VEGAS: A VST Early-type GAlaxy Survey.
The faint substructures of NGC 4472 stellar halo.

MARILENA SPAVONE

ON THE BEHALF OF THE VEGAS TEAM:

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OUTLINE

- The VST VEGAS survey
- Science aims
- Results on NGC 4472 field
- Conclusions
- Future plans

THE VEGAS SURVEY

- Multiband *u, g, r, i* survey of ~ 110 galaxies with v_{rad} < 4000 km/s in all environments (field to clusters).

An example

Obj. name	Morph. type	u	g	r	i
IC 1459	E3		5630	1850	1700
NGC 1399	E1		8100	5320	2700
NGC 3115	S0	14800	8675		6030

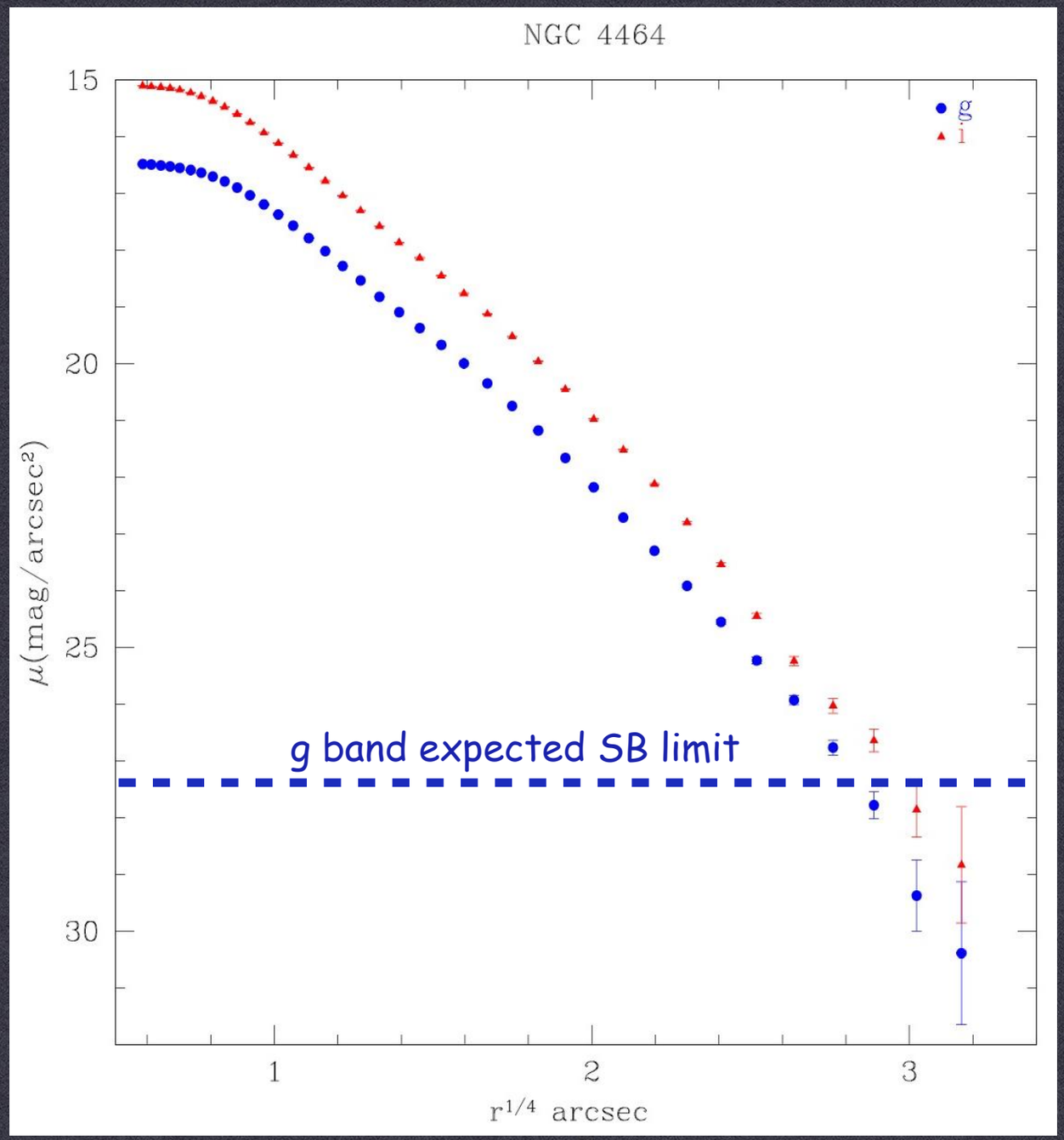
Observations to date (to P94)

g-BAND ~ 16%
i-BAND ~ 19%
r-BAND ~ 3%
u-BAND ~ 1%

\+ FORNAX

THE VEGAS SURVEY

- Multiband *u, g, r, i* survey of ~ 110 galaxies with v_{rad} < 4000 km/s in all environments (field to clusters).
- OT ~ 350 h @ vst over 5 years
- Expected SB limits: 27.5 g, 27.0 r and 26.2 i mag/arcsec^2.



THE VEGAS SURVEY

- Multiband *u, g, r, i* survey of ~ 110 galaxies with v_{rad} < 4000 km/s in all environments (field to clusters).
- ~ 350 h @ vst over 5 years
- Expected SB limits: 27.5 g, 27.0 r and 26.2 i mag/arcsec2.
- Total exposure time per pointing in each filter ~ 3h.
- Complementary survey in the south of "NGVS" with comparable depth

SCIENCE AIMS

- SB out to 8-10 r_e (stellar halos);
- (g – r) and (g – i) color gradients;
- GC density, color distribution and luminosity function;
- SBF fluctuations;
- Long-lived external structure and the diffuse component of the galaxies and their connection with the environment.

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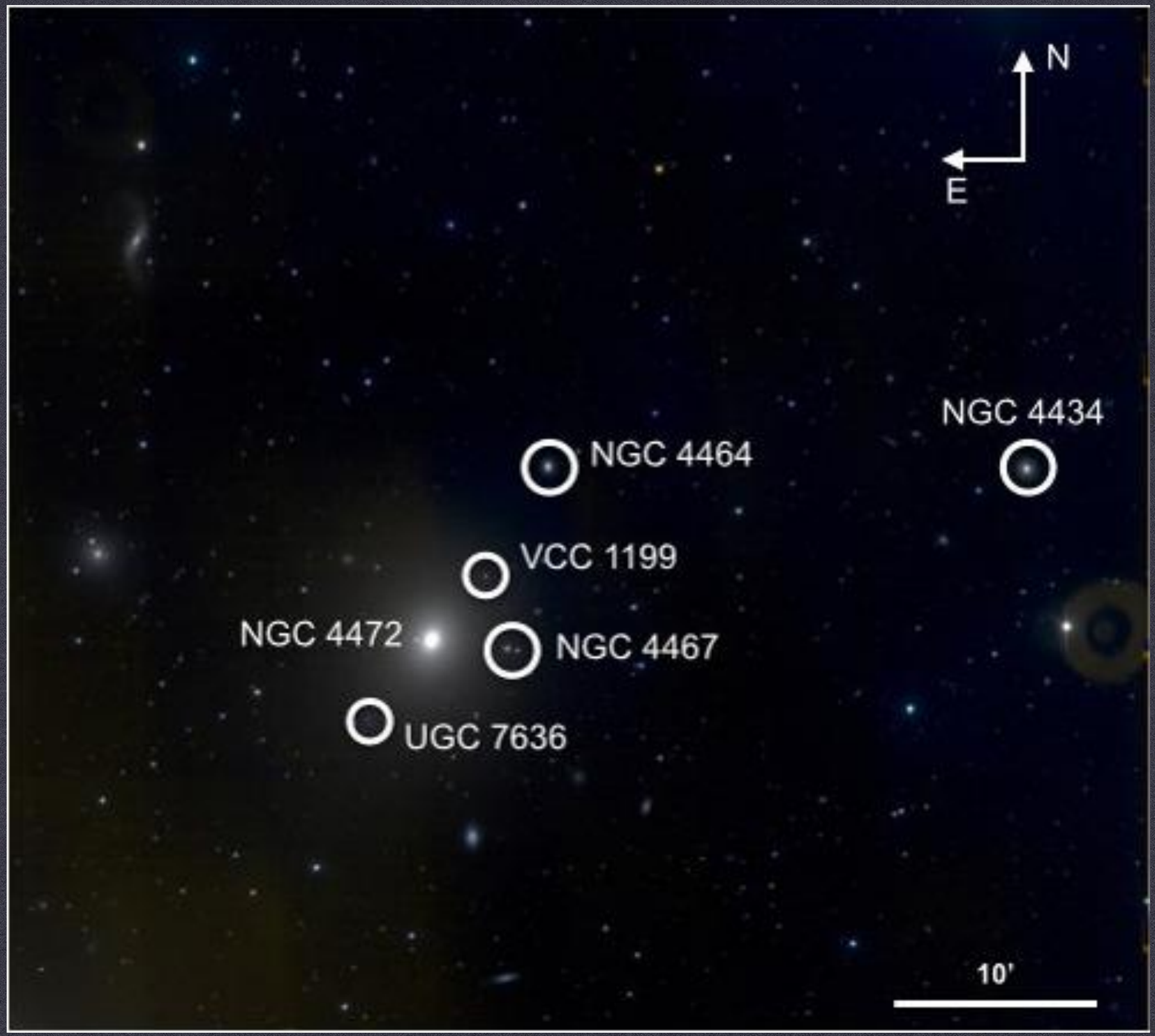
NGC 4472 FIELD: A TEST CASE

- Ample literature for comparisons
- Nearby field with both a very extended object and smaller galaxies over a giant galaxy halo
  - Tests on the data reduction and background subtraction
- Comparison with "NGVS"

NGC 4472 VST FIELD

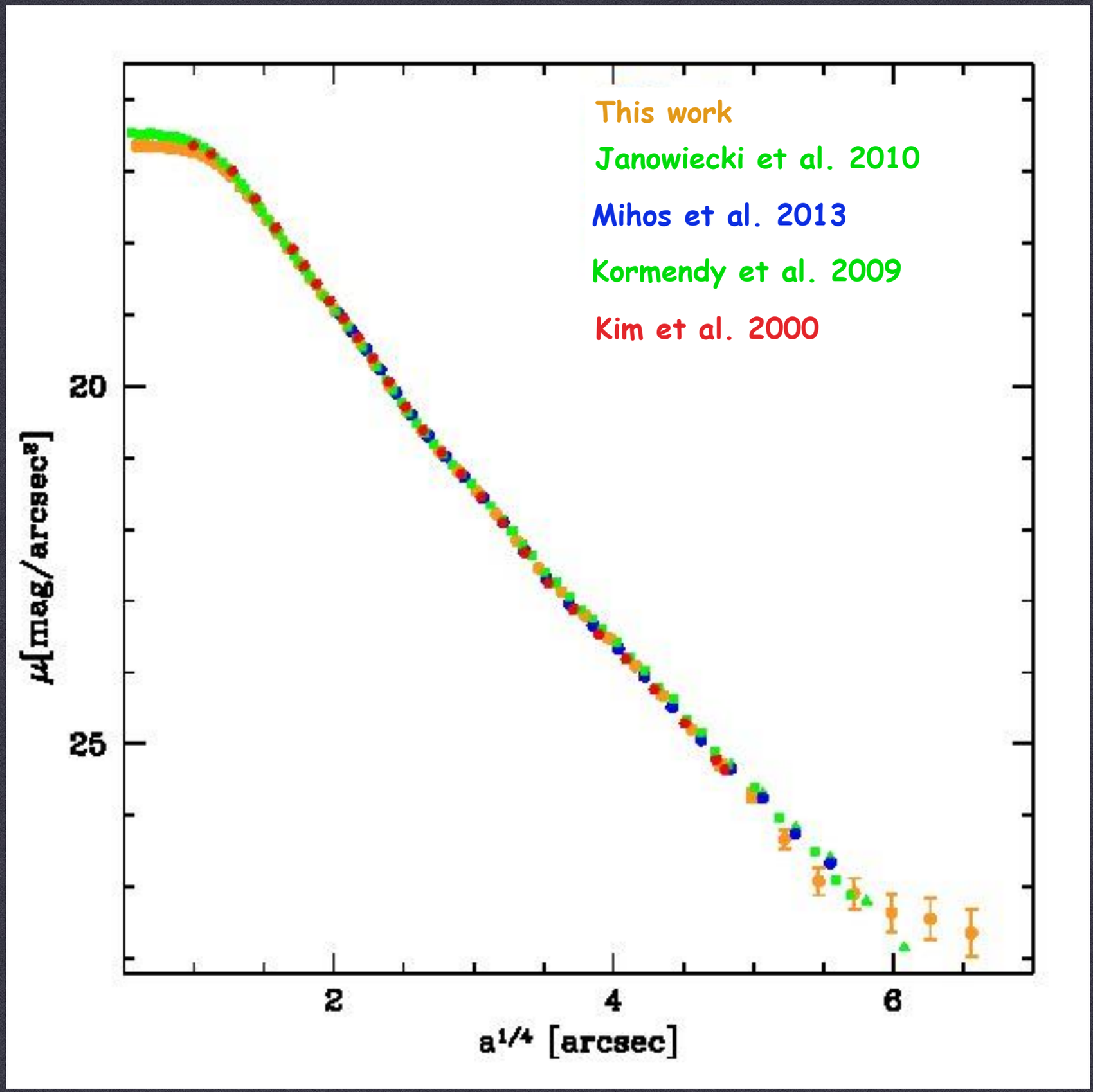


DATA REDUCTION

Pipeline developed in Naples by A. Grado & L. Limatola

- from raw data to fully calibrated images
- report on the data reduction (with QC plots)
- it includes a growing set of analysis tools, as:
  - mask of bright stars & halos
  - cold/hot pixel mask
  - aperture & PSF photometry
  - tool for the background fit

RESULTS ON NGC 4472

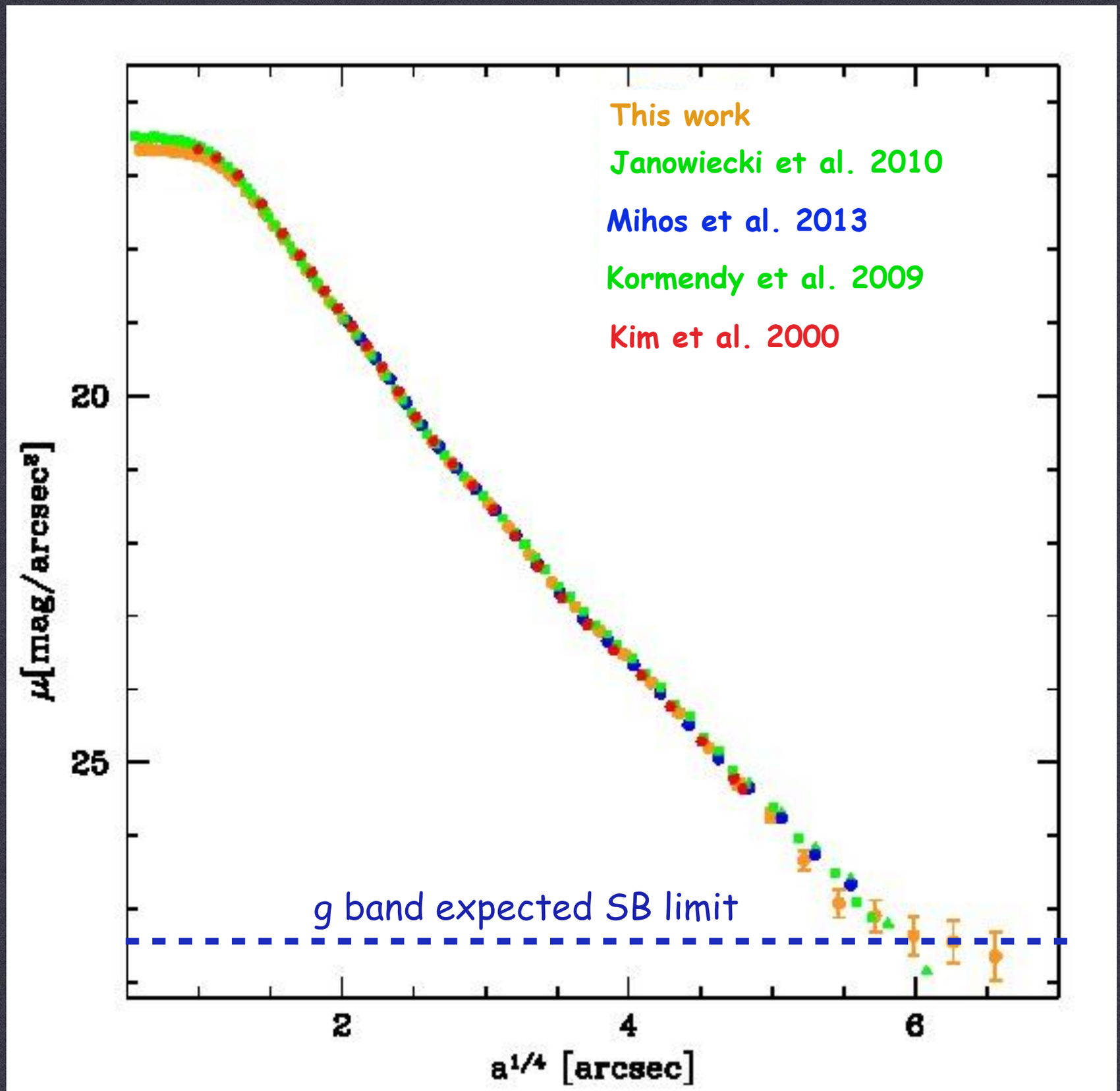


B band (Mihos et al. 2013)
$\Delta m = -0.4$ mag

V band (Kormendy et al. 2009 & Janowiecki et al. 2010) by
$\Delta m = +0.4$ mag

r band (Kim et al. 2000)
$\Delta m = +0.9$ mag

RESULTS ON NGC 4472



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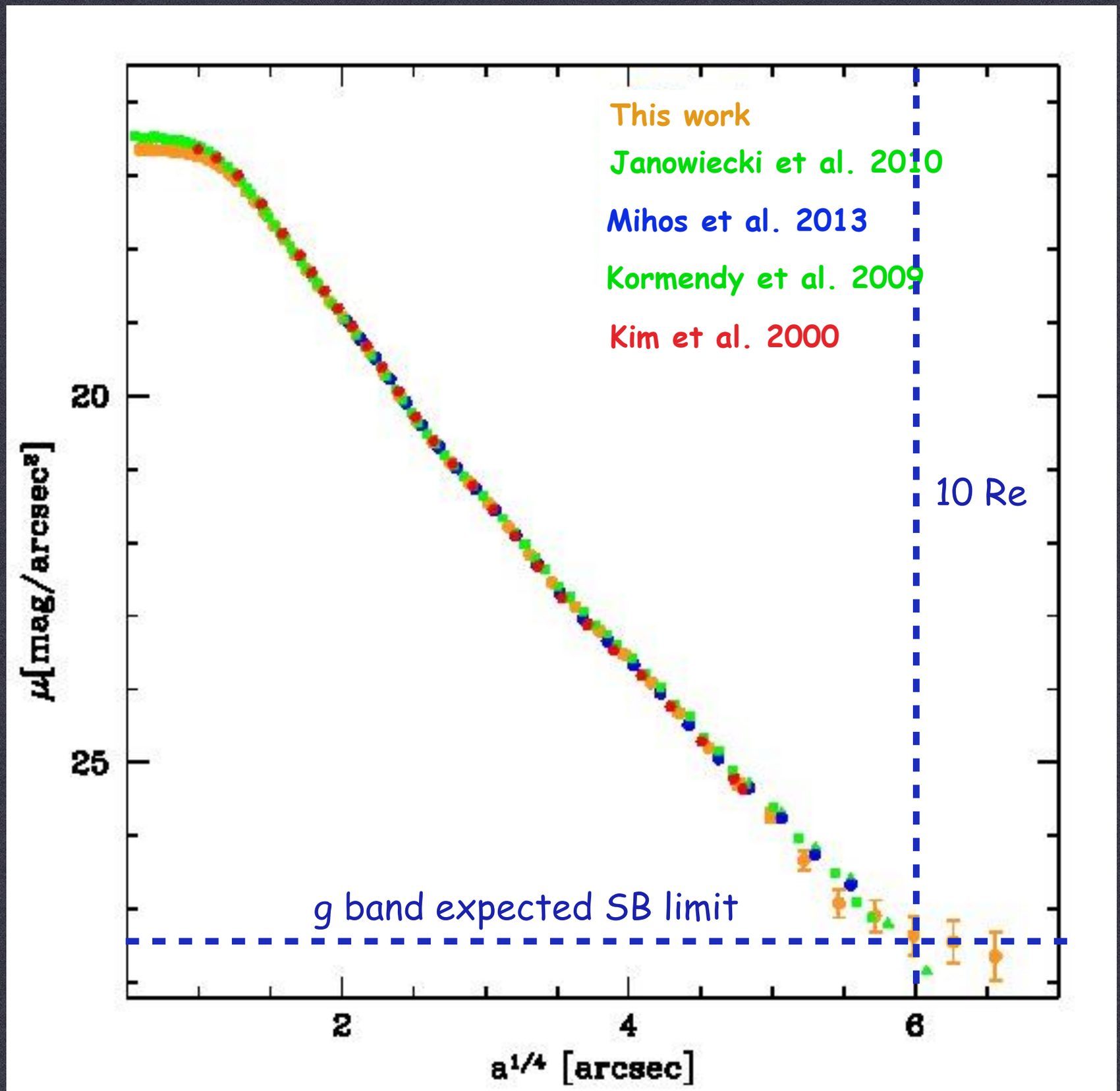

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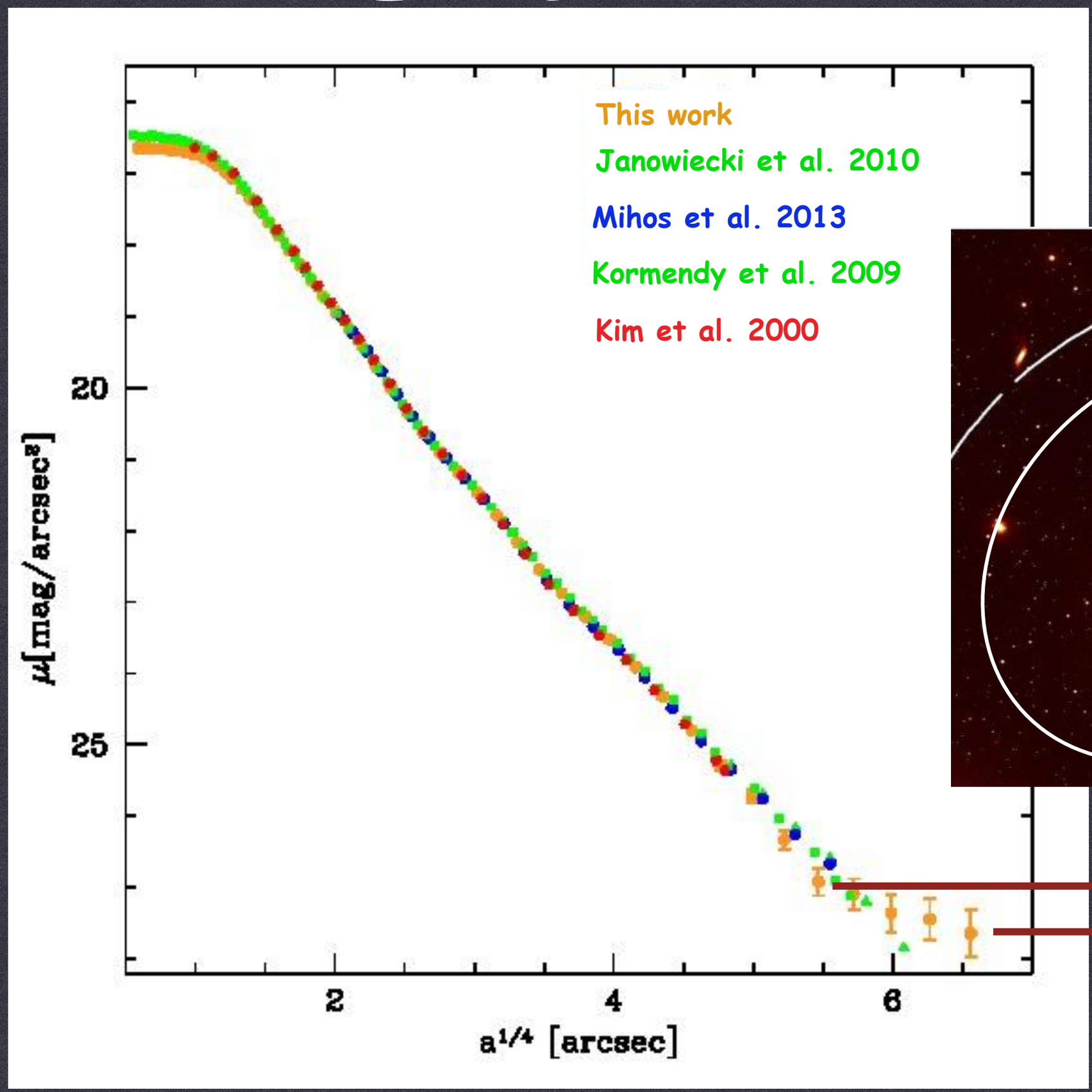
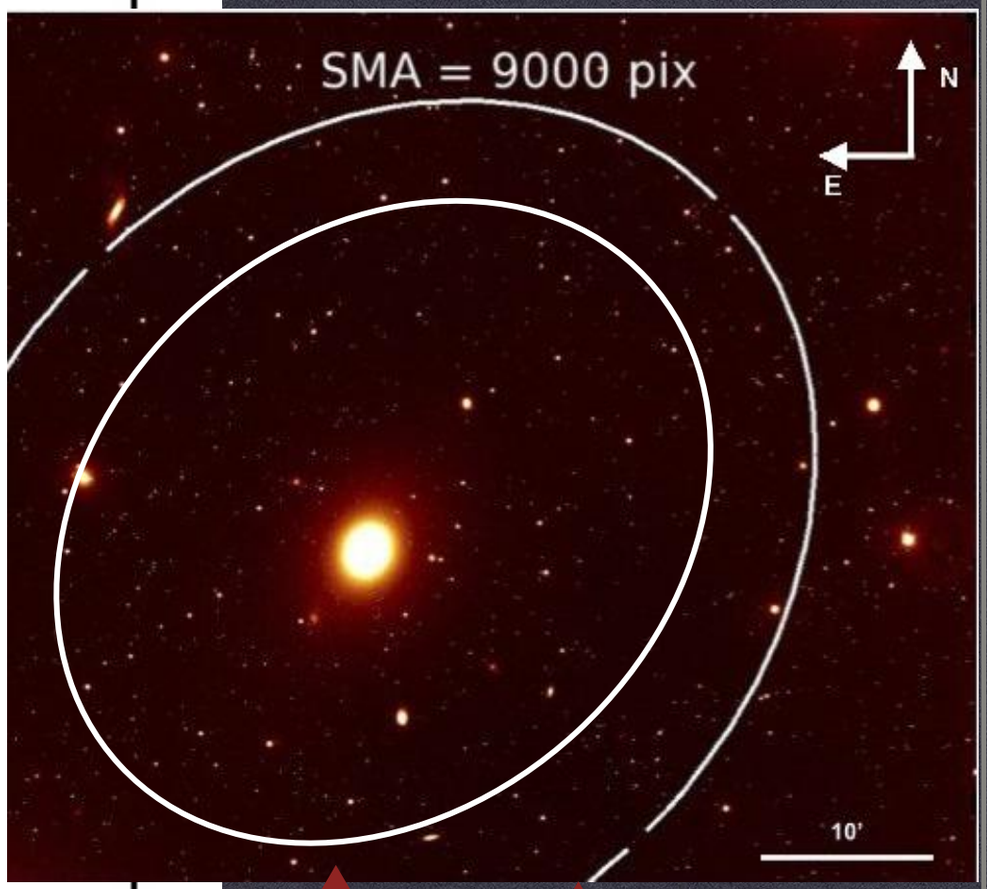
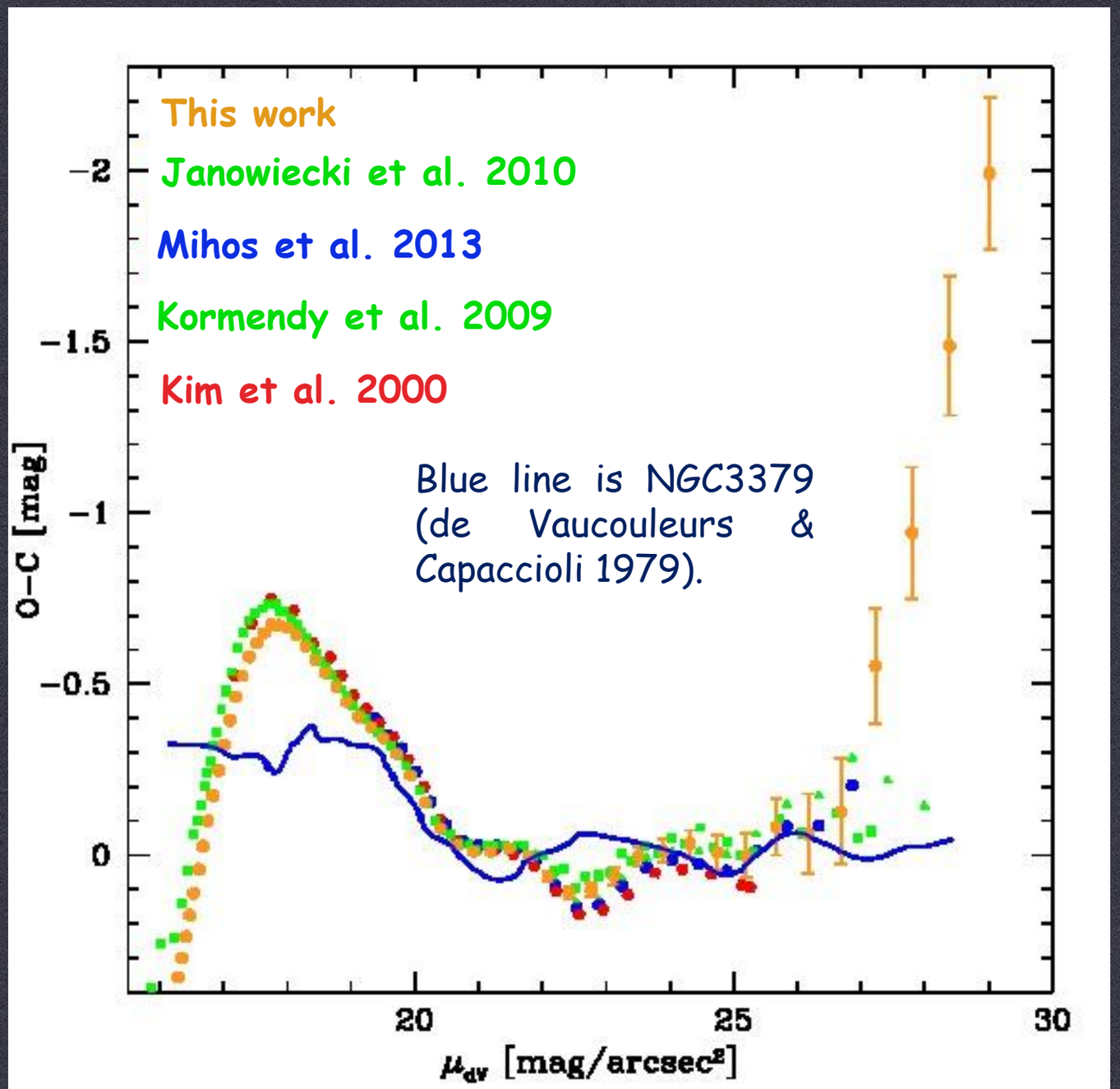
RESULTS ON NGC 4472





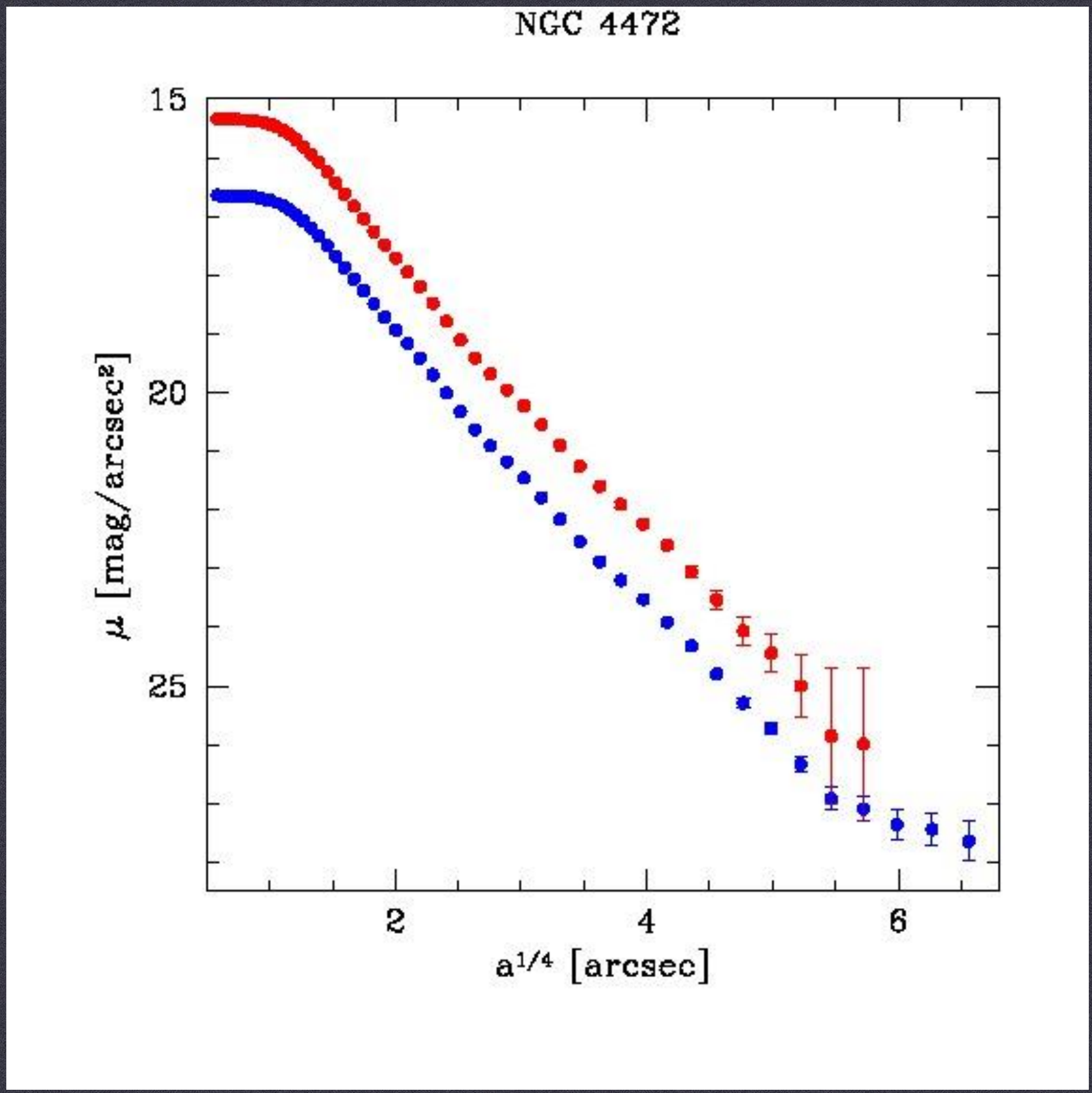
RESULTS ON NGC 4472

(O-C) residuals of mean profiles from the $r^{1/4}$ profile best fitting the main galaxy body, show a wave pattern also observed for NGC 3379 (de Vaucouleurs & Capaccioli 1979)



A recent study on the M96 galaxy group (Watkins et al., 2014) has revealed the presence of faint shells around NGC 3379, as well as of a dusty disk in the inner regions.

RESULTS ON NGC 4472



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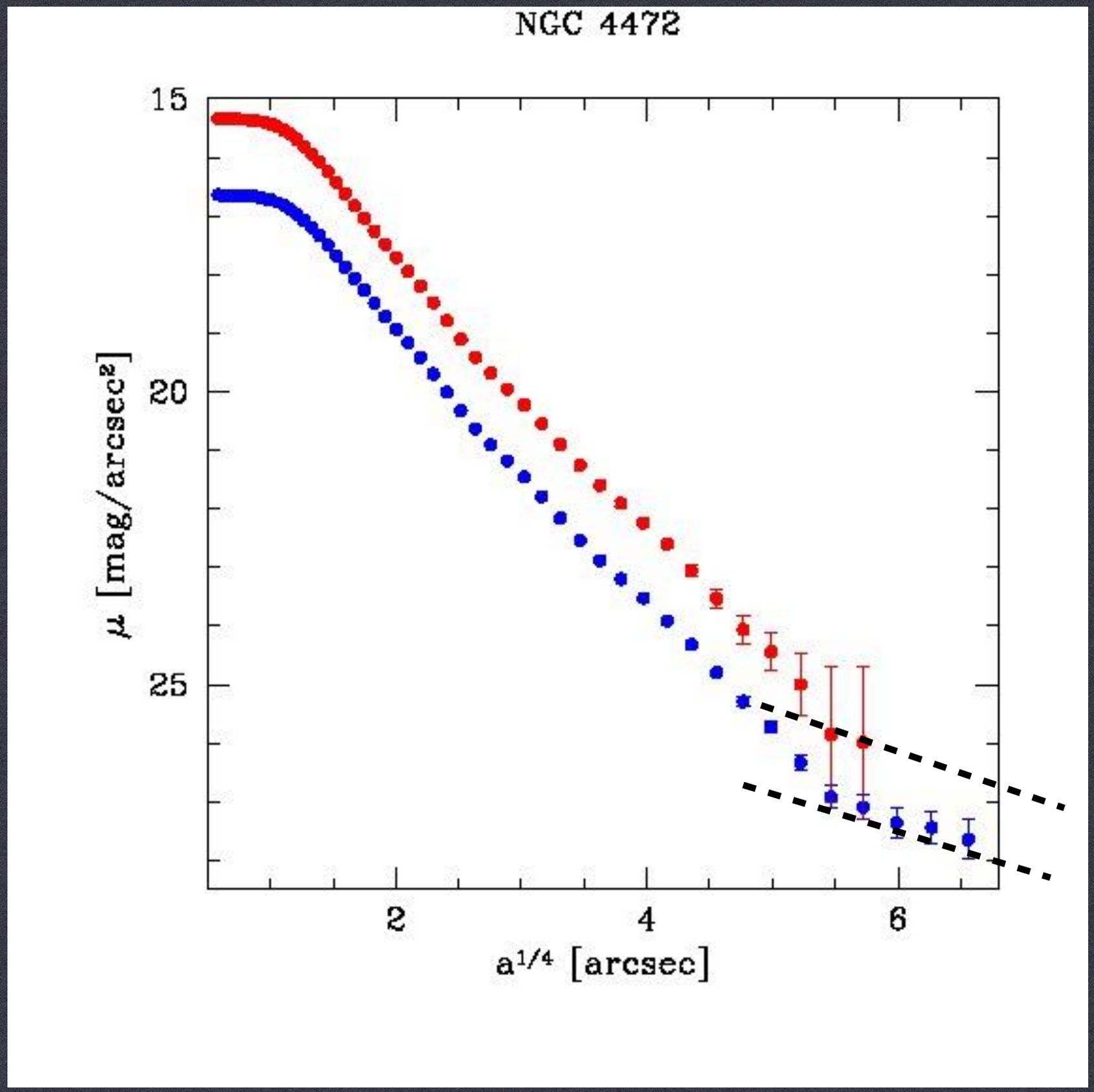
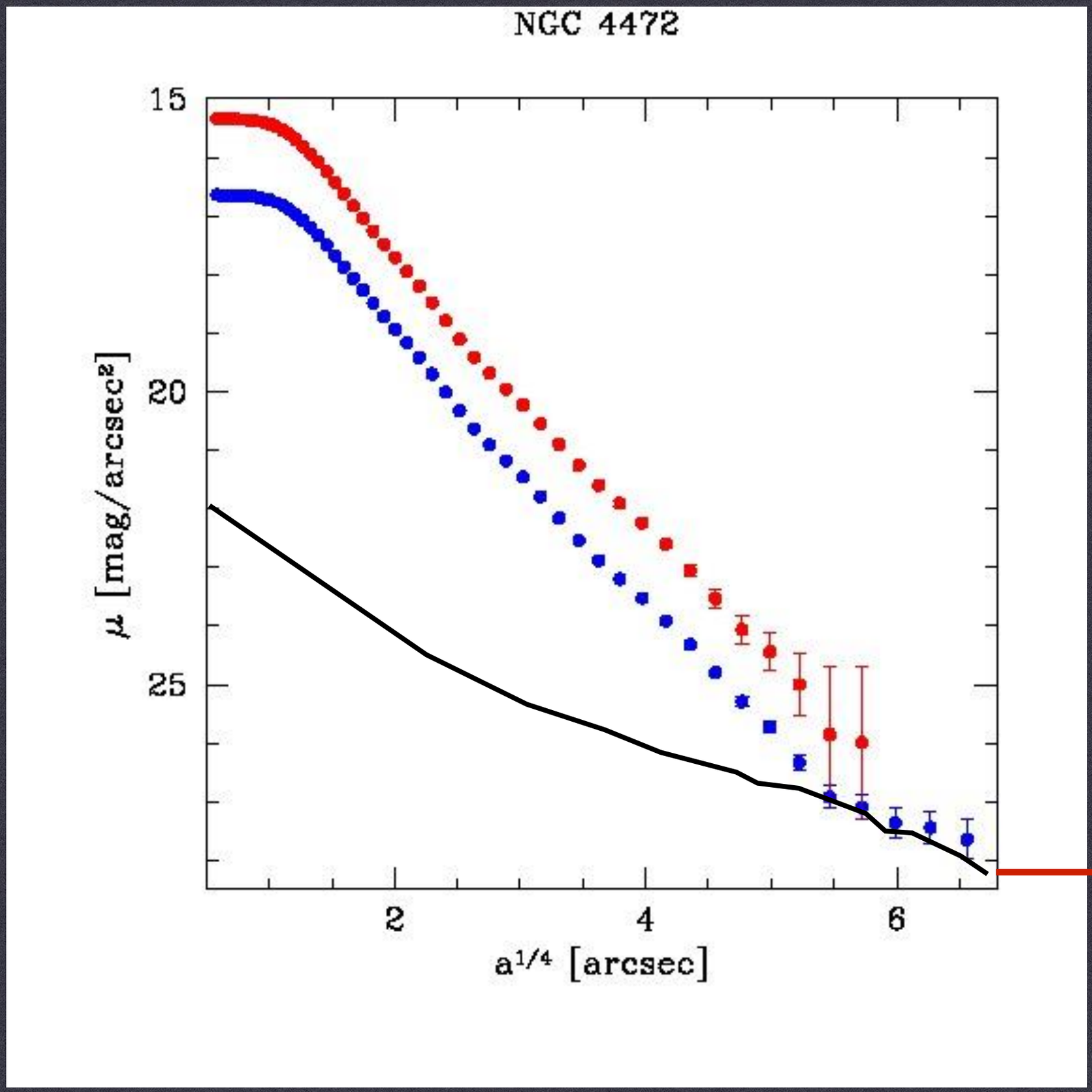


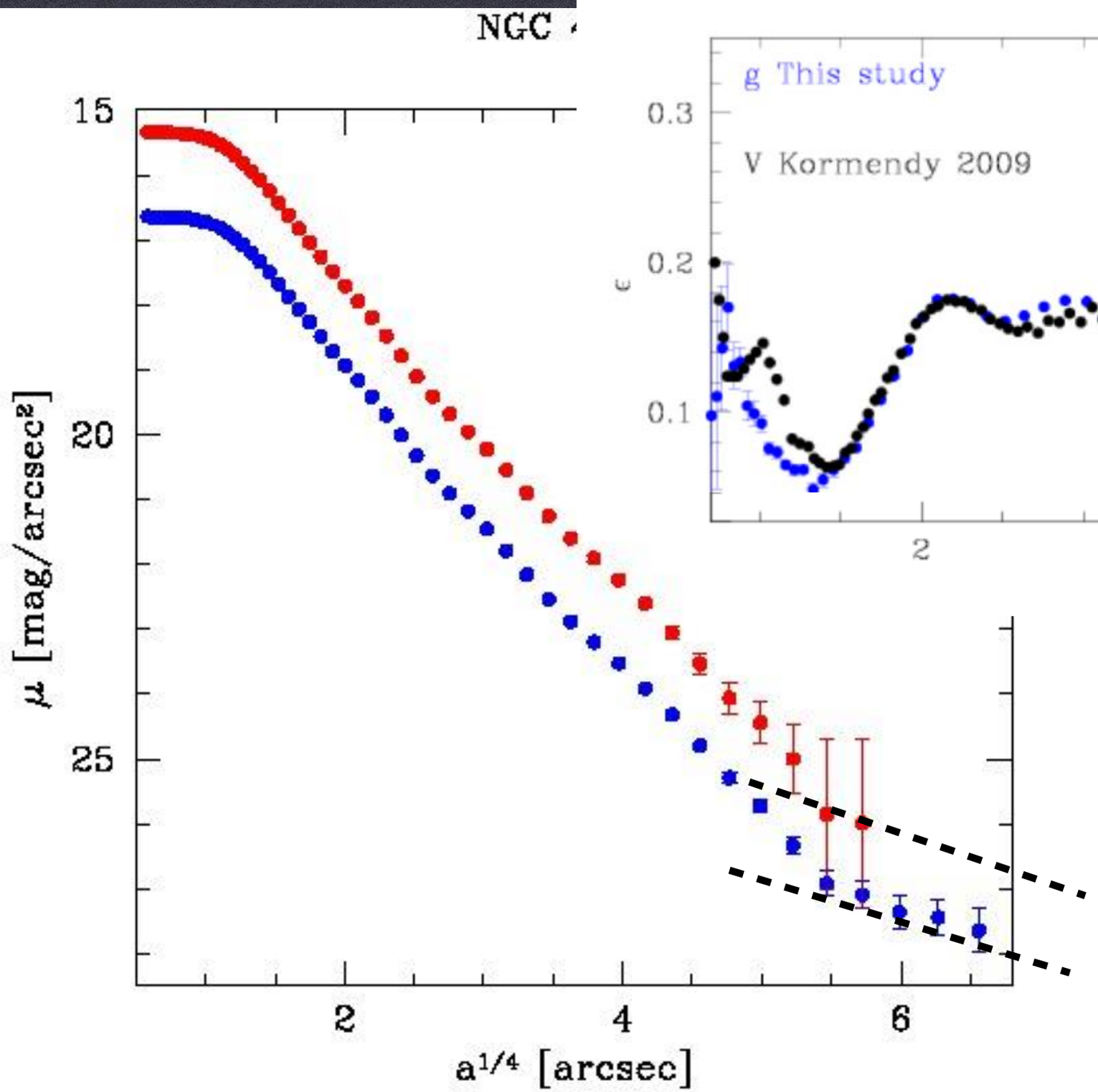
Halo

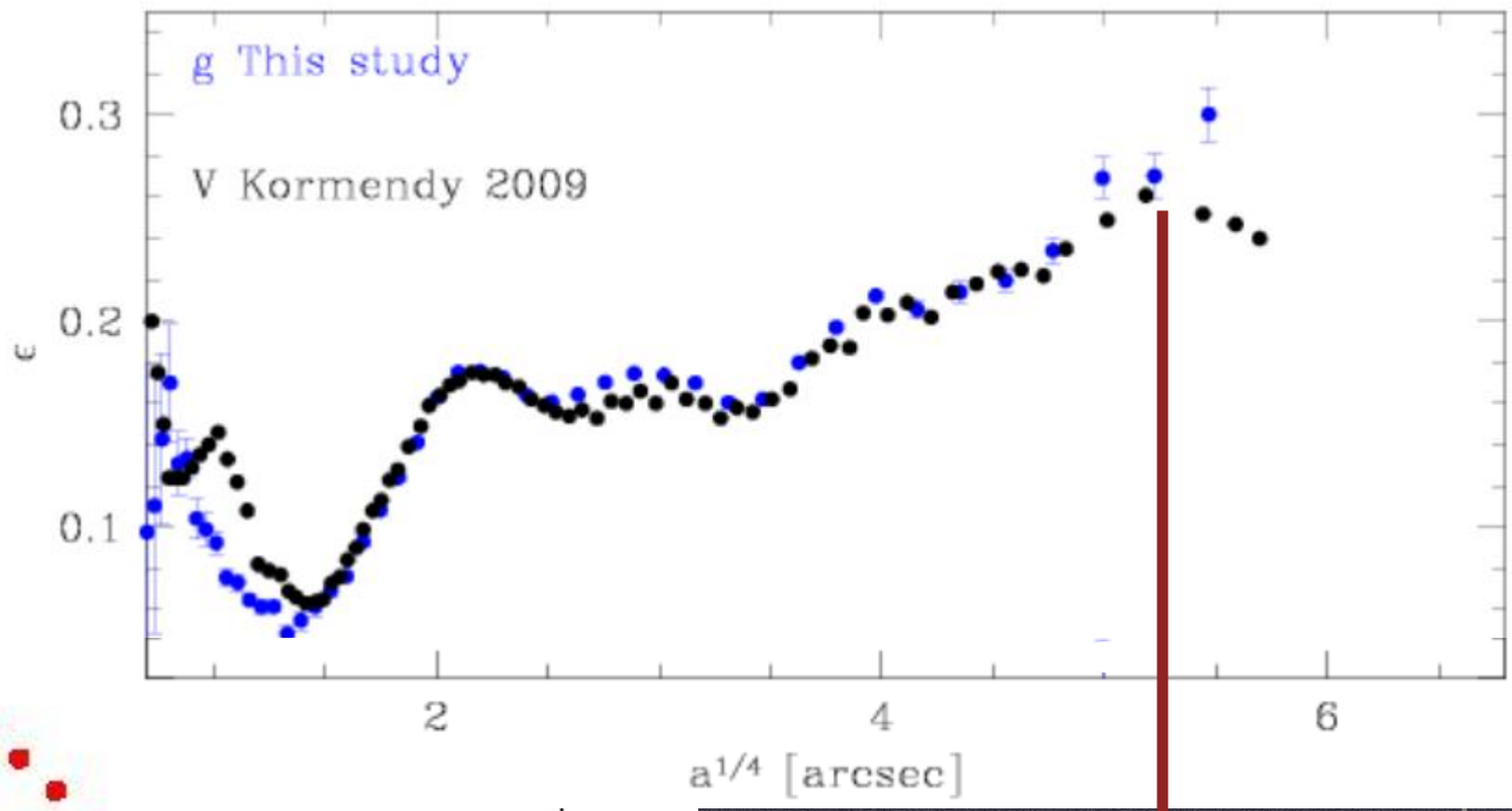
RESULTS ON NGC 4472



Zibetti et al. 2005

RESULTS ON NGC 4472

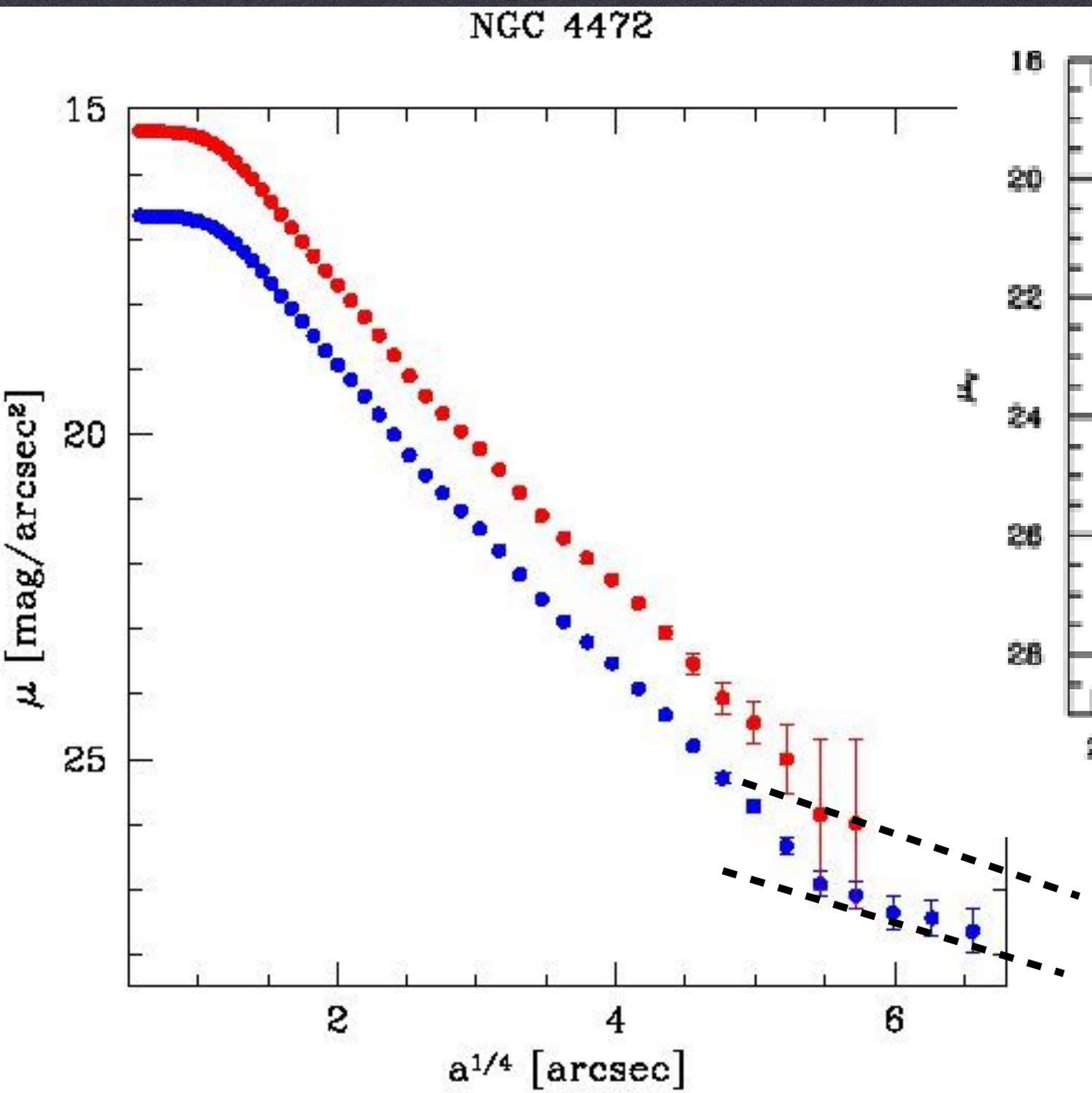


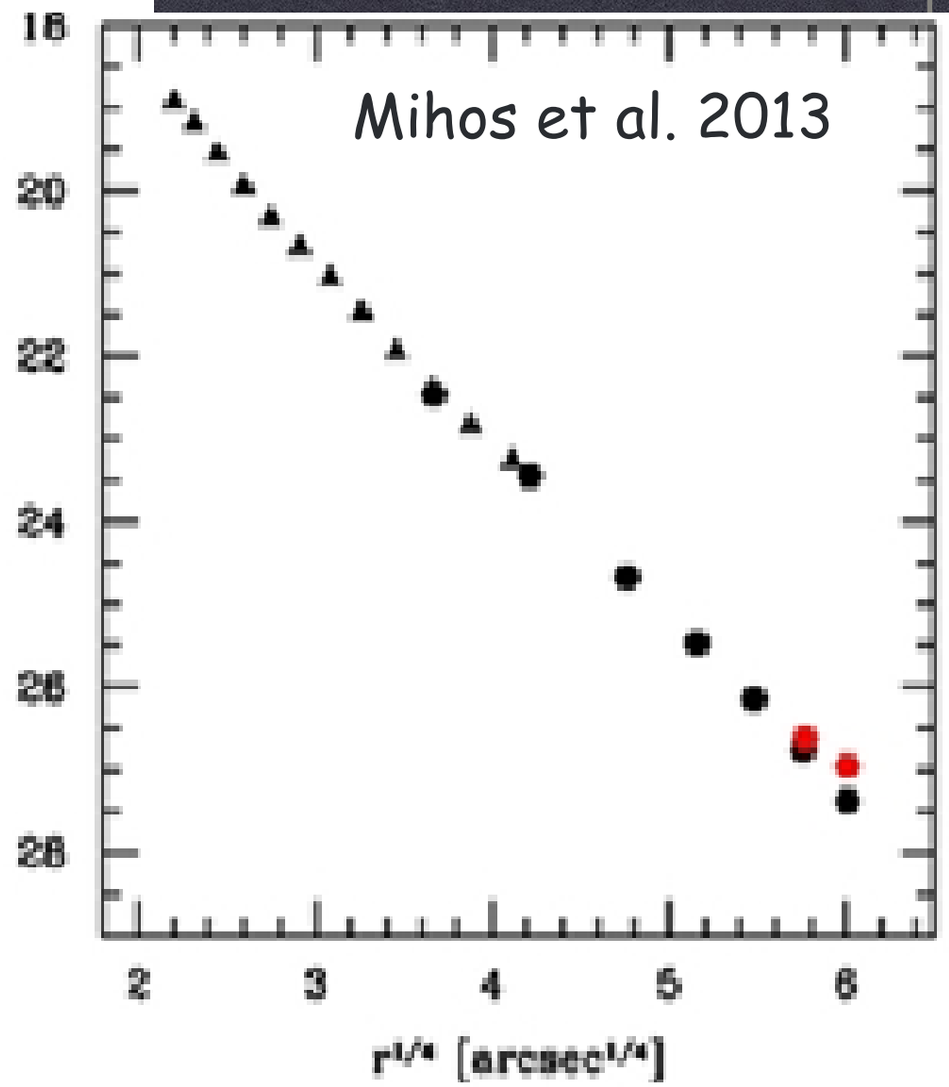


Flatter component.
(Gonzalez et al. 2005)

Halo

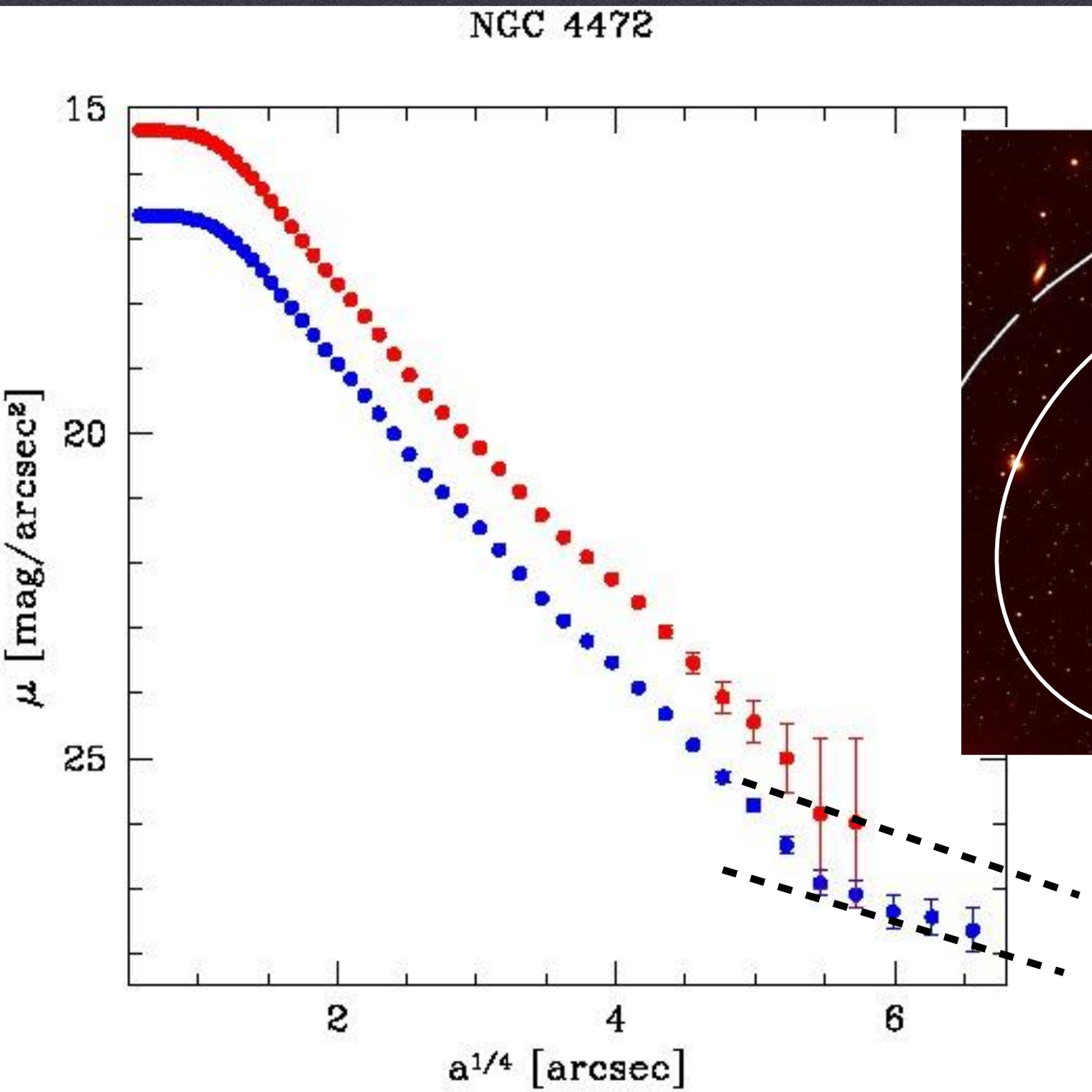
RESULTS ON NGC 4472

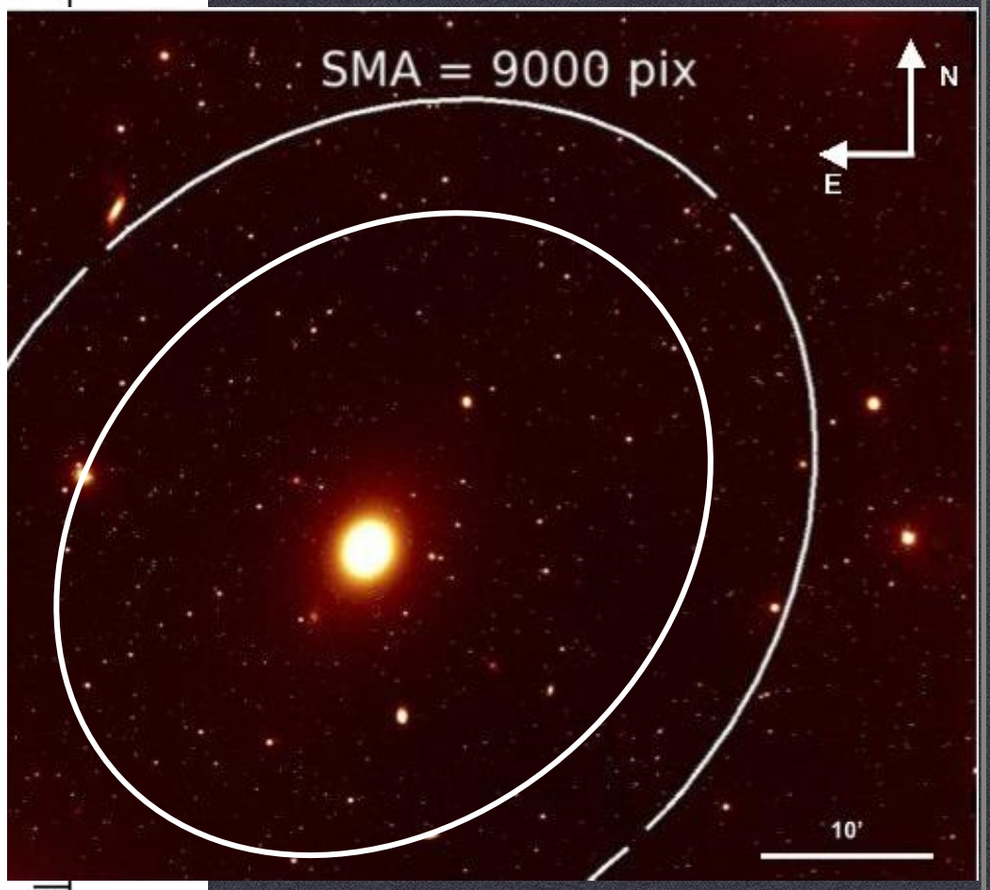




Halo

RESULTS ON NGC 4472





Halo

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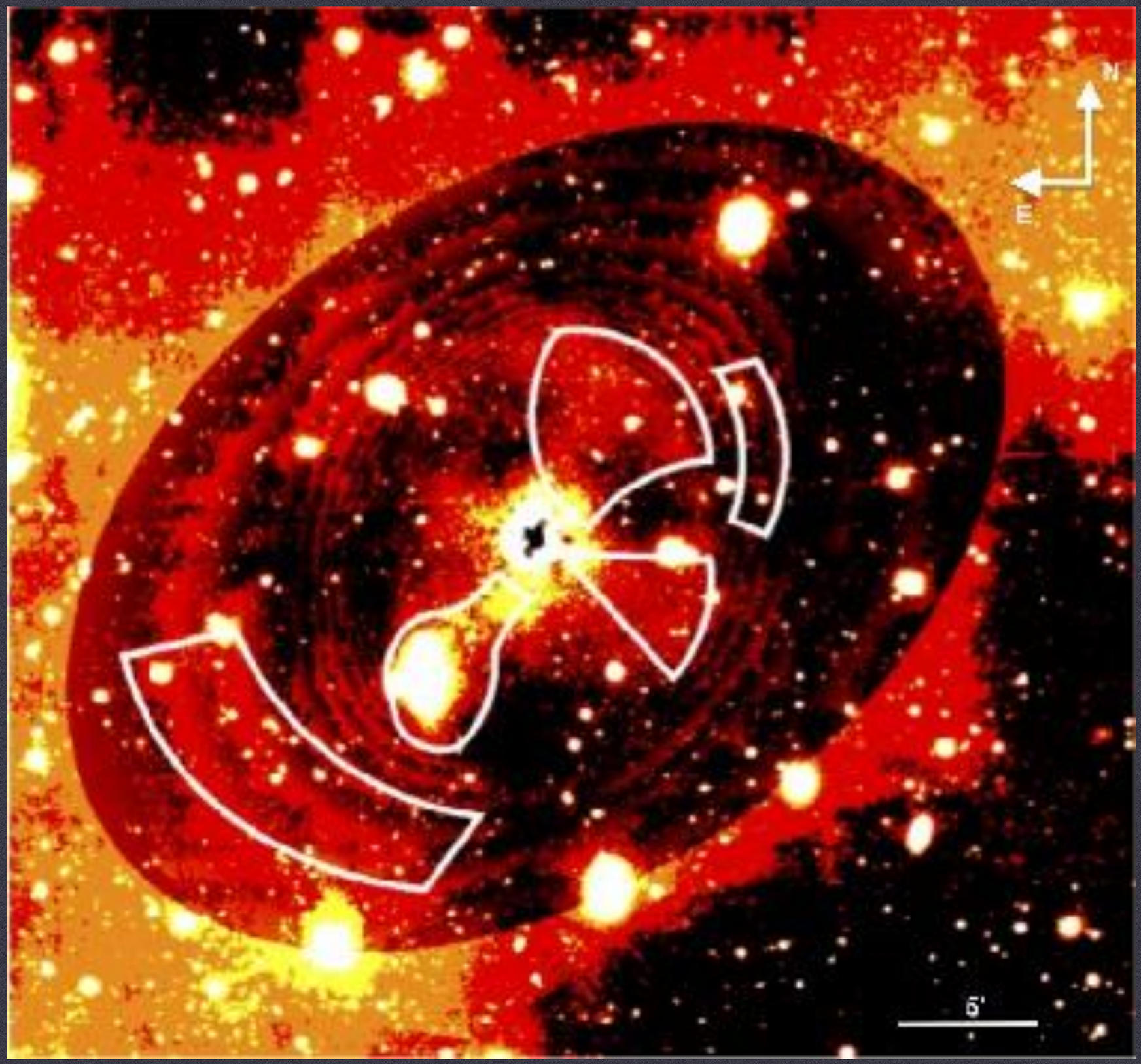
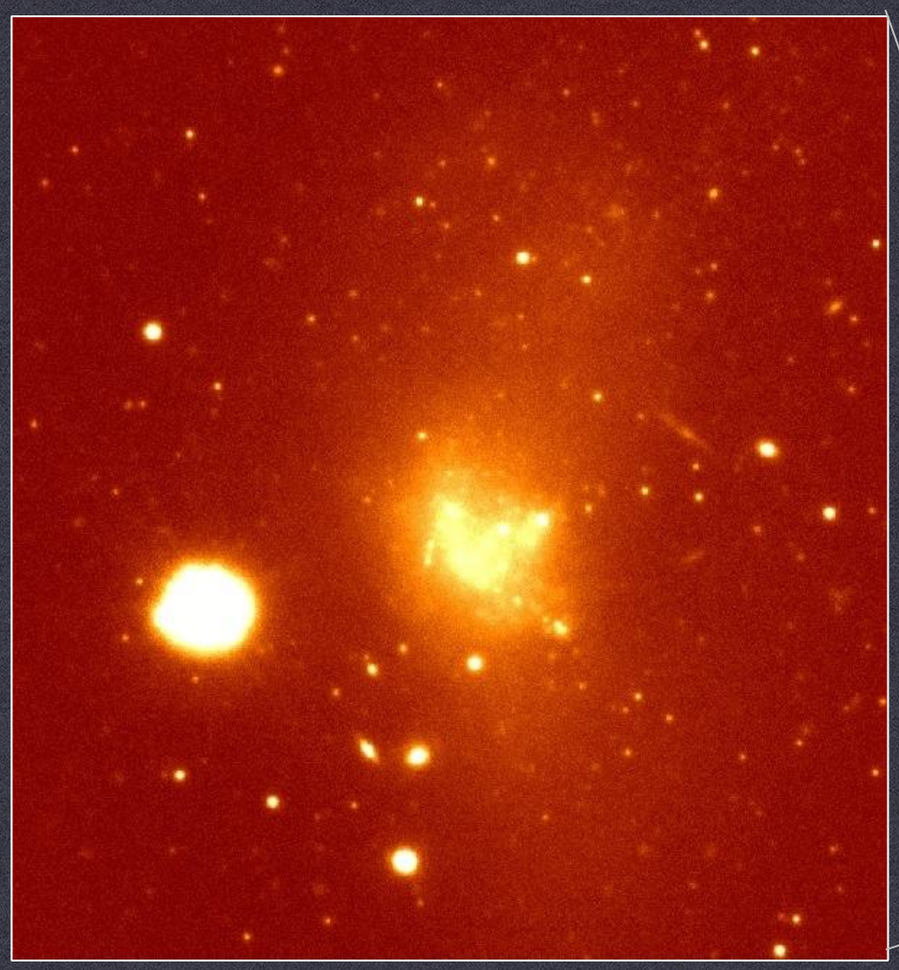
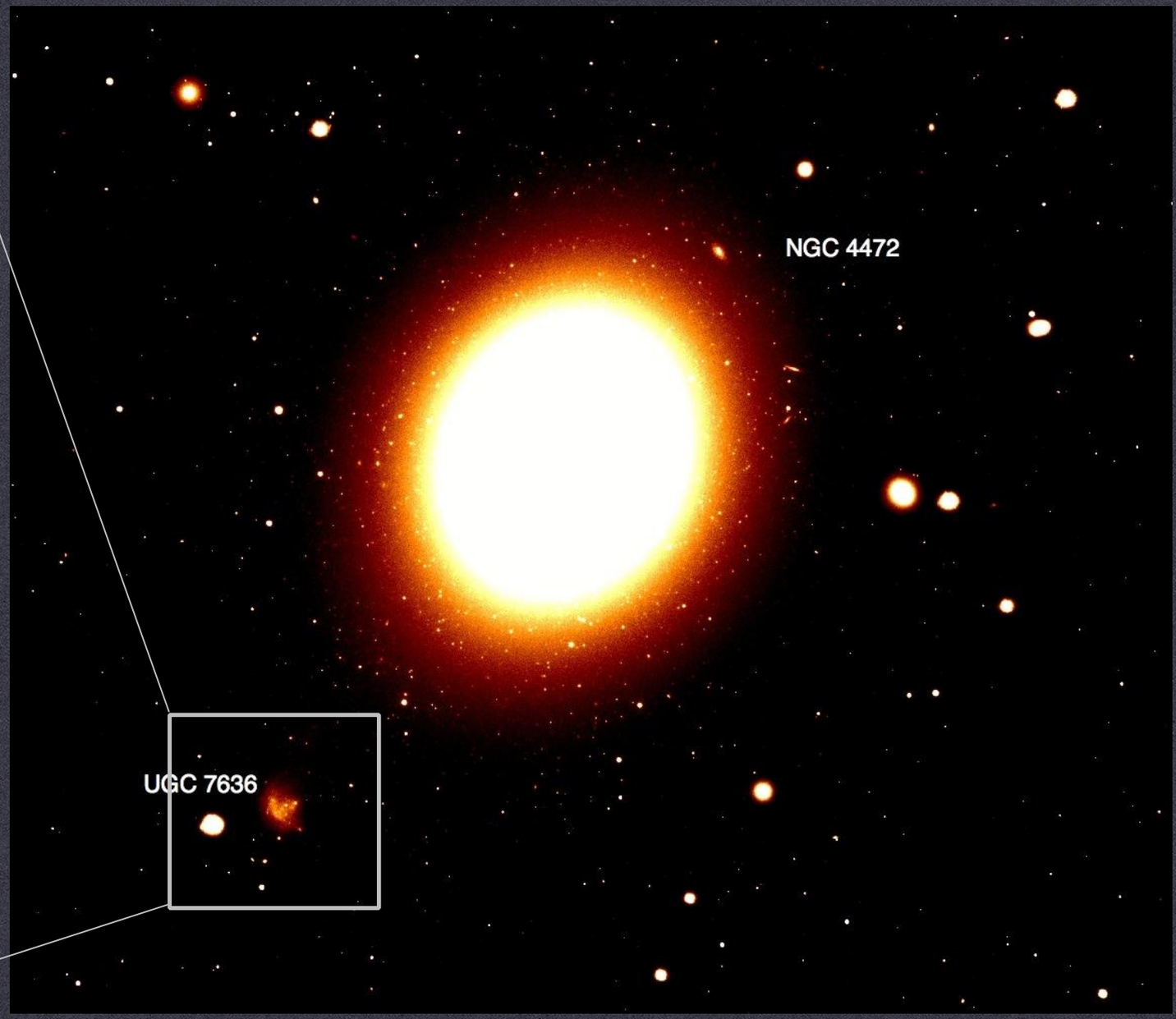


RESULTS ON NGC 4472

Ongoing interaction with UGC 7636

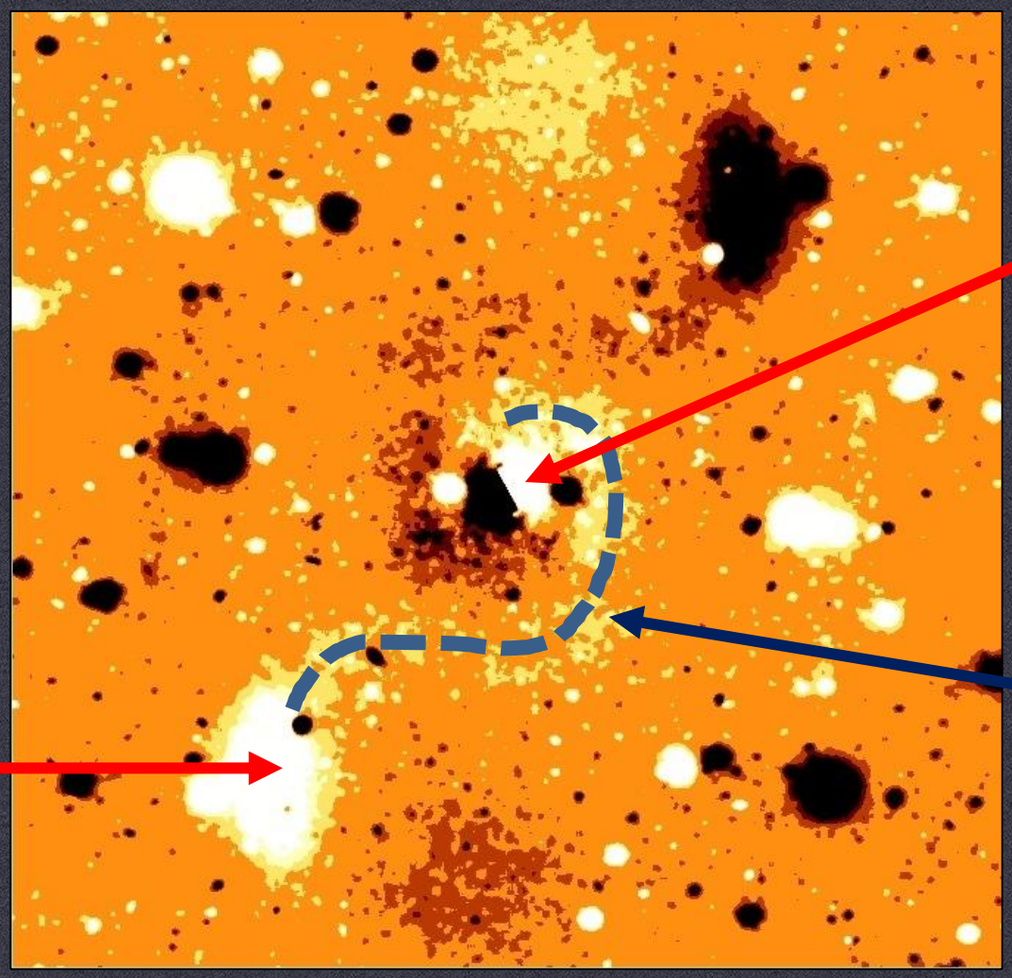




RESULTS ON NGC 4472

Ongoing interaction with UGC 7636

Flip the image twice about the center of NGC 4472 and subtract from the original



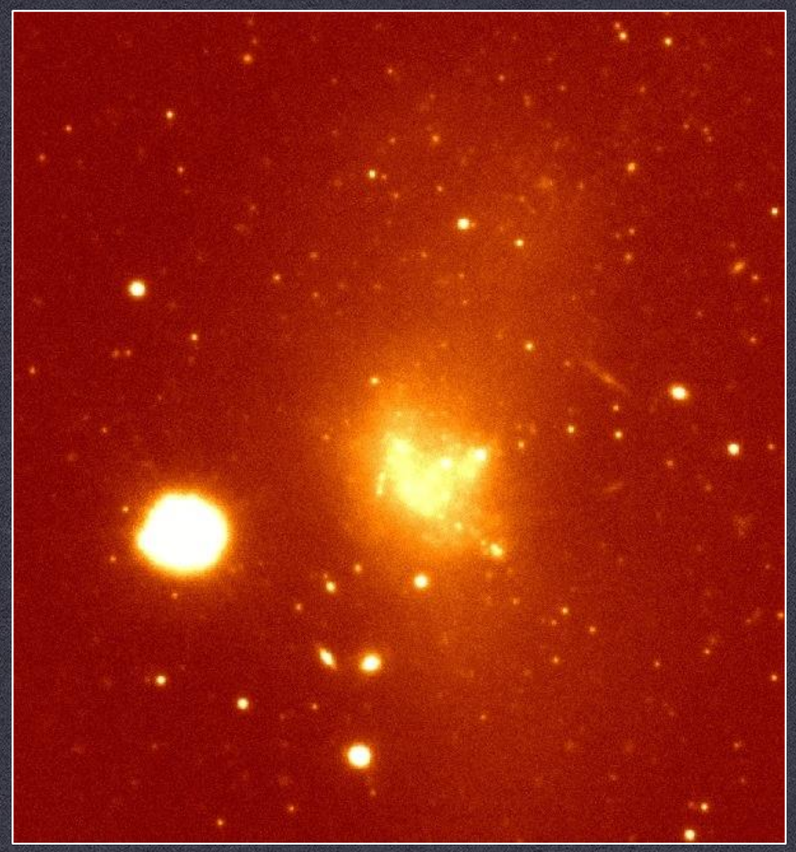
NGC4472 center with clear asymmetry

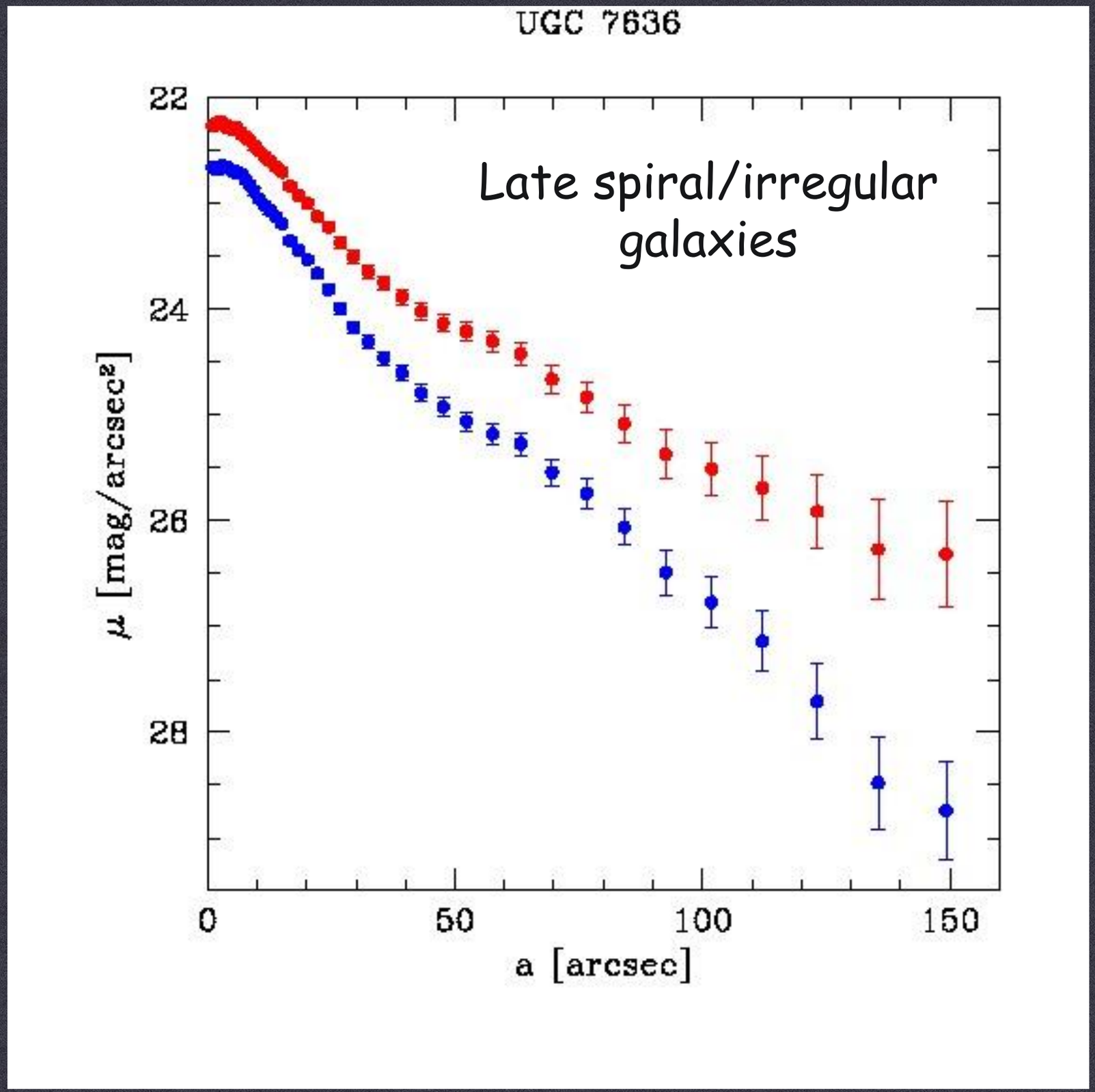
The long plume twisting about the center of NGC 4472

UGC 7636

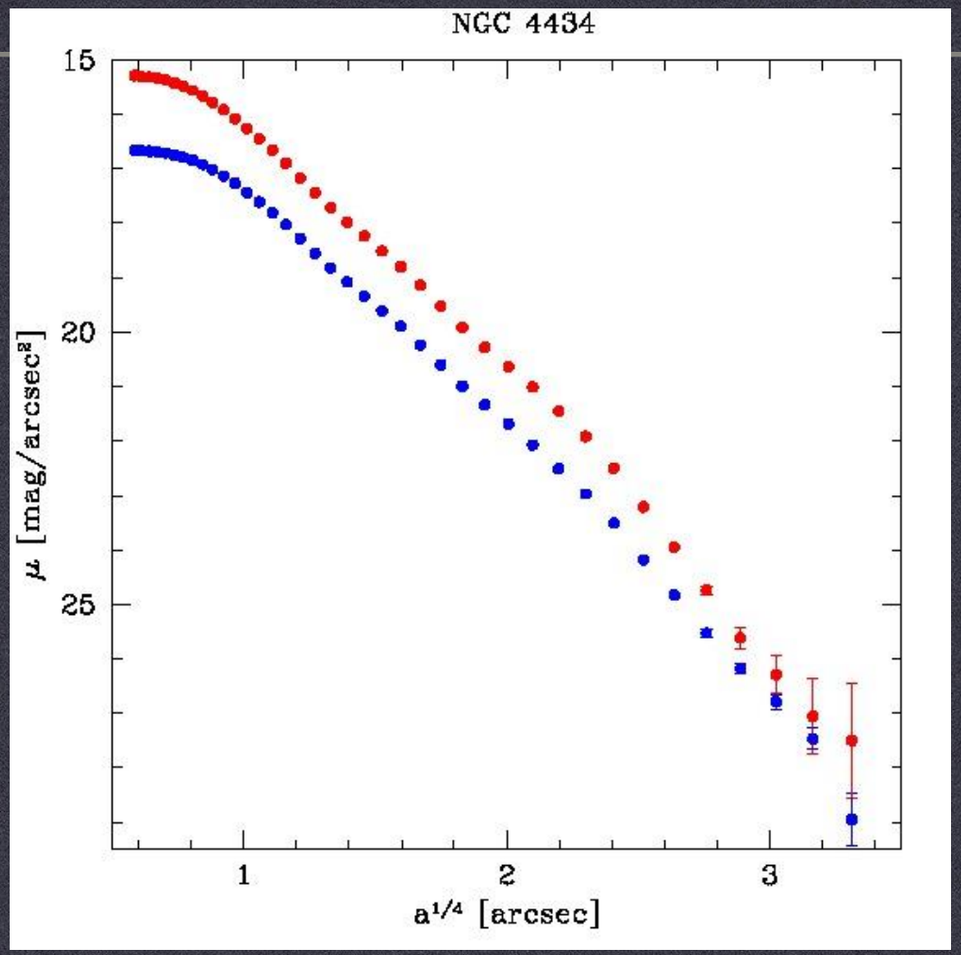
RESULTS ON NGC 4472

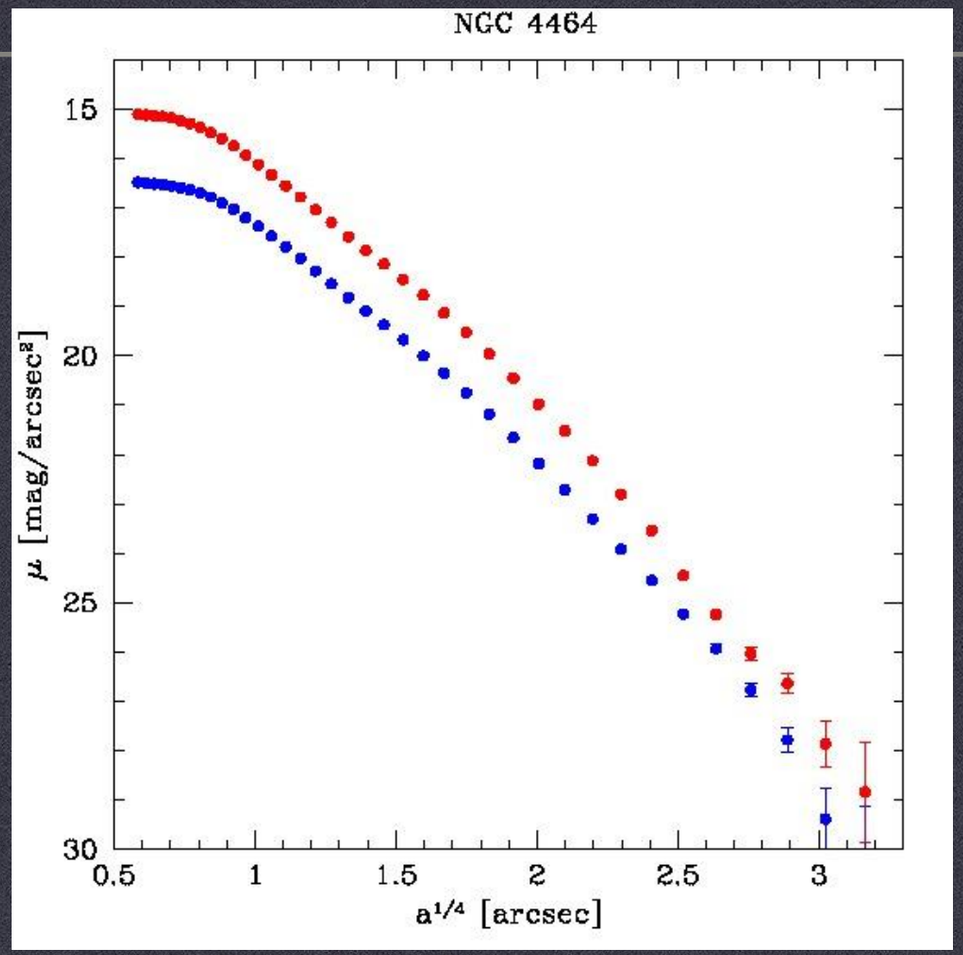
UGC 7636

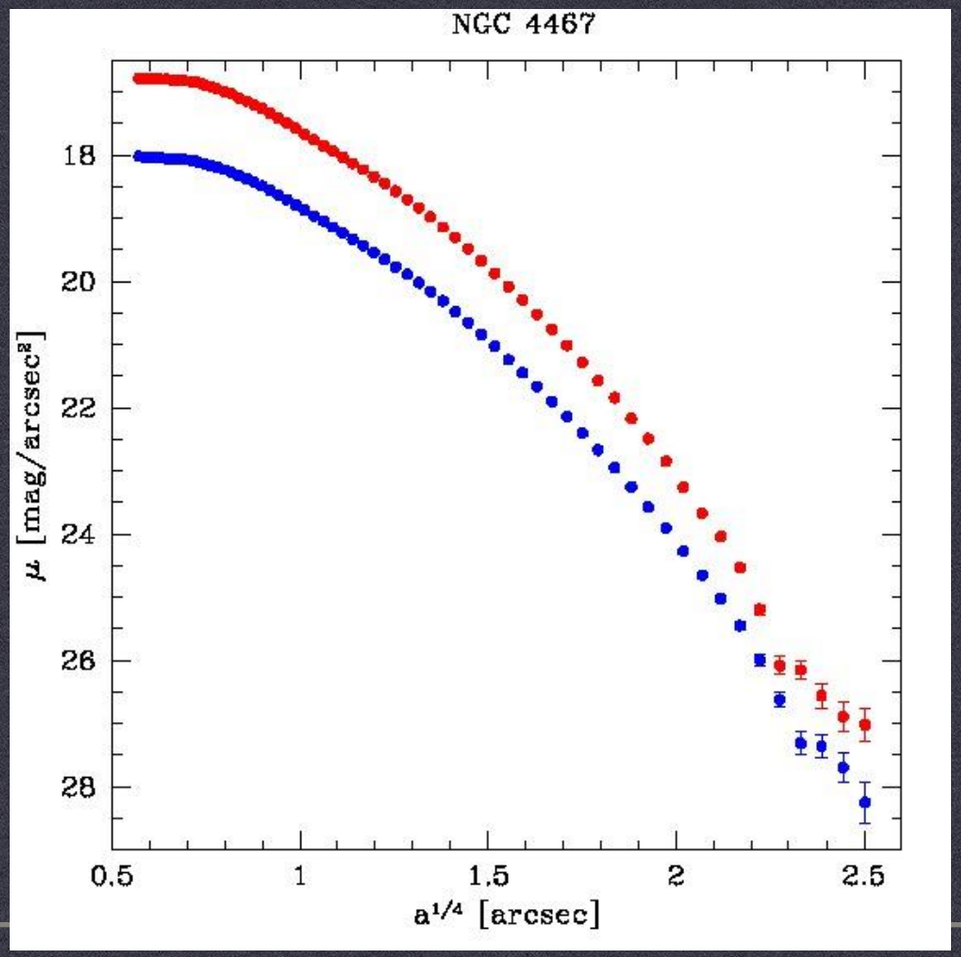


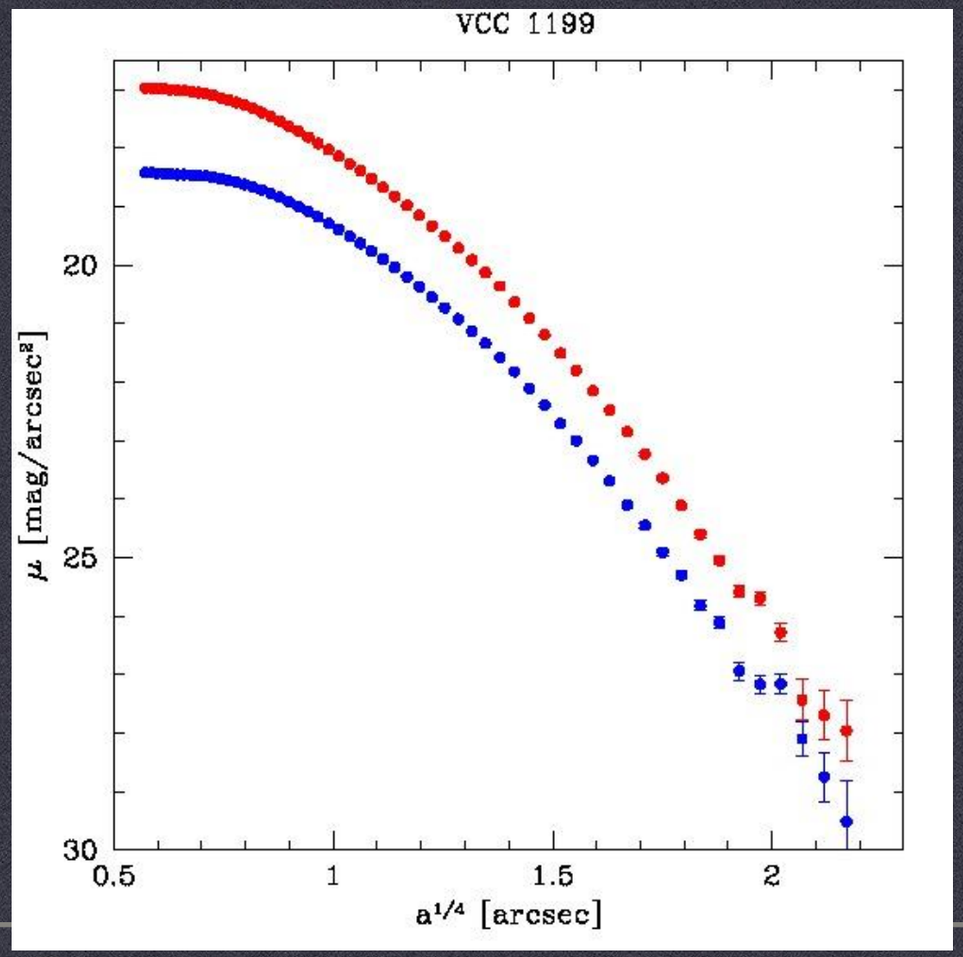


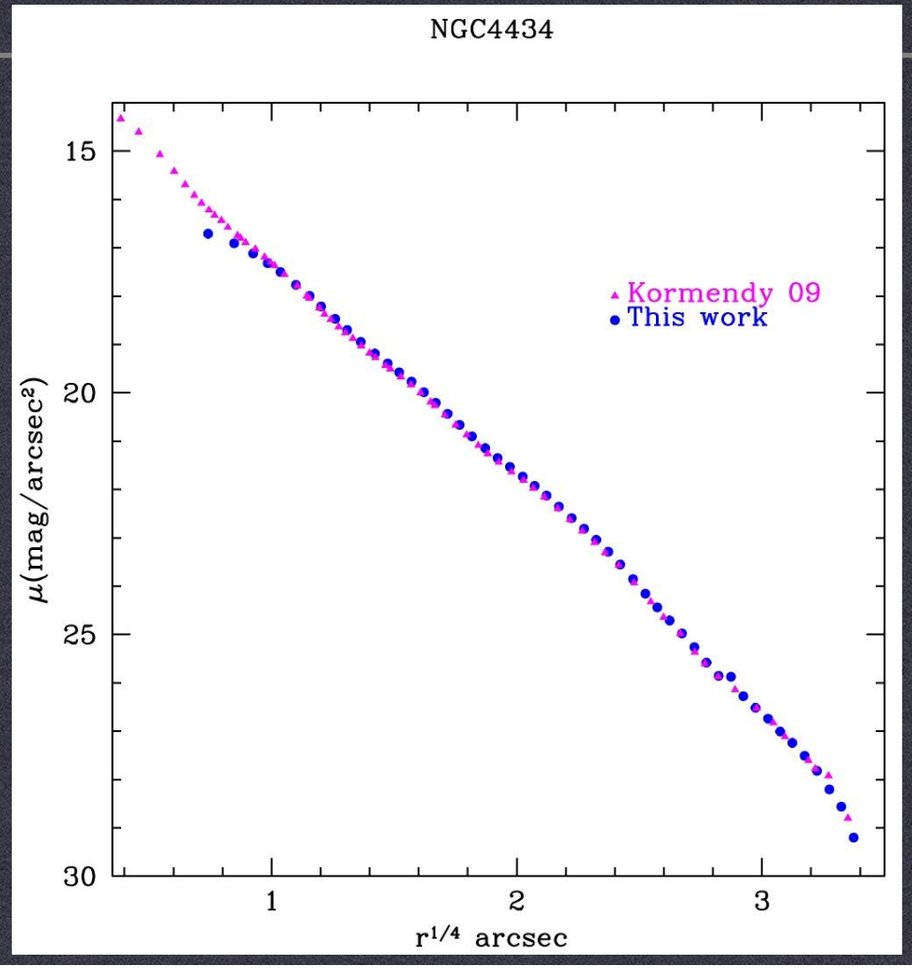
ETGs IN THE FIELD OF NGC 4472

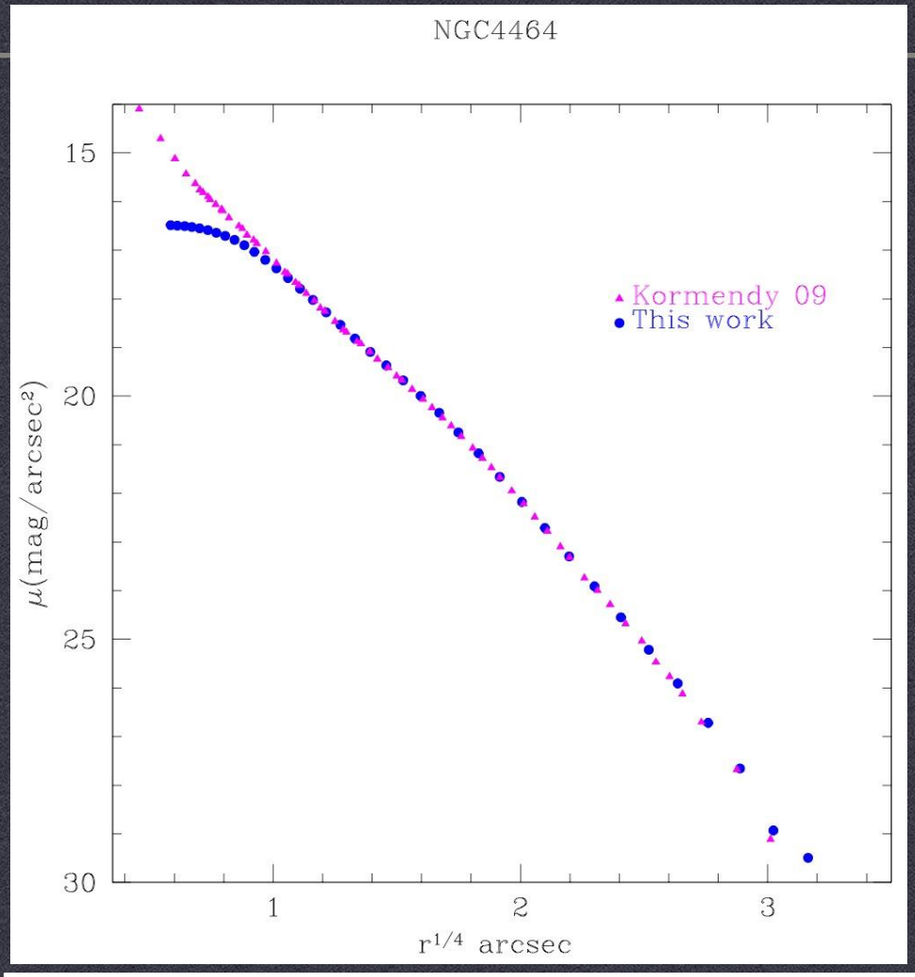

NGC 4434
15
20
25
μ [mag/arcsec²]
1
2
3
a¹/⁴ [arcsec]


NGC 4464
15
20
25
30
μ [mag/arcsec²]
0.5
1
1.5
2
2.5
3
a¹/⁴ [arcsec]


NGC 4467
18
20
22
24
26
28
μ [mag/arcsec²]
0.5
1
1.5
2
2.5
a¹/⁴ [arcsec]


VCC 1199
20
25
30
μ [mag/arcsec²]
0.5
1
1.5
2
a¹/⁴ [arcsec]


NGC4434
Kormendy 09
This work
μ(mag/arcsec²)
r^1/4 arcsec
15
20
25
30
1
2
3


NGC4464
Kormendy 09
This work
μ(mag/arcsec²)
r^1/4 arcsec
15
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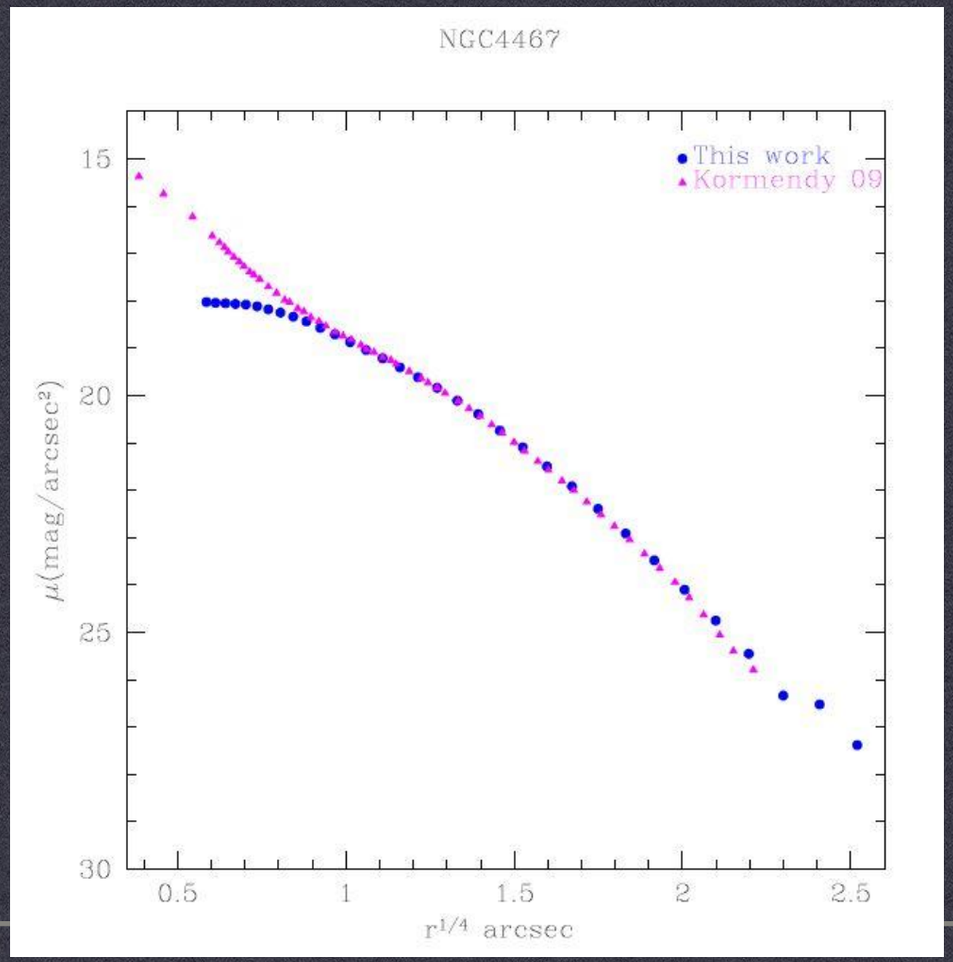
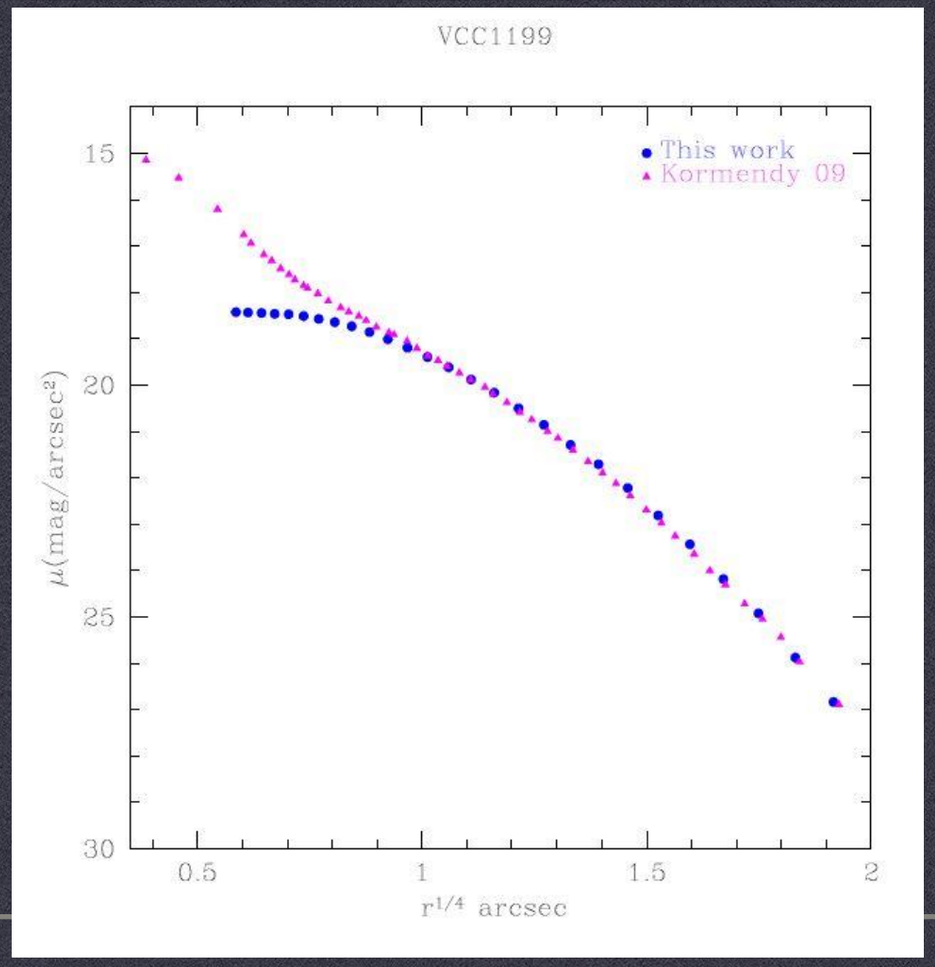
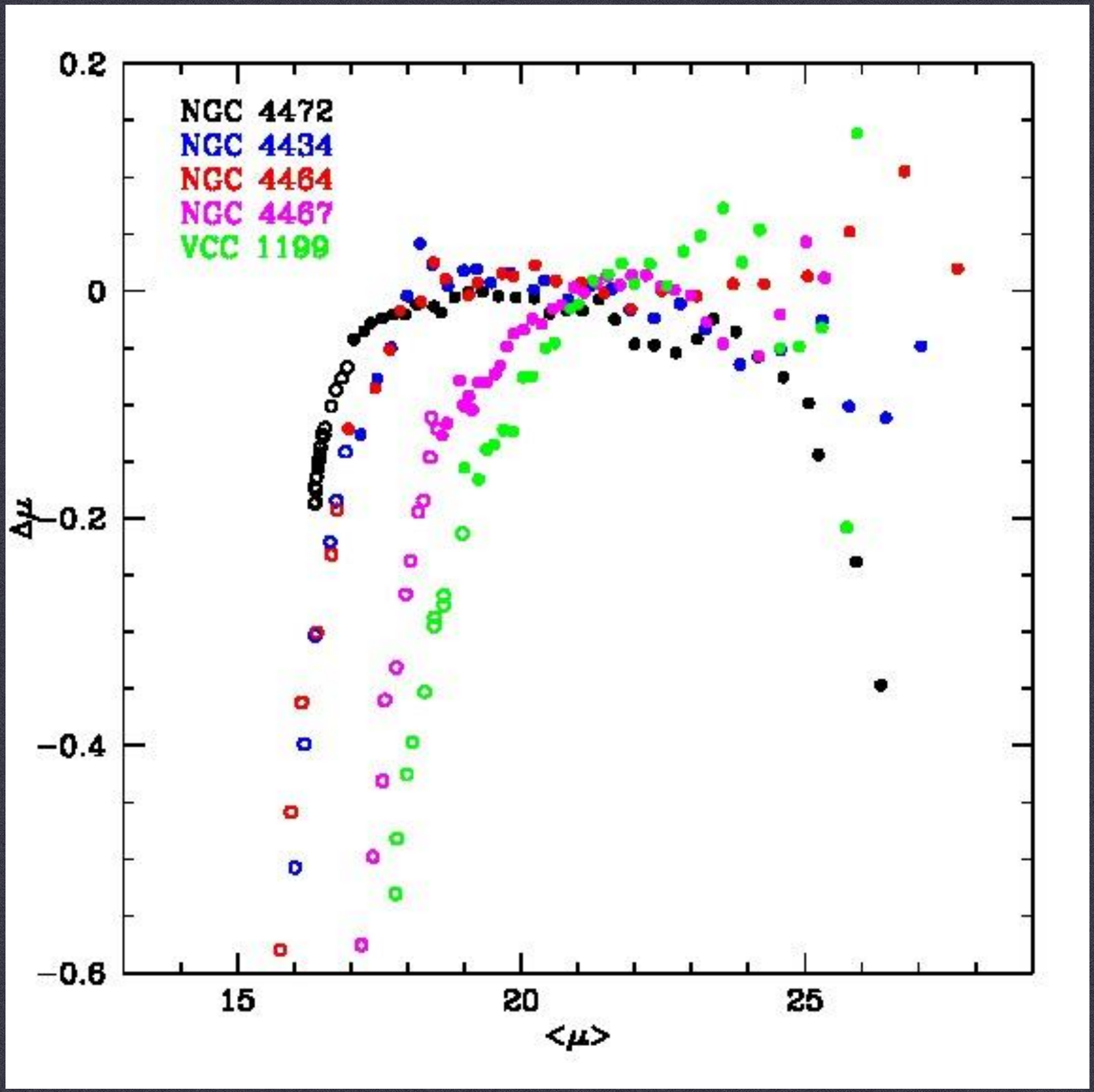

NGC4467
This work
Kormendy 09
μ(mag/arcsec²)
r^1/4 arcsec
15
20
25
30
0.5
1
1.5
2
2.5


VCC1199
This work
Kormendy 09
μ(mag/arcsec²)
r^1/4 arcsec
15
20
25
30
0.5
1
1.5
2

ETGs IN THE FIELD OF NGC 4472



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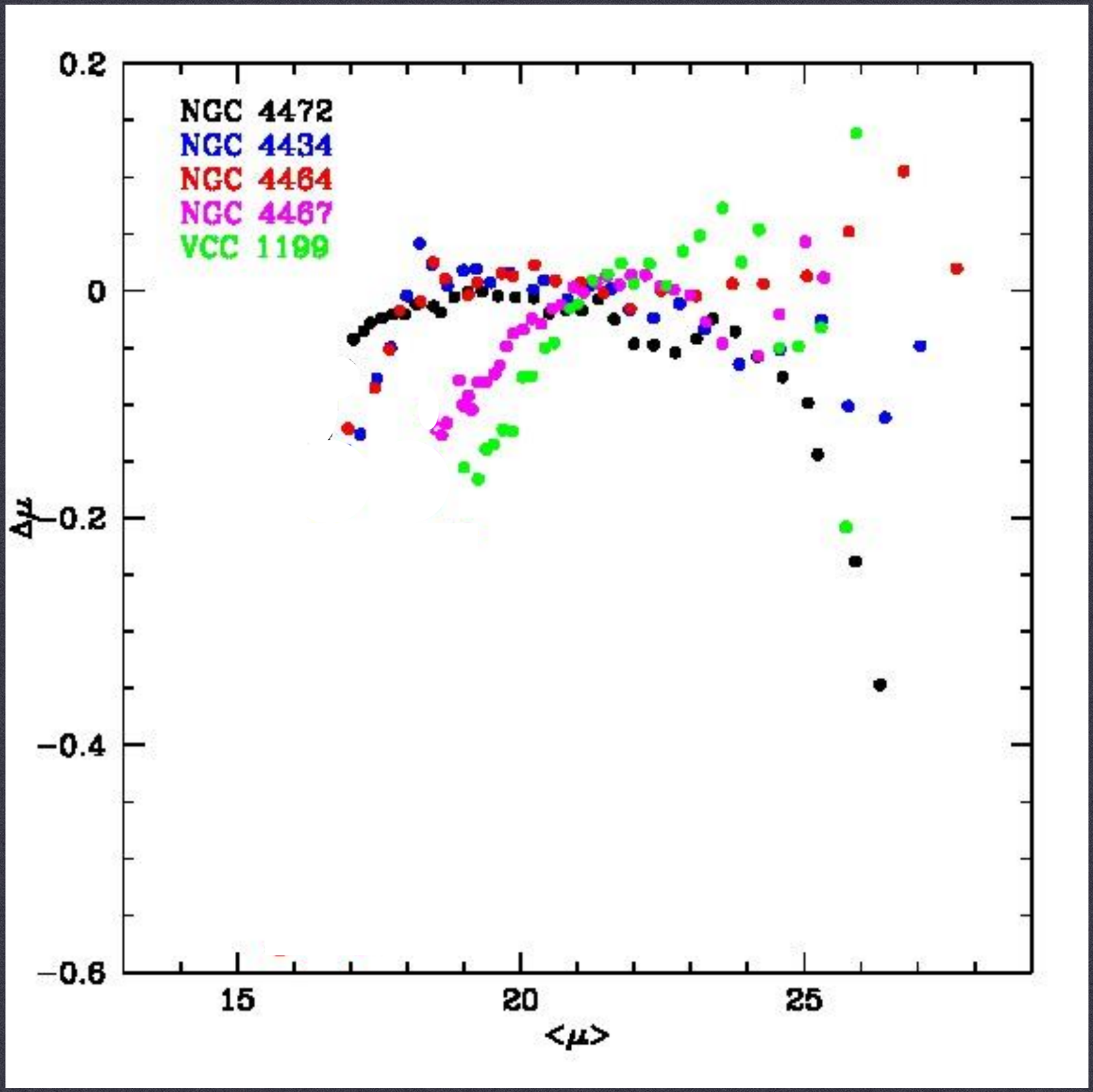

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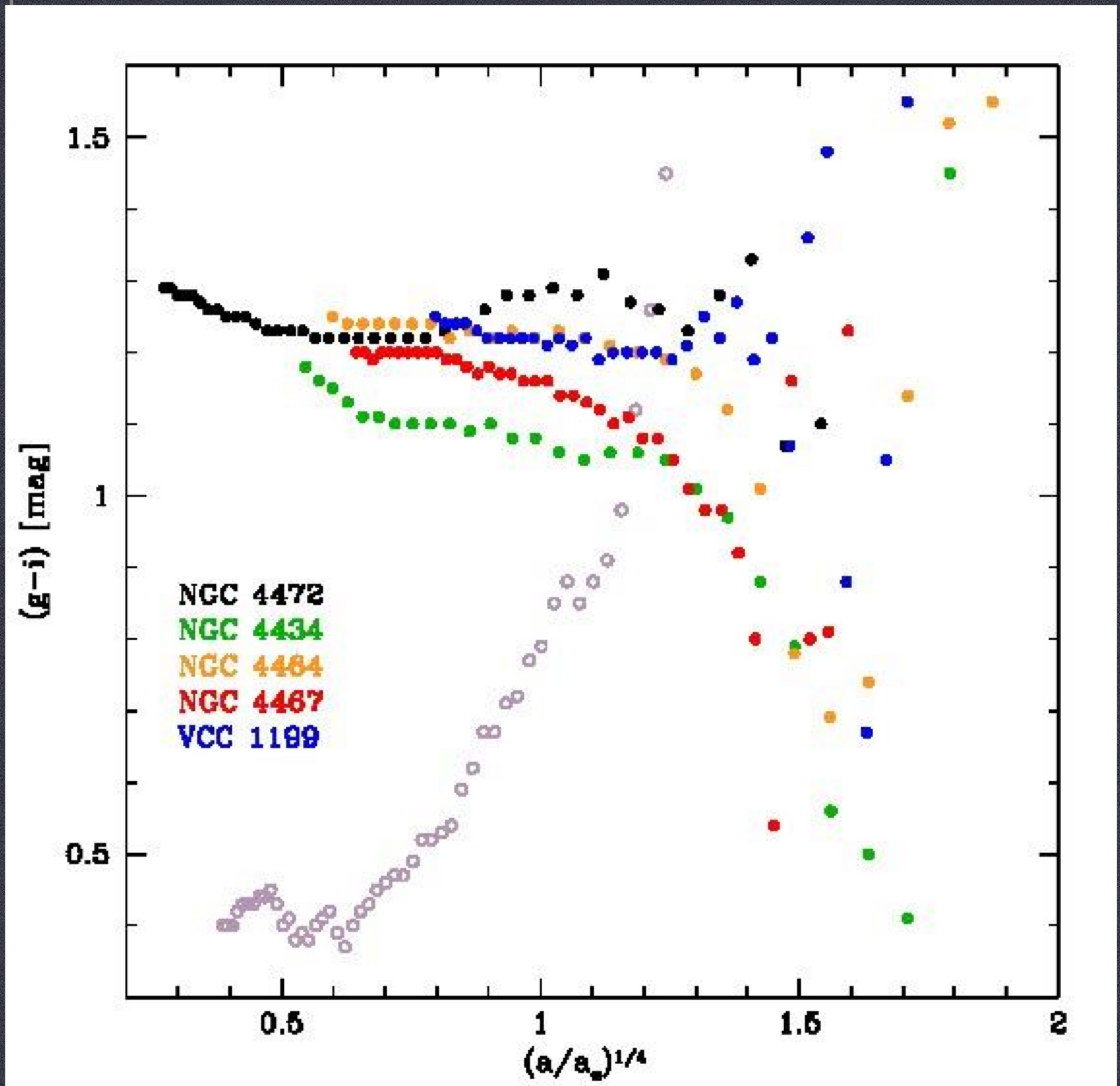
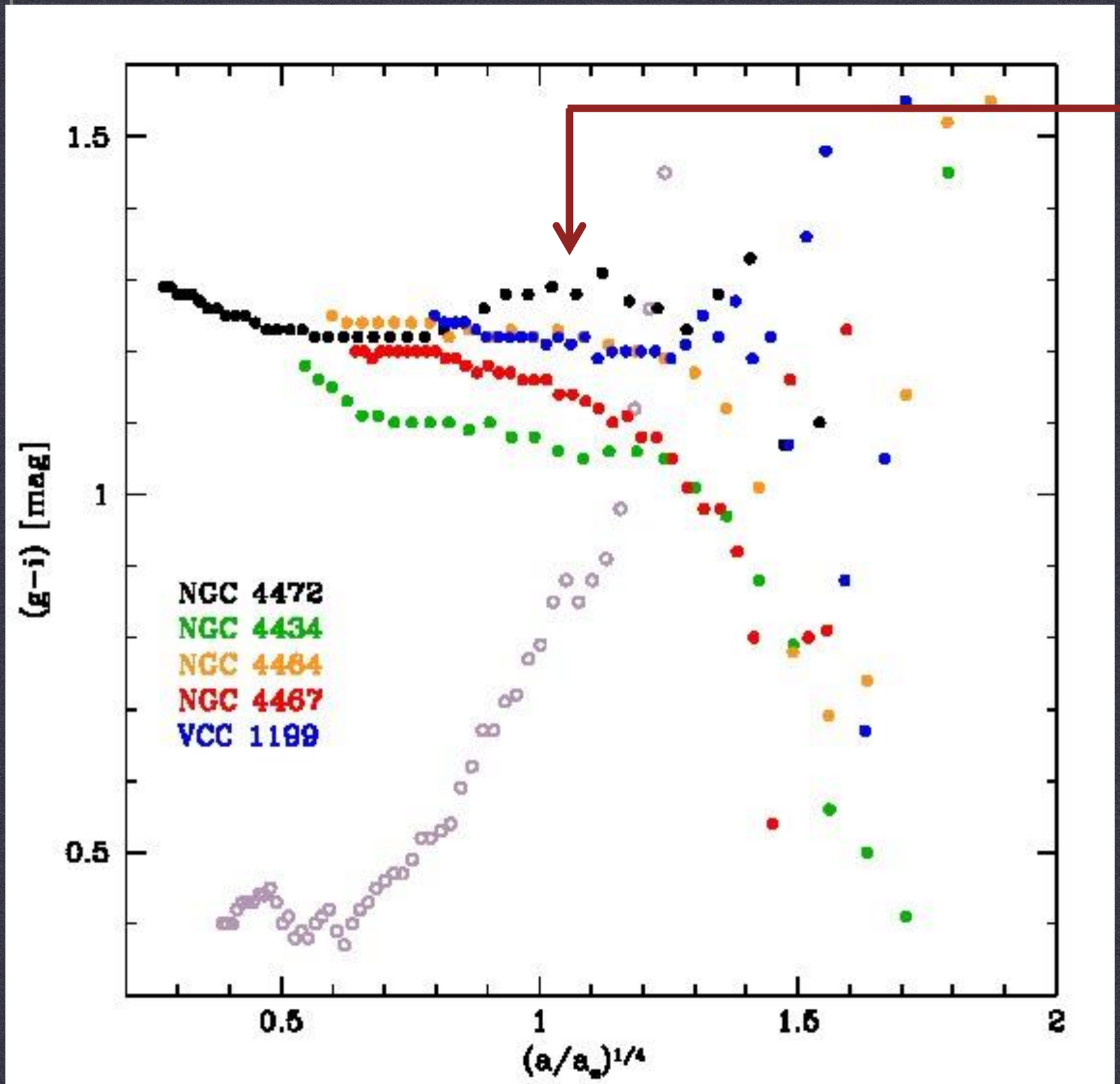


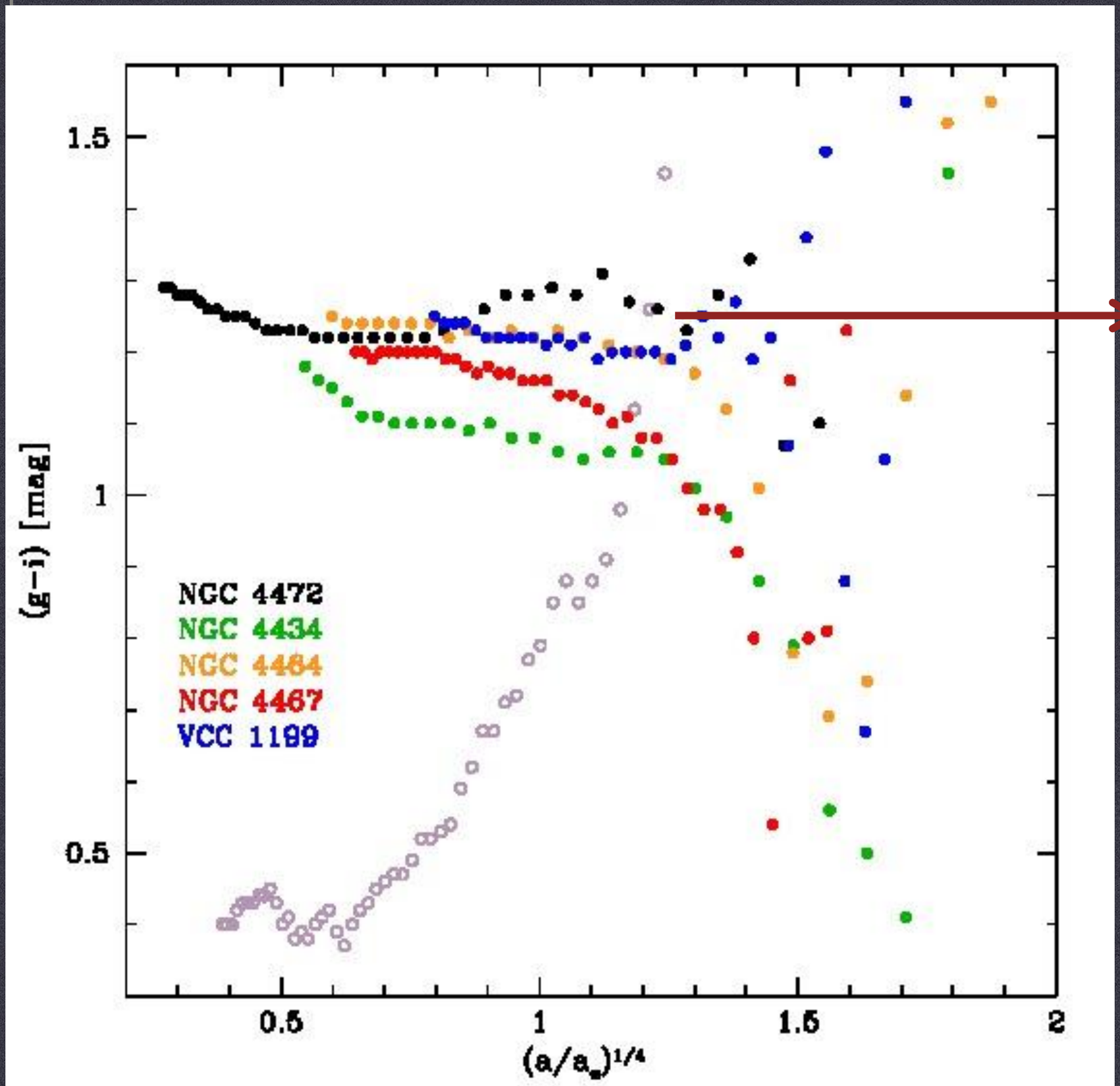
ETGs IN THE FIELD OF NGC 4472



Shells

Disruptive accretion event
(Mihos et al. 2013)

ETGs IN THE FIELD OF NGC 4472



Color of UGC7636 consistent with that of NGC4472

Continuity between the two systems!

CONCLUSIONS

- Goal of the survey reached! Ready for mass production!
- Signature of a stellar halo in NGC 4472 SB profiles
- Detection of shells and fans of diffuse material
- Wave pattern in O-C residuals
- Deep SB profiles for small ETGs
- Important informations to optimize next observations and future works

FUTURE PLANS

NIR-like "ON-OFF" observing strategy will allow us to reach very faint SB levels, significantly reducing uncertainties, for galaxies filling the VST FOV!

Local background subtraction with the standard polynomial fitting procedure for smaller galaxies embedded in the stellar halo of bigger companions!

FUTURE PLANS

		Bands and exp time in seconds			
Obj. name	Morph. type	u	g	r	i
IC 1459	E3		5630	1850	1700
NGC 1374	S0		2400		4592
NGC 1379	E0		8319		3710
NGC 1386	S0-a		4800		4110
NGC 1399	E1		8100	5320	2700
NGC 1407	E0		1035		955
NGC 1427	E5				1528
NGC 1533	S0				3250
NGC 1550	SA0				1910
NGC 2434	E0		5129		1920
NGC 2974	E4		4655		2200
NGC 3115	S0	14800	8675		6030
NGC 3258	E1		10535	1600	4120
NGC3379	E1		8175		1250
NGC 3923	E4		3355		4490
NGC 4365	E3		5475		6125
NGC 4472	E2		5695		6510
NGC 5044	E0		3254		1670
NGC 6868	E2		3445		1720
NGC 7144	E0		3455		1720
NGC 7626	E1		4333		2408

THANK YOU!!!

COLOR COMPOSITE IMAGE OF NGC 4472

CREDITS: A. GRADO & L. LIMATOLA (INAF-OAC)