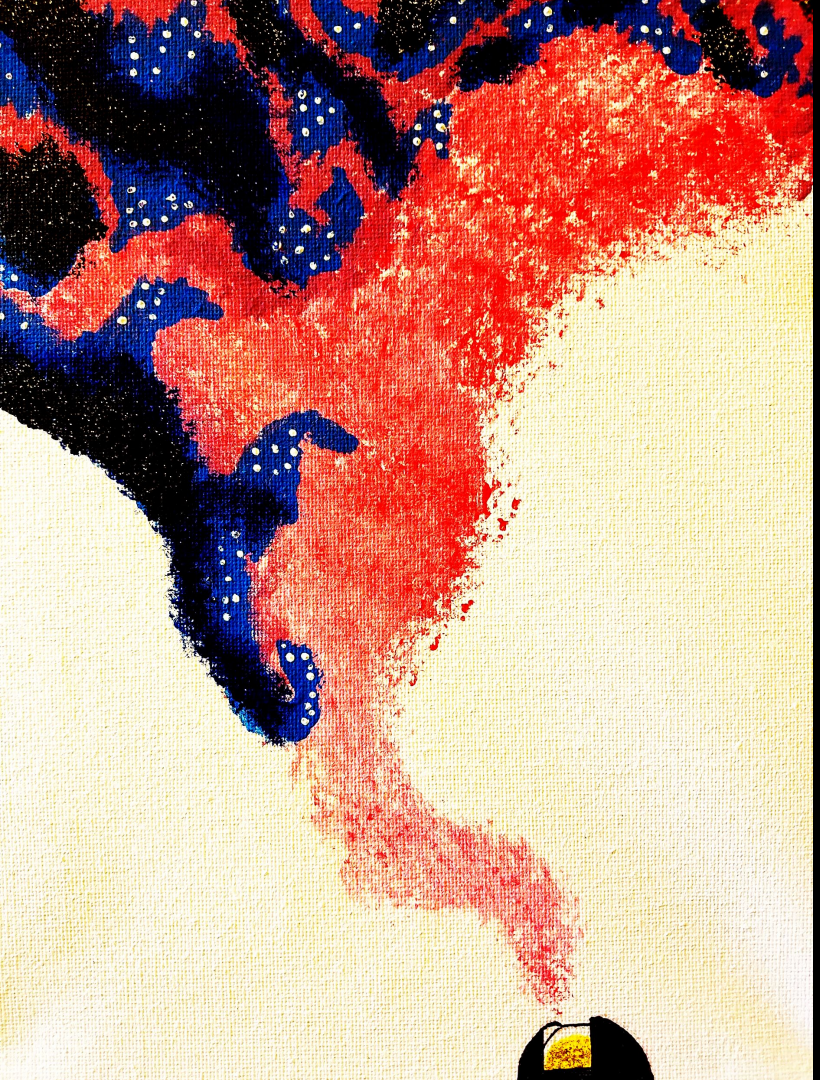

Rebecca Nevin, CU Boulder, NSF GRFP
Julie Comerford,
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Moderate Luminosity AGN as Drivers of Feedback

Outline

Introduction 1

The Sample 2

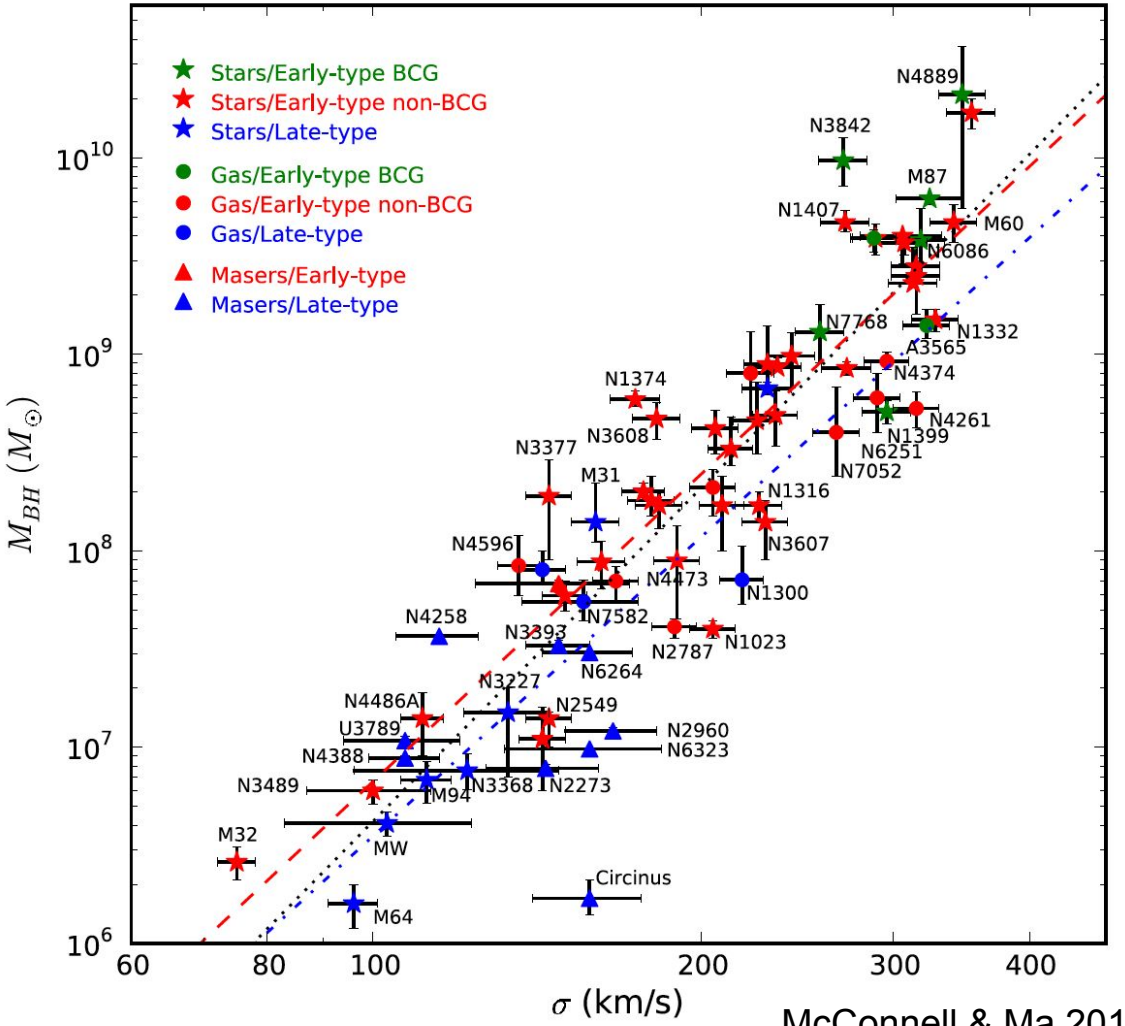
Modeling AGN Outflows 3

Outflow Impact on Host Galaxies 4

1.

Introduction

AGN scaling relations require a mechanism for feedback

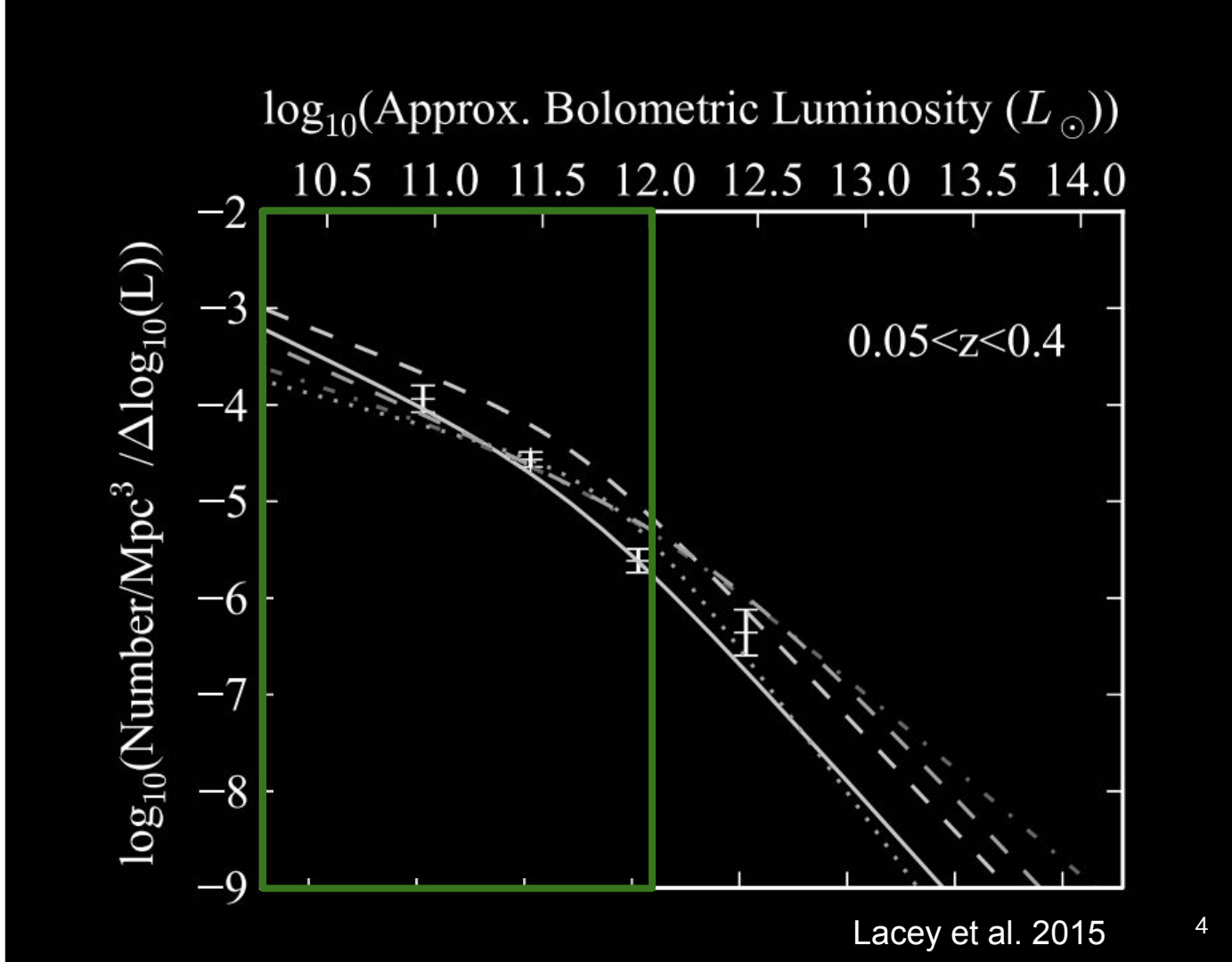


McConnell & Ma 2013

1.

Introduction

Moderate luminosity AGN are common

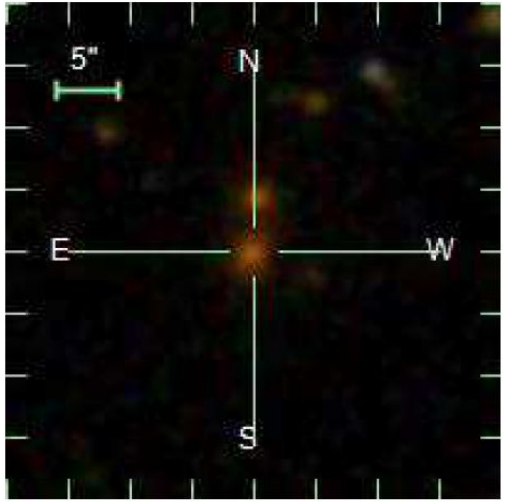


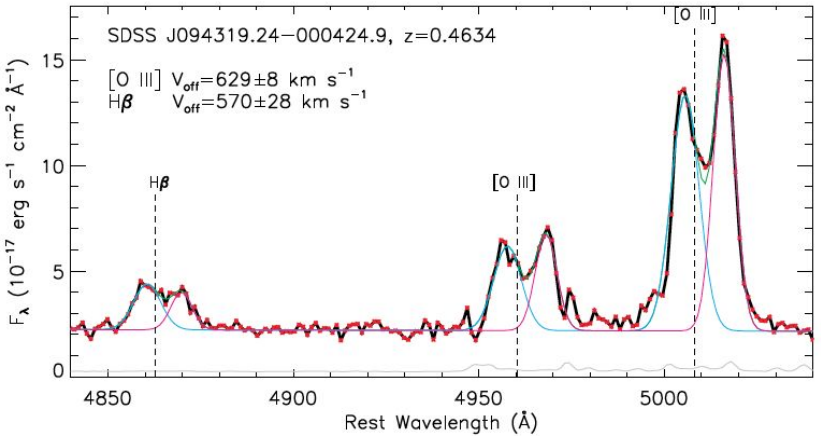
Lacey et al. 2015

2.

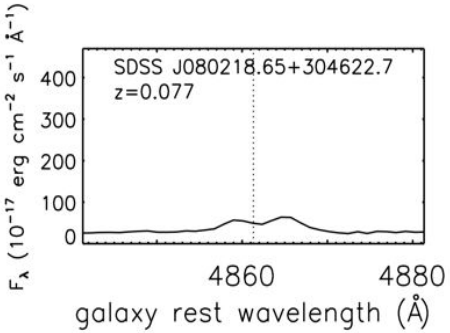
The Sample

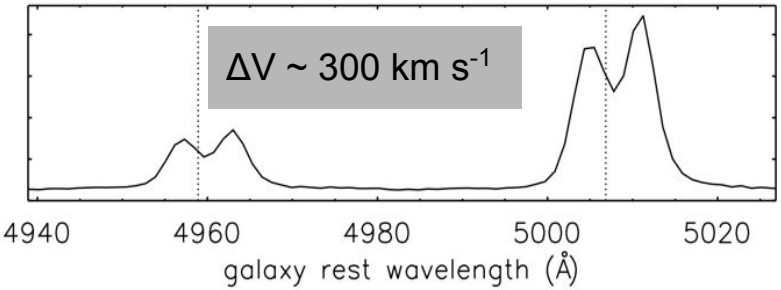
Double-peaked emission lines can be produced by AGN outflows





Lyu & Liu 2016





Comerford et al. 2012

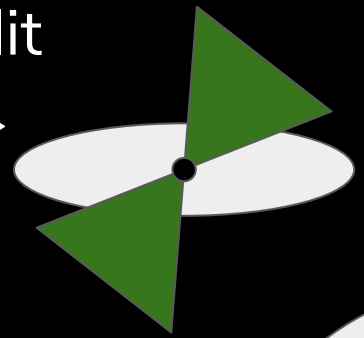
Parent sample is 71 DPAGN at z < 0.1 in SDSS

2.

The Sample

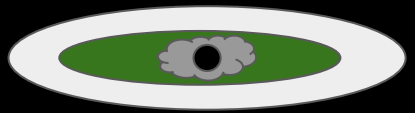
The double-peaked lines in this sample are mostly produced by outflows

Nevin et al. 2016 optical longslit spectra of 2 orthogonal PAs →
58 / 71 are outflows

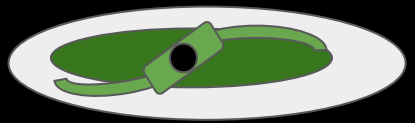


Inflow

Rotation-dominated +
Obscuration



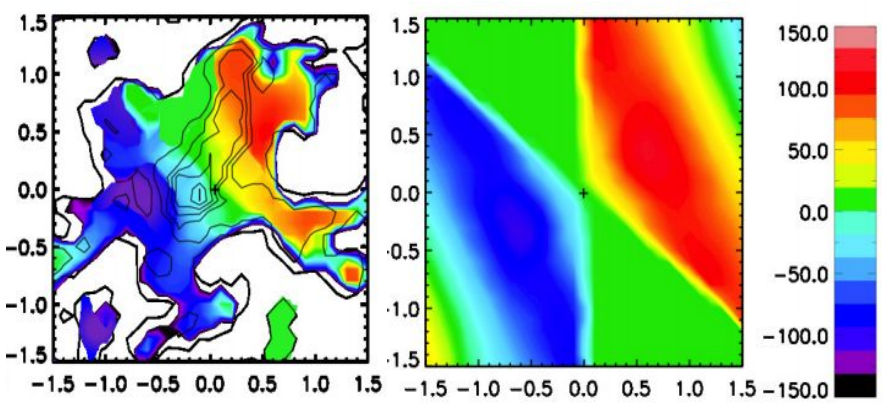
Rotation-dominated +
Disturbance

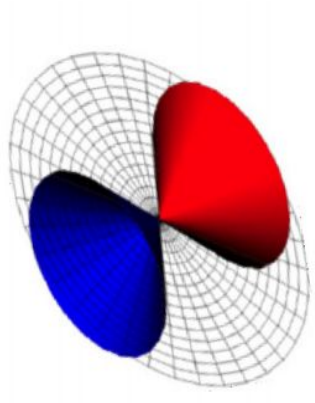


3.

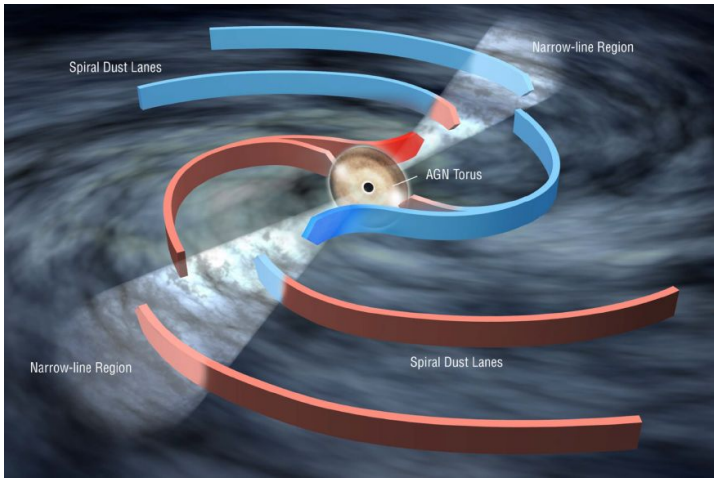
Modeling AGN Outflows

We model the 18 AGN (that are dominated by outflows on all scales) as biconical outflows

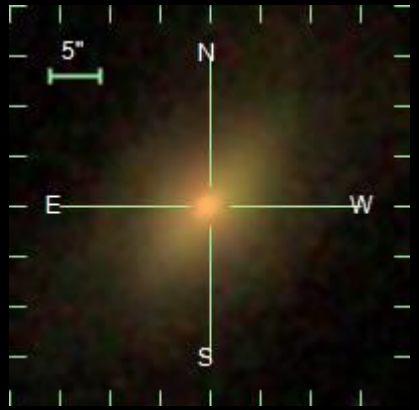




Müller-Sánchez et al. 2016



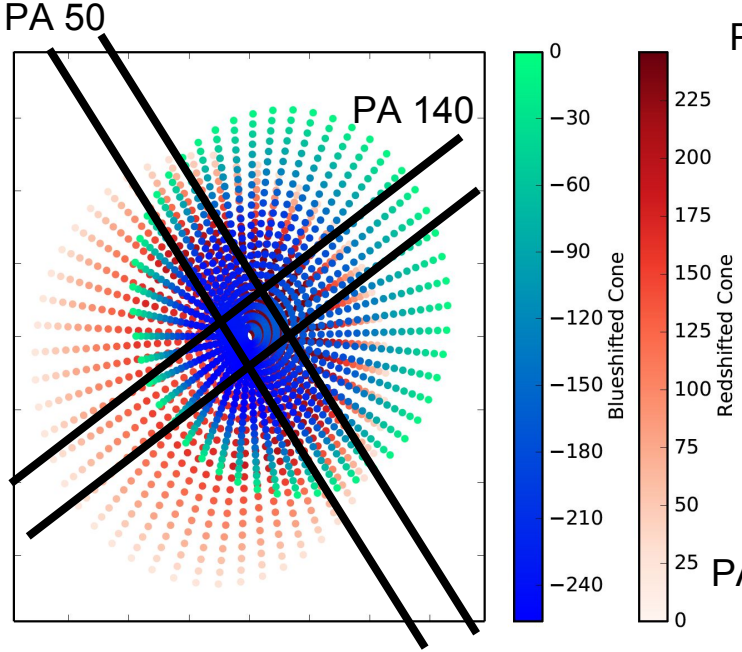
Fischer et al. 2017

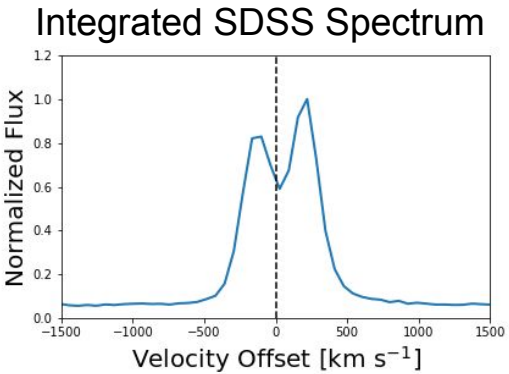


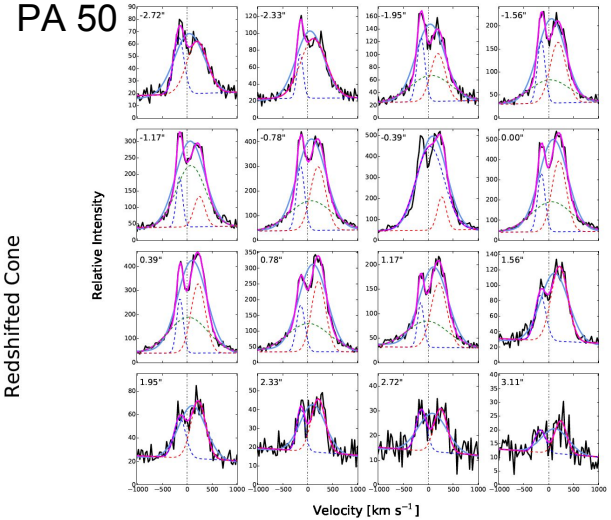
3.

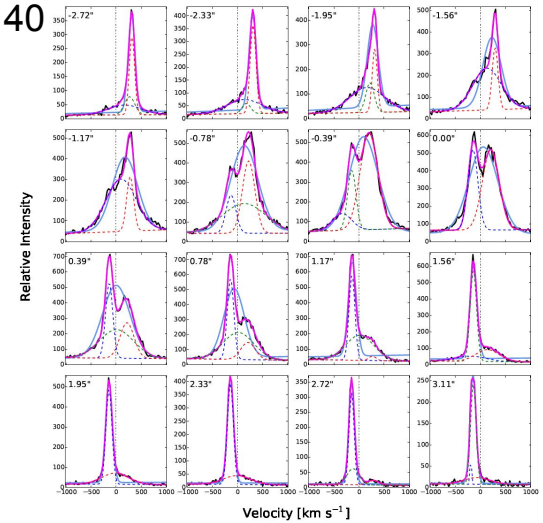
Modeling AGN Outflows

Modeled as bicones, extracted kinematics and energetics







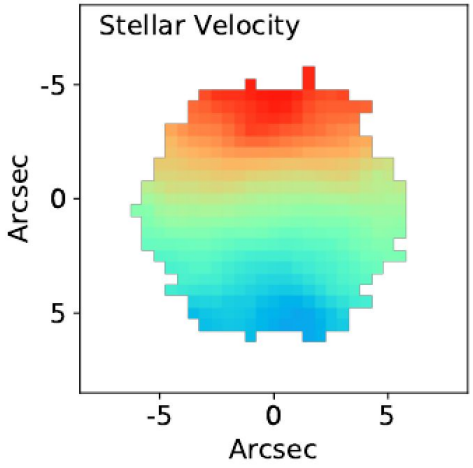


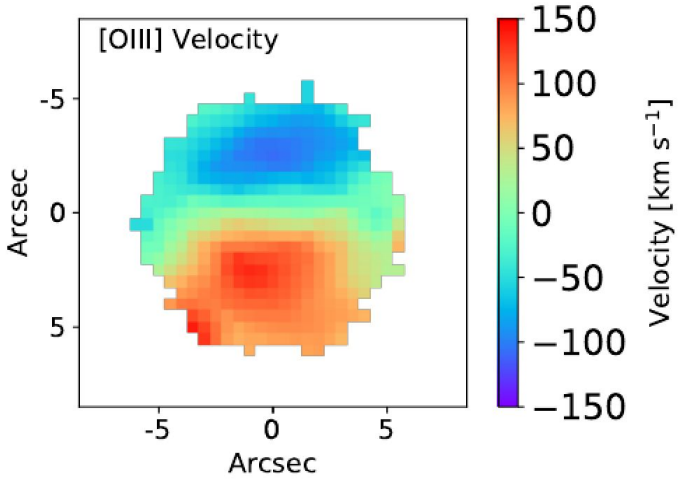
MaNGA IFS confirms large scale outflow

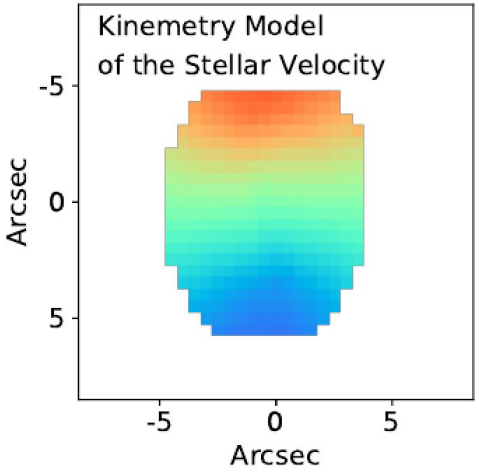
3.

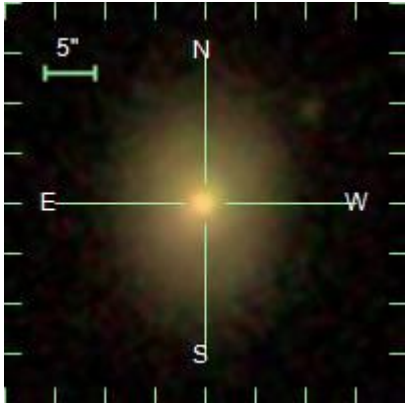
Modeling AGN Outflows

Tests: 4 PAs or MaNGA IFS yield consistent results







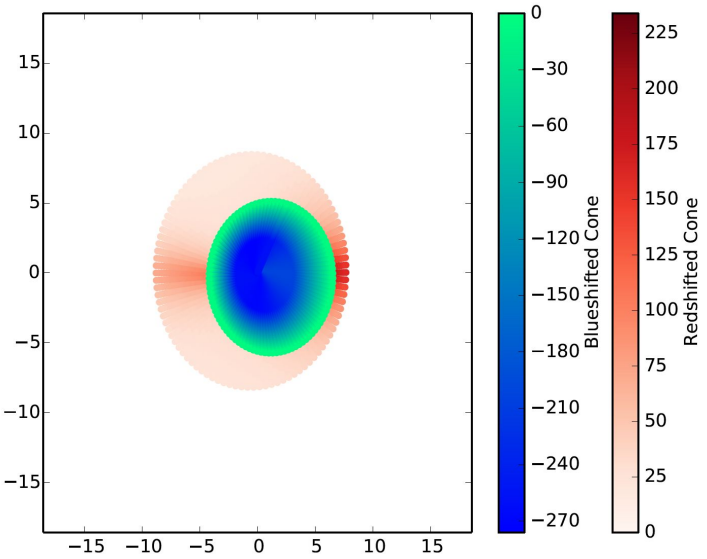


4 PAs confirm outflow parameters

3.

Modeling AGN Outflows

Test: 4 PAs or MaNGA IFS yield consistent results



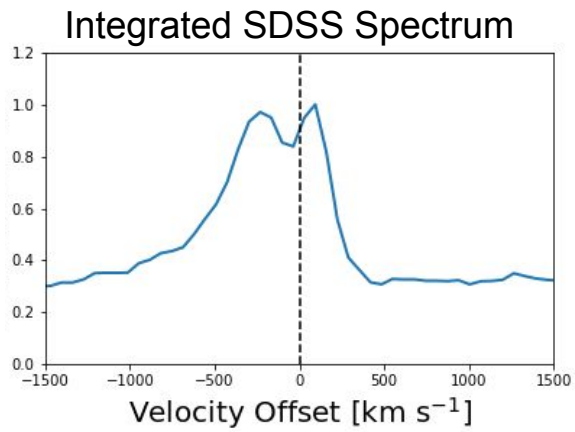


Table 1. Asymmetric Bicone Model Parameters

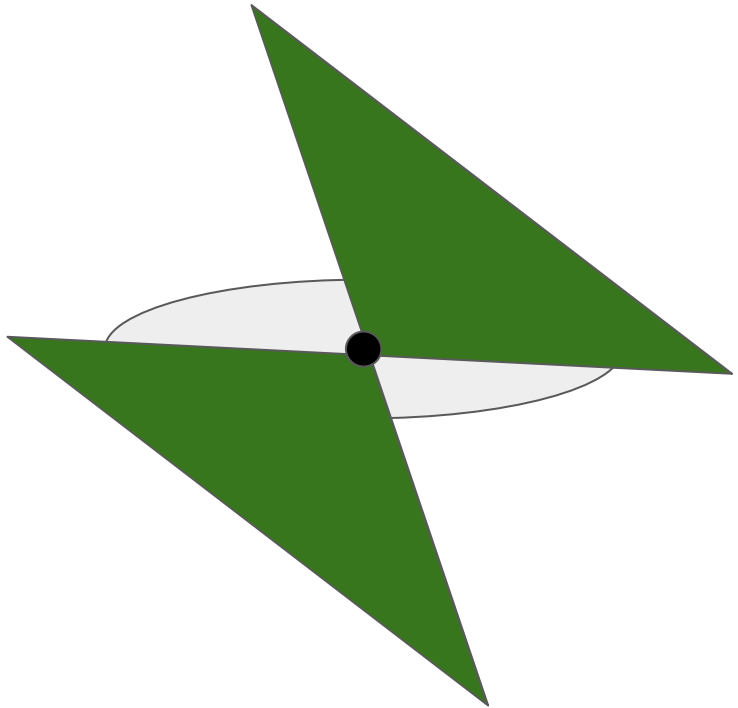
Modeled PAs	i [°]	PA_{bicone} [°E of N]	r_t [″]	$\theta_{1,half}$ [°]	$\theta_{2,half}$ [°]	V_{max} [km s^{-1}]
Pseudo-IFU	62^{+16}_{-22}	75^{+121}_{-53}	9^{+4}_{-5}	38^{+23}_{-27}	81^{+5}_{-23}	320^{+290}_{-170}
21, 66	68^{+15}_{-29}	92^{+105}_{-45}	9^{+5}_{-5}	34^{+28}_{-27}	75^{+10}_{-14}	330^{+240}_{-170}
21, 111	72^{+12}_{-20}	71^{+75}_{-47}	10^{+5}_{-9}	33^{+22}_{-22}	74^{+7}_{-23}	340^{+240}_{-190}
21, 156	72^{+12}_{-25}	85^{+100}_{-63}	9^{+5}_{-6}	30^{+23}_{-23}	79^{+5}_{-14}	350^{+270}_{-170}
66, 156	55^{+26}_{-35}	128^{+119}_{-91}	10^{+7}_{-7}	23^{+24}_{-17}	63^{+18}_{-28}	360^{+300}_{-190}
66, 111	69^{+15}_{-20}	90^{+98}_{-56}	9^{+6}_{-6}	37^{+23}_{-19}	70^{+13}_{-14}	330^{+300}_{-180}
111, 156	69^{+14}_{-33}	105^{+105}_{-70}	10^{+4}_{-8}	29^{+25}_{-19}	76^{+6}_{-20}	390^{+330}_{-210}

3.

Modeling AGN Outflows

Bicones have large surface geometries

$\Theta_{half,\ outer} = 69.5 \pm 12.4°$

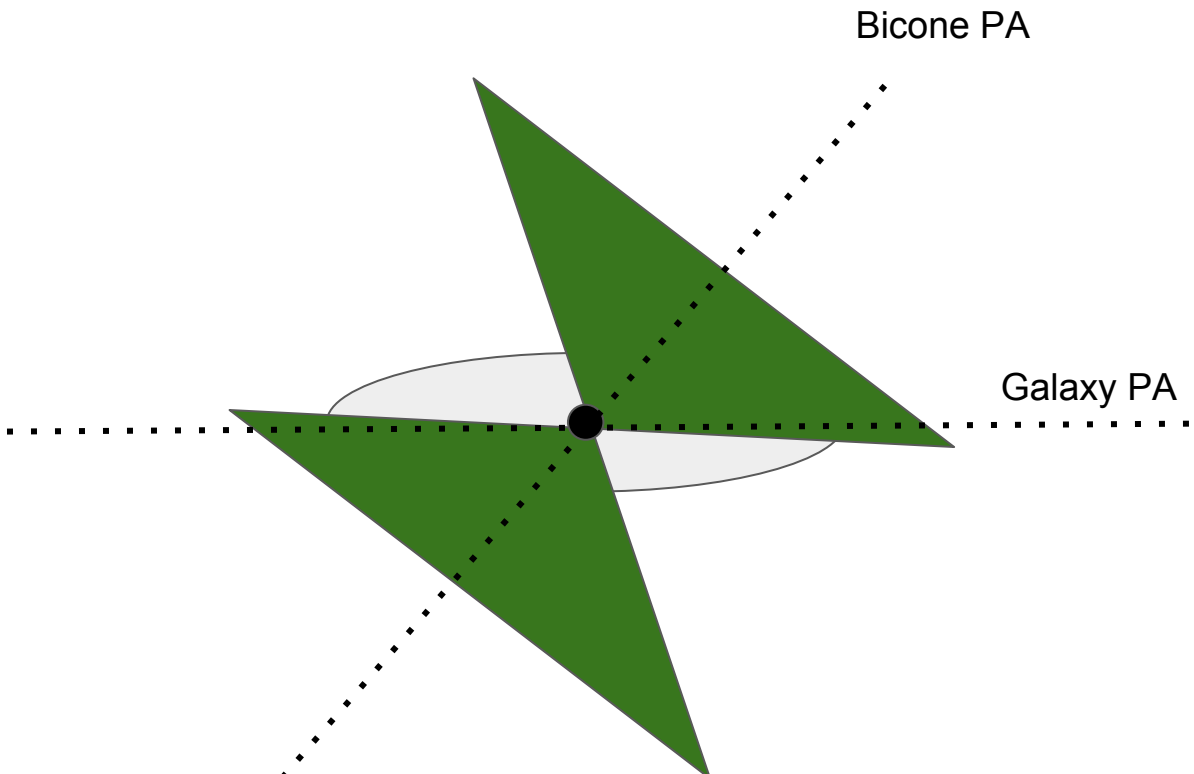


Bicone Orientation

3.

Modeling AGN Outflows

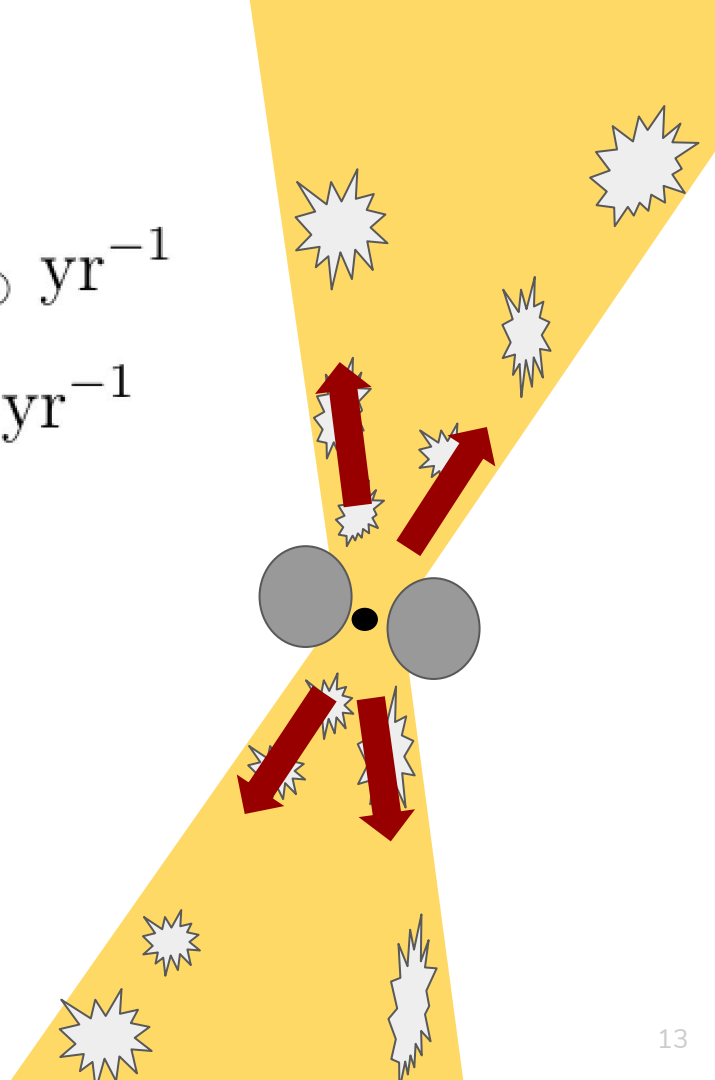
Randomly oriented bicones intersect ISM, can impact their host galaxies



Bicone Energetics

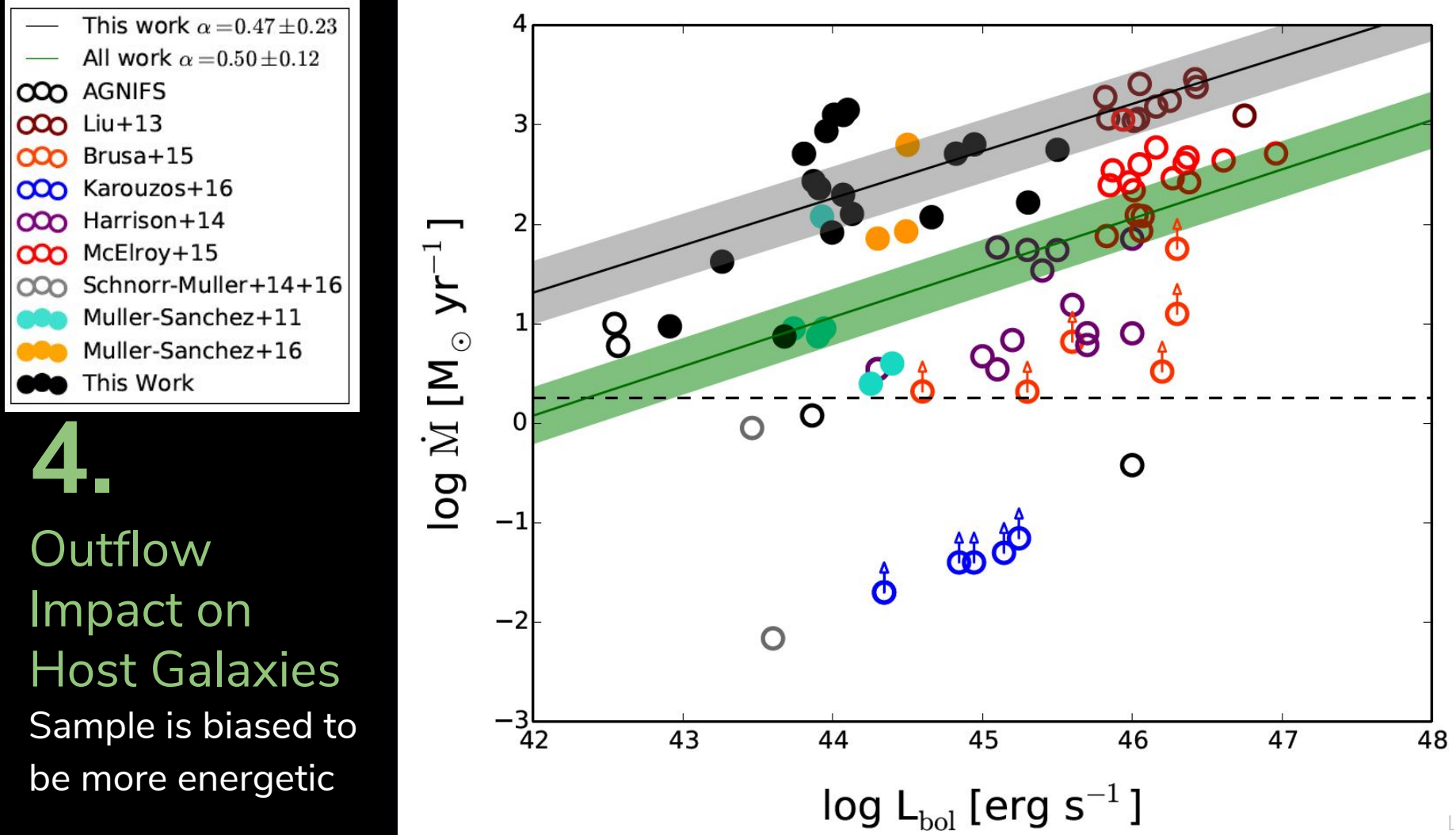
$$\dot{M}_{\text{average}} \sim 10^{2.7}\ M_\odot\ \text{yr}^{-1}$$

$$\sim 500\ M_\odot\ \text{yr}^{-1}$$



3. Modeling AGN Outflows

Selected for large surface geometries and energetics



4.

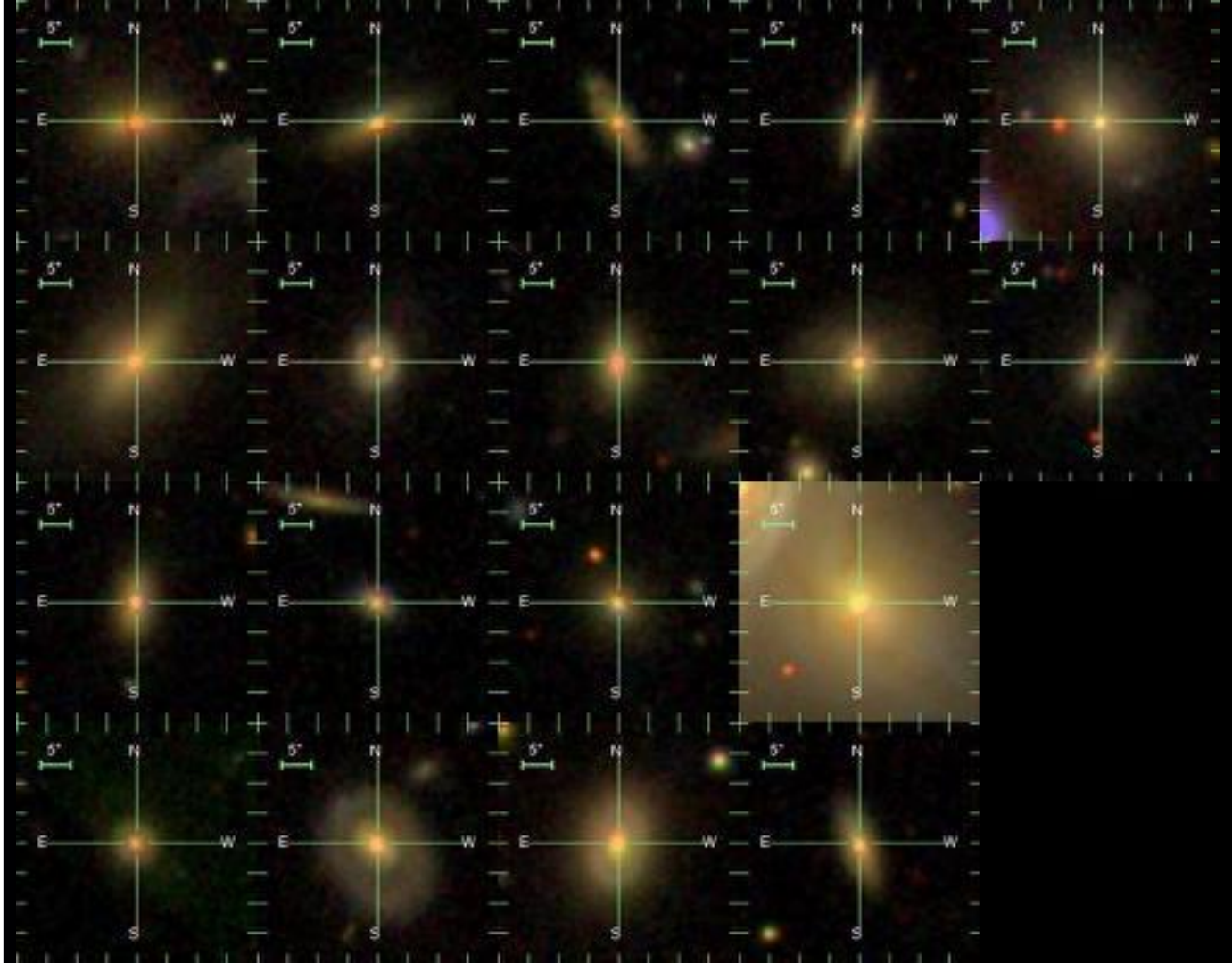
Outflow Impact on Host Galaxies

Sample is biased to be more energetic

4.

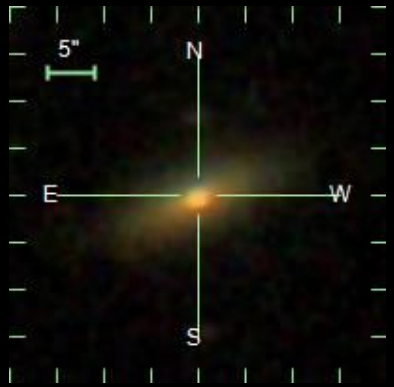
Outflow Impact on Host Galaxies

Measured g-r color and sSFR compared to a control sample

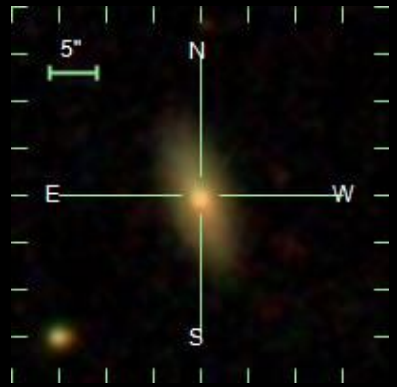


4.

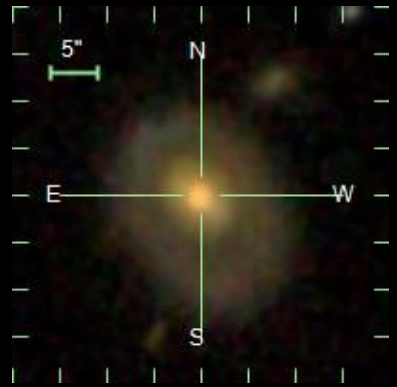
Outflow Impact on Host Galaxies



J0930+3430



J1606+3427



J1109+0201

3 host galaxies have lower sSFRs and/or redder

0 host galaxies have higher sSFRs and/or bluer

12 host galaxies are consistent

Conclusion

Double-peaked narrow lines select for large AGN outflows 2

A sample of energetic AGN outflows 3

Potentially demonstrate negative feedback 4