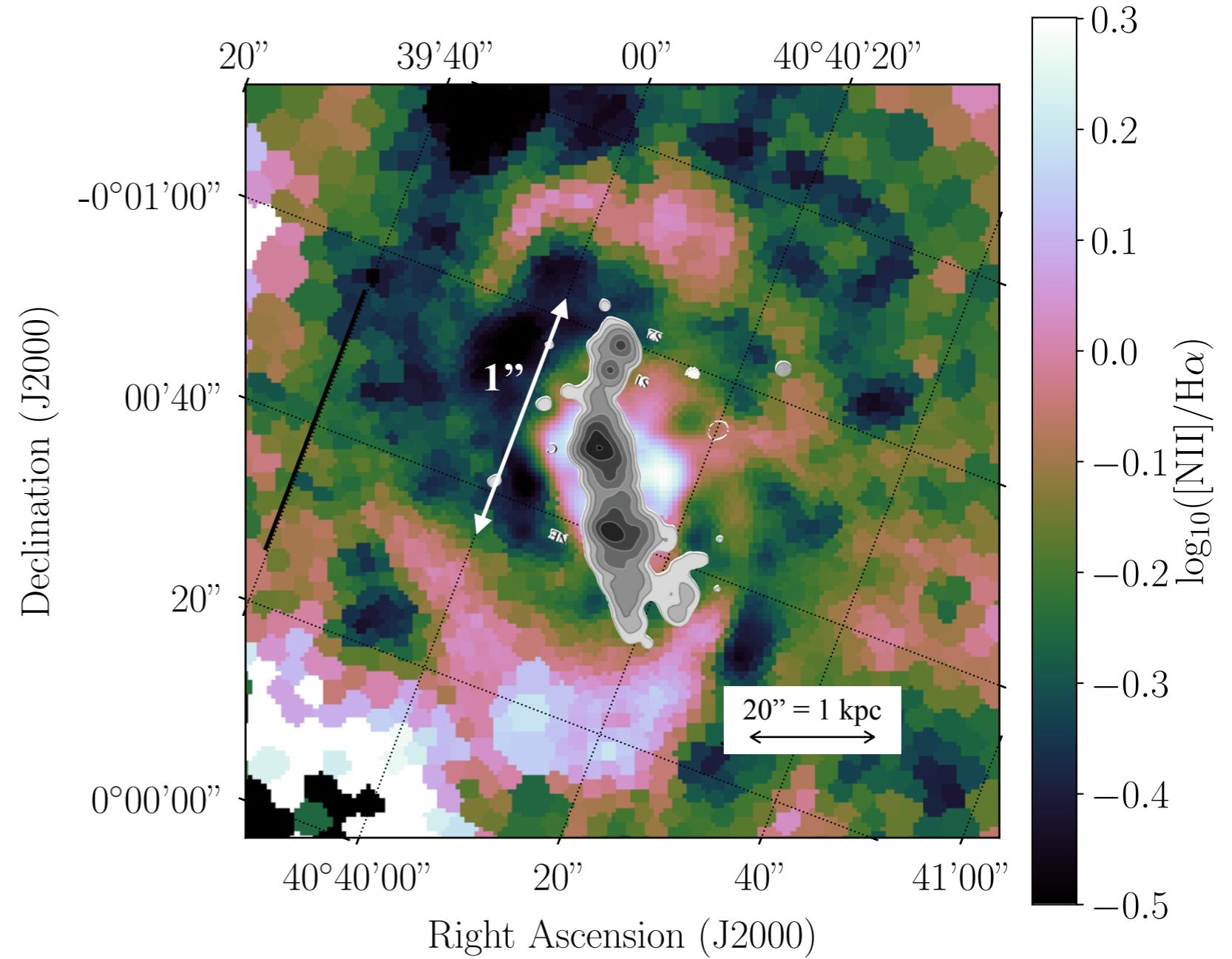


D'Agostino et al. 2018

Ionization Features as Outflows

Evidence:

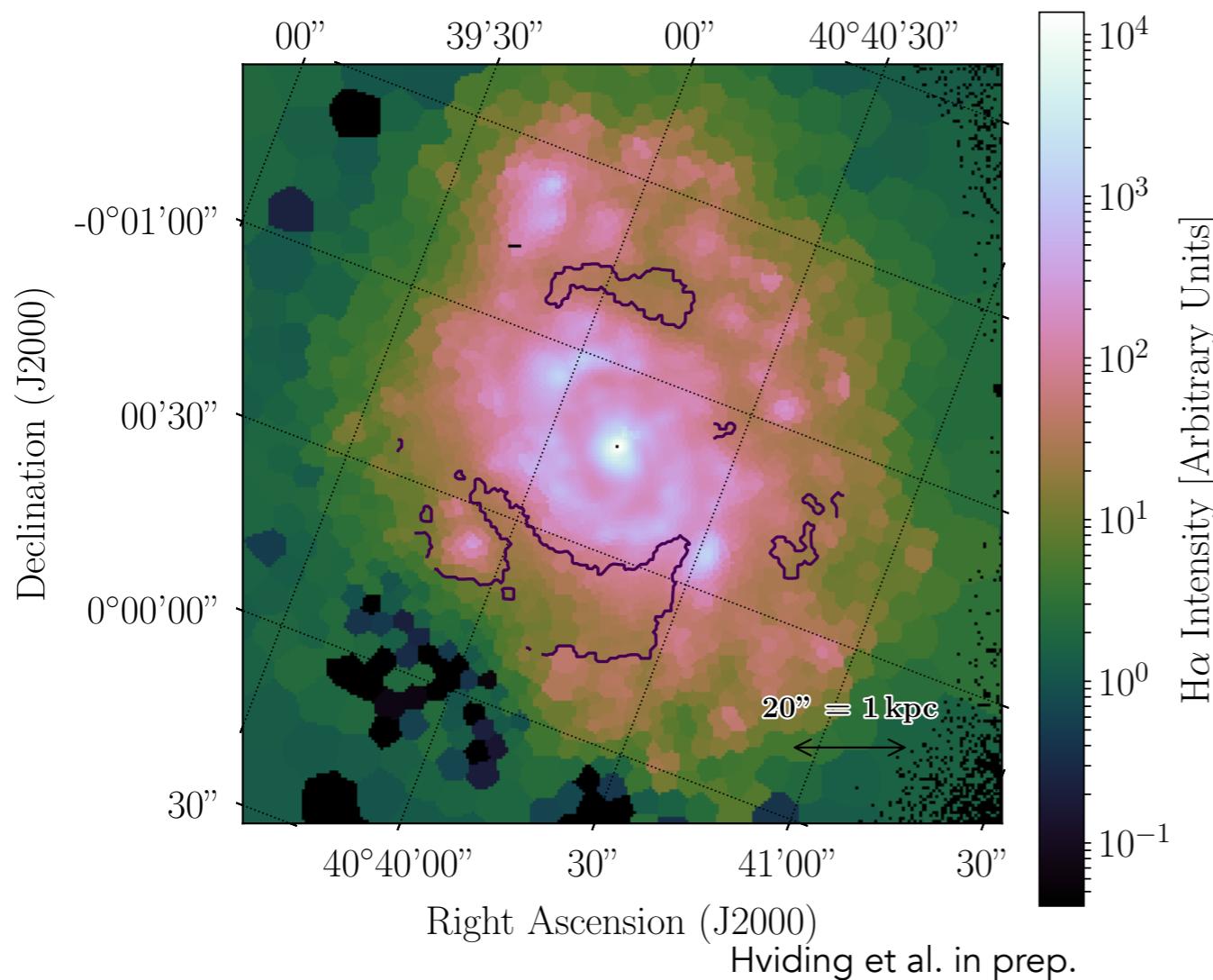
- High ionization parameters in both features, consistent with an AGN from the BPT
- D'Agostino et al. 2018 argue that the features are consistent with radio jets/lobes
- **Not** to scale, about 30X smaller than shown



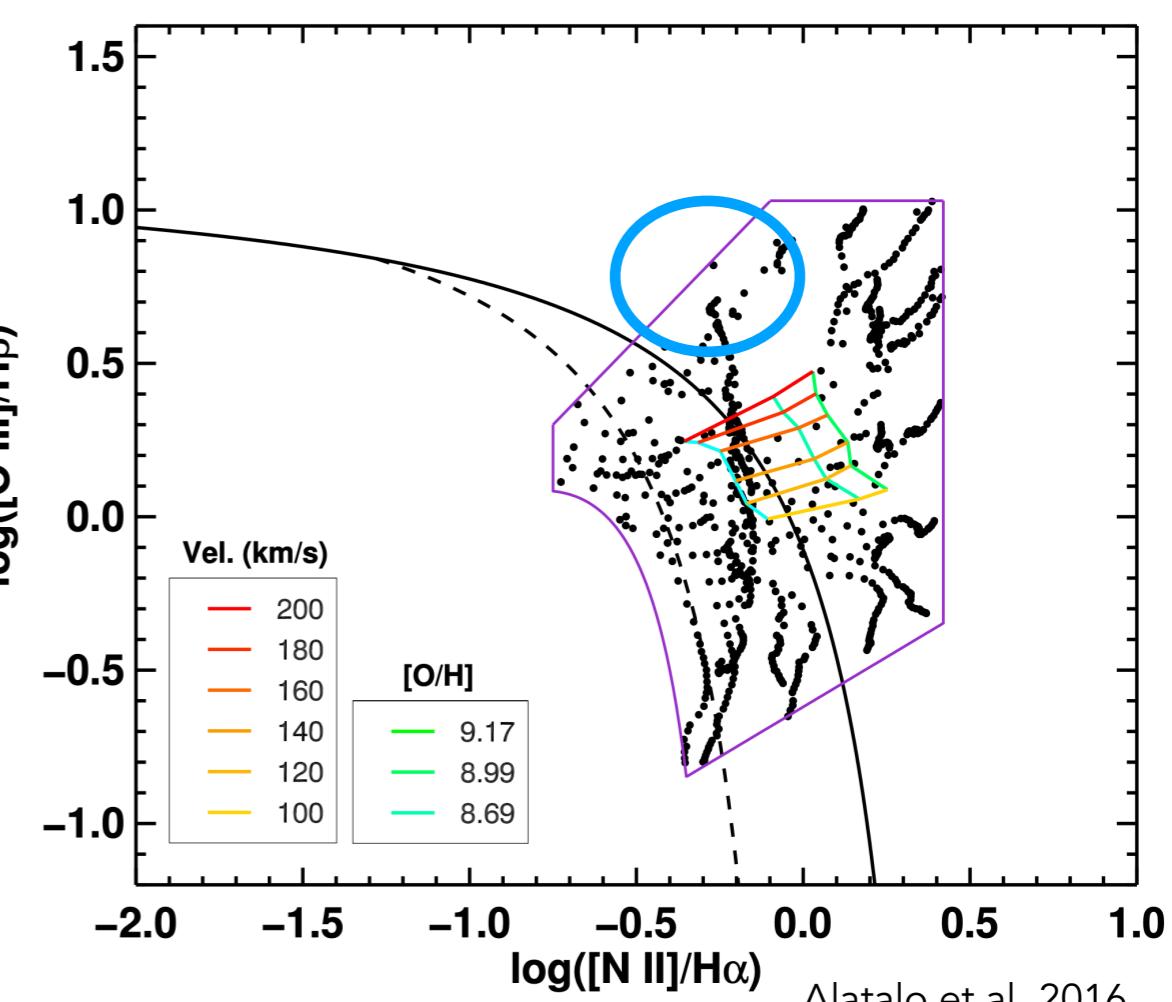
Ionization Features as Outflows

Problems

No excess emission in H α , unlikely to be gas that has been pushed out to this radius



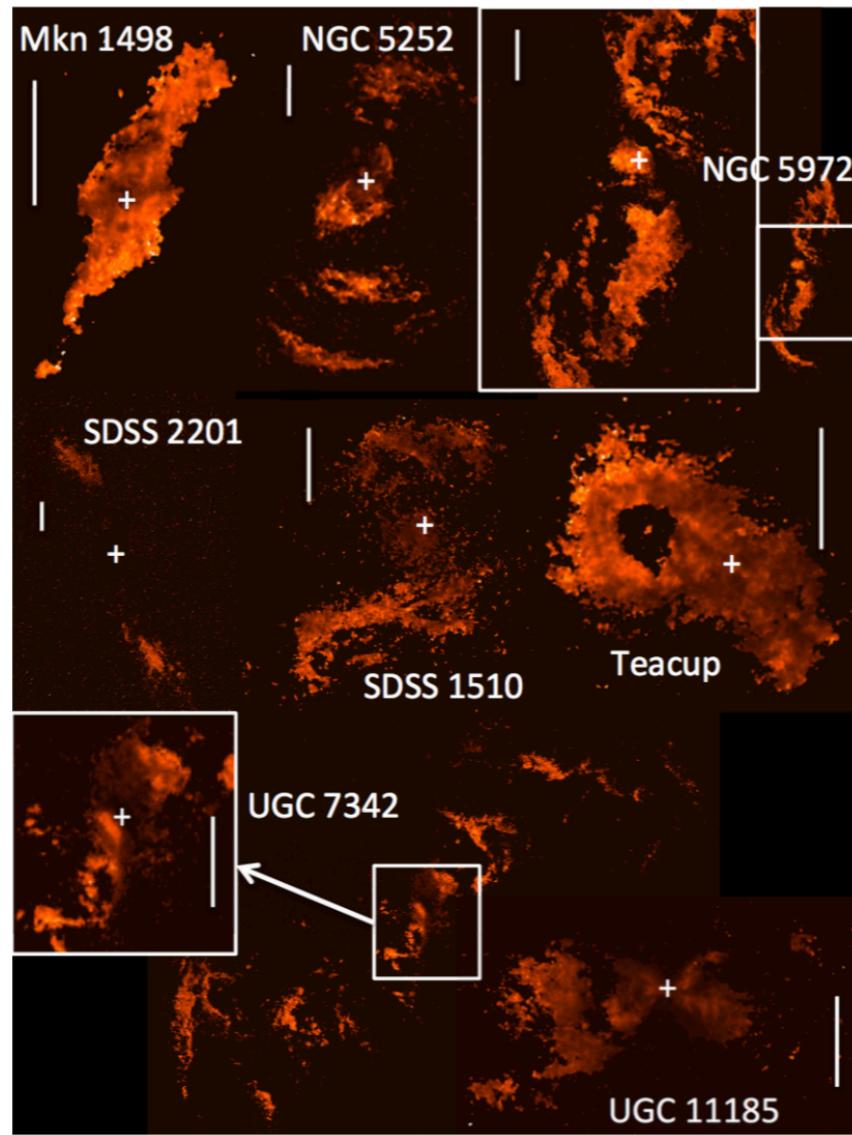
[OIII]/H β to [NII]/H α diagnostic may not be consistent with shock ionization



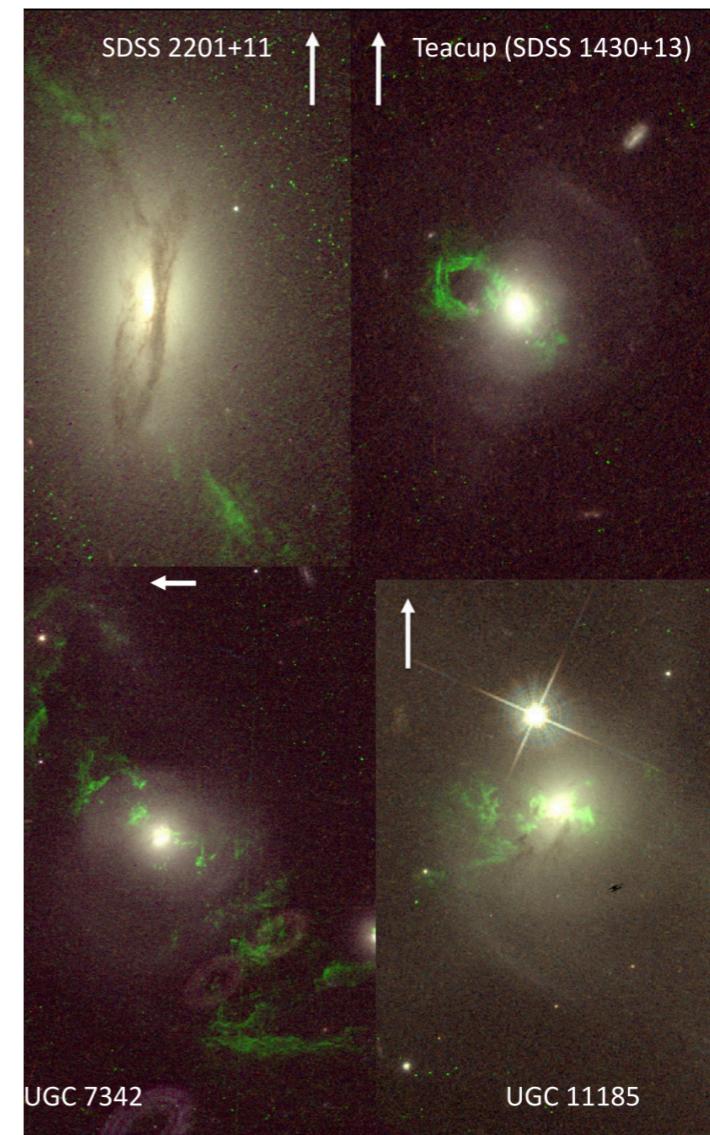
An Alternate Interpretation: Light Echoes

Light echoes have been observed in AGN to characterize fading AGN candidates

AGN light echoes may shed light into the characteristic timescales of mass accretion and AGN evolution



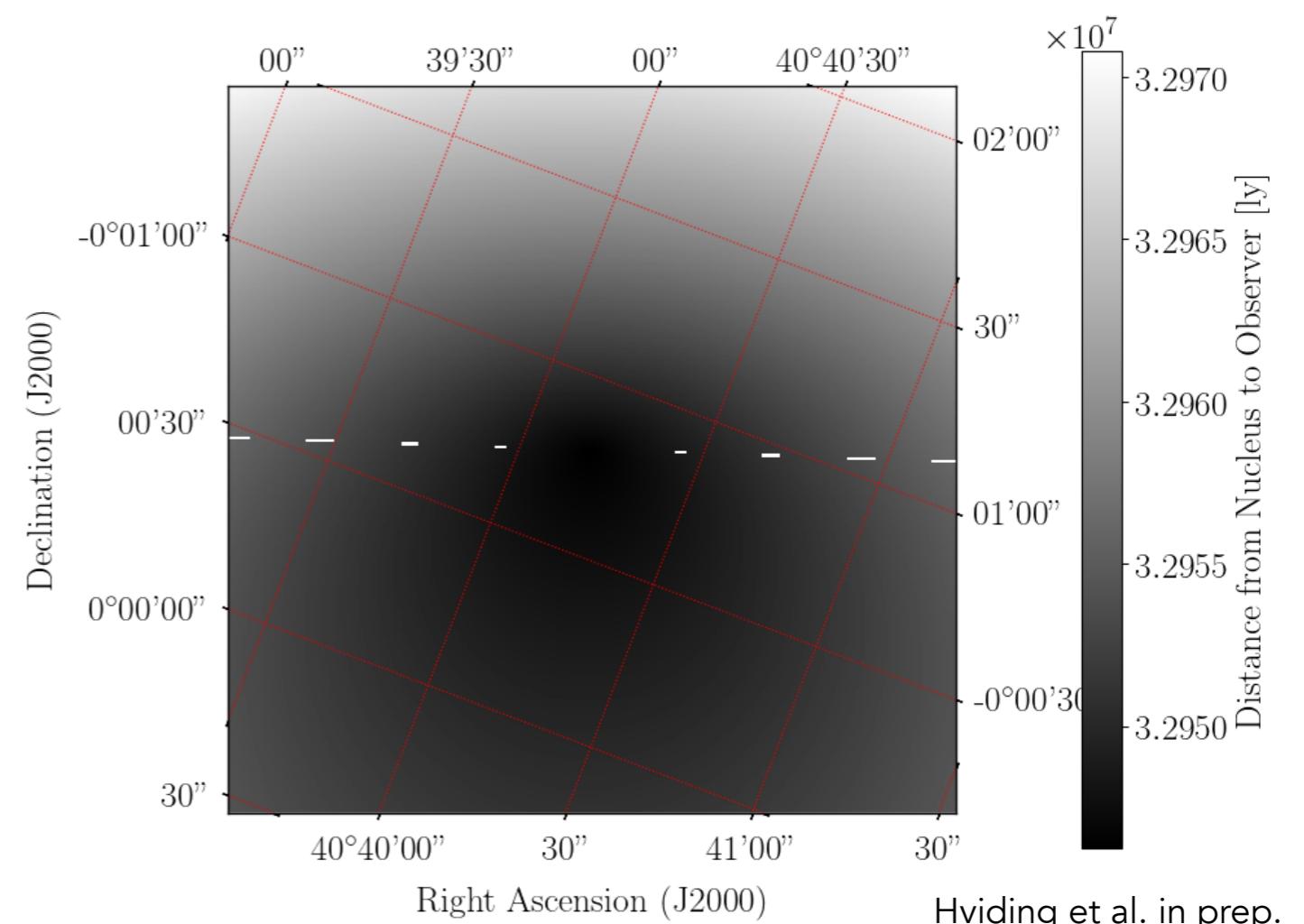
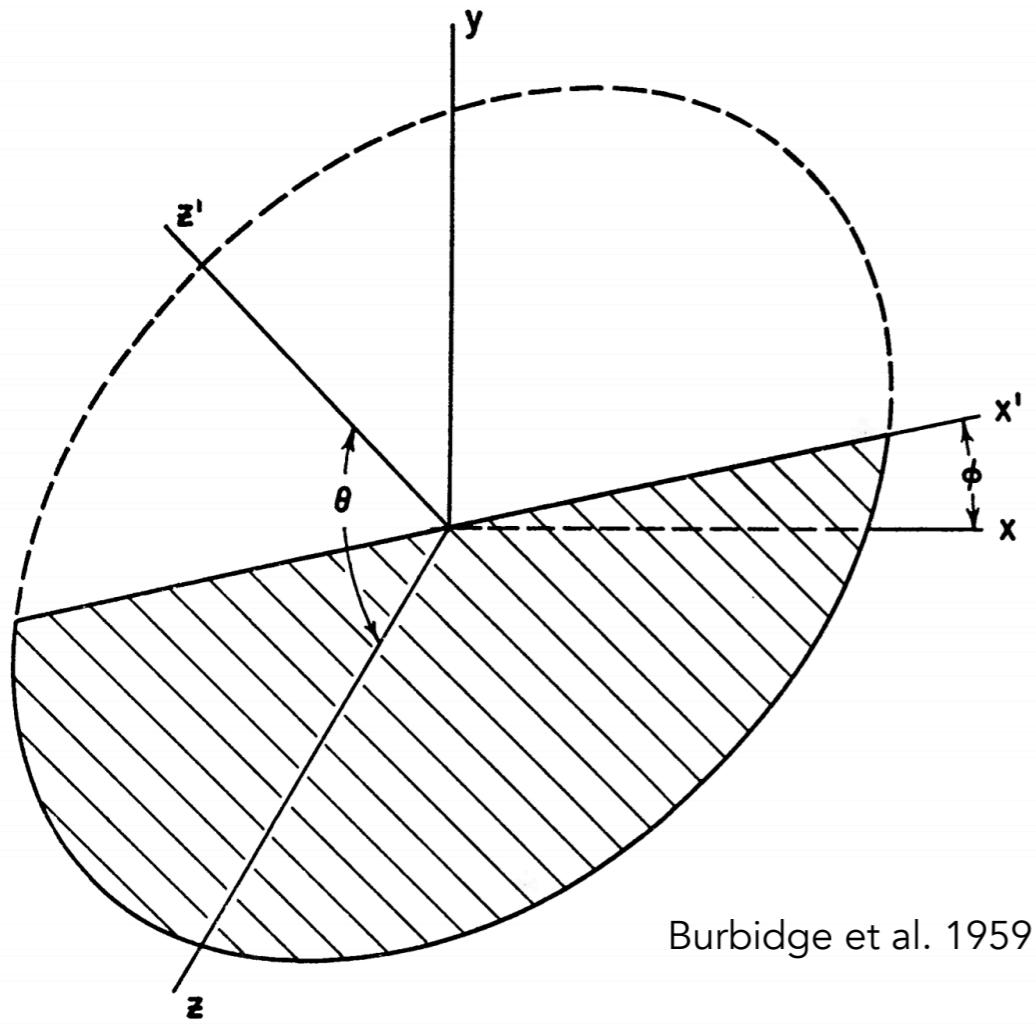
Keel et al. 2016



Yang et al. 2018

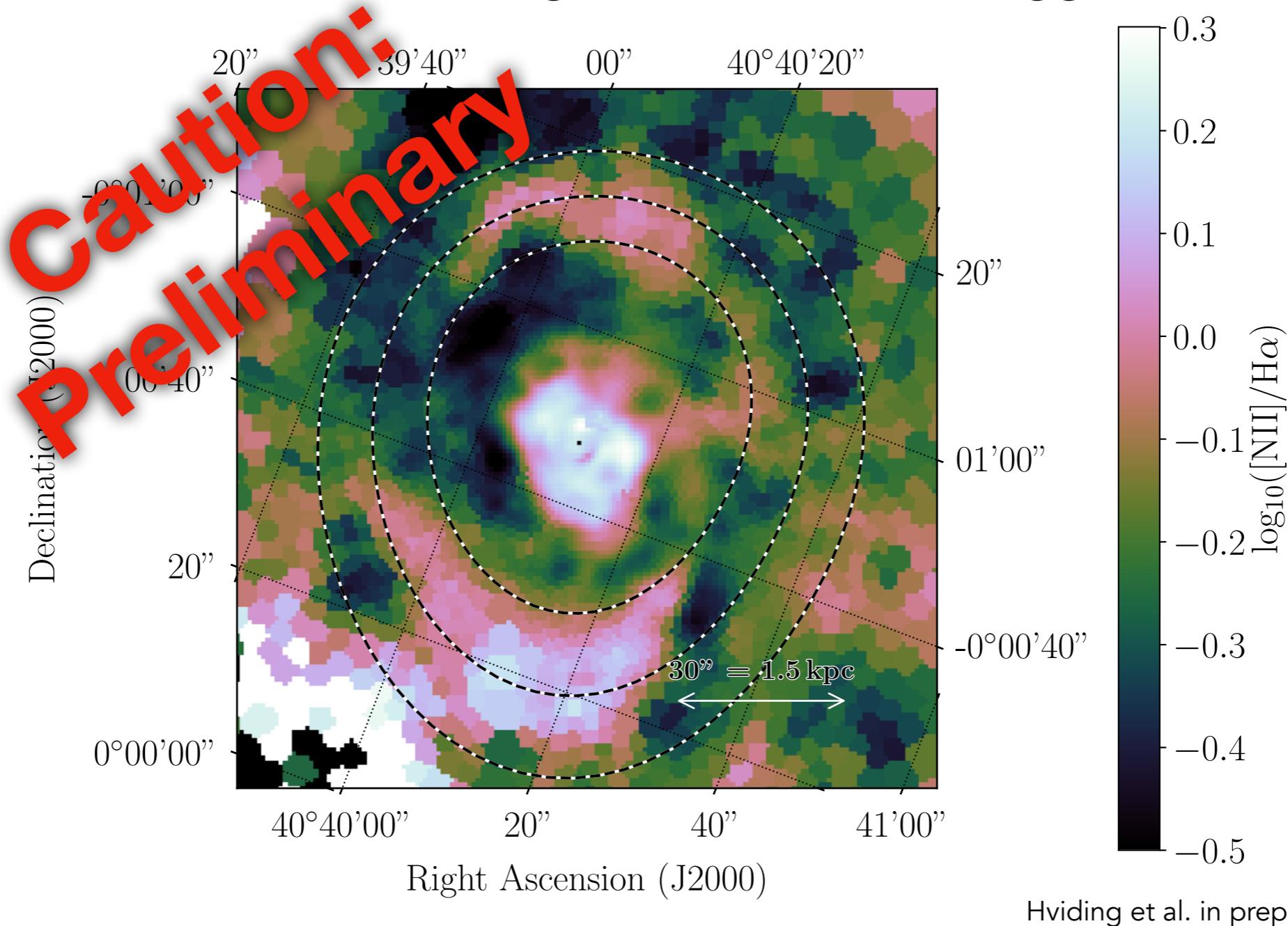
An Alternate Interpretation: Light Echoes

De-projecting and de-lagging NGC 1068



An Alternate Interpretation: Light Echoes

Lines of constant light travel time (de-lagged)



Conclusions & Questions

Conclusions:

RSS Fabry-Pérot successful for studying large nearby sources

Ionization features in NGC 1068 may be evidence for light echoes rather than outflows.

The ionization features will shed light on AGN evolution and the role of Type II sources

Opportunities for Future Work

Completing and maintaining the existing FP pipeline with SALT

Distinguishing between shock ionization and photoionization

Quantifying the inclination of NGC 1068 to constrain de-lagged physical distances to nucleus