NGC 4435: a bulge dominated galaxy with a unforseen low mass central black hole

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and

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There is a strong correlation between the SMBH mass and the physical properties of the spheroidal component of the hosting galaxy:

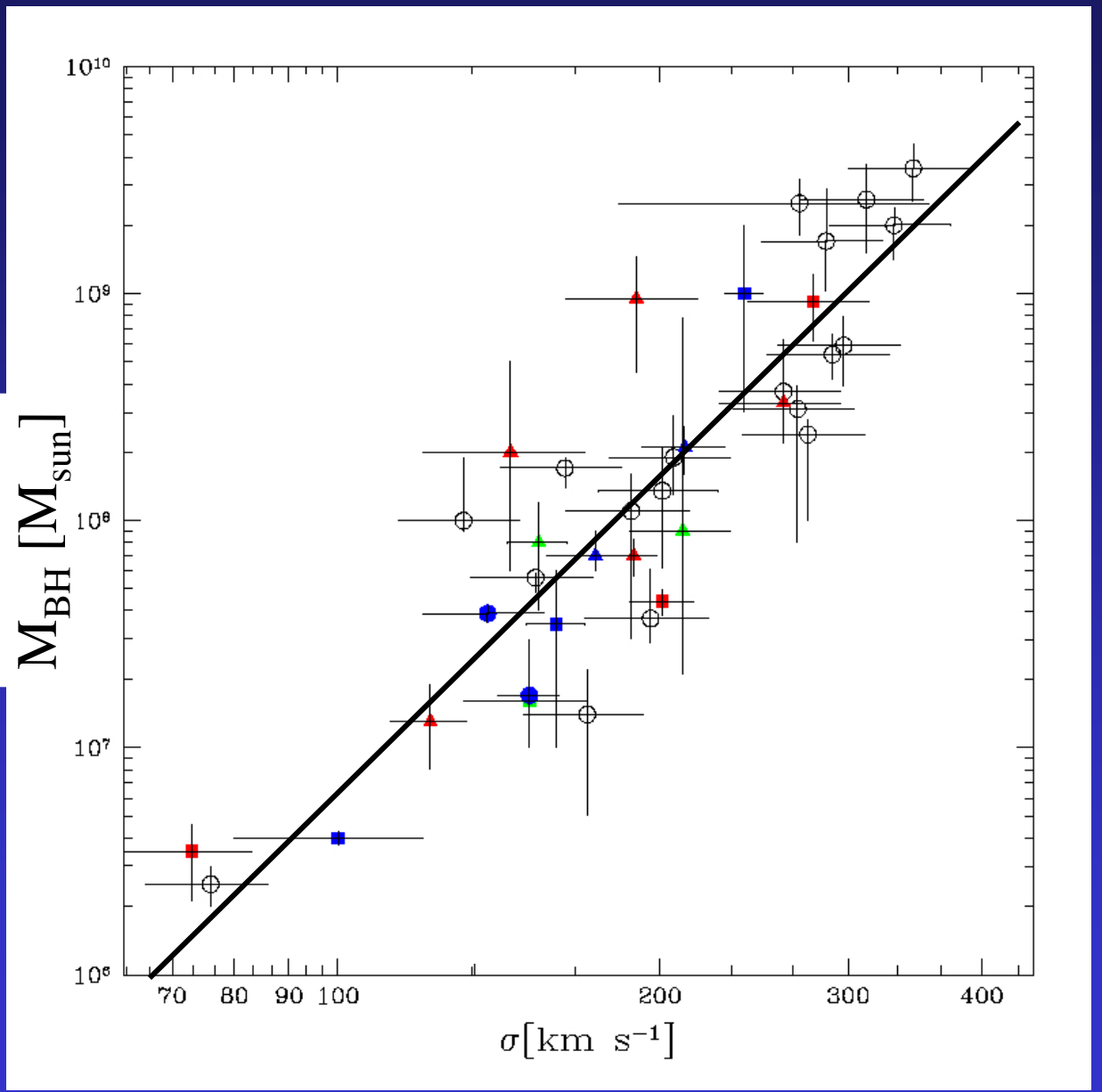
M_{SMBH} - L_{sph}: Kormendy & Richstone 1995; Magorrian et al. 1998; Marconi & Hunt 2003.

M_{SMBH} - σ_c:Ferrarese & Merritt 2000; Gebhardt et al. 2001

M_{SMBH} - γ: Graham et al. 2001

M_{SMBH} - M_{Sph}: Haring & Rix 2004

$M_{SMBH} - \sigma_c$ Relation



- Ellipticals
- S0
- SB0
- Spirals

Data from
Ferrarese & Ford 2004

Our sample:

NGC 2179, NGC 4343, NGC 4435

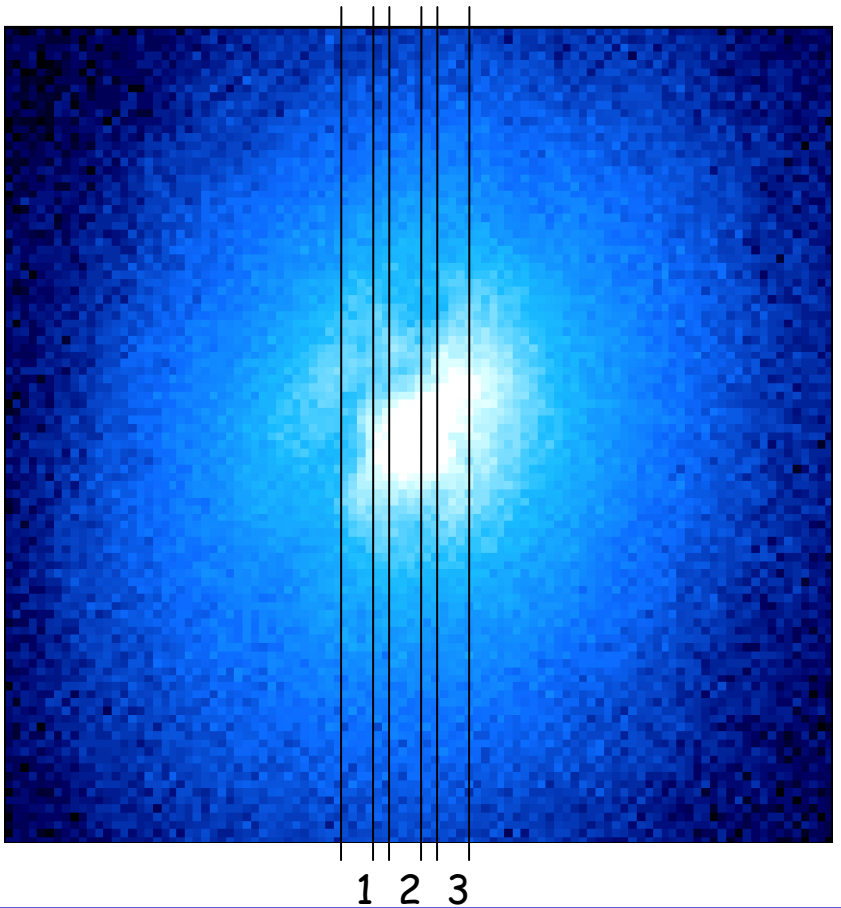
a critical region in the M-σ plane:

- high scatter region between ionized gas and water masers

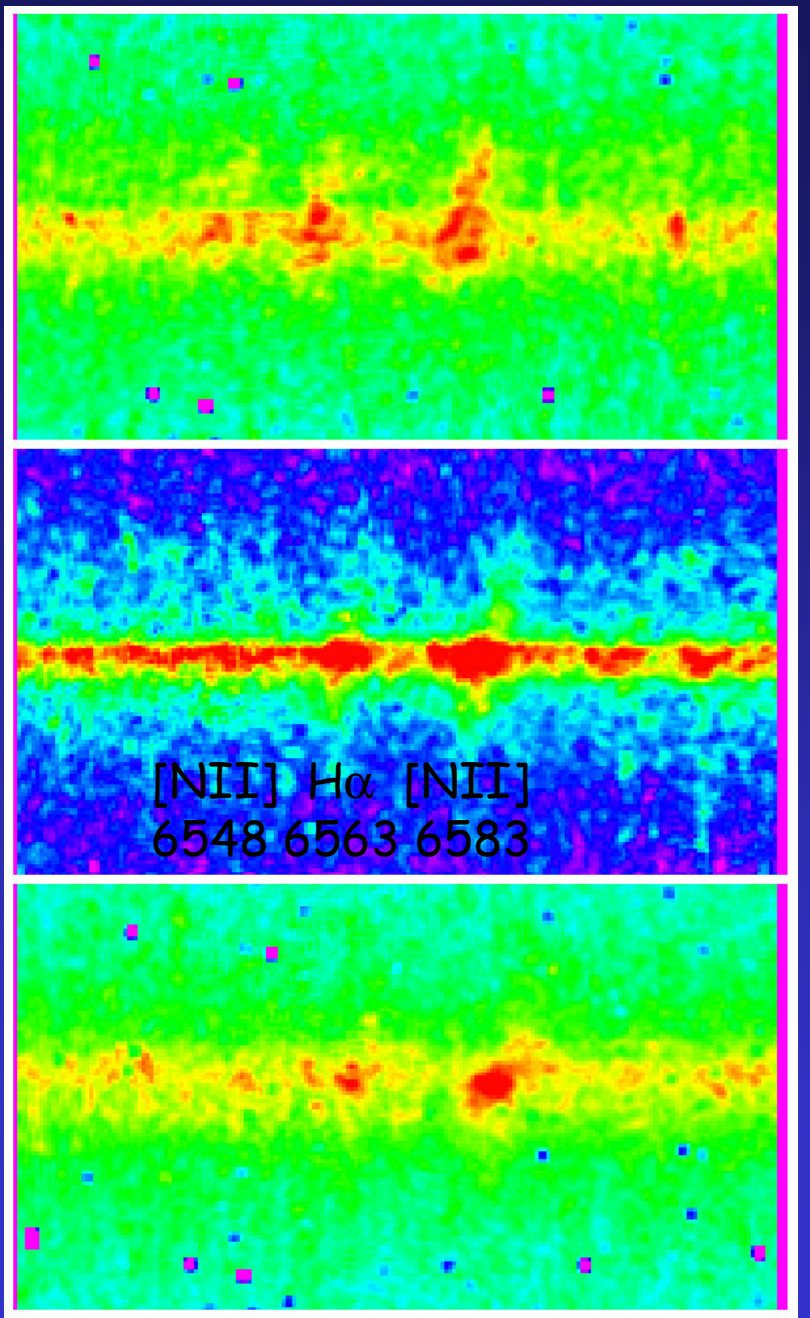
- Ground based kinematical data consistent with the presence of a CNKD rotating around a SMBH

NGC 2179

0"2 arcsec slits

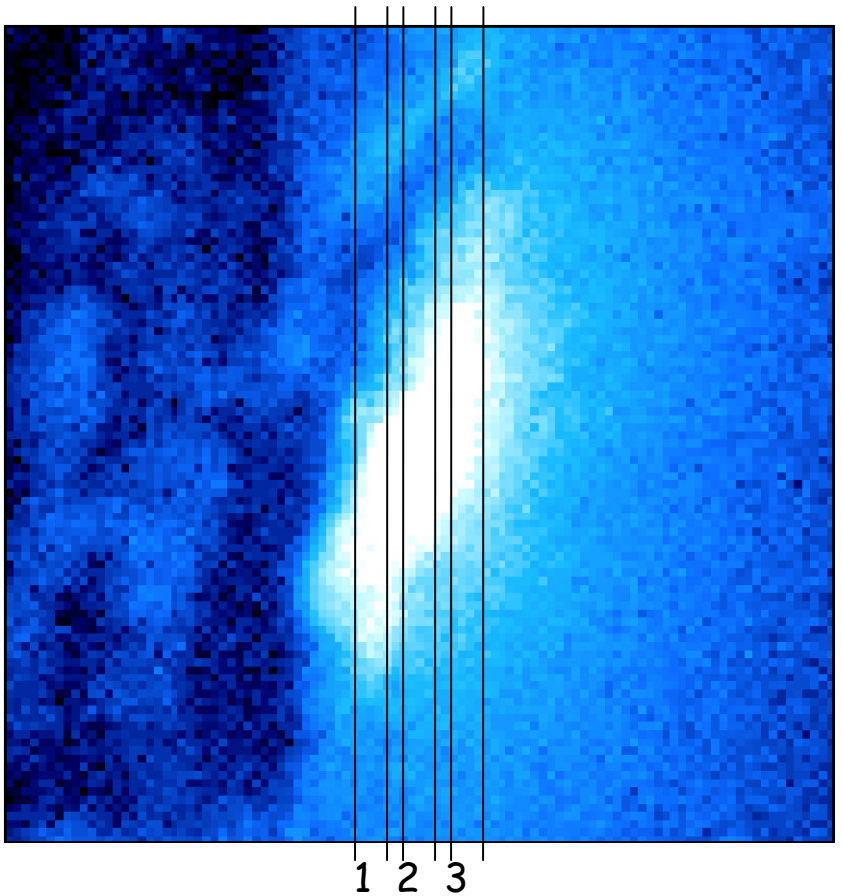


Field of view 5"X5"



NGC 4343

0"2 arcsec slits



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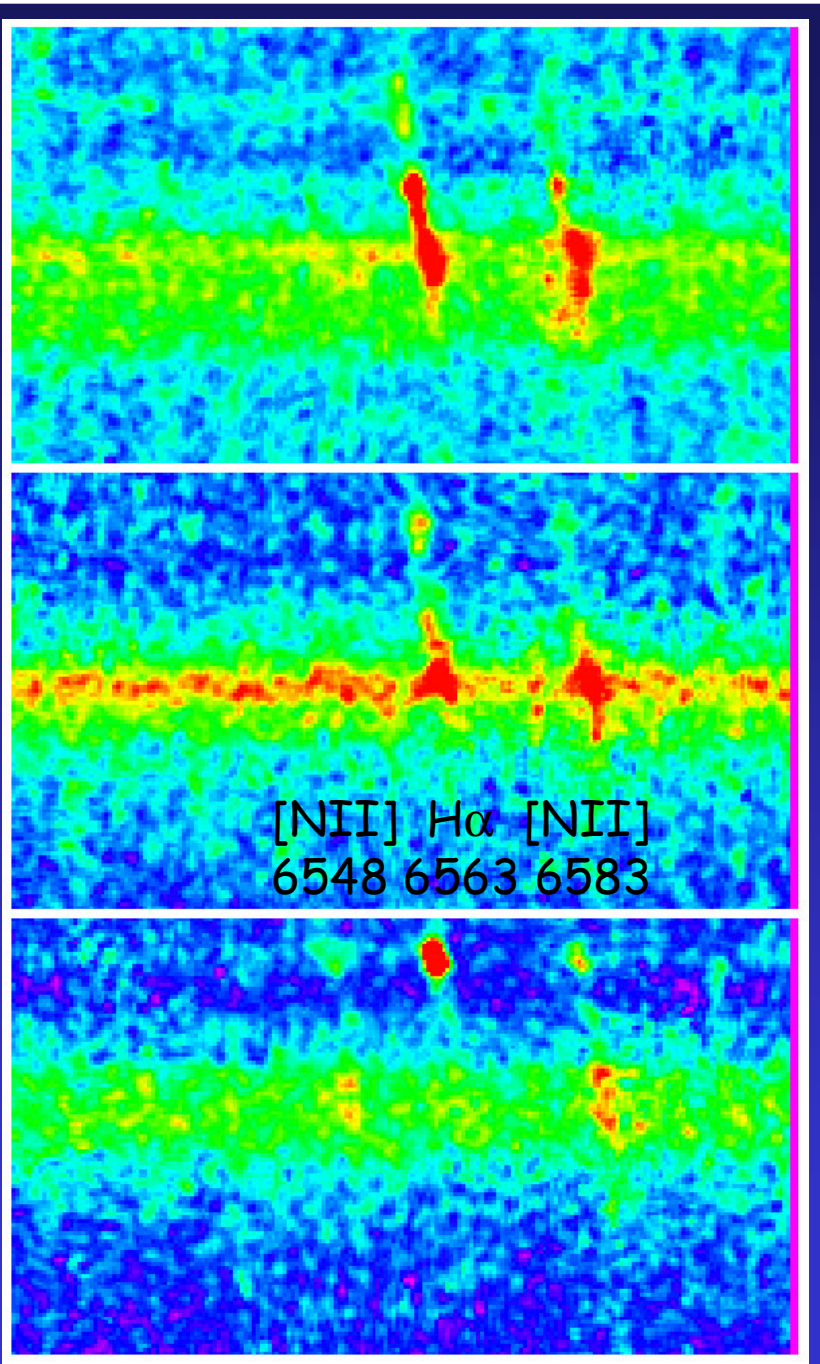
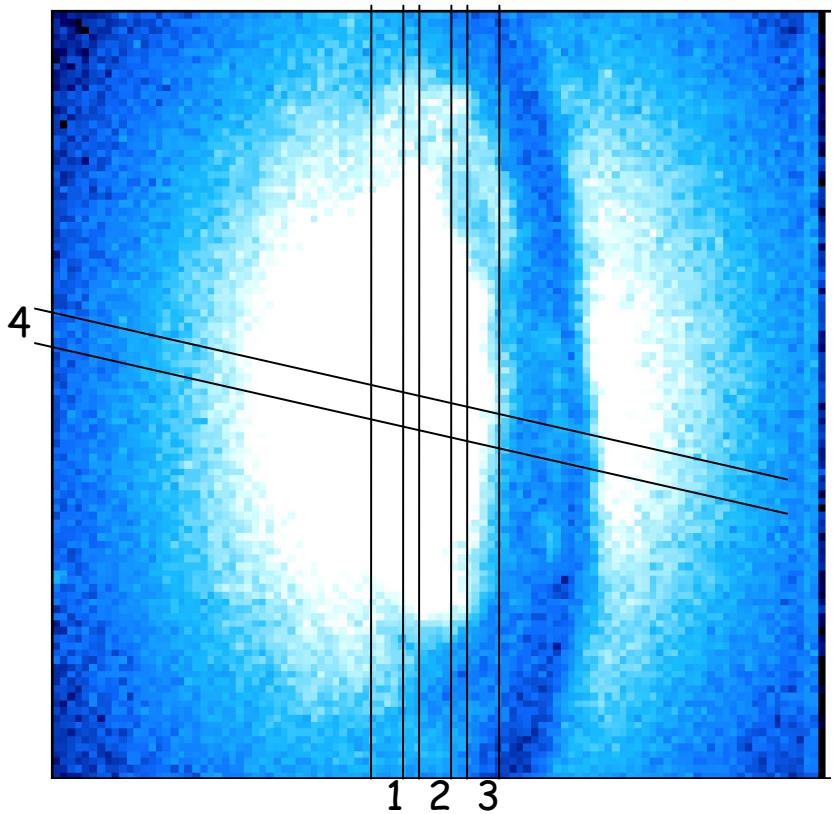


NGC 4435



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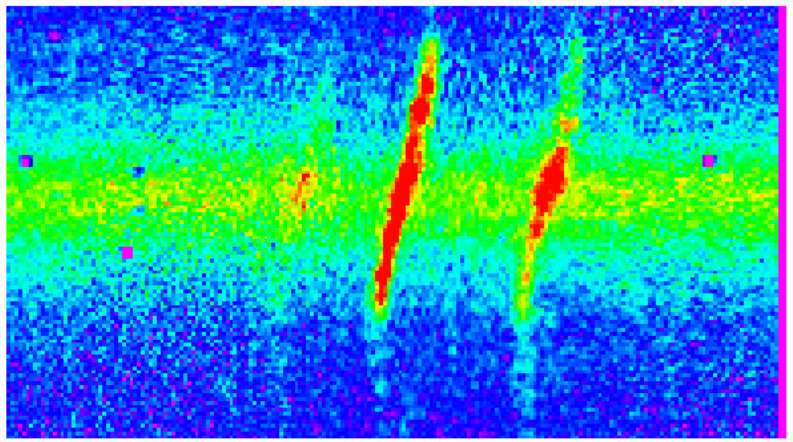

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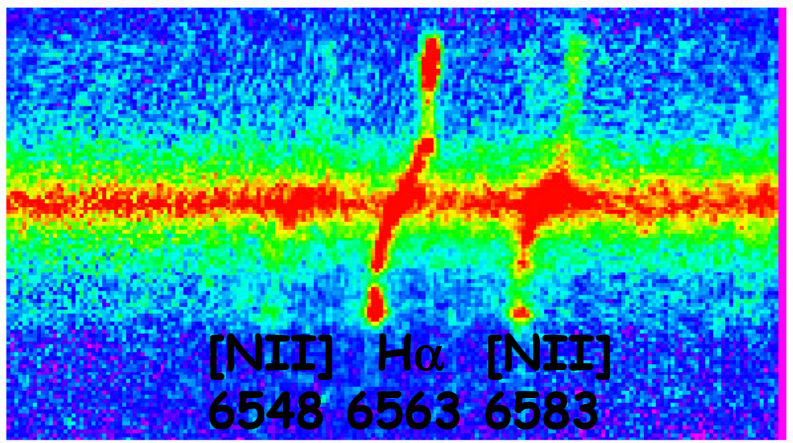

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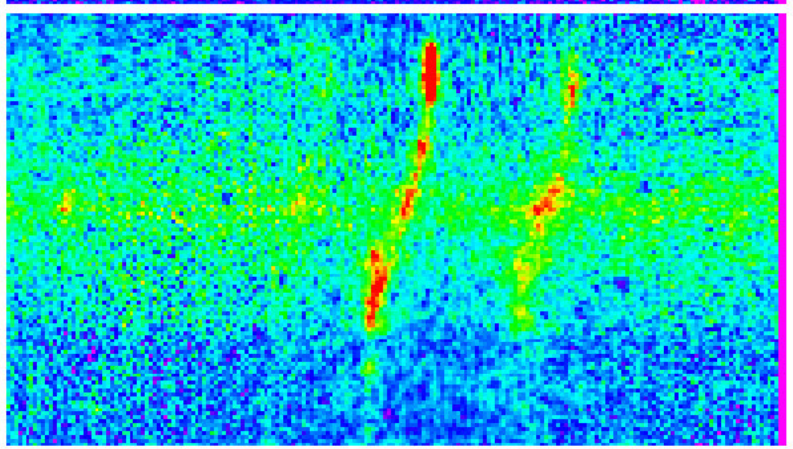

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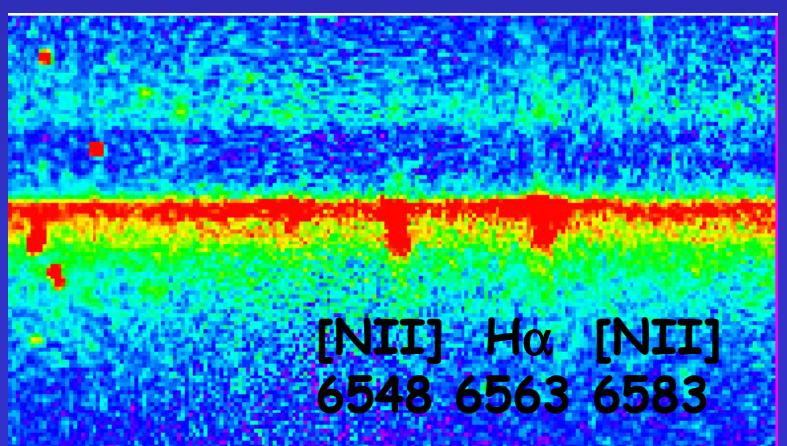
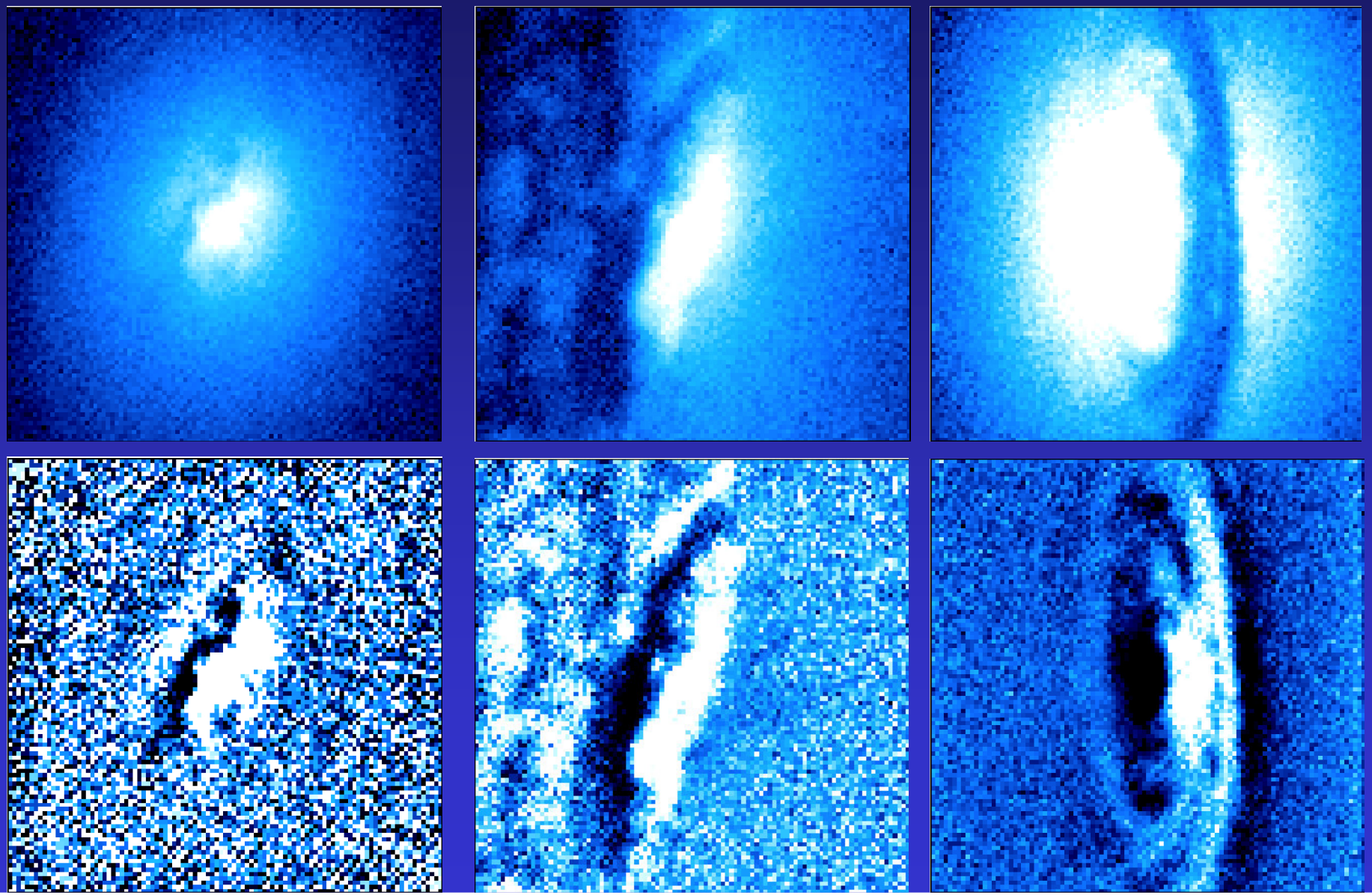


Dust lane morphology:

NGC 2179 NGC 4343 NGC 4435



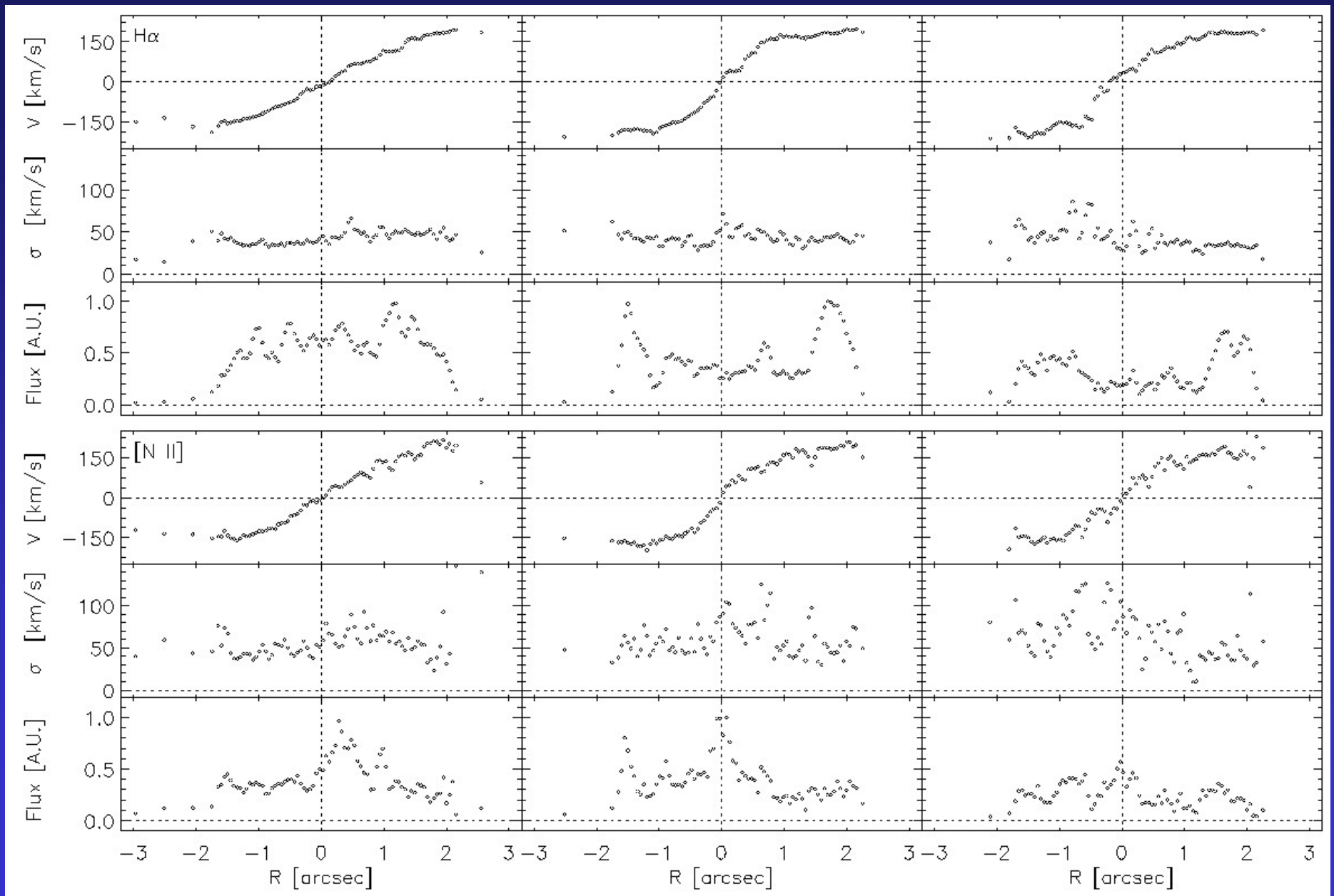
NGC 2179 and NGC 4343 show:

1. Irregular kinematics
2. Irregular dust lane morphology
3. Differences between Hα and [NII] kinematics

NGC 4435 shows:

1. Regular kinematics
2. Regular dust lane morphology
3. Small differences between Hα and [NII] kinematics

Ionized gas kinematics – NGC 4435



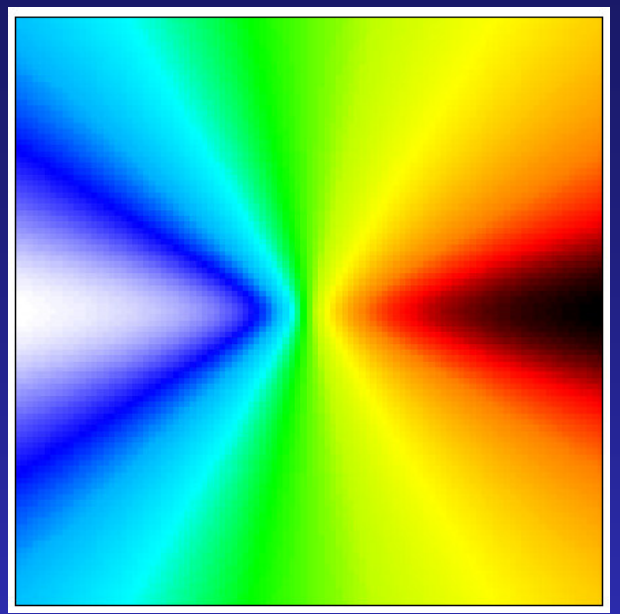
Preliminary results:

1. The ground based selection criteria does not ensure the regularity of kinematics (but improve the fraction of finding measurable BH).
2. Regular kinematics is associated with a regular dust lane morphology (Ho et al 2001).

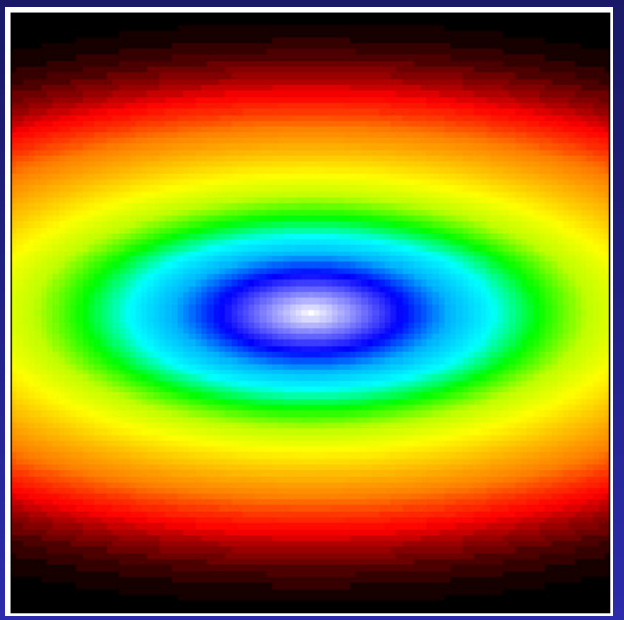
WE WILL DETERMINE THE M_{SMBH} ONLY FOR NGC 4435

THE 2D MODEL

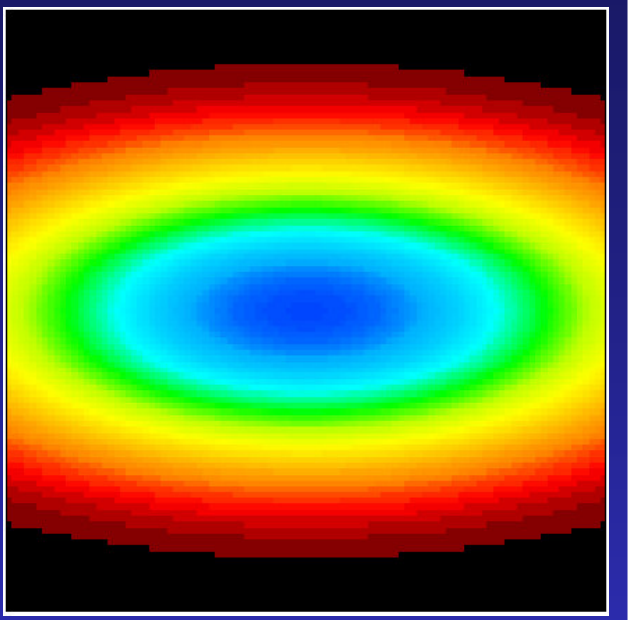
velocity field



velocity dispersion field



flux field



Velocit field: 1. The gas is moving into circular orbits in a thin disk

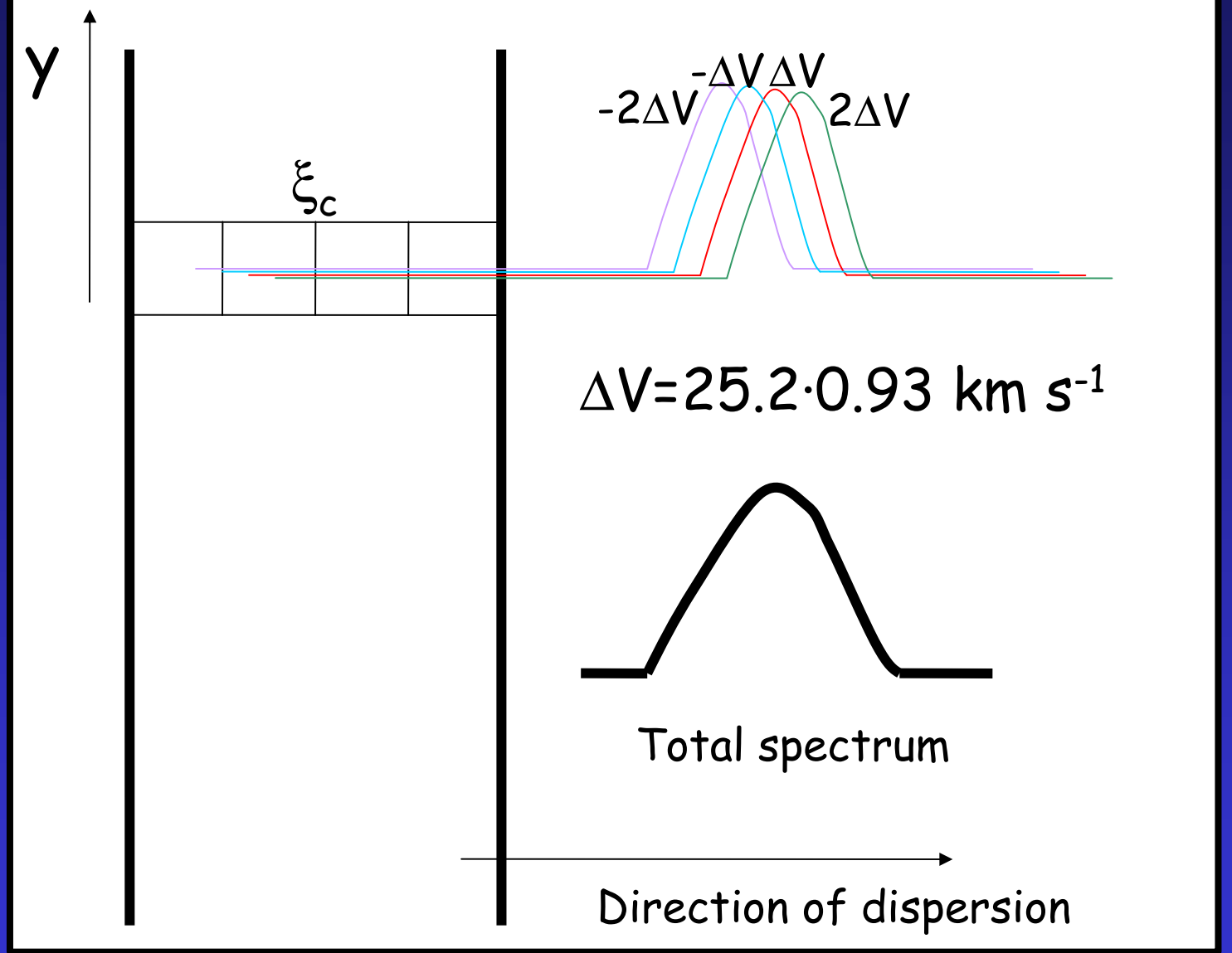
2. The circular velocity V_c is given by the contribution of the stellar potential V_* and the SMBH:

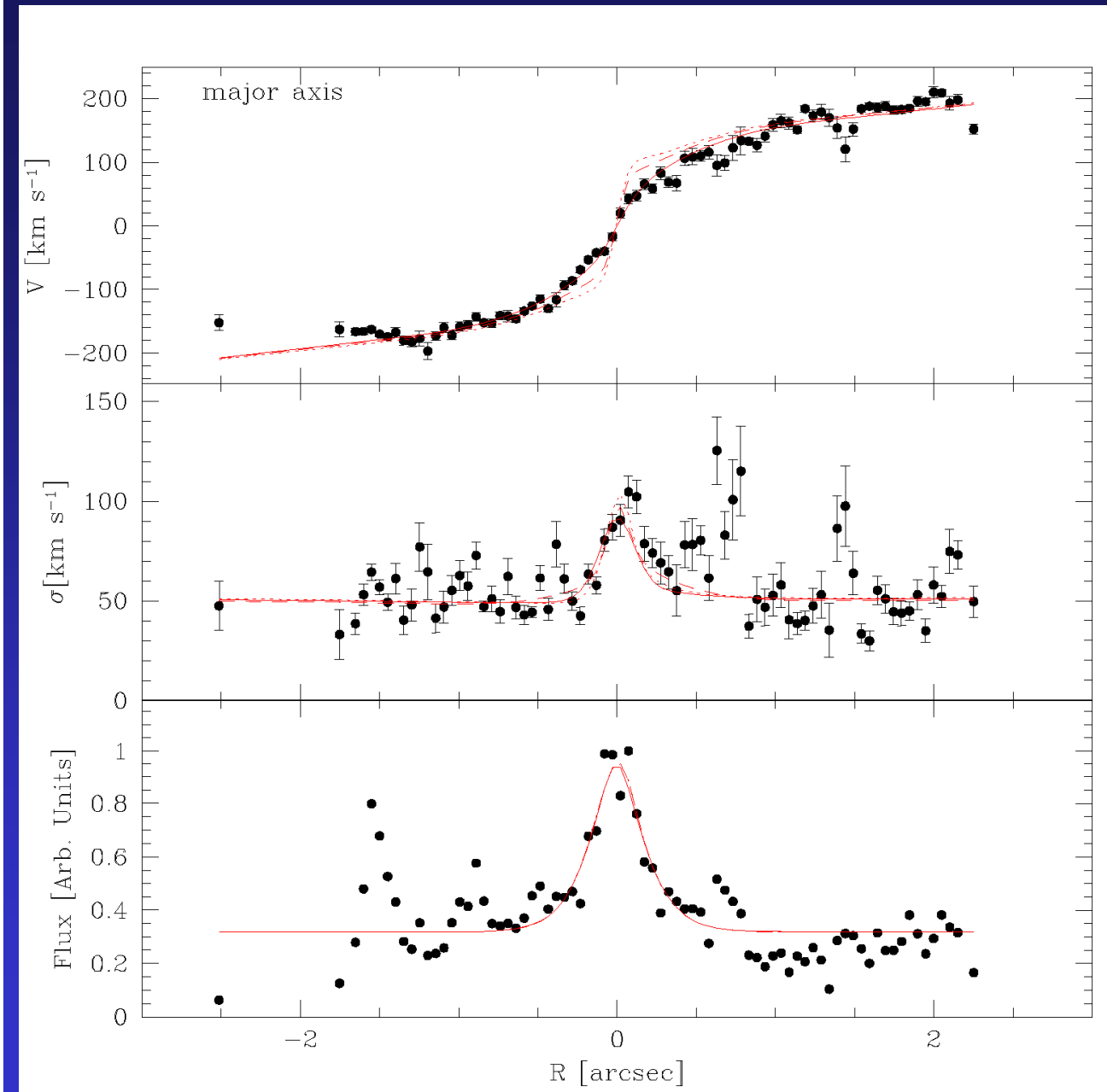
$$V_C = \sqrt{\frac{M}{L} V_*^2 + G\frac{M_{SMBH}}{R}}$$

Vedi Poster #2

SLIT EXTRACTION

Vedi
Poster #2

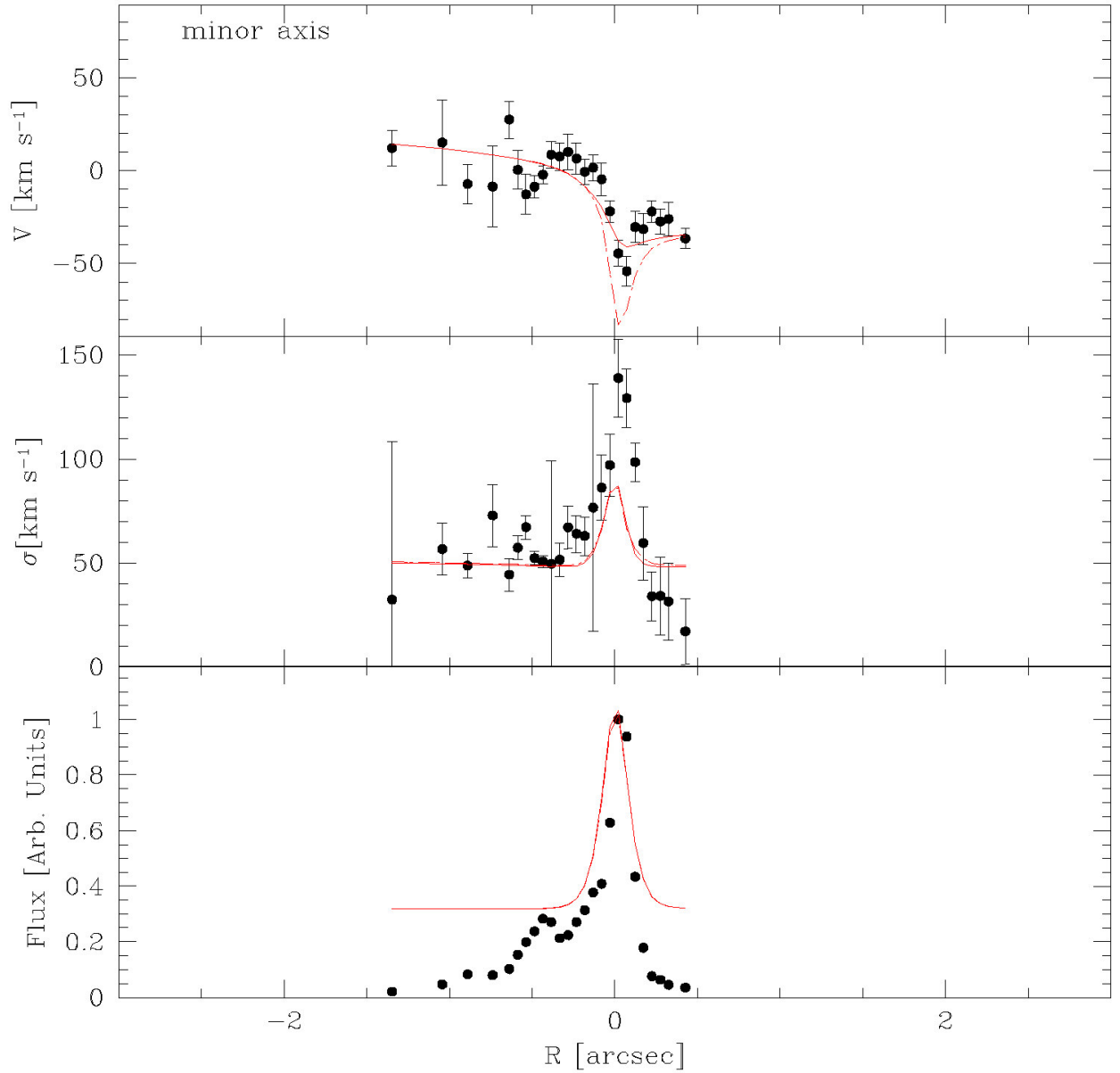




our model

$M_{BH} = 5\ 10^7$

$M_{BH} = 3\ 10^7$

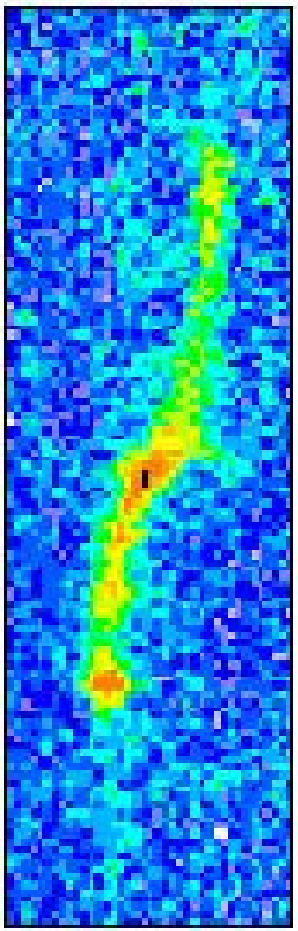


our model

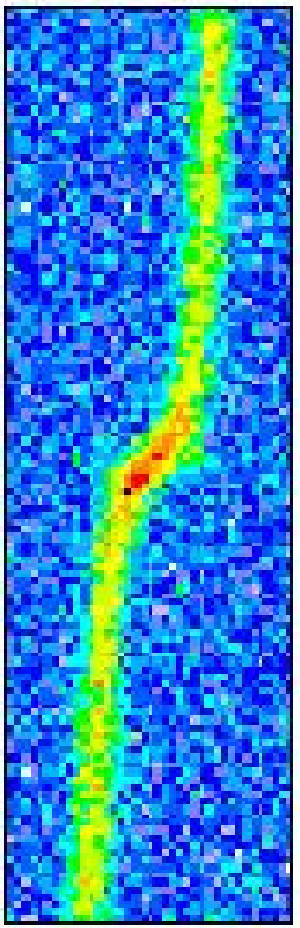
$M_{BH} = 5\ 10^7$

$M_{BH} = 3\ 10^7$

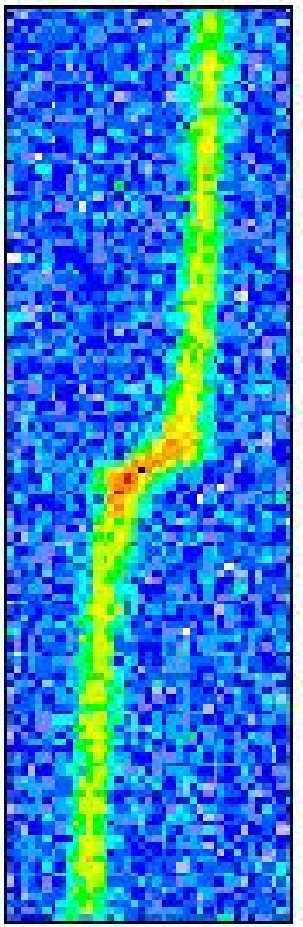
Observed



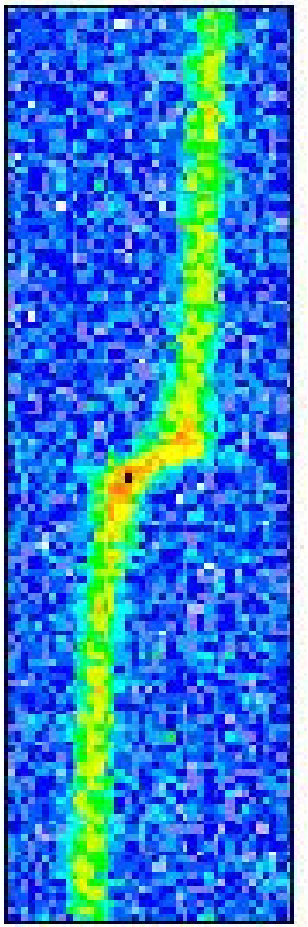
best model



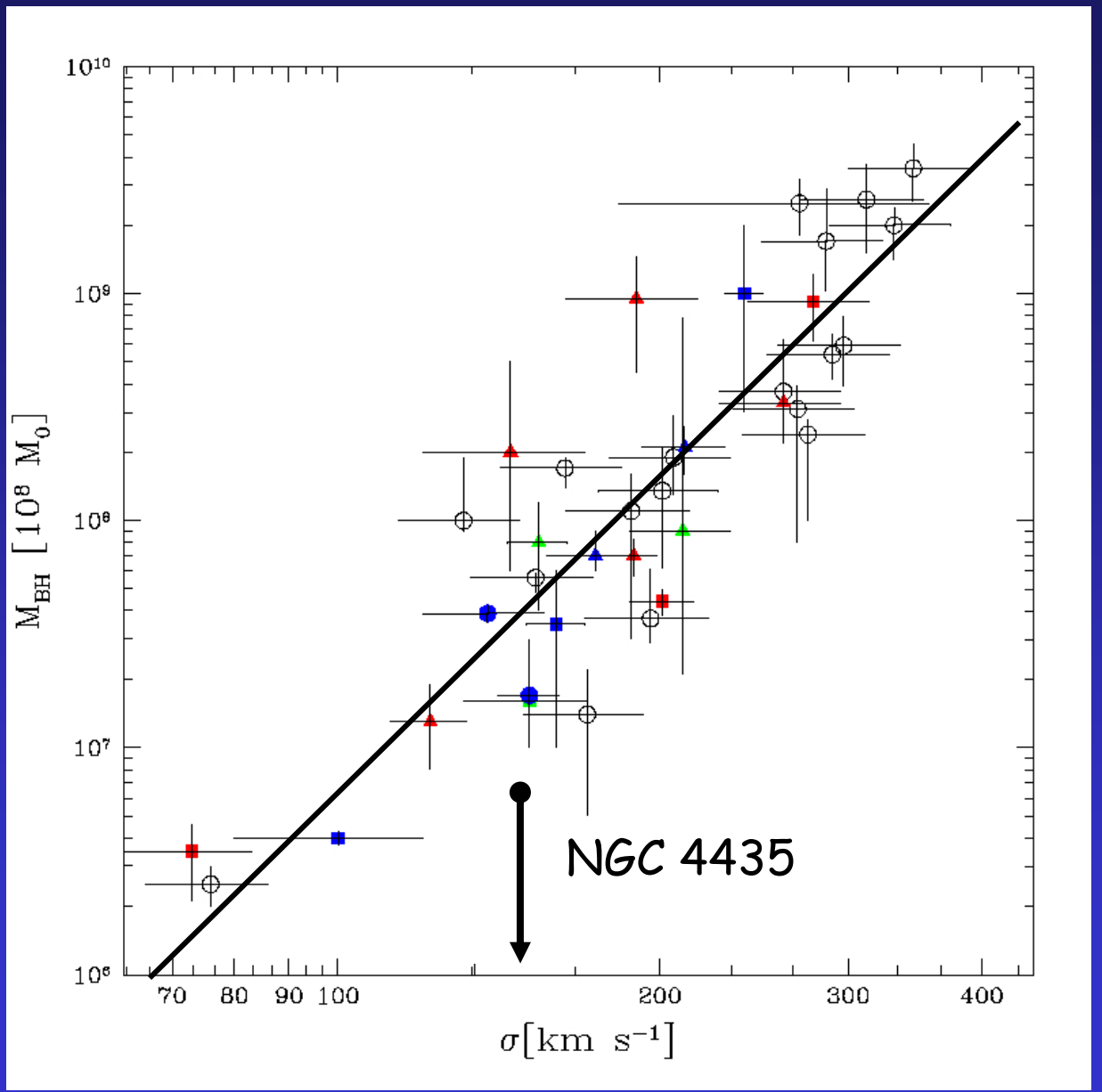
$M_{BH}=3\cdot10^7$



$M_{BH}=5\cdot10^7$



Comparison with the M-σ_* relation



$\sigma_* = 154$ km s^{-1}

$M = 5 \cdot 10^7 M_{sun}$

SUMMARY AND CONCLUSIONS

HST/STIS observations for 3 galaxies selected from ground based observations.

Only the galaxy with a regular dust lane morphology has a regular kinematics

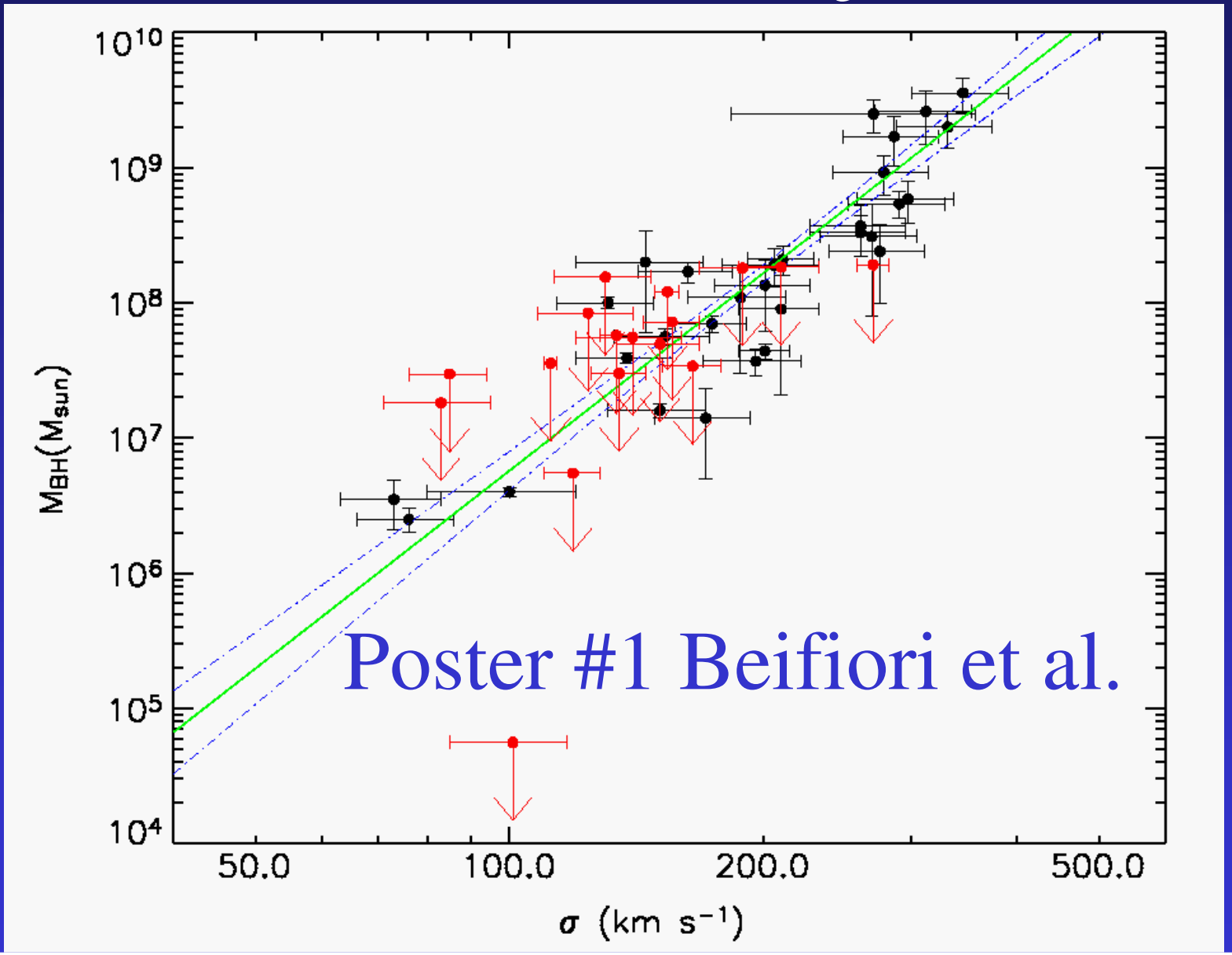
Gaseous kinematics is consistent with $M_{SMBH} = 0$, upper limit $M^{UP}=10^7\ M_{SUN}$

Not consistent with M-σ and M-L_B relations

FUTURE WORK.....

Upper limits : 214 galaxies in the HST-STIS archive

The first 20 galaxies…



Poster # 1 e ½ - Tundo et al.

Black hole mass function through the M-σ_* relation

E.Tundo[1], M.Bernardi[2], E.M.Corsini[1], E.Dalla Bontà[1], A.Pizzella[1], and F.Bertola[1]

(1) Dipartimento di Astronomia, Universitá di Padova, Italy; (2) Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA, USA

ABSTRACT

Studying black holes masses across the time will help clarify the formation of black holes themselves and their host galaxies. Since a direct measure of black holes masses is difficult, we use the M-σ_* relation to infer the black hole mass function. With this aim we use the stellar velocity dispersion measurements in the Sloan Digital Sky Survey to derive the present black hole mass function. Since the majority of the galaxies we use do not have such measurements, we plan to use the relation between the stellar sigma and the width of the [OIII]5007 line. In this poster we present our preliminary results on the calibration of such relation.

ABELL 3565 –BCG CENTRAL

*** NII**

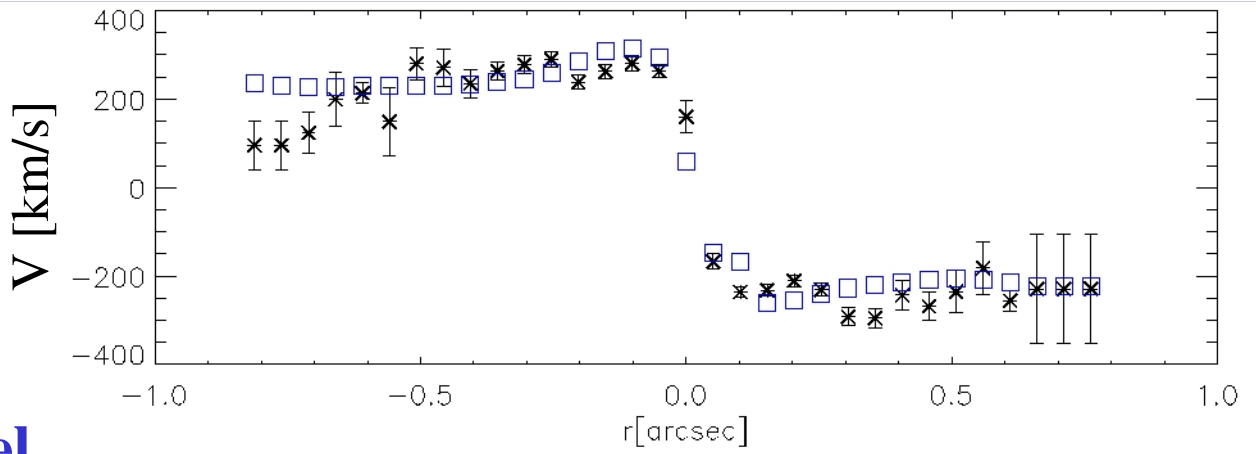
□ model

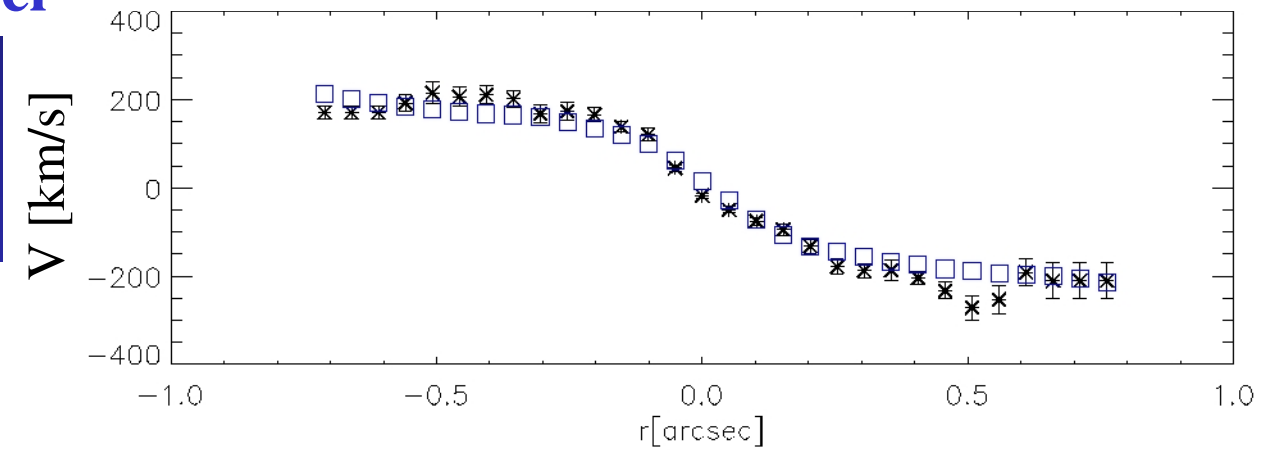
+ 0.2 arcsec OFFSET

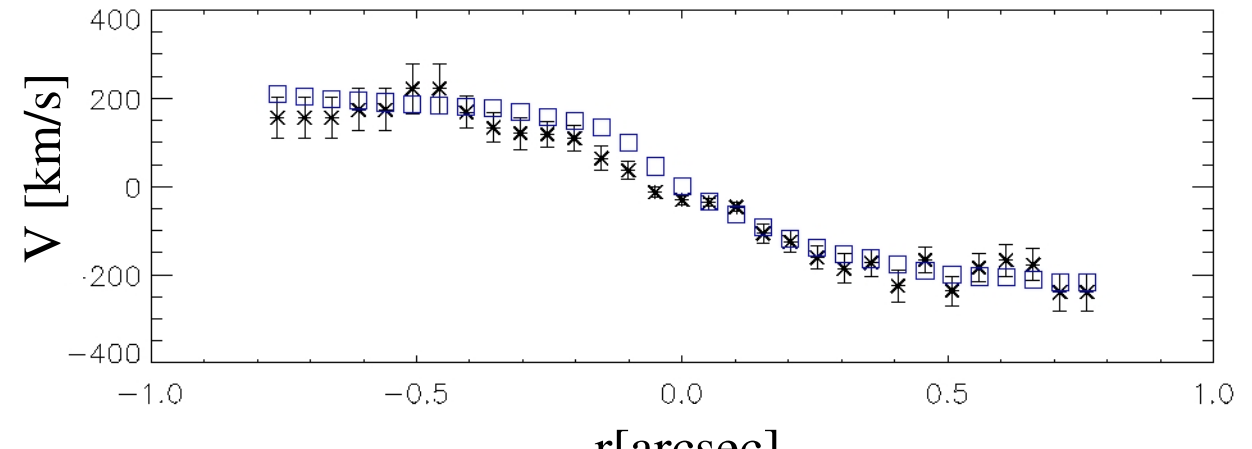
Poster #2

Dalla Bontà et al.

- 0.2 arcsec OFFSET

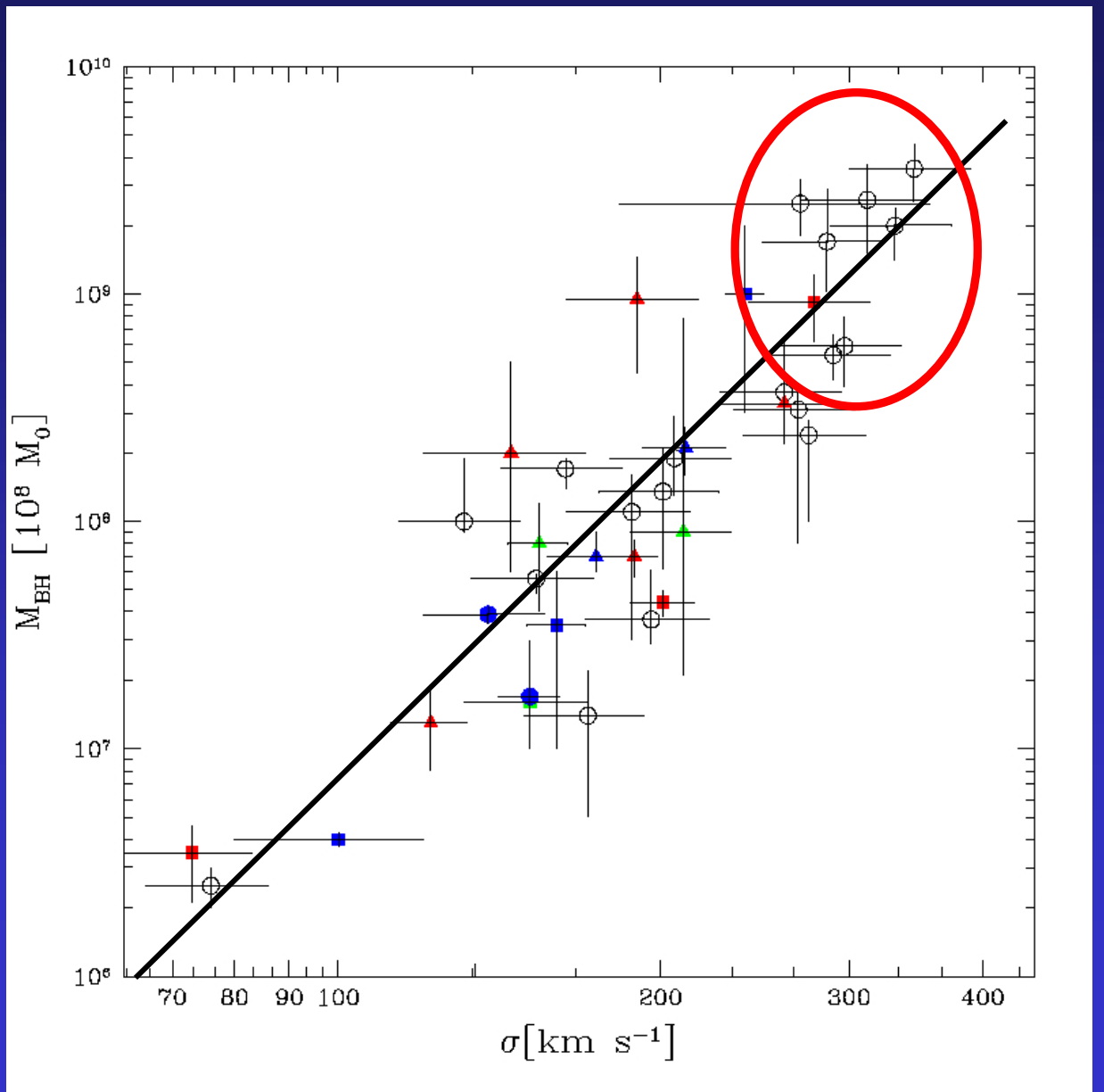




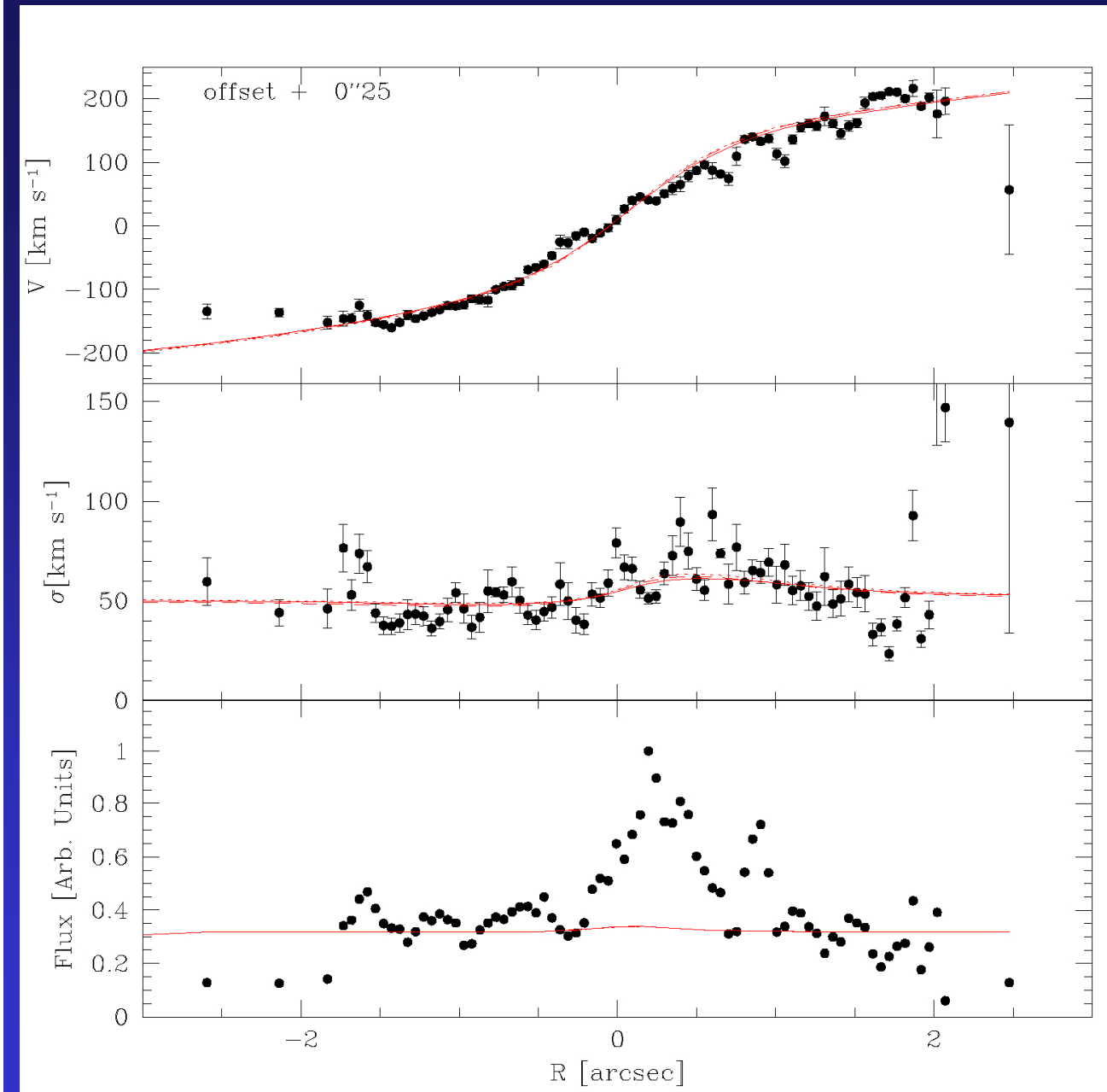


Scale=193pc/arcsec

Comparison with the M-σ_* relation



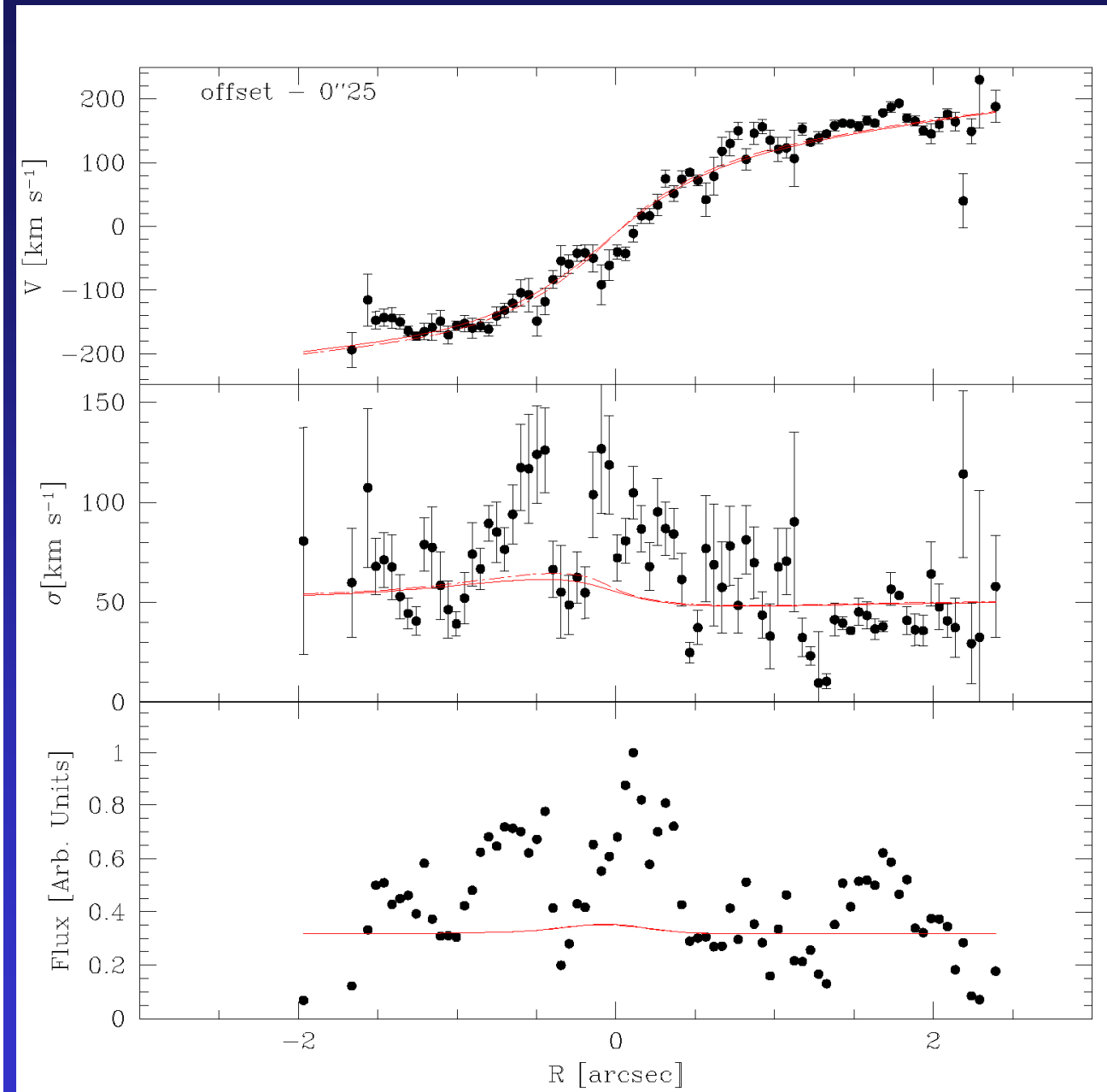
Poster #2



our model

$M_{BH} = 5\ 10^7$

$M_{BH} = 3\ 10^7$

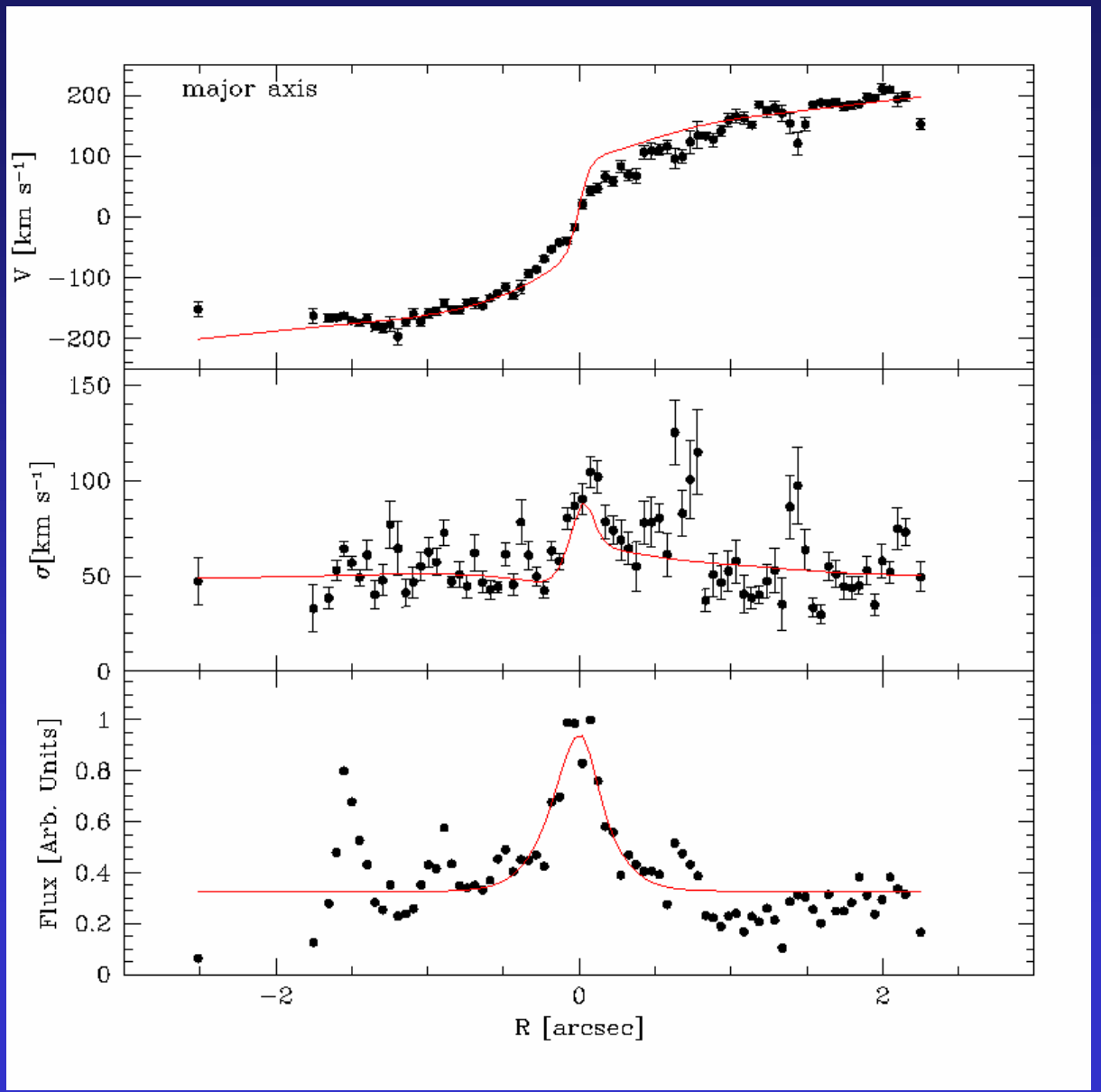


our model

M_{BH} =5 10^7

M_{BH} =3 10^7

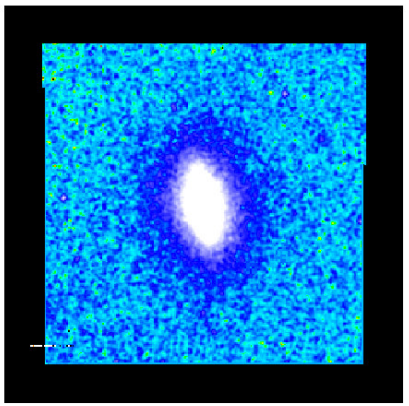
Constraining the M_{SMBH} = 3 10^7 M_{sun}

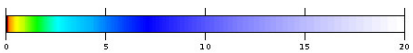


For
ΔPA = -6°
i=74°

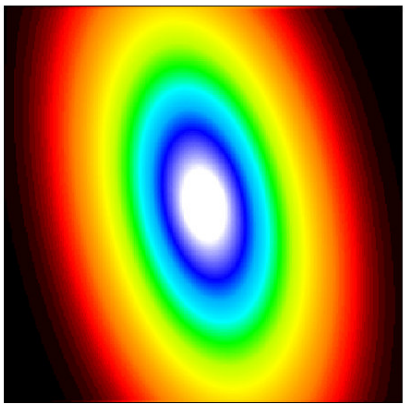
Comparison with the Marconi & Hunt (2003) relation

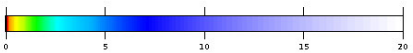
2mass H



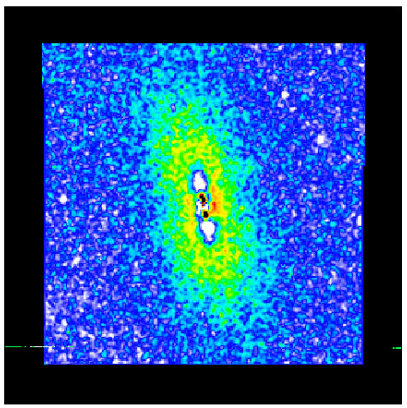


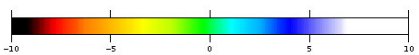
model (Bulge+ Disk)



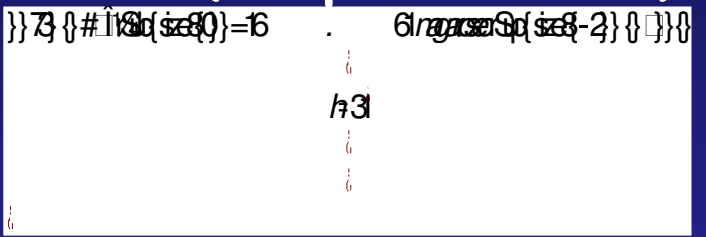


residuals

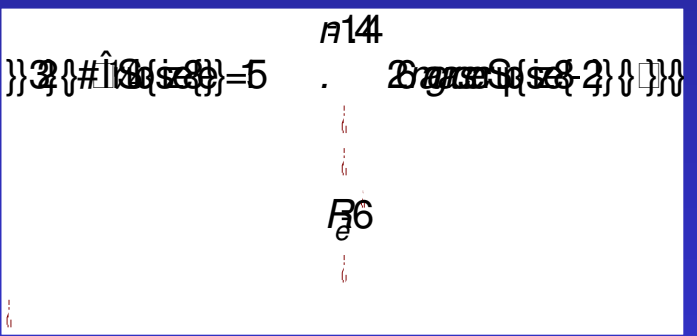




Disk (Exponential)



Bulge (Sersic law)



$L_{BL} = 1.53 \cdot 10^{10}\ L_{sun}$

$M_{BH} = 3 \cdot 10^{7}\ M_{sun}$

Parameters for the model…

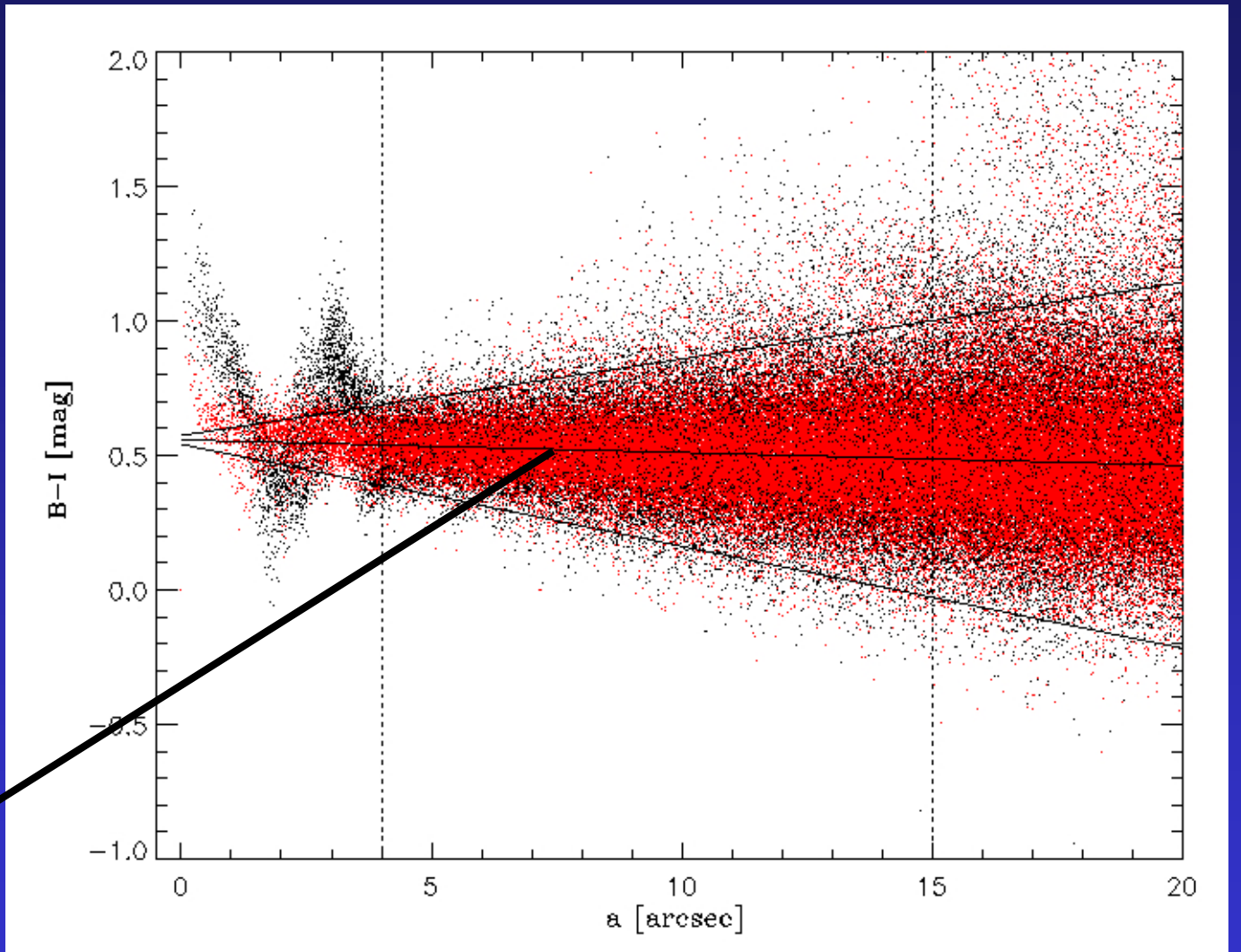
1. Determination of the stellar potential (and v_*) from the surface brightness radial profile (correction for dust absorption, decomposition of the SB profile into Gaussian functions, spherical symmetry and constant mass-to-light ratio)

2. Determination of the geometrical parameters of the gaseous disk (center, inclination, position angle) from the analysis of the dust lanes morphology.

3. Determination of the slit position by comparing the spectra profile to the STIS acquisition image, taking into account the 4-pixel slit width.

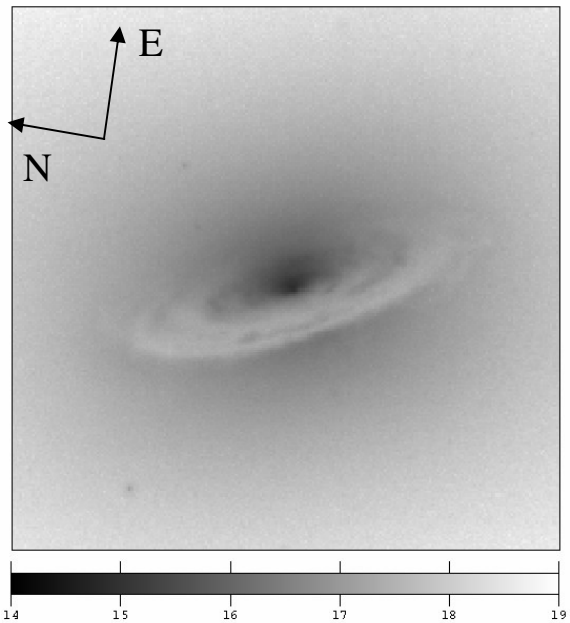
Determination of the Stellar potential

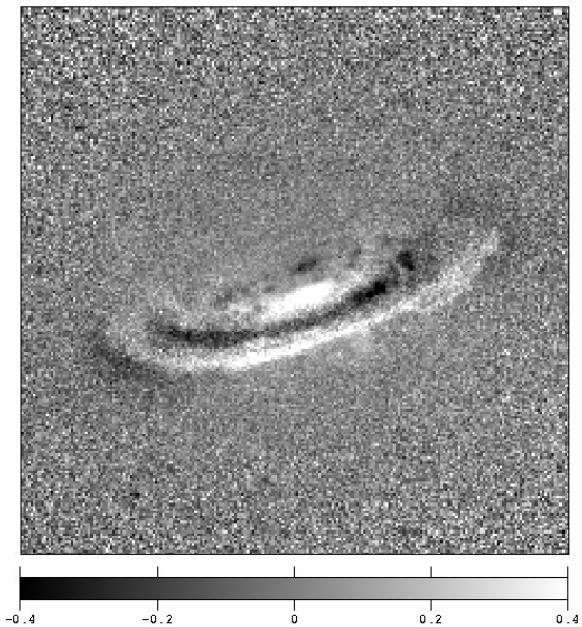
$A_I \alpha E(B-I)$

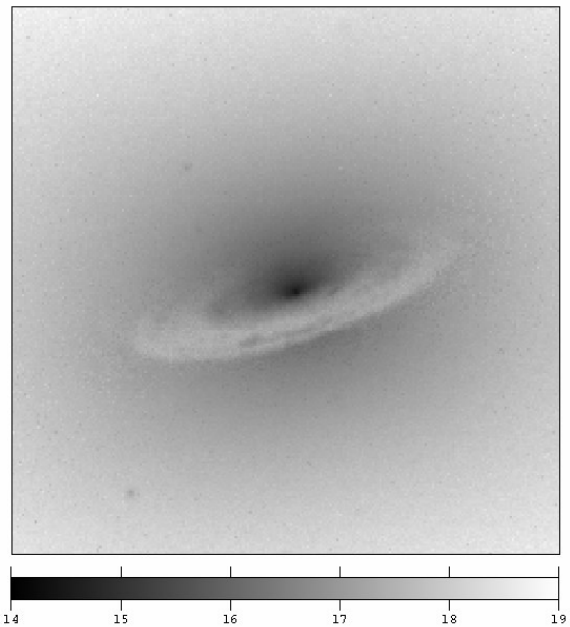


$(B-I)_0$

Determination of the Stellar potential







I E(B-I) I_{CORR}

field: 10" X 10"
HST/PC data

Dependencies from Position angle and inclination

We explored the range $67° < i < 72°$, $0°3 < \Delta PA < 5°5$

we found that
$2.10 < M/L < 2.25$
$M_{SMBH} = 0$ always