Stellar and gas dynamics in the transition between black hole activity and quiescence

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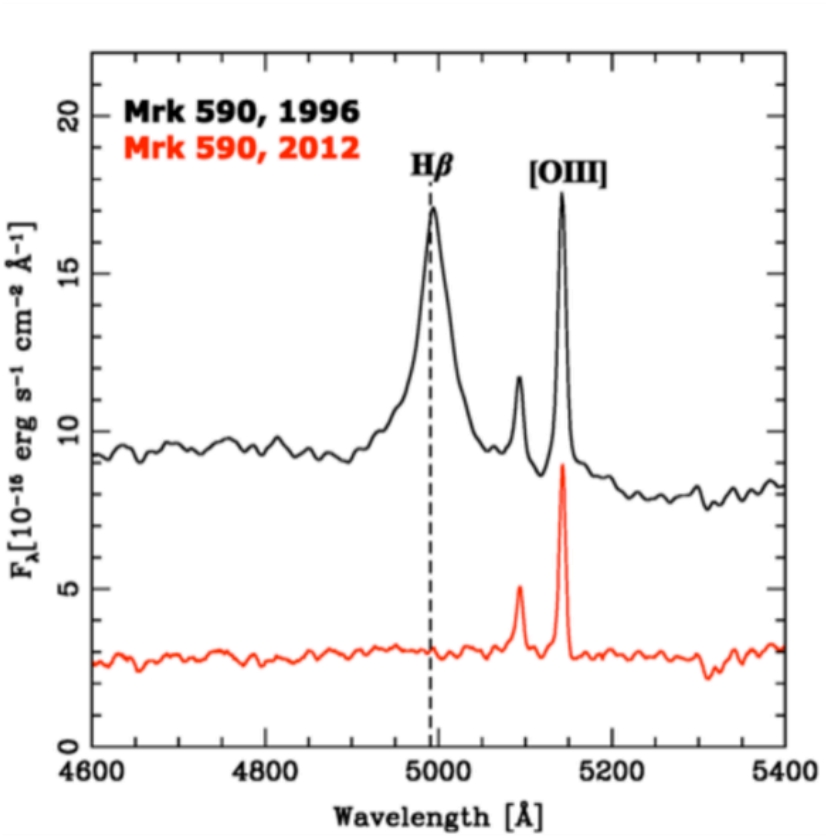
Dark Cosmology Centre

Outline

- Changing-look Active Galactic Nuclei
- MUSE observations of Mrk 590
- Stellar and gas dynamics in Mrk 590
- The AGN fuelling reservoir
- Conclusions

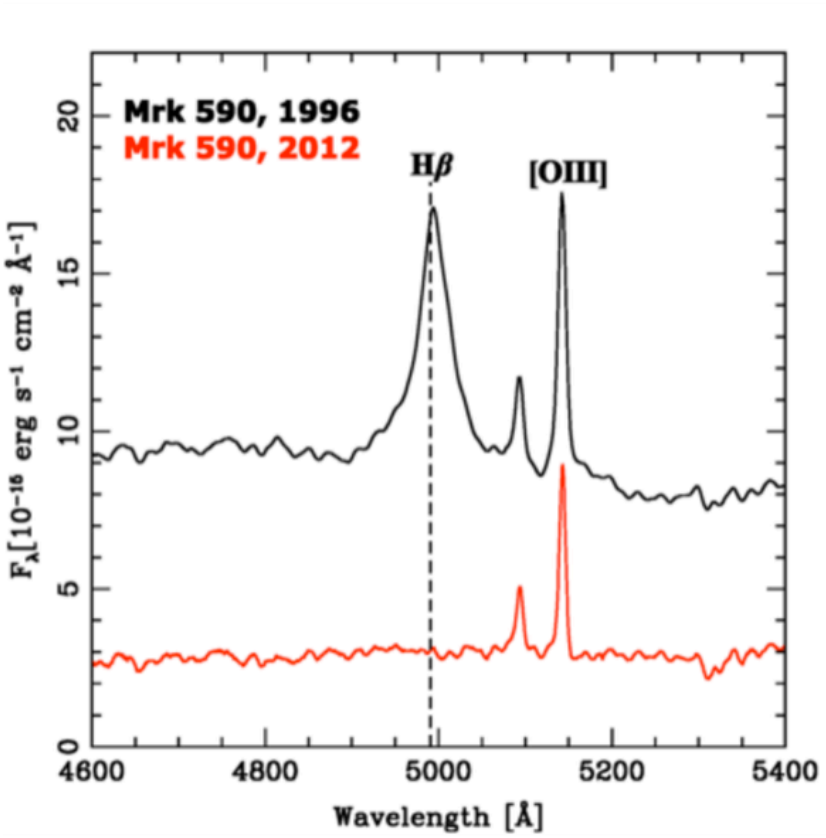
Changing-look AGN



Credits: Bradley Peterson

- Only a few examples of type 1/ type 2 transition (e.g. LaMassa 2015)

Changing-look AGN



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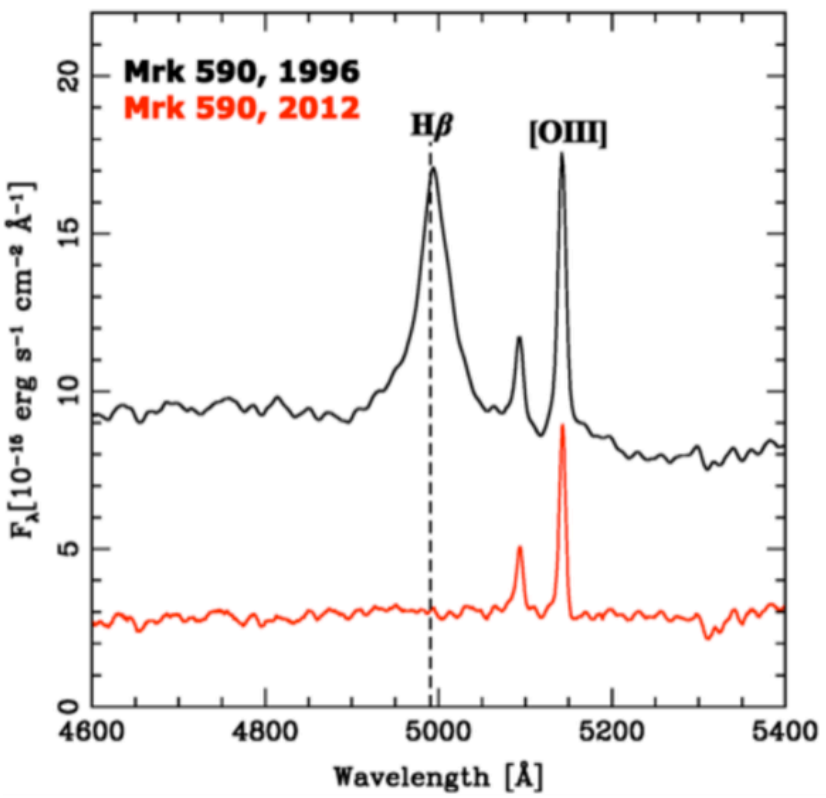
<u>Mrk 590:</u>

- Standard Seyfert 1 in 1990's
- Since the 1990's the AGN flux decreased by a factor of 100.
- Between 2006 – 2012 the broad lines disappeared.
- Decrease in gas accretion (Denney et al. 2014) – is the AGN turning off?

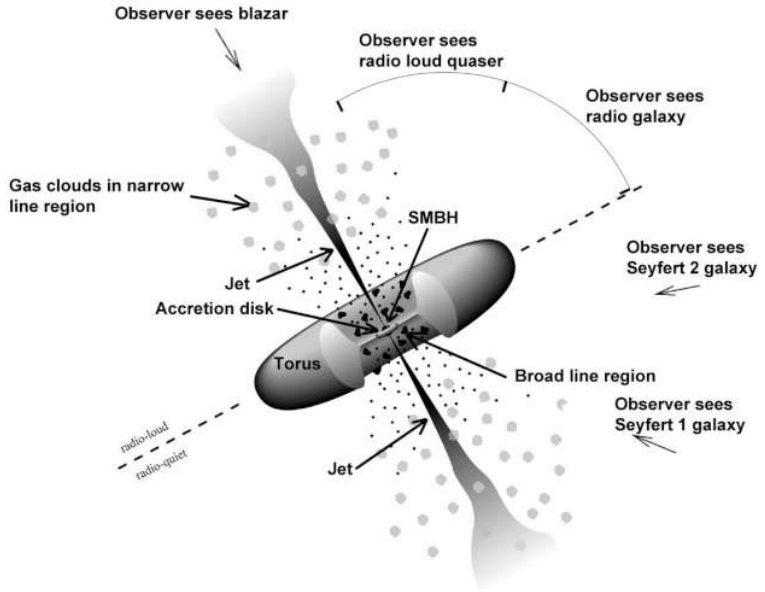
Changing-look AGN



Credits: Bradley Peterson

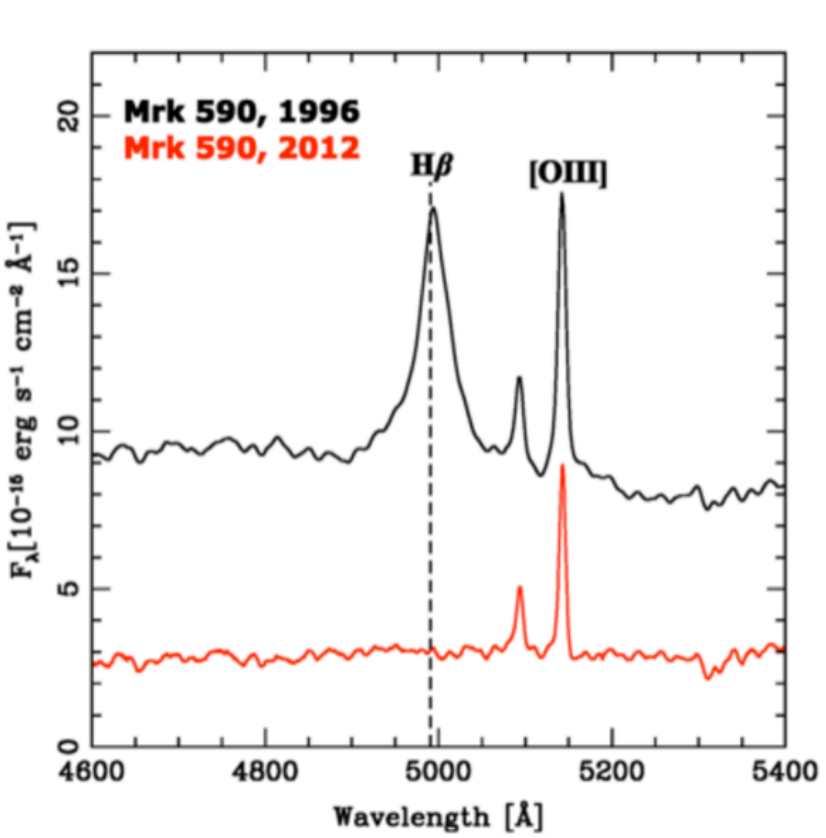
Provides a unique laboratory to:

- Test our understanding of AGN geometry and black hole accretion physics



Credits: Fermi

Changing-look AGN



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Provides a unique laboratory to:

- Test our understanding of AGN geometry and black hole accretion physics

- Clues to AGN fuelling

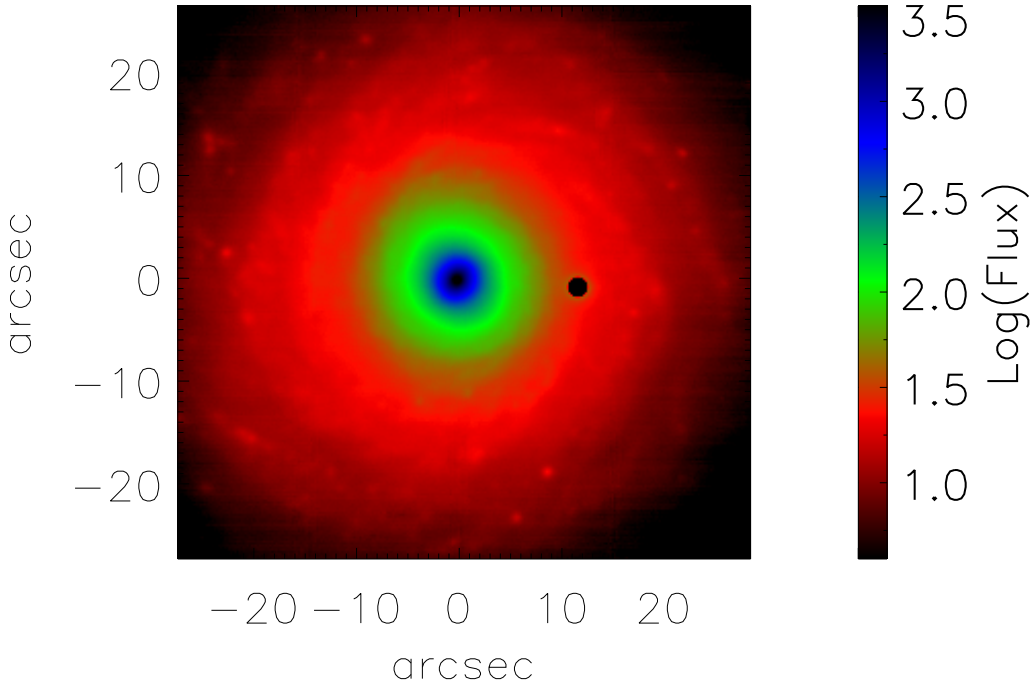
- On-going multi-wavelength campaign:

  What is the accretion physics?

  What is the gas flow dynamics?

  Is there an AGN gas reservoir?

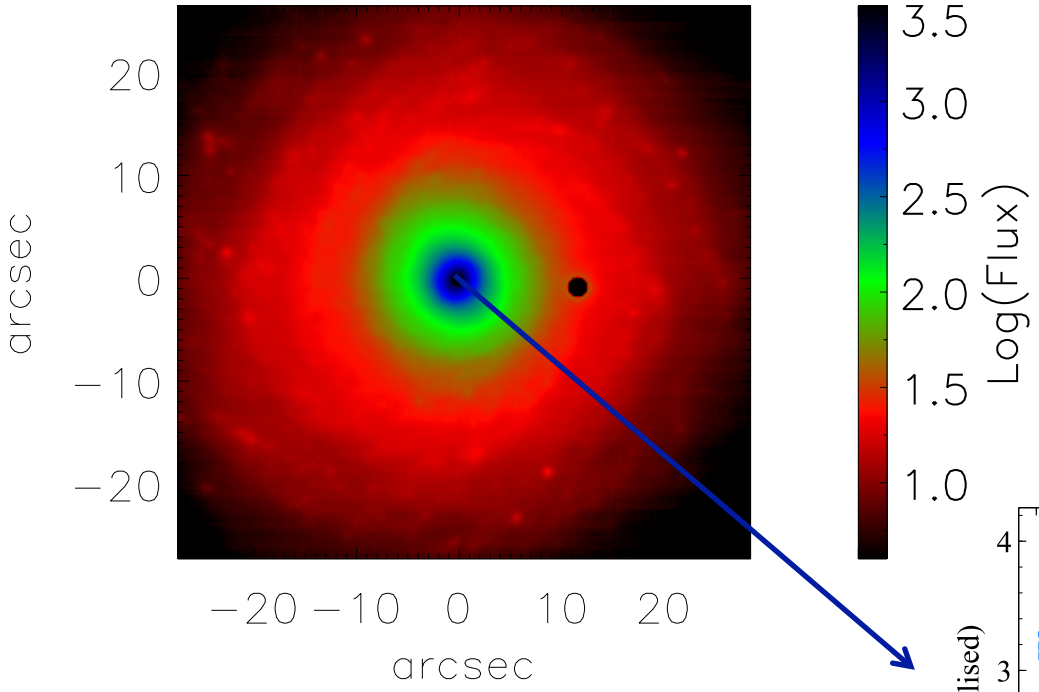
Mrk 590 – MUSE observations



Sa galaxy, z = 0.026
500 pc/arcsec

MUSE IFU observations
λ 4750 – 9350 Å

Mrk 590 – MUSE observations



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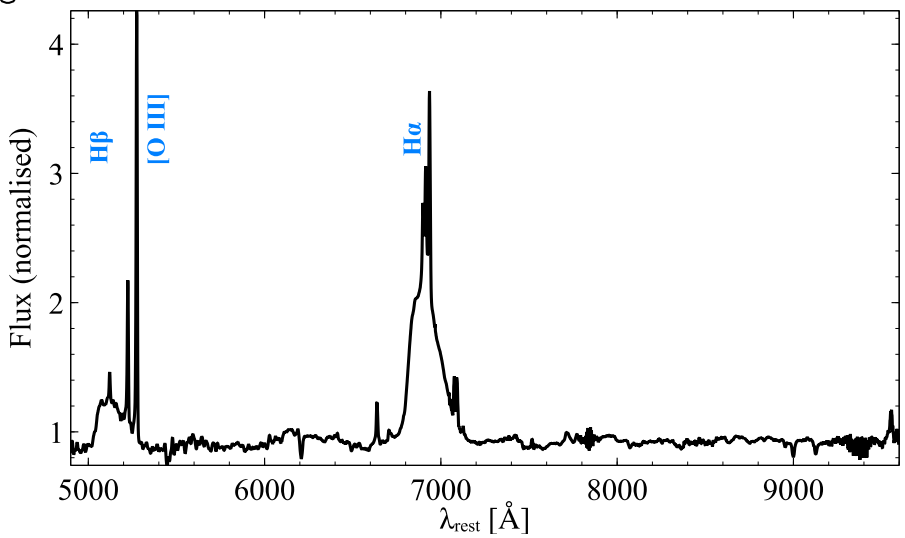
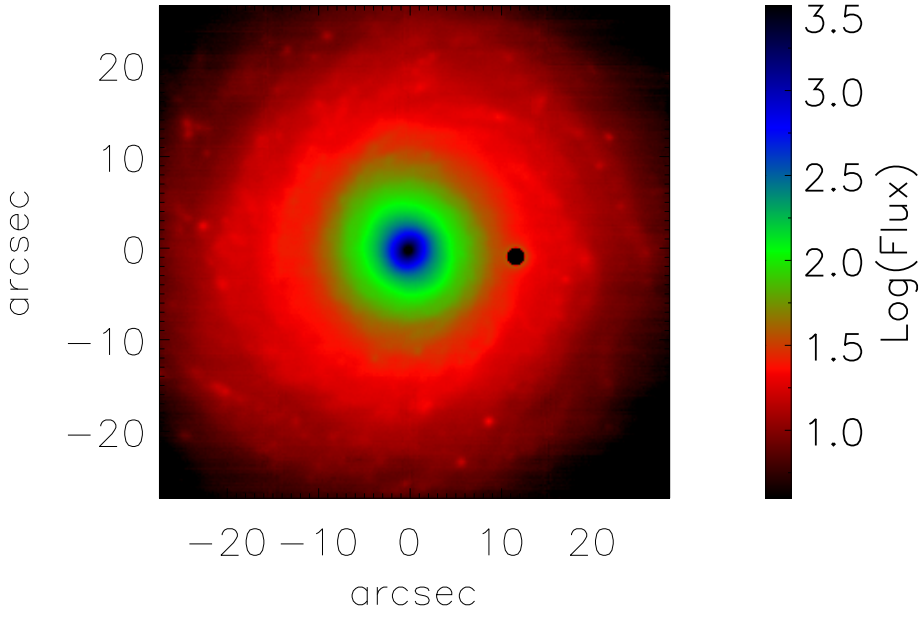


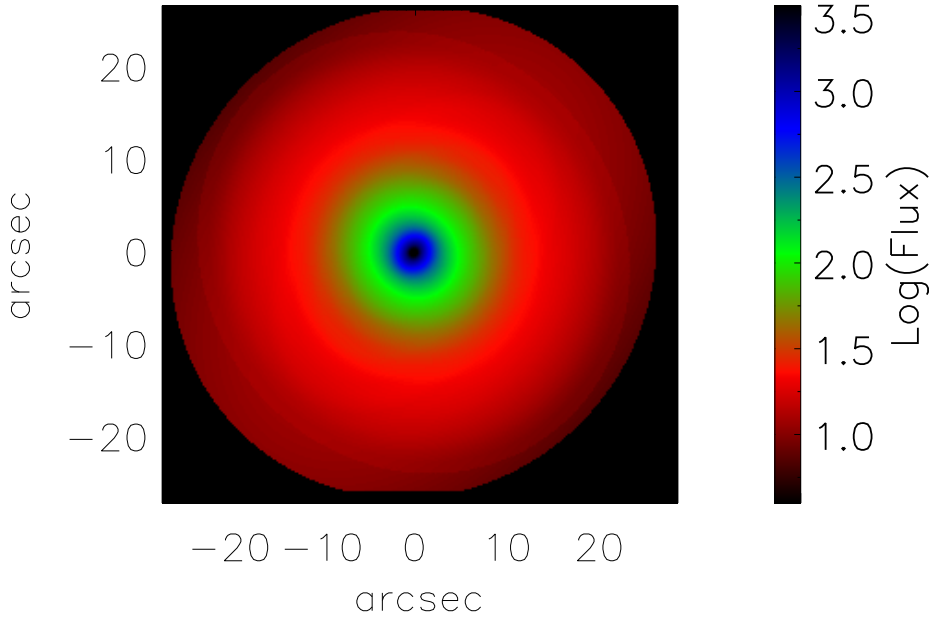
Raimundo et al. 2018 in prep.

Mrk 590 - Morphology

Data

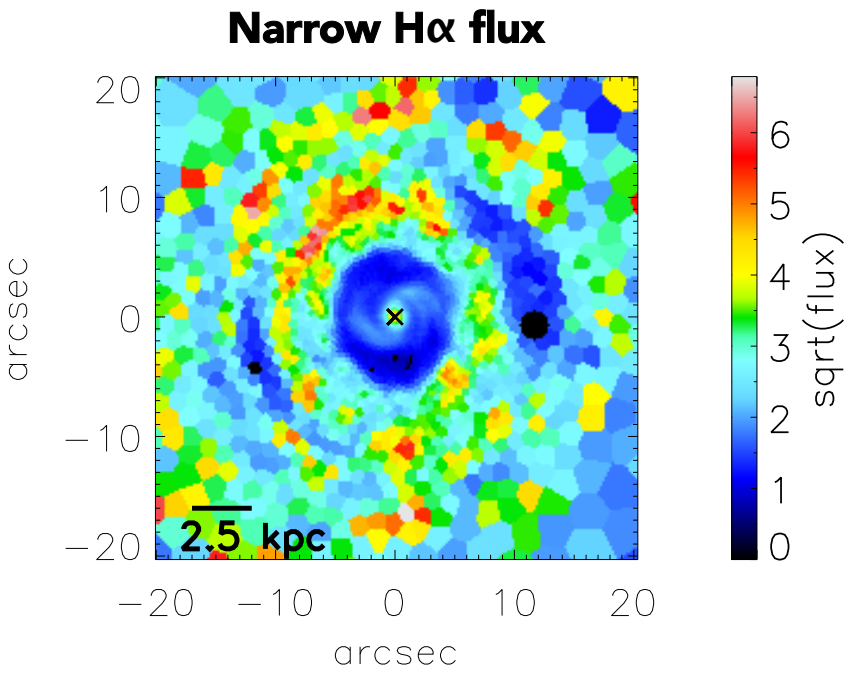


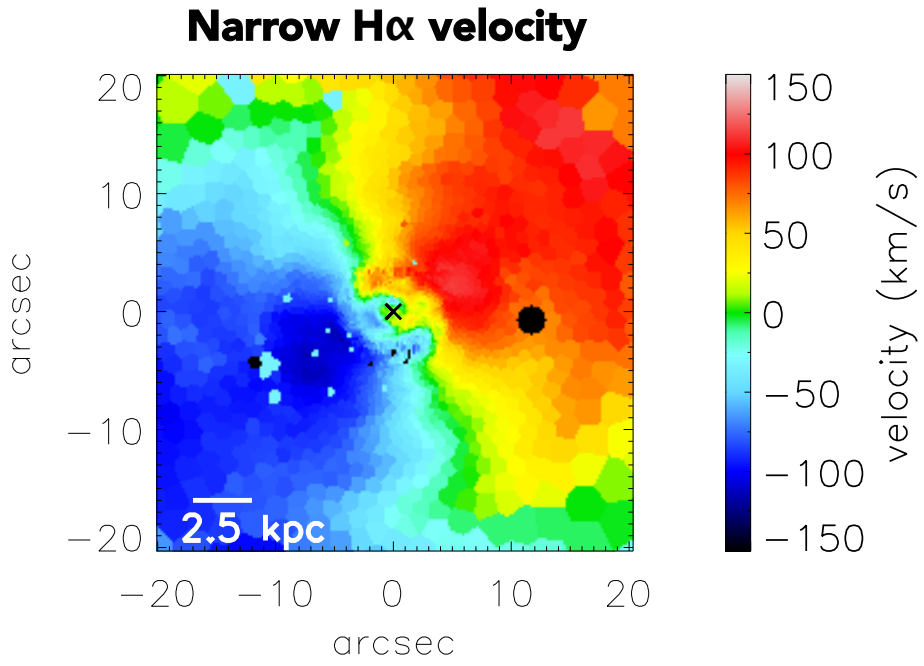
Model: Disc + bulge + bar



Bar component contributing at r < 3 arcsec (Bentz et al. 2006)
Role in the gas dynamics?

Mrk 590 – ionised gas dynamics





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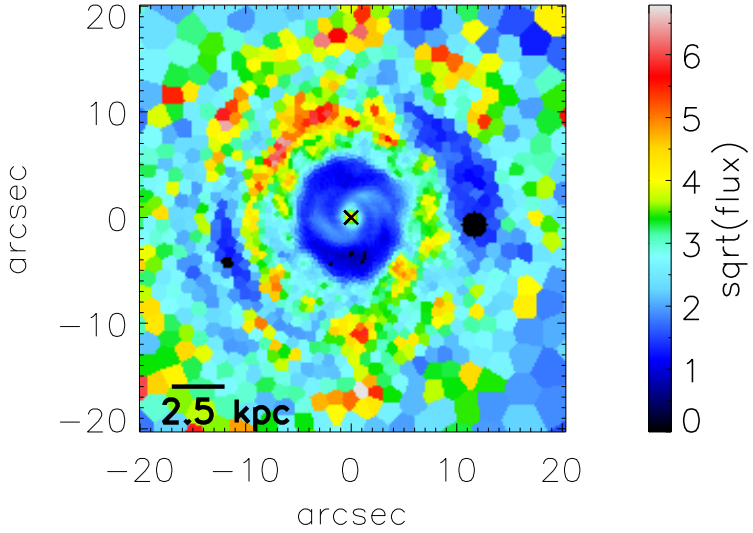
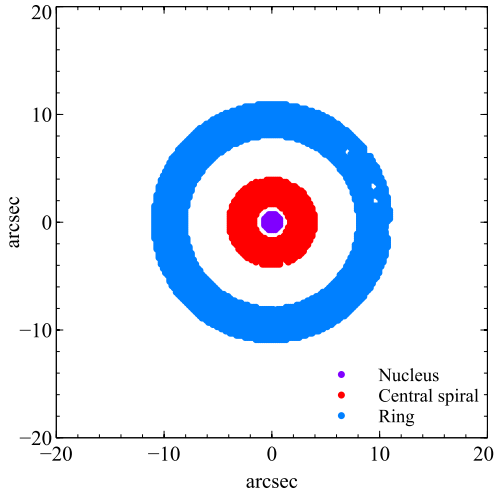
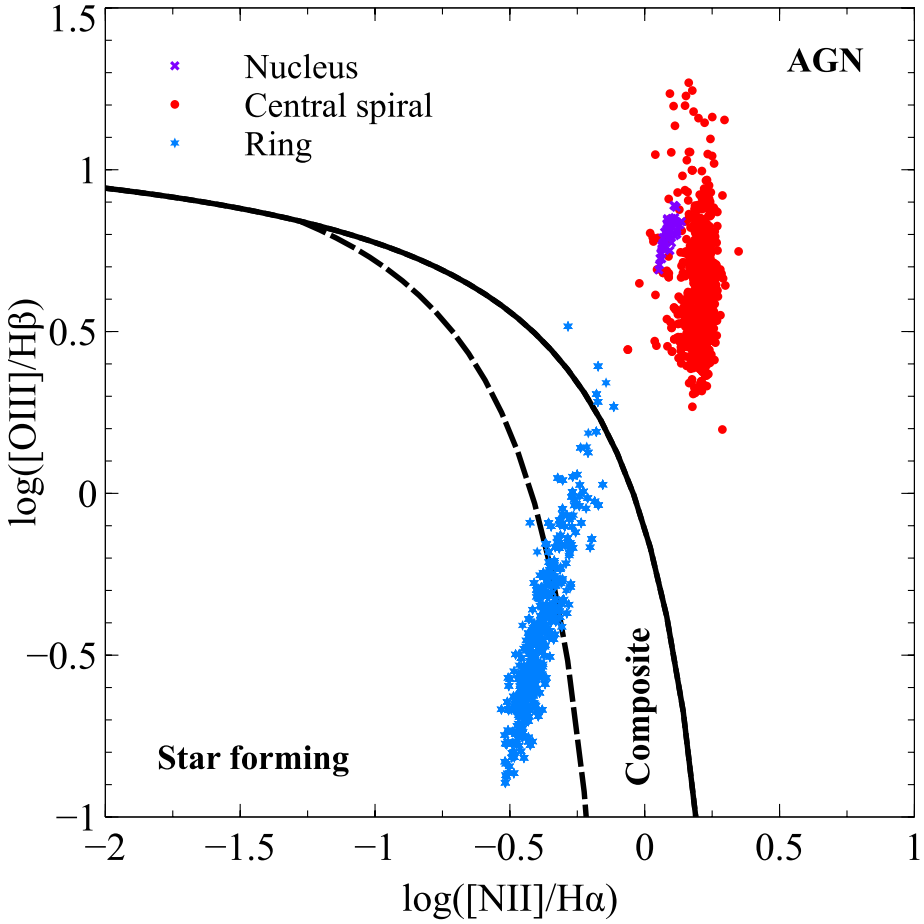
Disturbed dynamics – large scale disc + nuclear dynamics affected by the bar
Disc inclination ~ 18 degrees

Mrk 590 - Line ratios





Regions from Kewley et al. 2006



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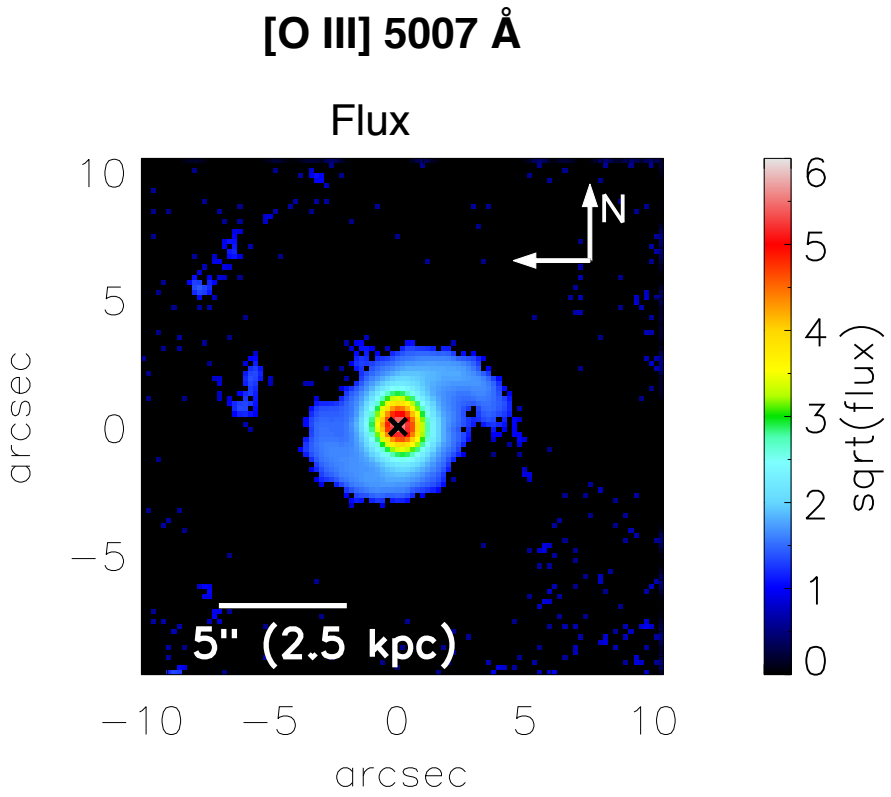
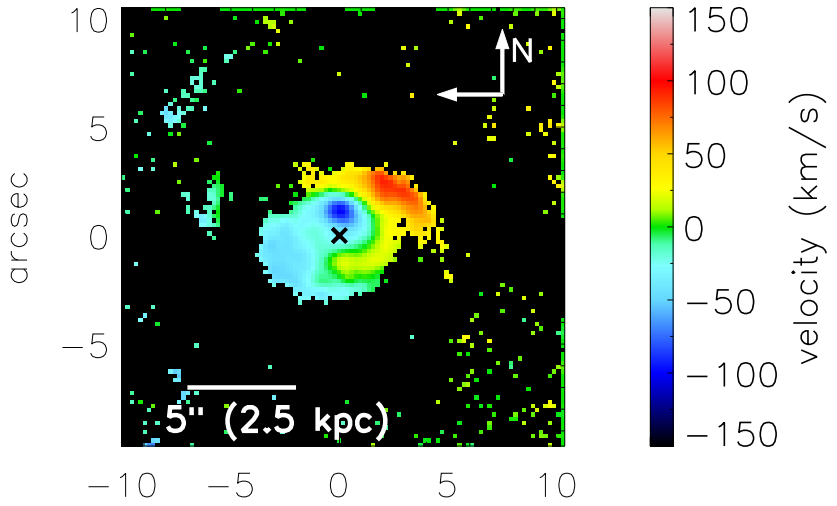
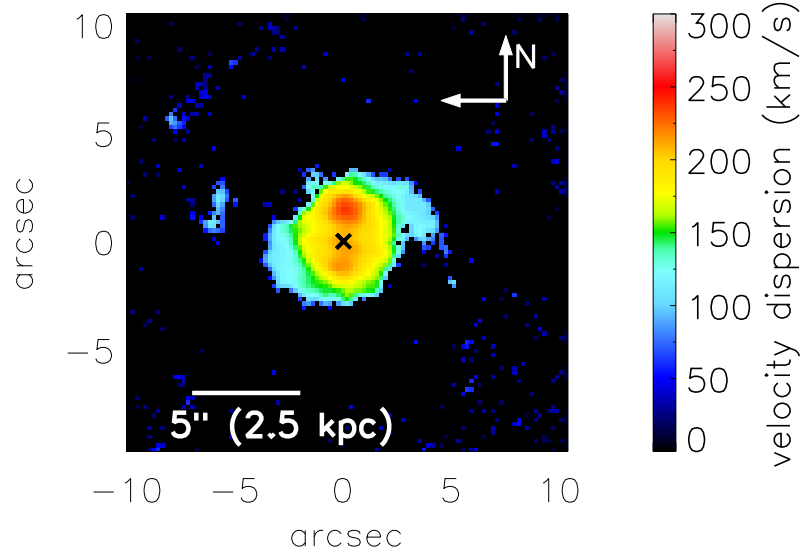
Mrk 590 - Nuclear gas dynamics







Outflow signatures

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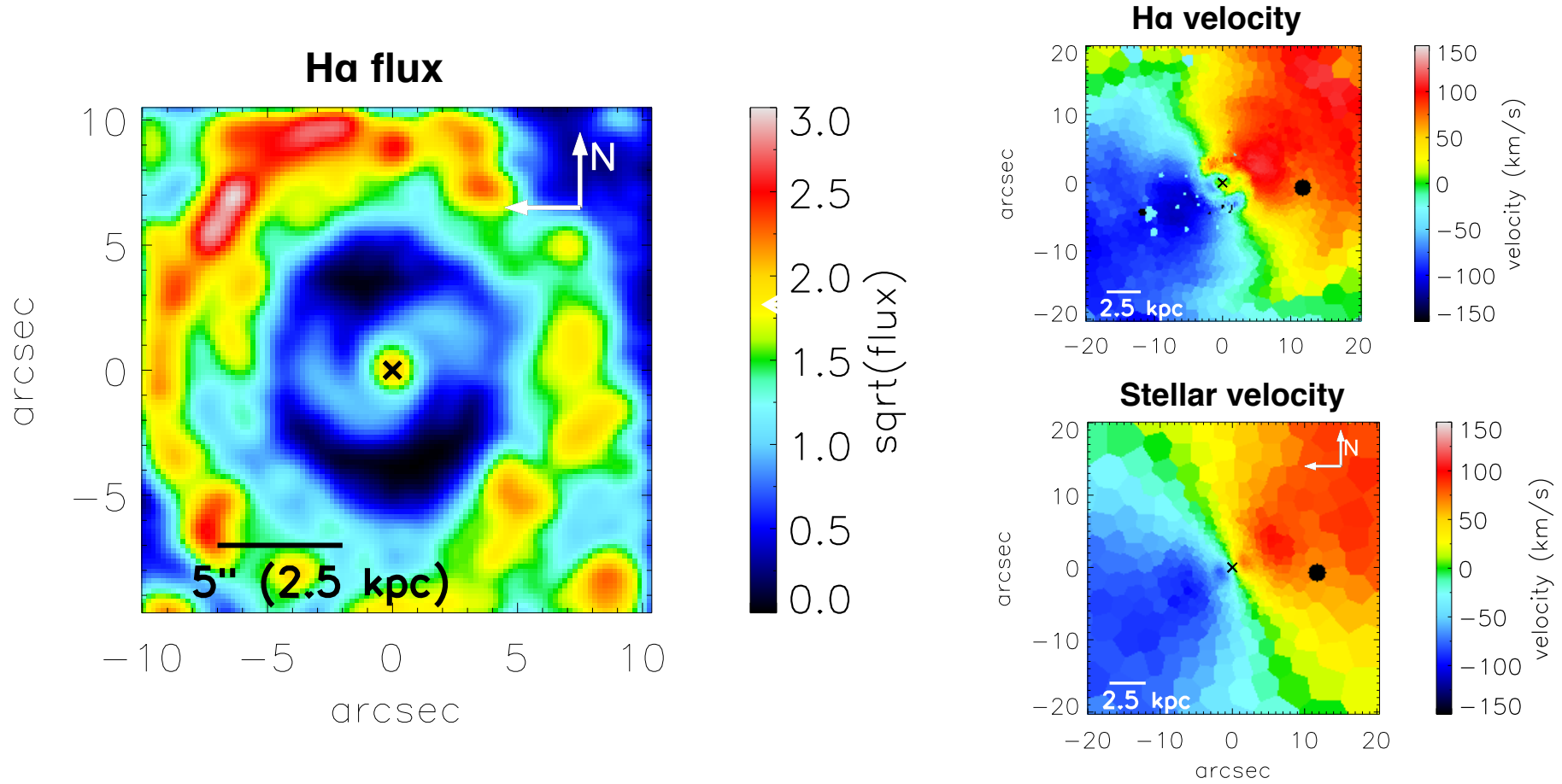
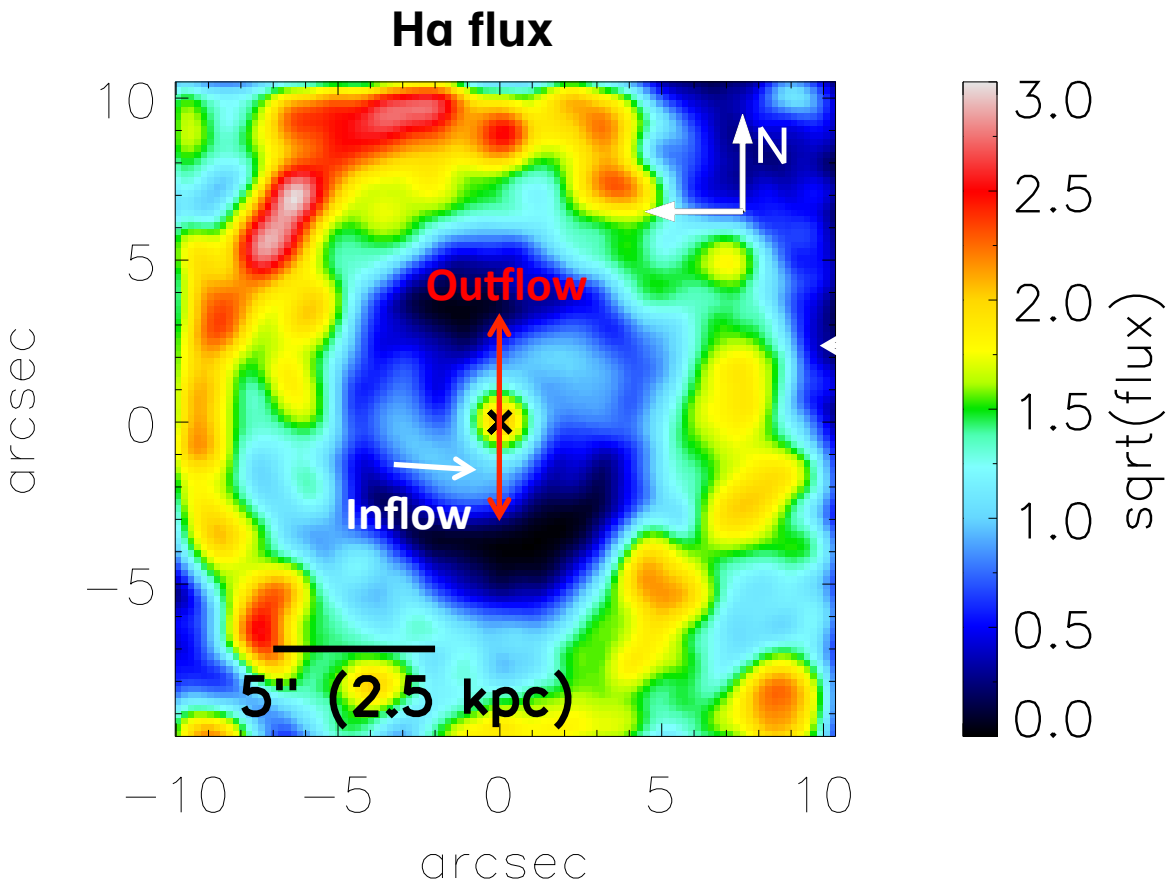
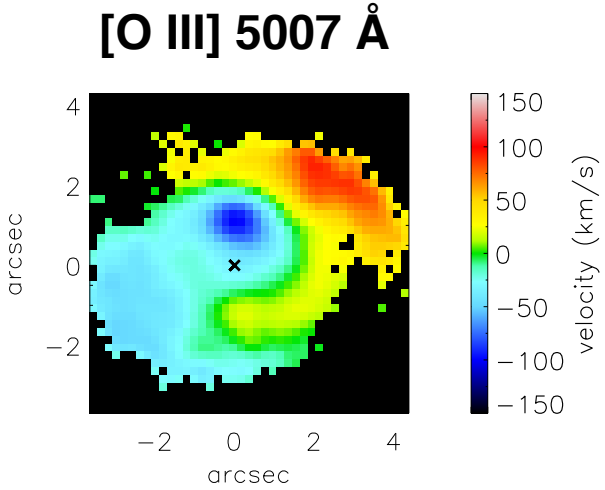
Mrk 590 - Nuclear gas dynamics



Nuclear spirals are candidates to drive gas to fuel the AGN (Maciejewski 2004, Storchi-Bergmann et al. 2007, Combes et al. 2014, Davies et al. 2014, Schnorr-Muller et al. 2017)

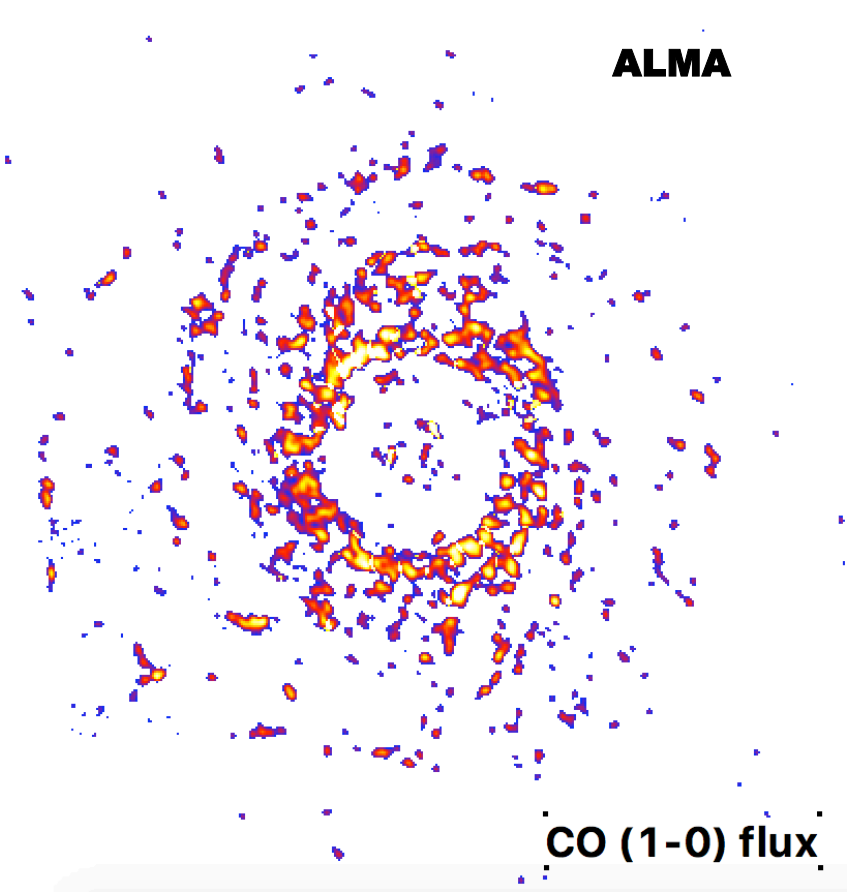
Mrk 590 - Nuclear gas dynamics

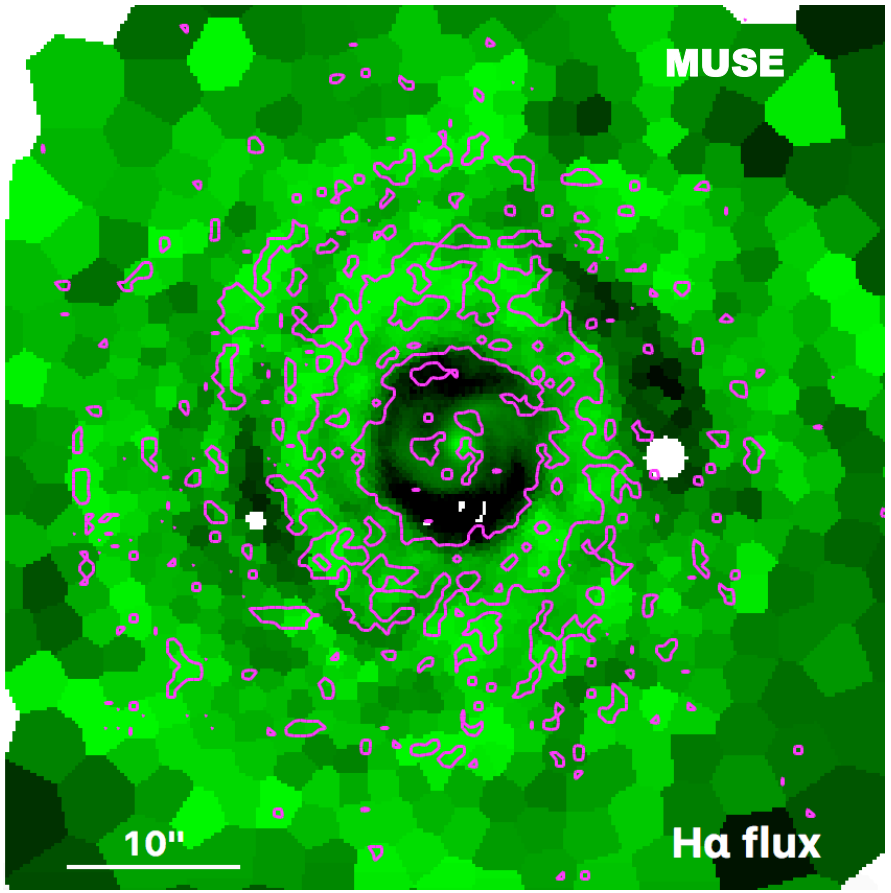




Low velocity AGN outflow may remove gas on short timescales but likely will fall back again. Timescale of change is long.

Mrk 590: AGN cold gas reservoir

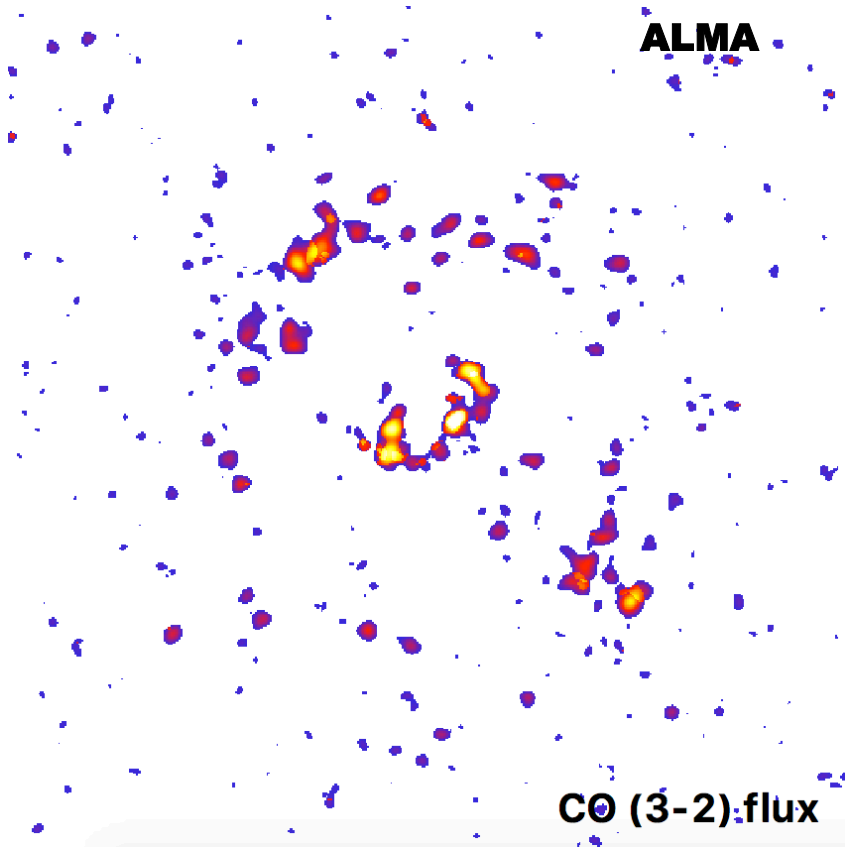


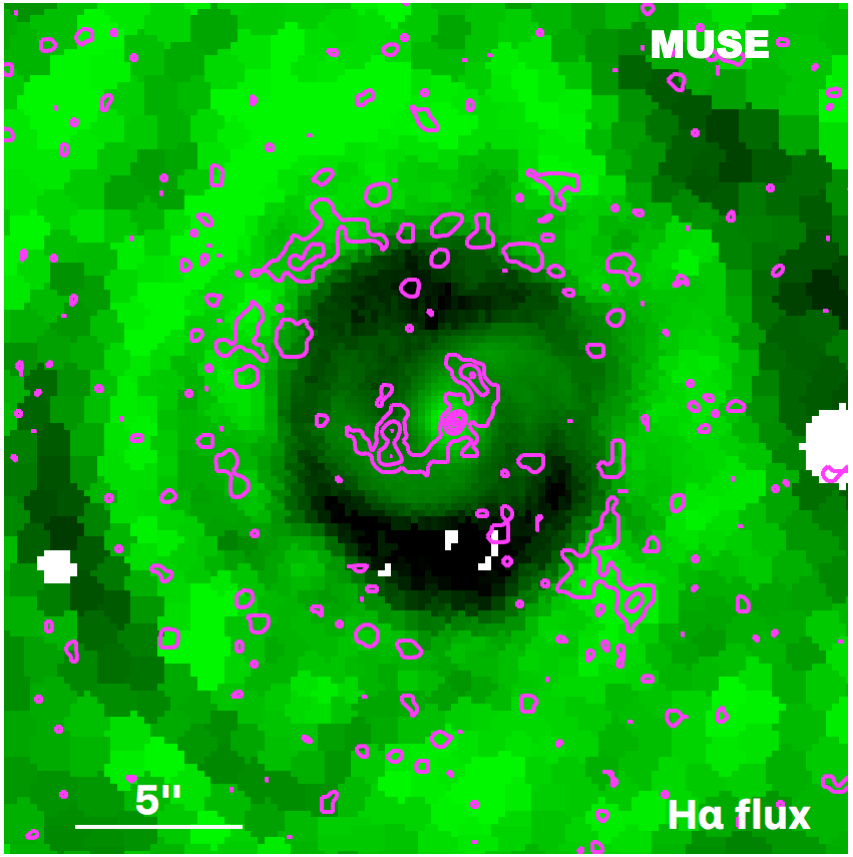


Koay et al. 2018, in prep

Raimundo et al. 2018, in prep

Mrk 590: AGN cold gas reservoir



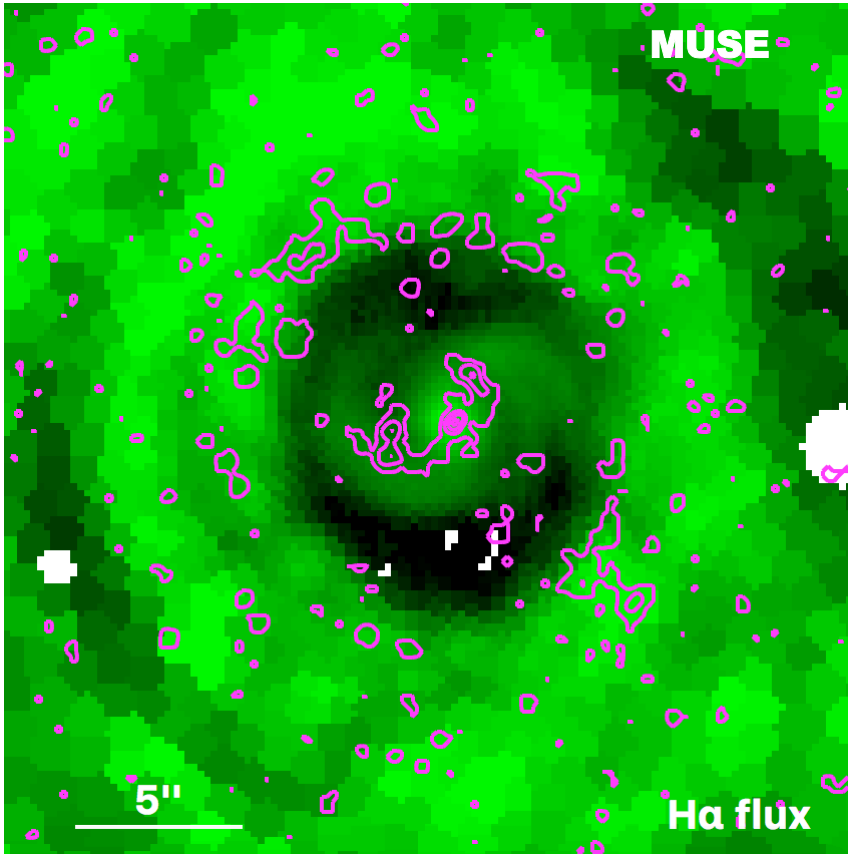


Koay et al. 2016a

Raimundo et al. 2018, in prep

Mrk 590: AGN cold gas reservoir

- There is a gas reservoir
- There are inflow/outflow structures
- Similar to other Seyferts
- Change in type driven by mass accretion rate (e.g. Elitzur et al. 2014)



Raimundo et al. 2018, in prep

Conclusions

- Changing-look AGN provide a view into AGN fuelling and geometry
- Our group is carrying out a multi-wavelength monitoring of Mrk 590
- The AGN in Mrk 590 is showing broad emission lines again
- Indications that the AGN fuelling and activity in Mrk 590 changes on timescales of years/decades
- Presence of an AGN gas reservoir
- At larger scales gas dynamics indicate possible outflow and inflow structure to remove and replenish the nuclear gas reservoir