



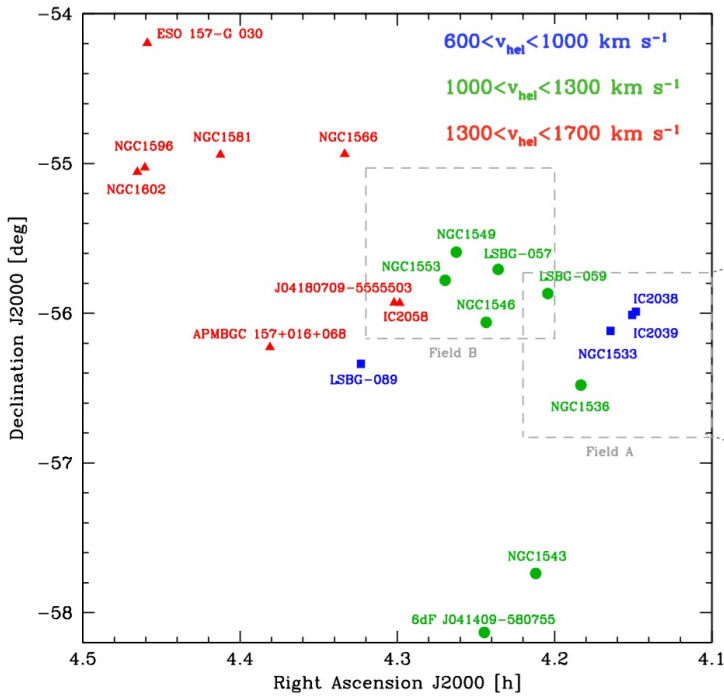
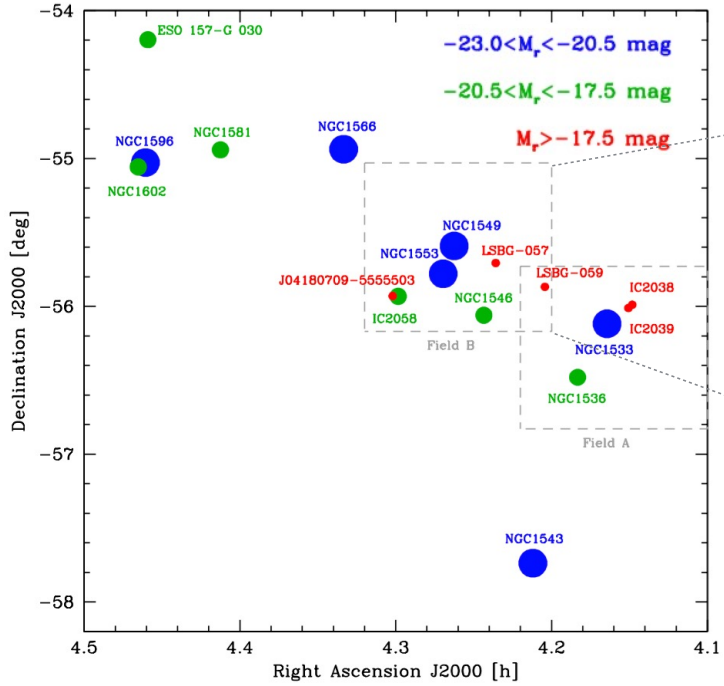
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<b>Title</b>	A Deep Look at NGC1533 in the Dorado Group with VST
<b>Authors</b>	CATTAPAN, ARIANNA, IODICE, ENRICHETTA, RAMPAZZO, Roberto, Ciroi, S., MAZZEI, Paola, GRADO, ANIELLO, LIMATOLA, LUCA, SPAVONE, MARILENA, SCHIPANI, Pietro, Marino, A., HELD, Enrico Valerio
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# *A deep look at NGC1533 in the Dorado Group with VST*

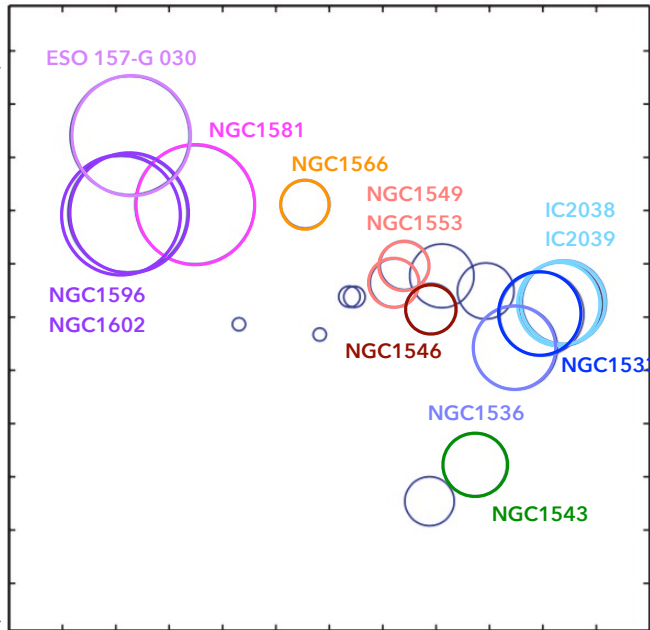
*A. Cattapan*<sup>1</sup>

*E. Iodice*<sup>2</sup>, *R. Rampazzo*<sup>3</sup>, *S. Ciroi*<sup>1</sup>, P. Mazzei<sup>3</sup>, A. Grado<sup>2</sup>, L.  
Limatola<sup>2</sup>, M. Spavone<sup>2</sup>, P. Schipani<sup>2</sup>, A. Marino<sup>3</sup>, E. V. Held<sup>3</sup>

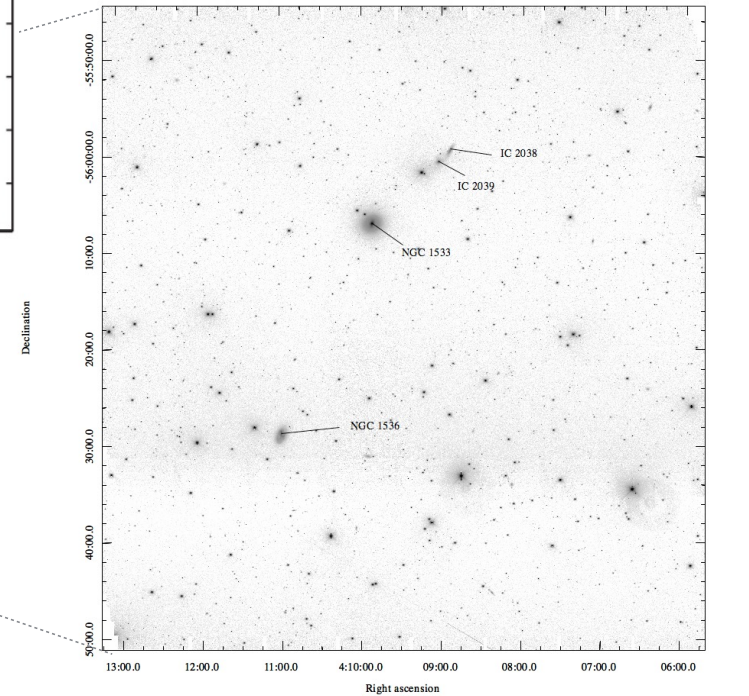
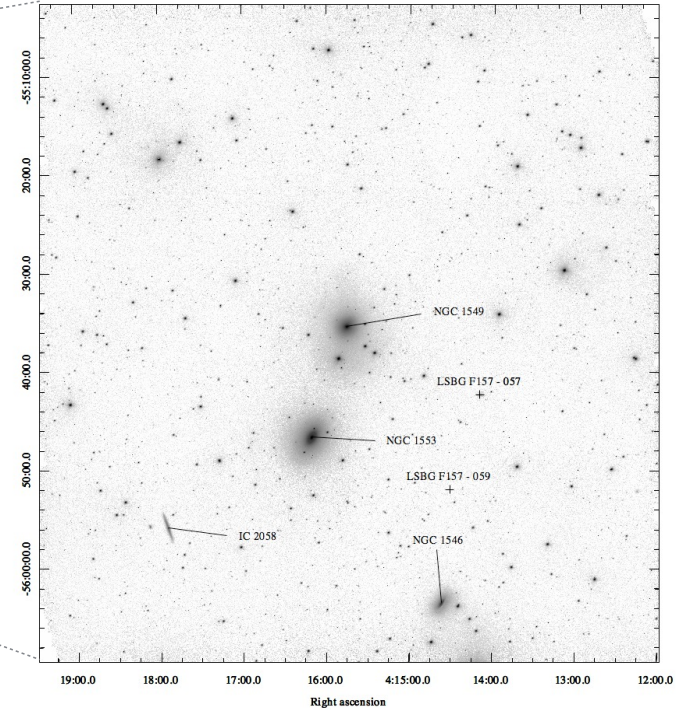
# Dorado Group



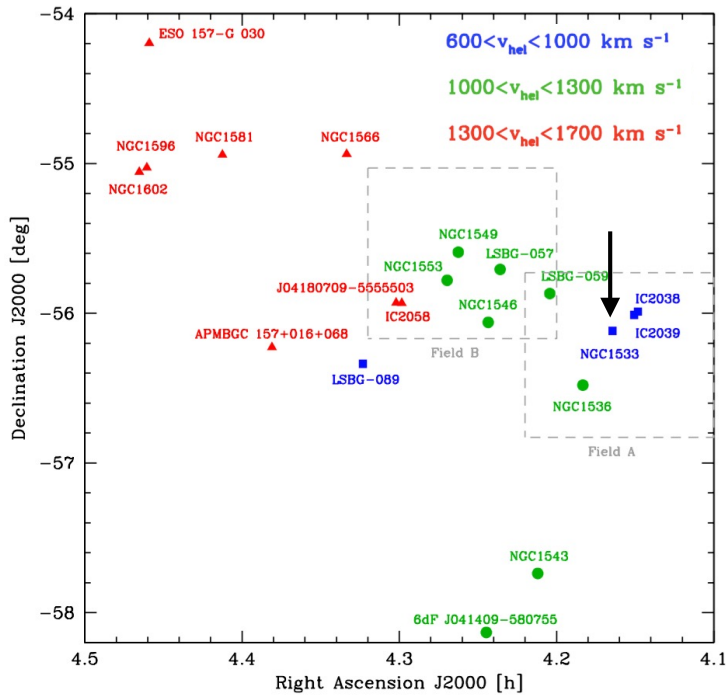
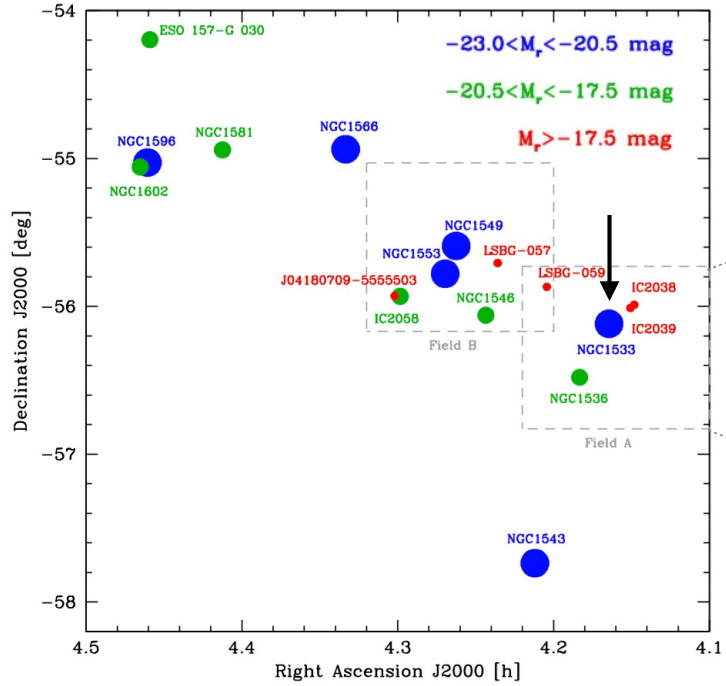
Bubble plots from the Dressler-Shectman test



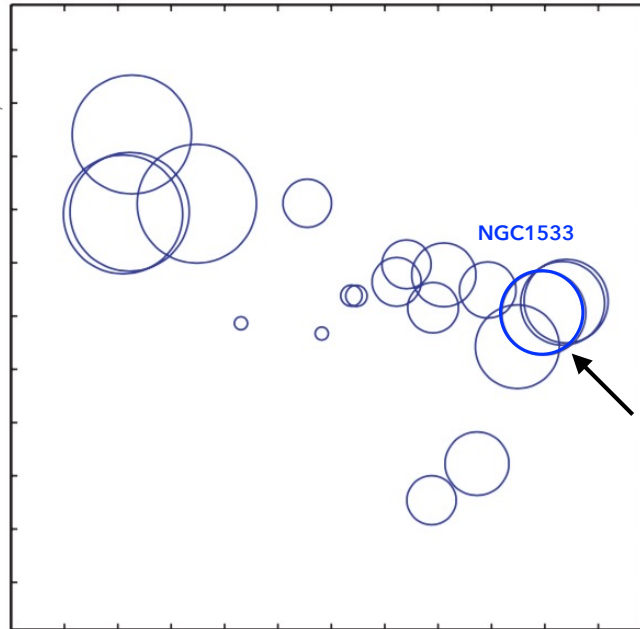
Firth et al. 2006



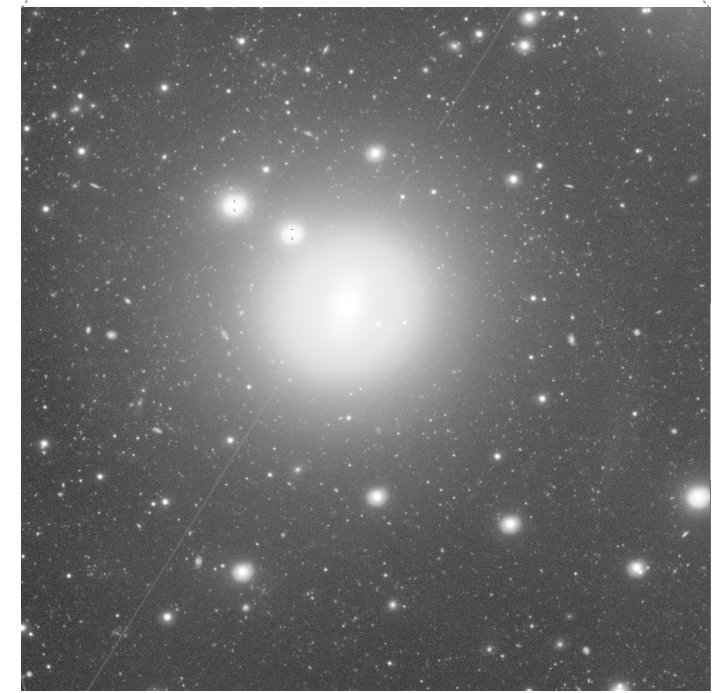
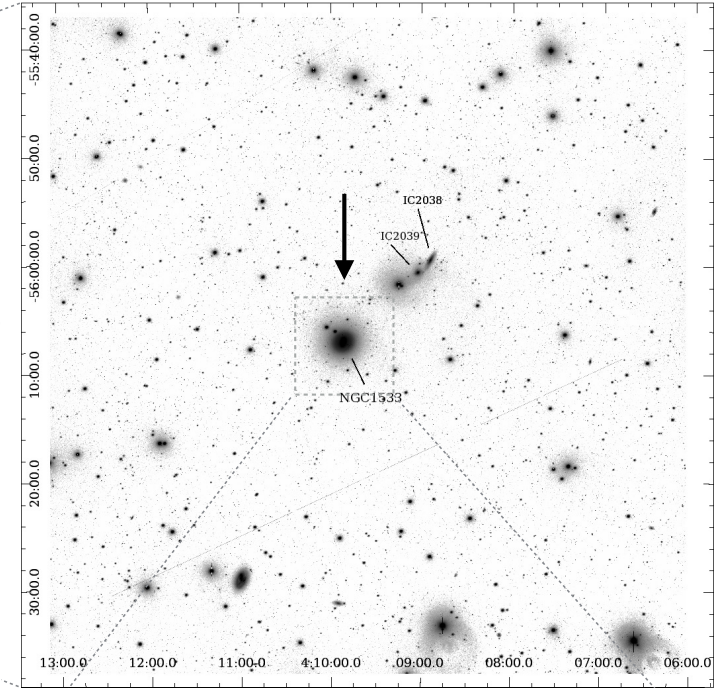
# VEGAS target - NGC 1533



Bubble plots from the Dressler-Shectman test



Firth et al. 2006



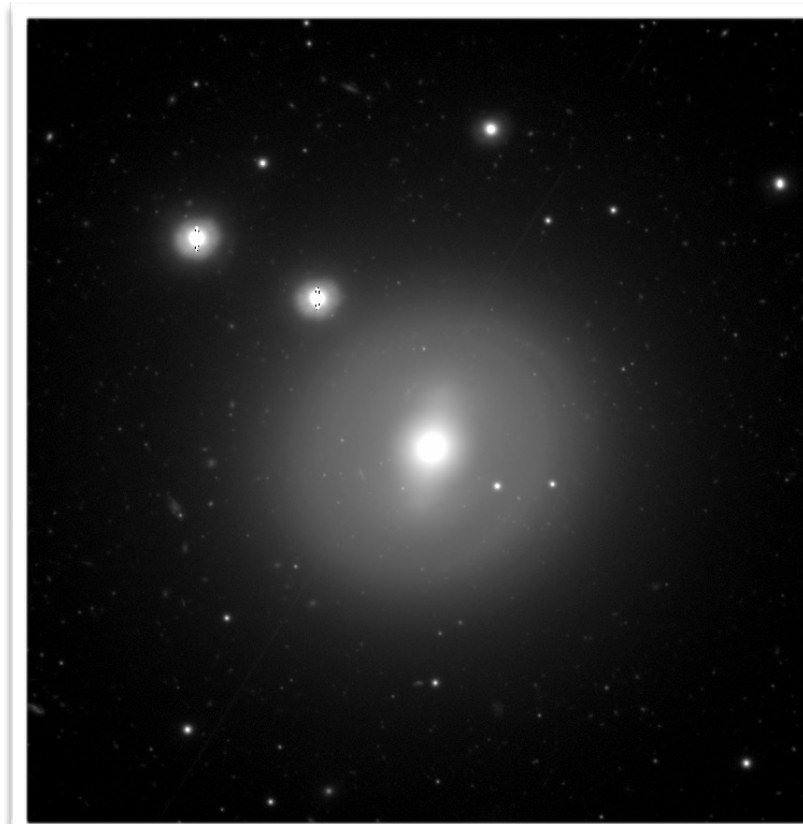
# VEGAS target - NGC 1533

<b>RA</b> [h:m:s]	<b>Dec</b> [°:':"]	<b>V<sub>hel</sub></b> [km s <sup>-1</sup> ]	<b>z</b>
04:09:51.8	-56:07:06	790±5	0.002635±0.000017

Firth et al. 2006

## Outline

1. Previous works
2. Photometry
3. Decomposition
4. Conclusion



**g band** image from VST

**ARRAKIS classification:**

**(RL)SB0<sup>0</sup>**

Comerón et al. (2014)

<b>Band</b> (SDSS)	<b>RA pointing</b> [deg]	<b>Dec pointing</b> [deg]	<b>T<sub>exp</sub></b> [s]	<b>FWHM</b> [arcsec]	<b>Combined frames</b>
g	62.444	-56.101	7800	0.7893	26
r	62.289	-56.114	4800	0.7852	16

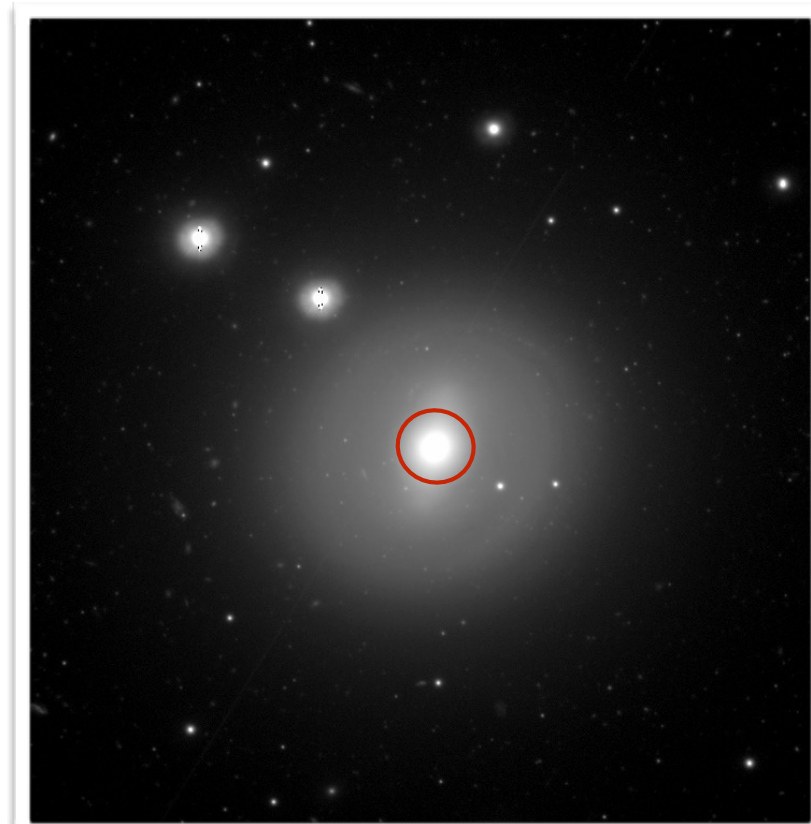
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<b>RA</b> [h:m:s]	<b>Dec</b> [°:':"]	<b>V<sub>hel</sub></b> [km s <sup>-1</sup> ]	<b>z</b>
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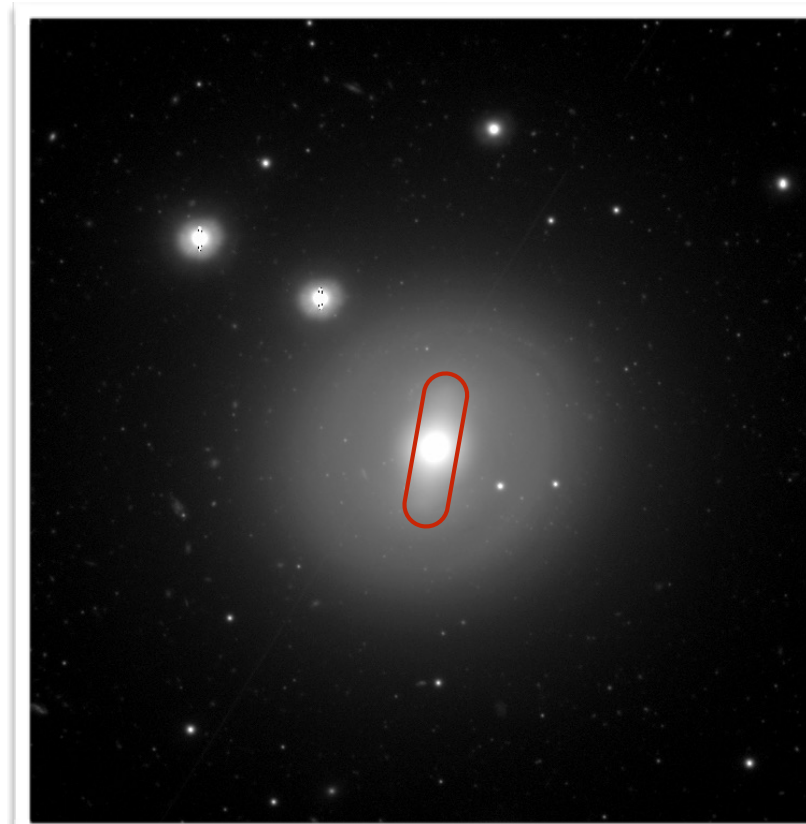
# VEGAS target - NGC 1533

<b>RA</b> [h:m:s]	<b>Dec</b> [°:':"]	<b><math>V_{hel}</math></b> [km s <sup>-1</sup> ]	<b>z</b>
04:09:51.8	-56:07:06	790±5	0.002635±0.000017

Firth et al. 2006

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**(RL)SB0<sup>0</sup>**

Comerón et al. (2014)

**g band** image from VST

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g	62.444	-56.101	7800	0.7893	26
r	62.289	-56.114	4800	0.7852	16

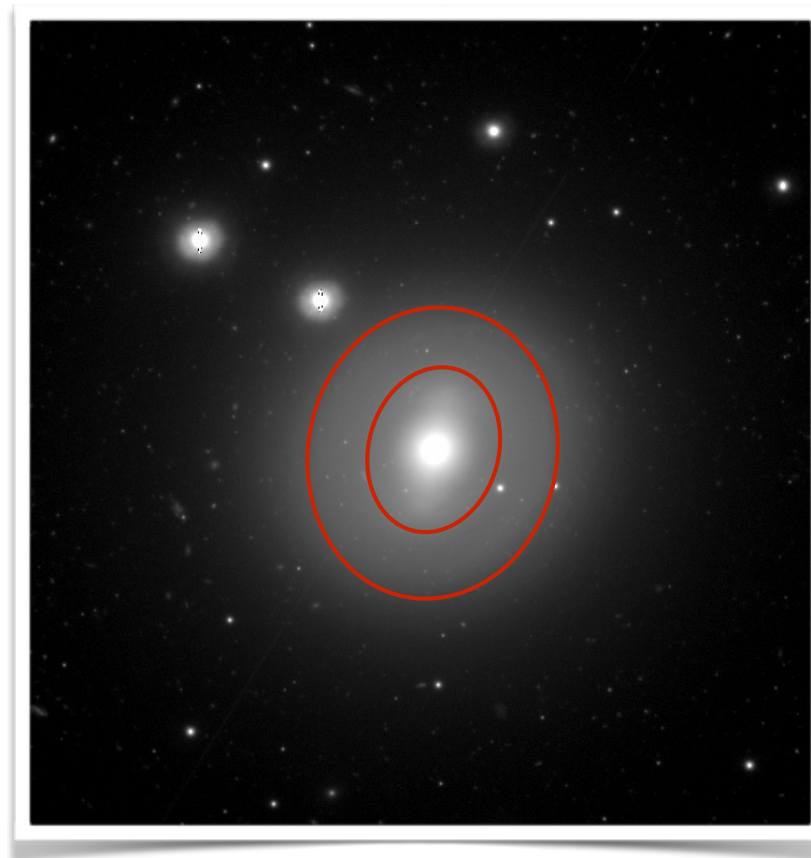
# VEGAS target - NGC 1533

RA	Dec	$V_{hel}$	$z$
[h:m:s]	[°:':"]	[km s <sup>-1</sup> ]	
04:09:51.8	-56:07:06	790±5	0.002635±0.000017

Firth et al. 2006

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**g band** image from VST

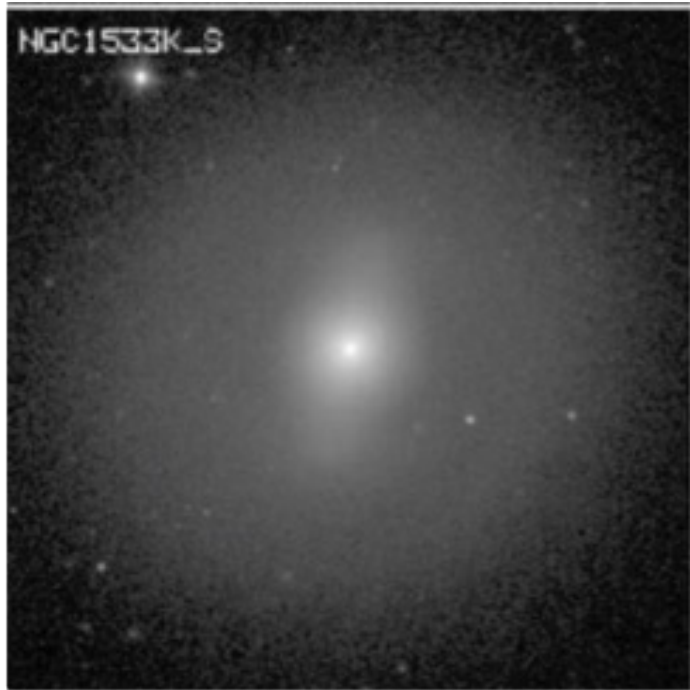
**ARRAKIS classification:**

**(RL)SB0<sup>0</sup>**

Comerón et al. (2014)

Band (SDSS)	RA pointing [deg]	Dec pointing [deg]	$T_{exp}$ [s]	FWHM [arcsec]	Combined frames
g	62.444	-56.101	7800	0.7893	26
r	62.289	-56.114	4800	0.7852	16

# From imaging previous works

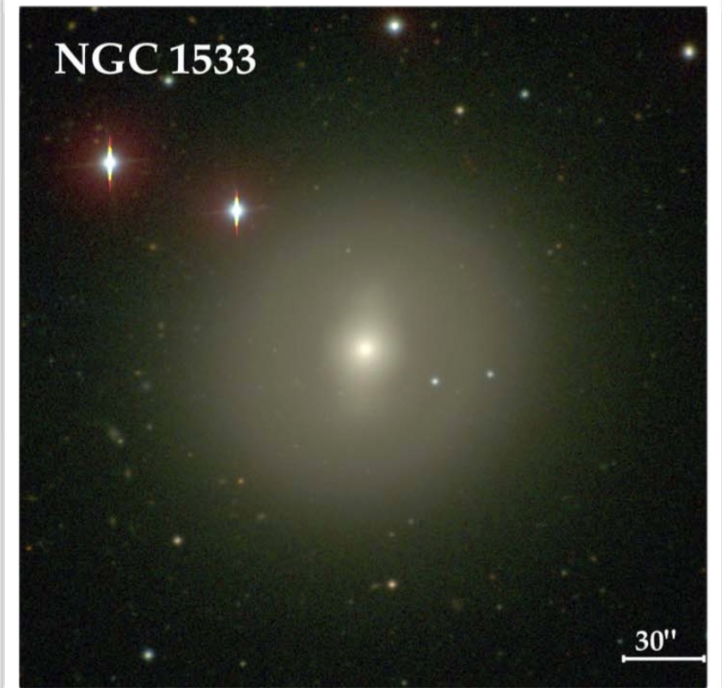


Direct  $K_s$ -band ( $\lambda \sim 2.15 \mu\text{m}$ ) image from NTT, image is in units of  $\text{mag arcsec}^{-2}$  and is displayed from  $\mu_{K_s} = 12.0$  to  $22.0 \text{ mag arcsec}^{-2}$ .  
FoV =  $4' \times 4'$

**Laurikainen et al. 2006**

du Pont telescope image, stacked image from Johnson B and V and Kron-Cousins R and I filters.  
FoV =  $4'.8 \times 4'.8$

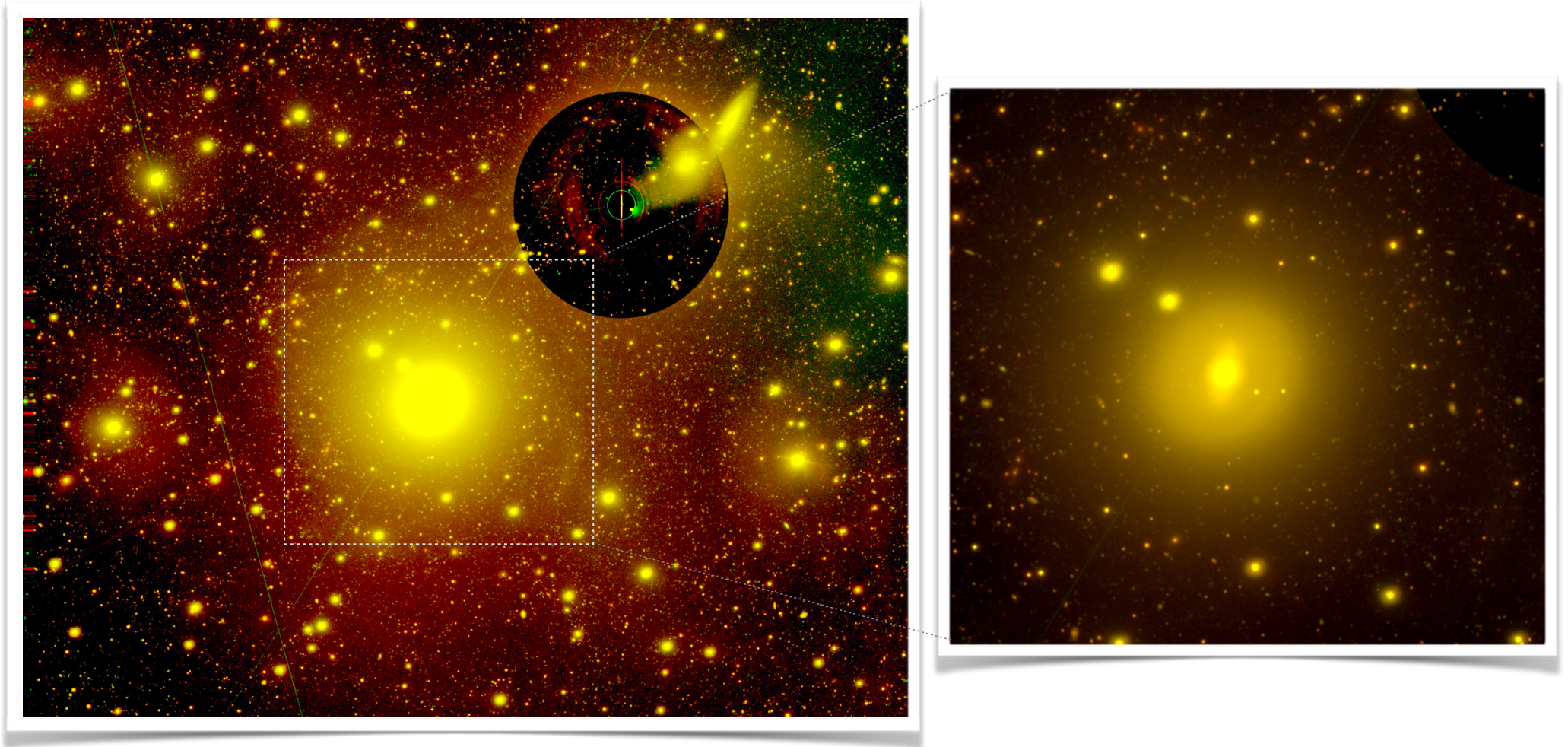
**Ho et al. 2011**



Swift-UVOT image, color composite image in the W2 (blue), M2 (green) and W1 (red) filters. FoV =  $5' \times 5'$

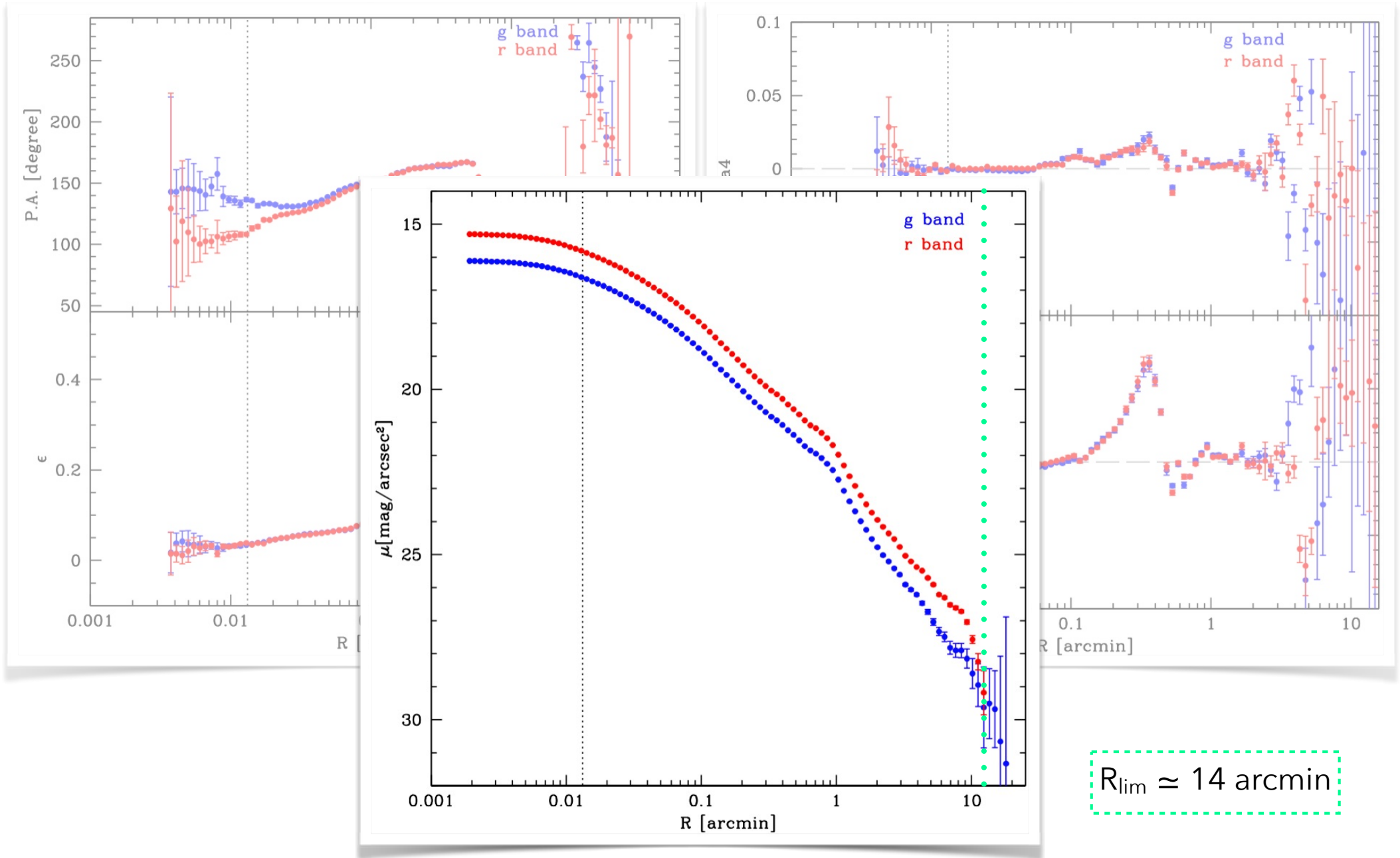
**Rampazzo et al. 2017**

# Imaging with VST

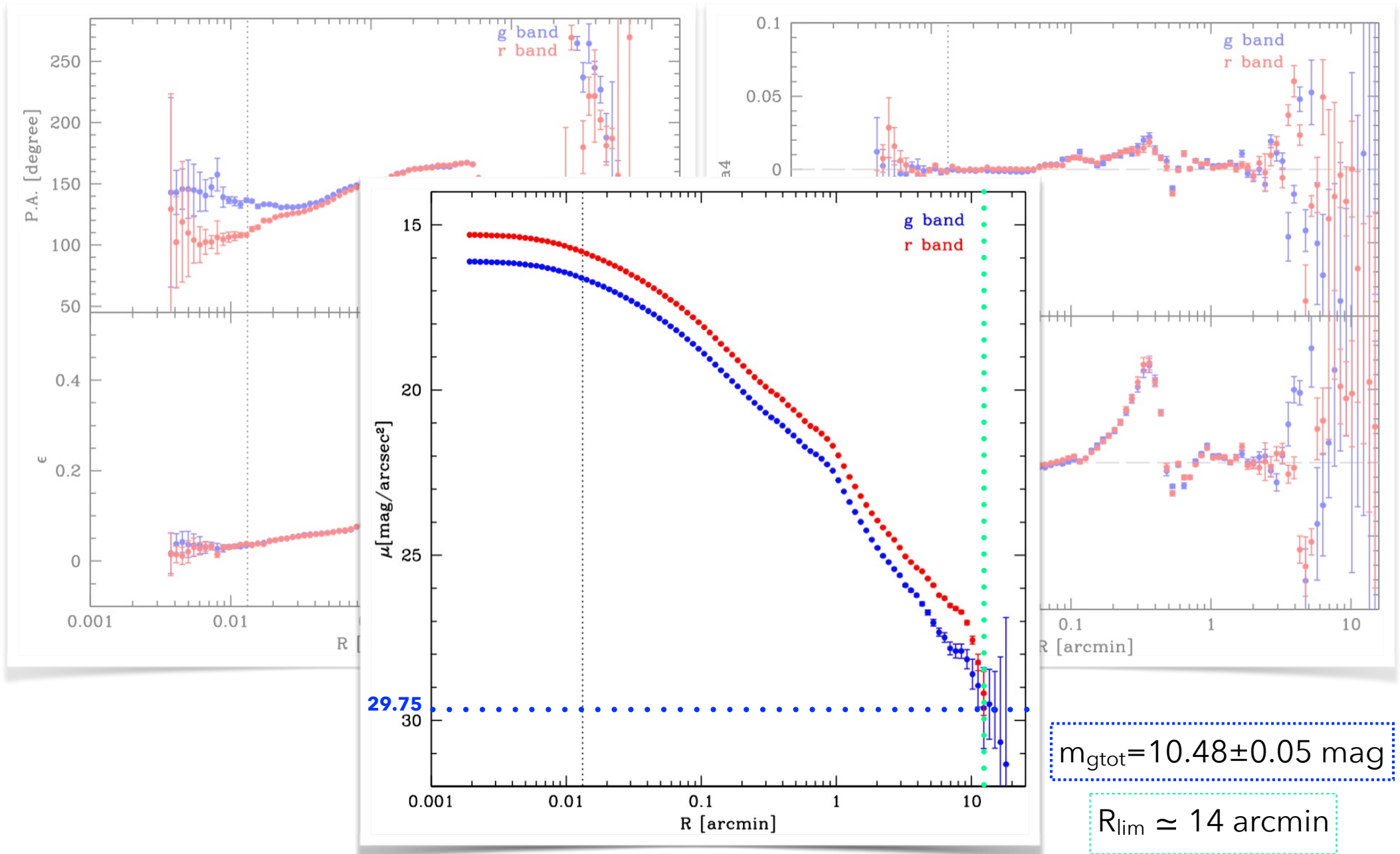


Colour composite image from g (green channel) and r (red channel) band VST image,  
24.15x18.9 arcmin.

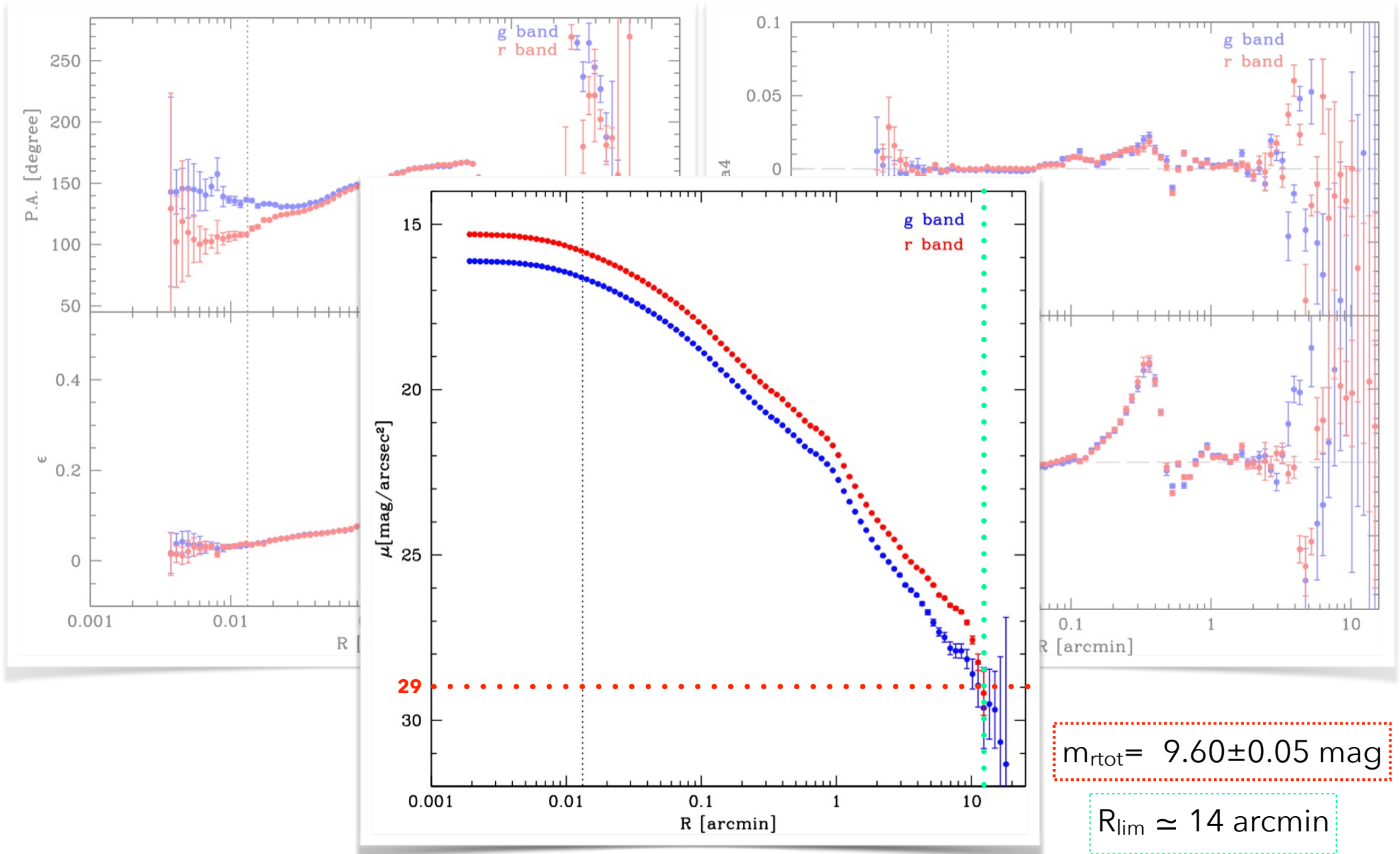
# Photometry - Surface Brightness Profile



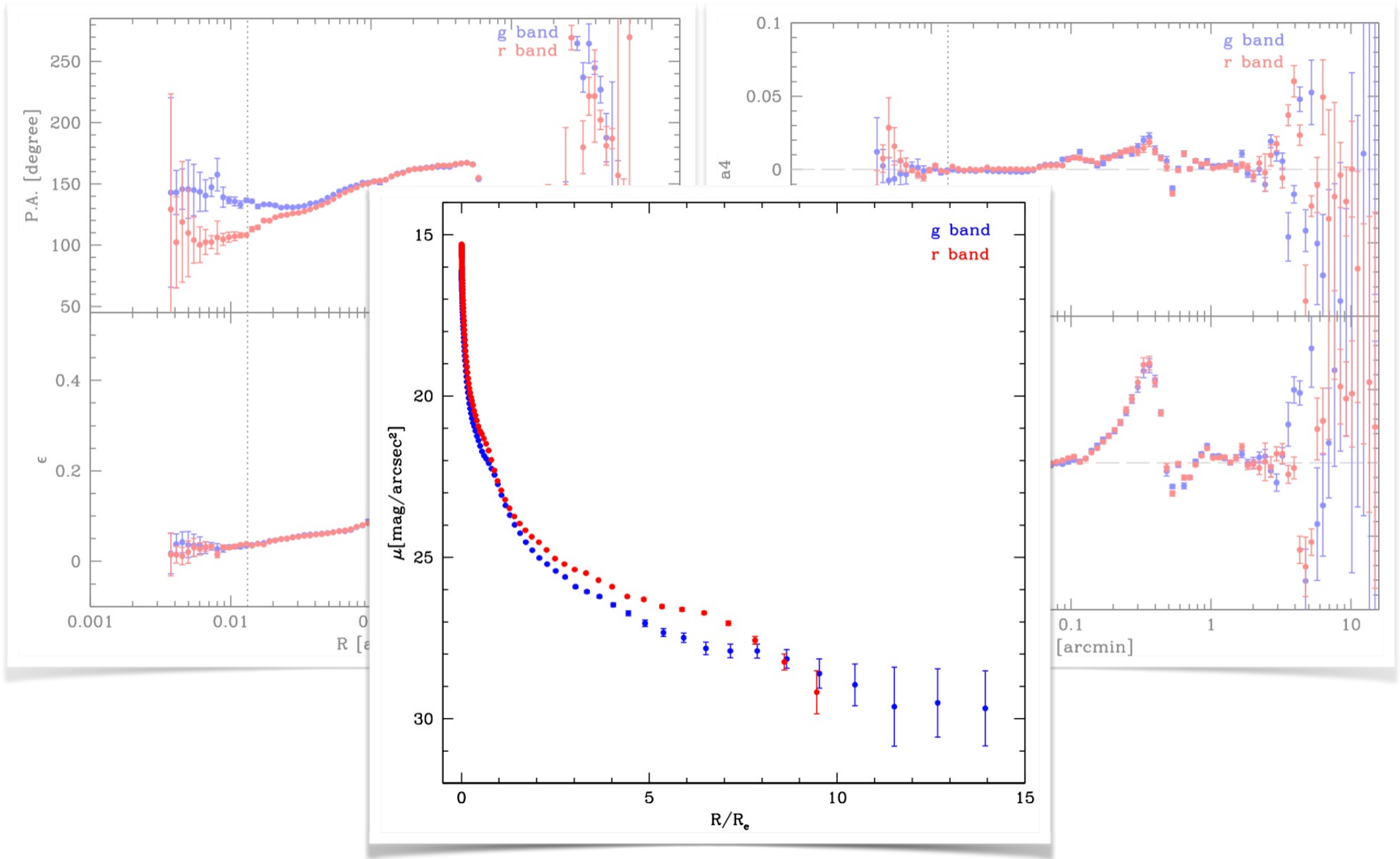
# Photometry - Surface Brightness Profile



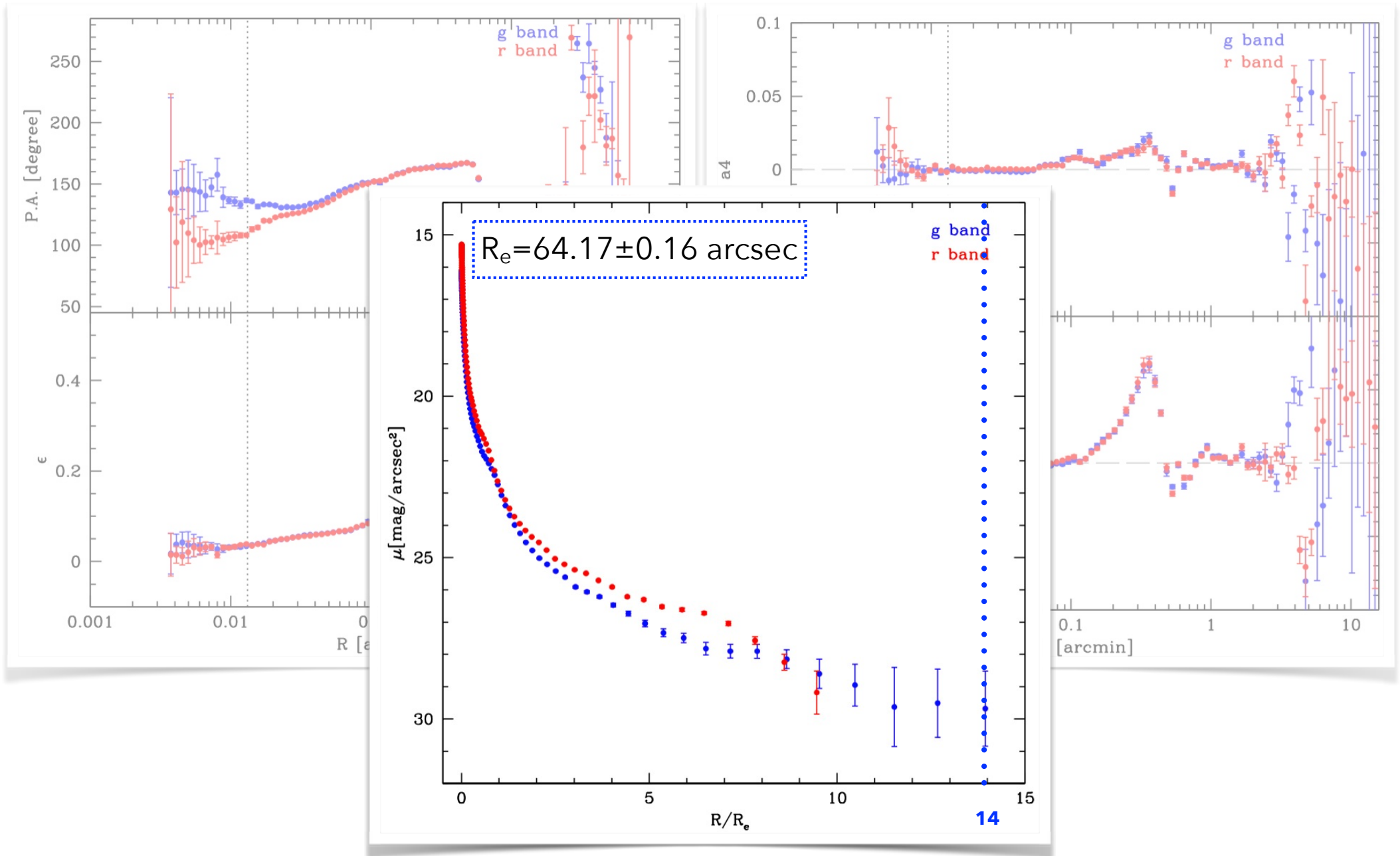
# Photometry - Surface Brightness Profile



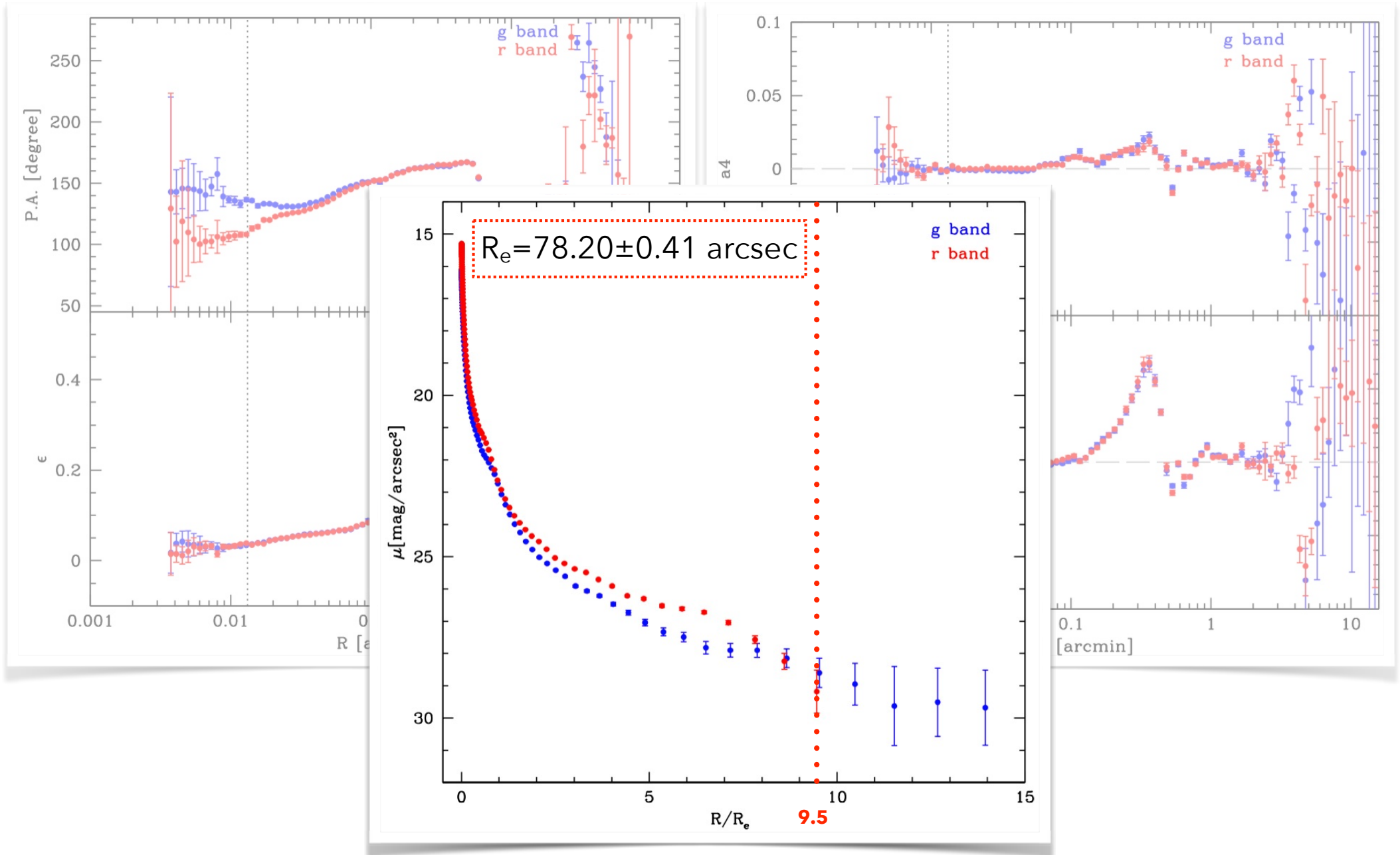
# Photometry - Surface Brightness Profile



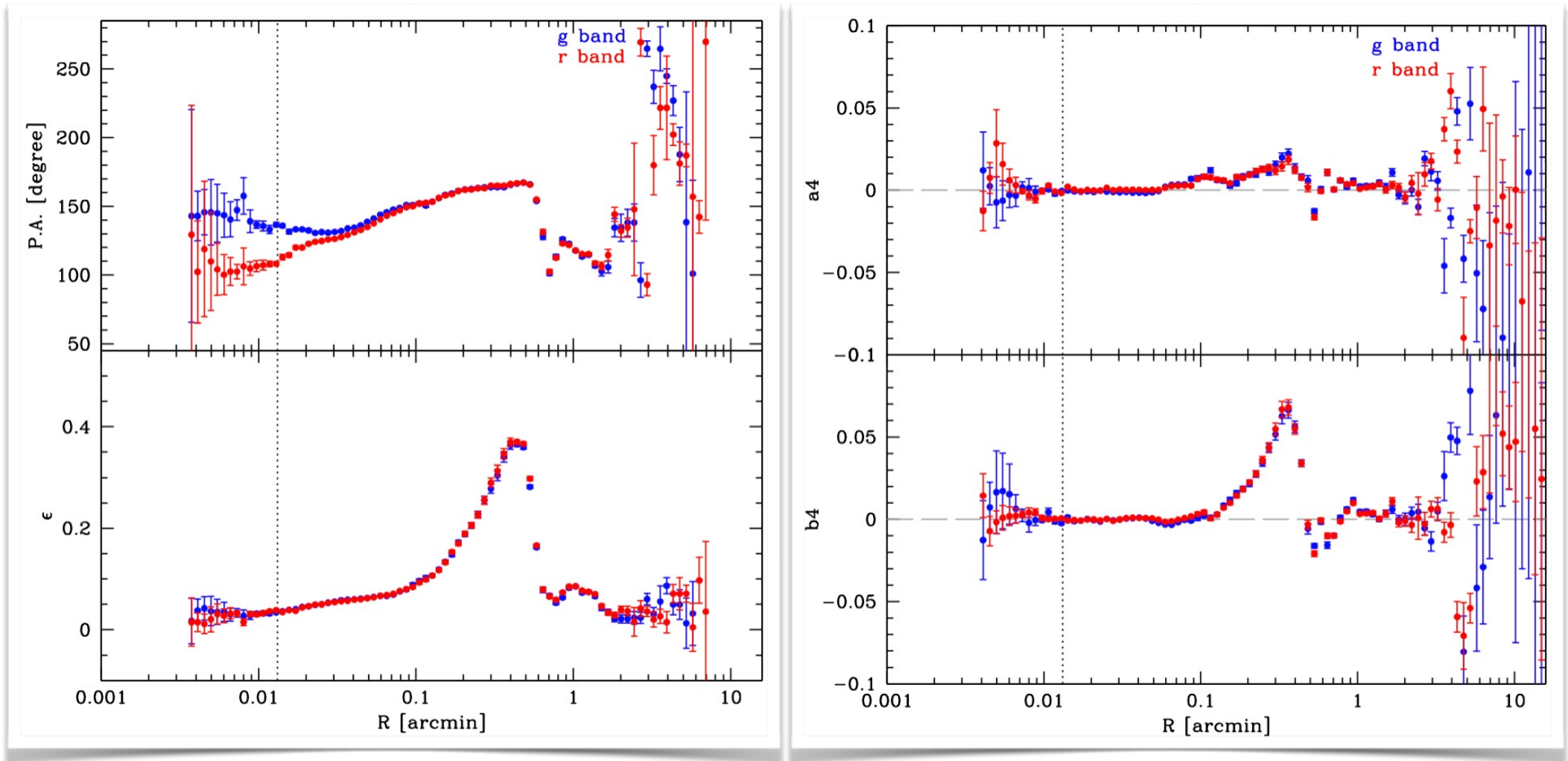
# Photometry - Surface Brightness Profile



# Photometry - Surface Brightness Profile

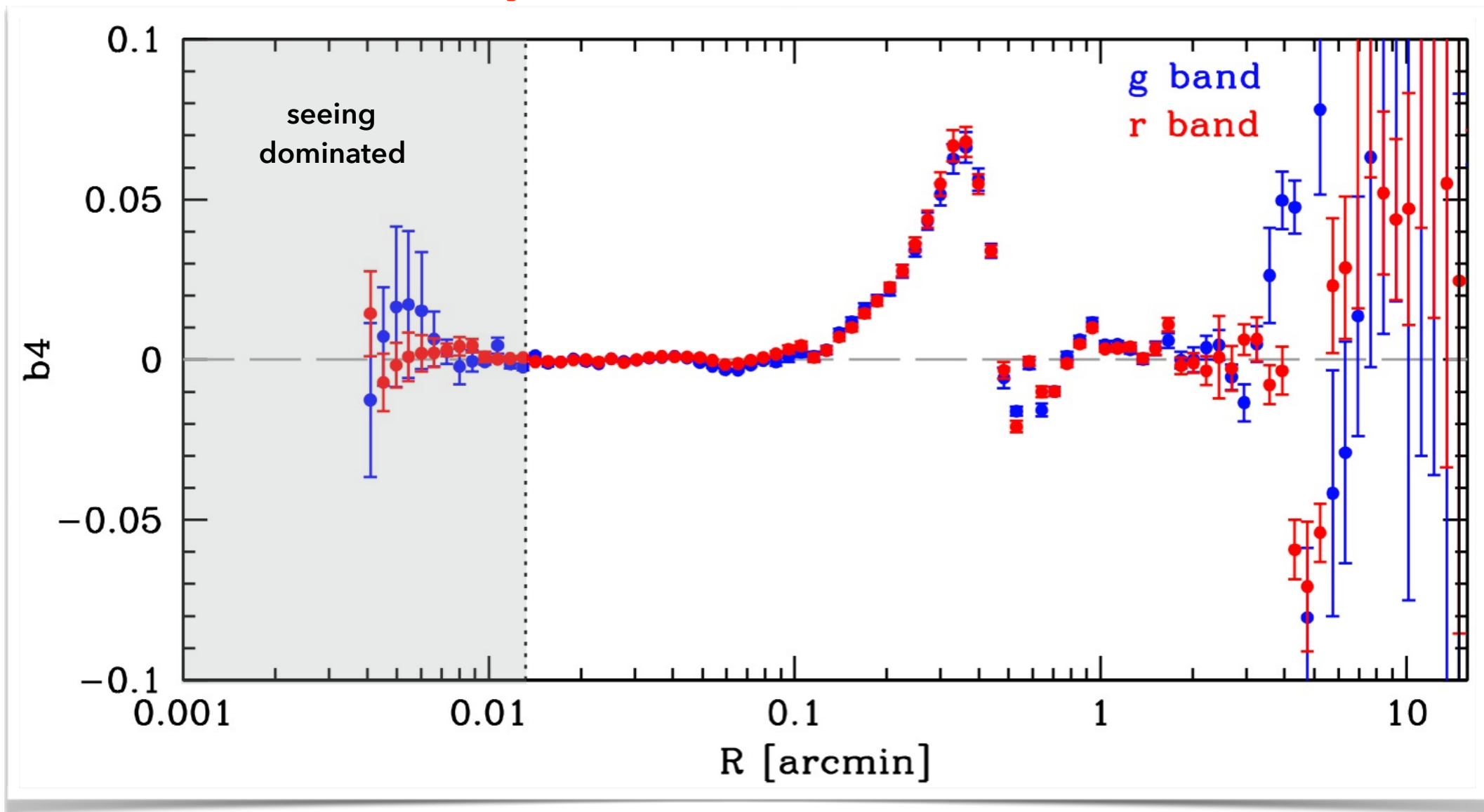


# Photometry - Geometrical Parameters



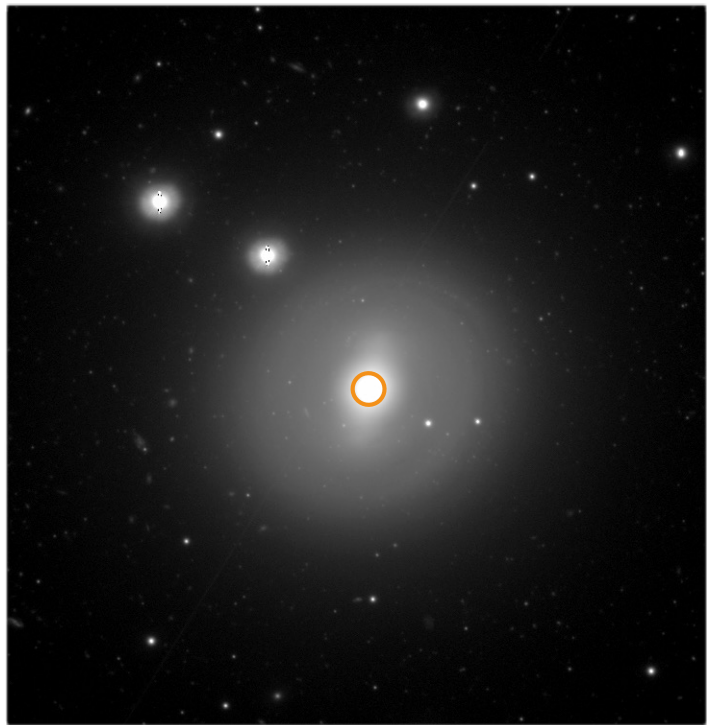
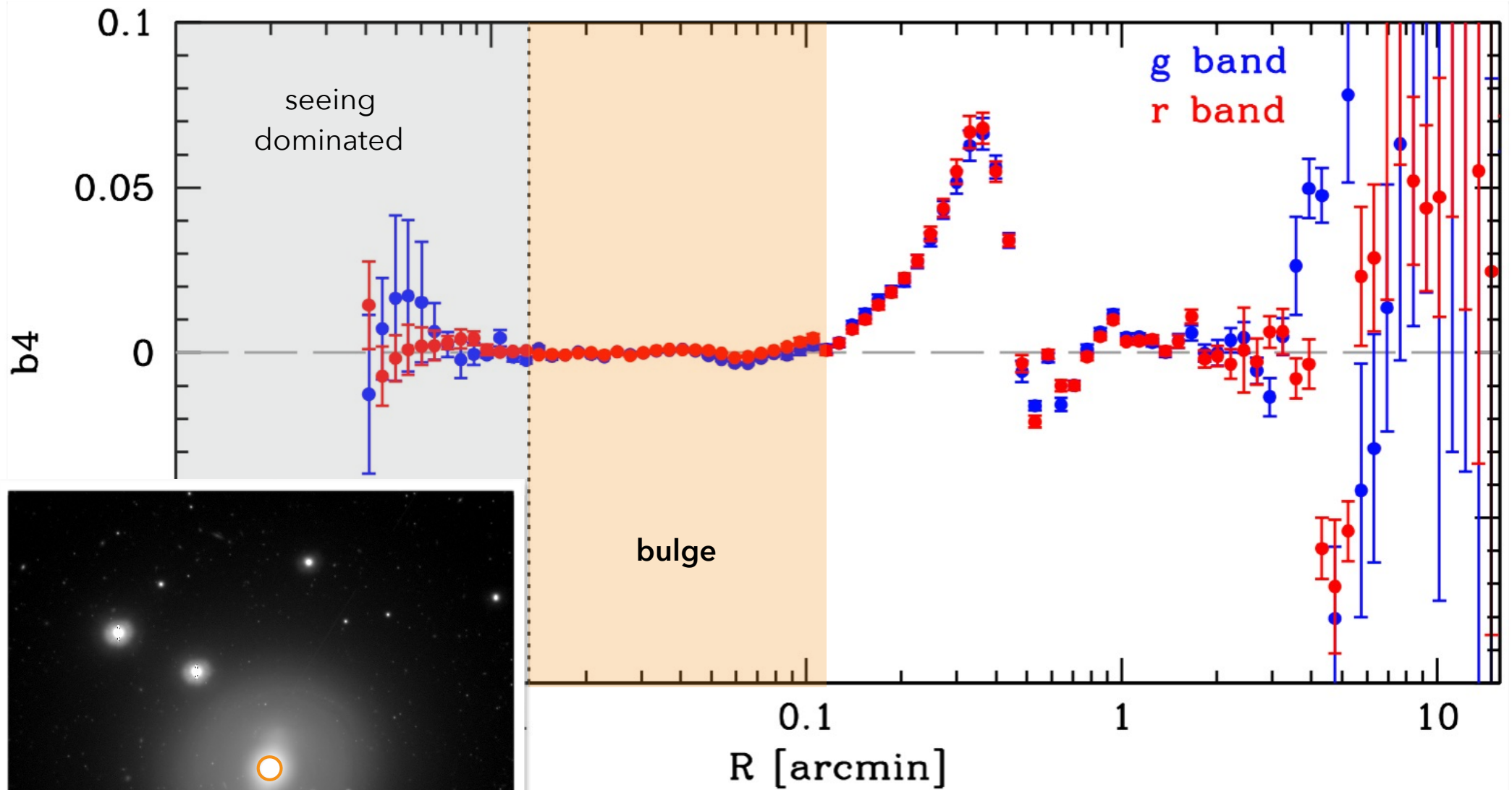
Jedrzejewski, 1987: 
$$I(\alpha, \vartheta) = I_0 + \sum_k \left[ a_k \sin(k\vartheta) + b_k \cos(k\vartheta) \right]$$

# Photometry - Geometrical Parameters



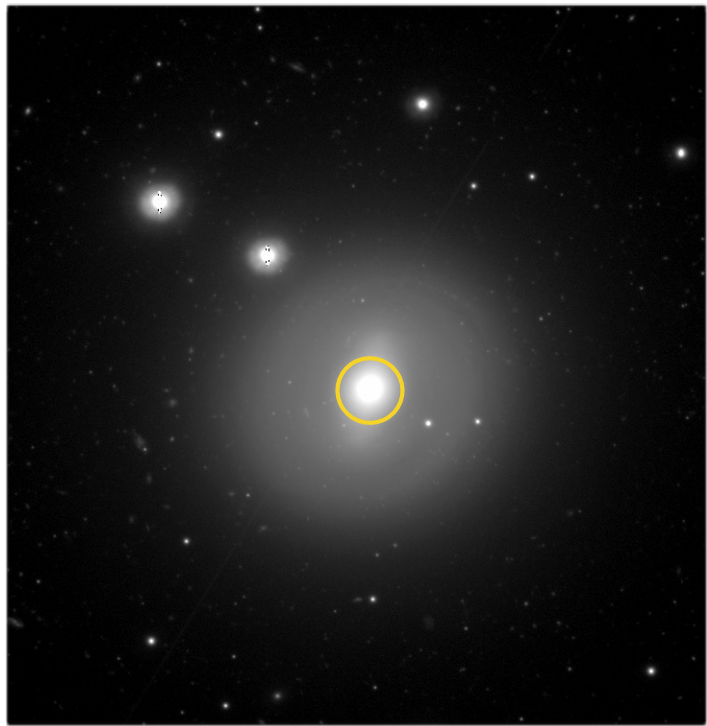
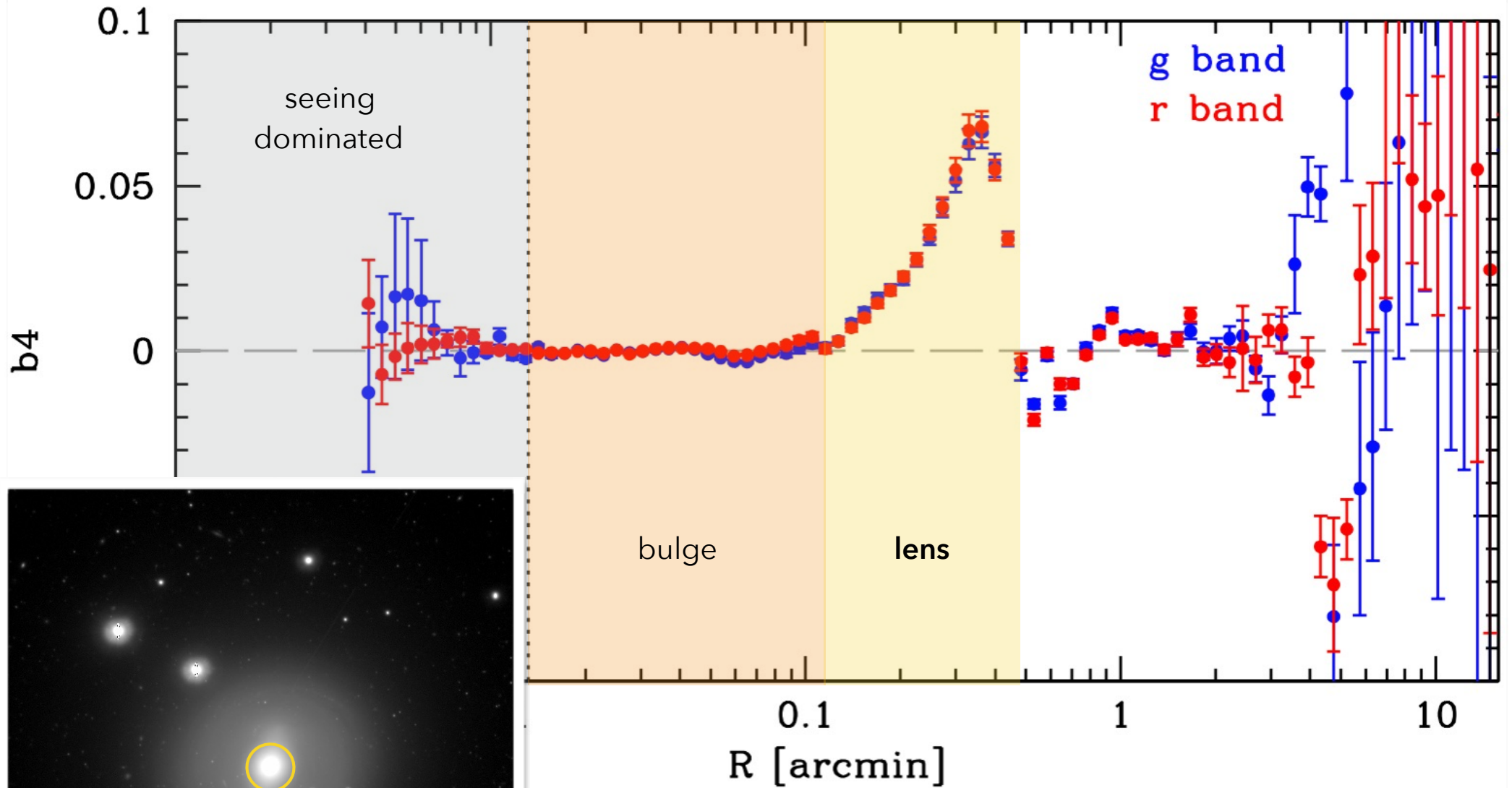
$R \lesssim 0.79$  arcsec

# Photometry - Geometrical Parameters



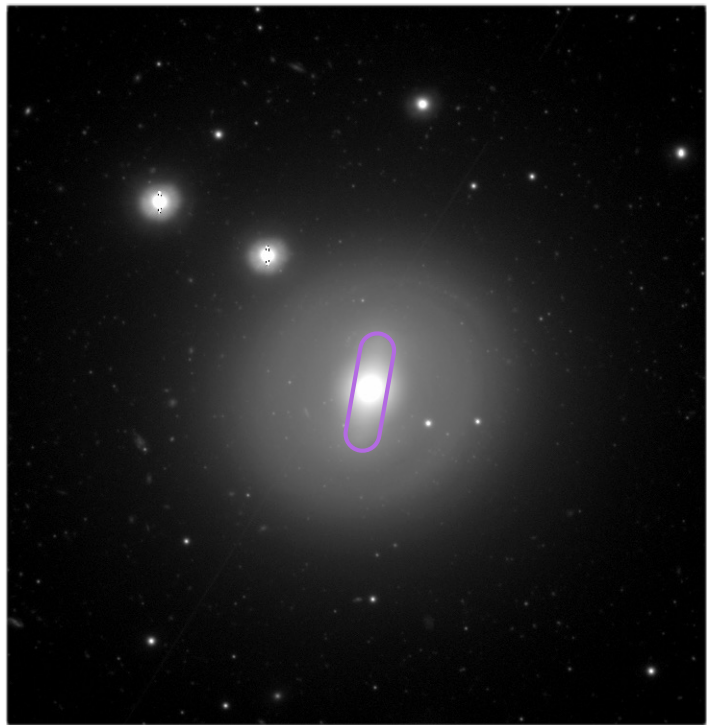
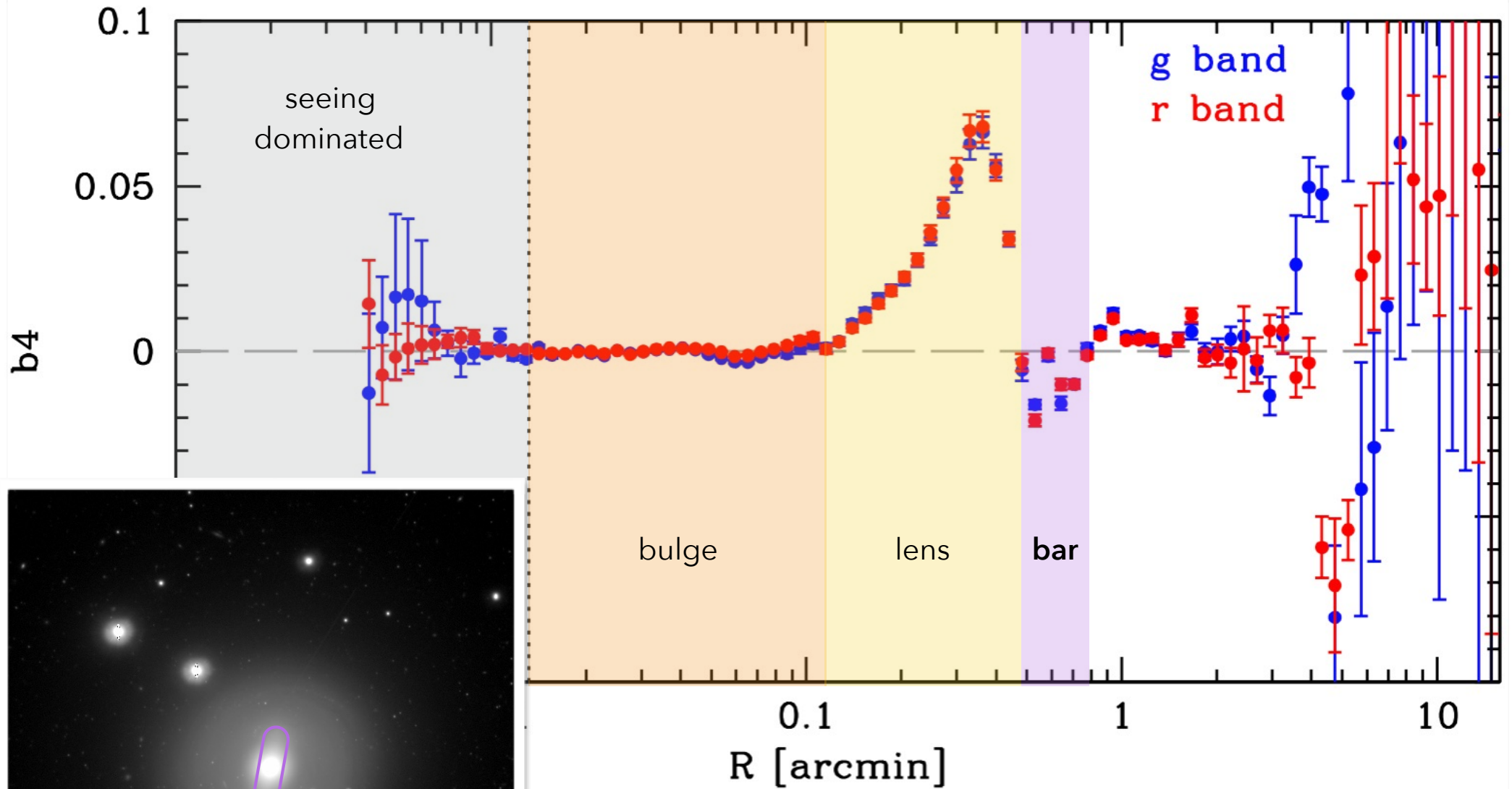
$$0.79 \lesssim R \lesssim 6.95 \text{ arcsec}$$

# Photometry - Geometrical Parameters



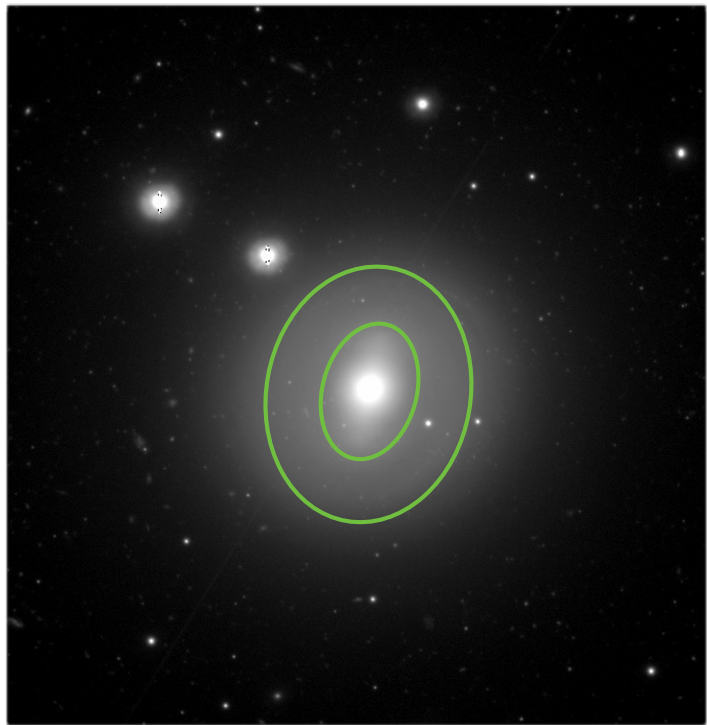
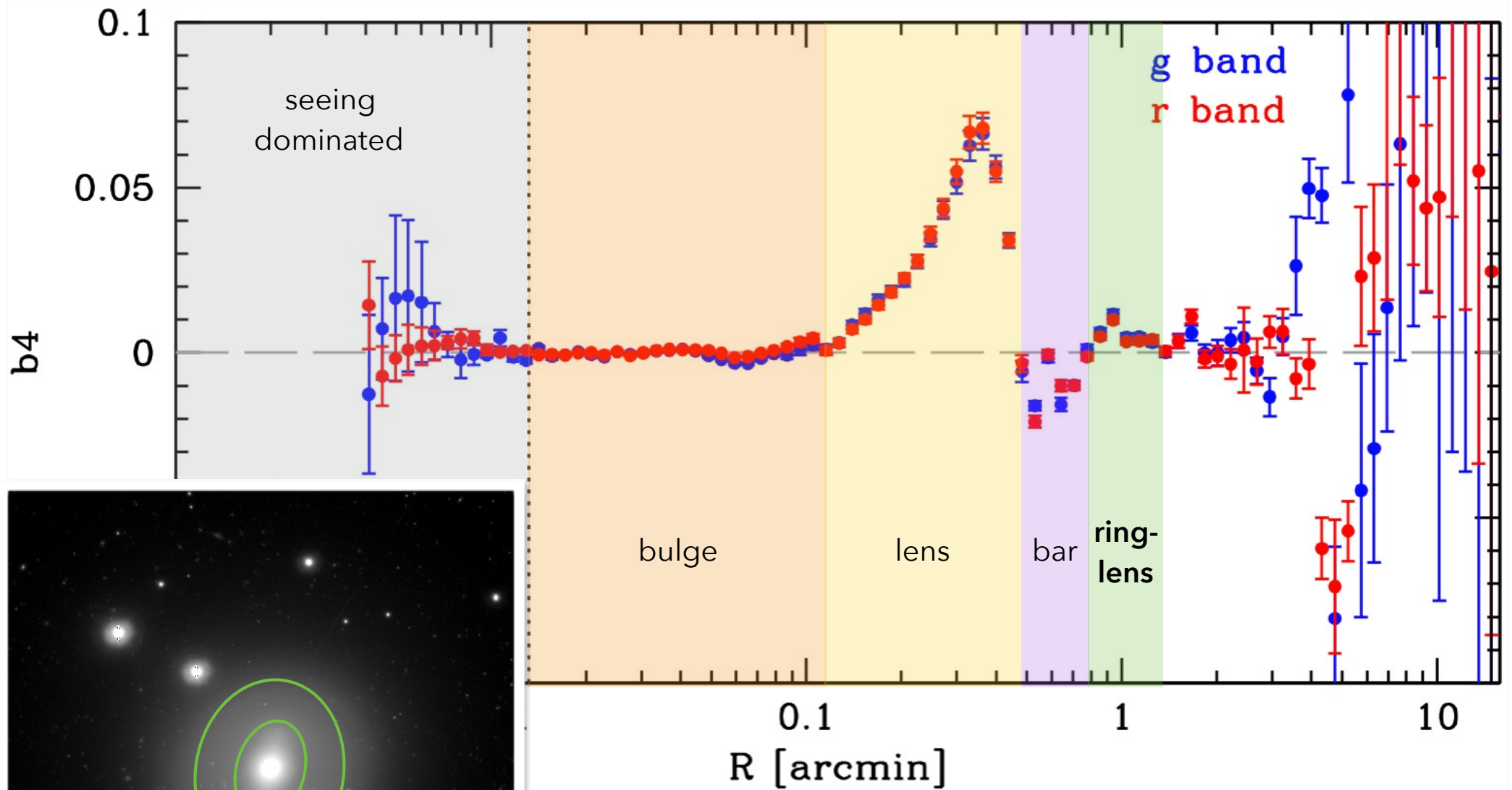
$$6.95 \lesssim R \lesssim 29.00 \text{ arcsec}$$

# Photometry - Geometrical Parameters



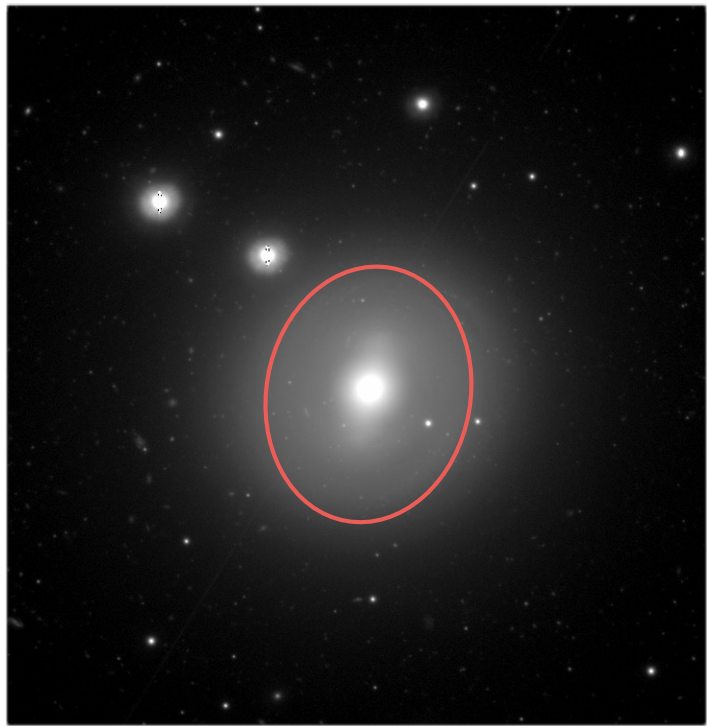
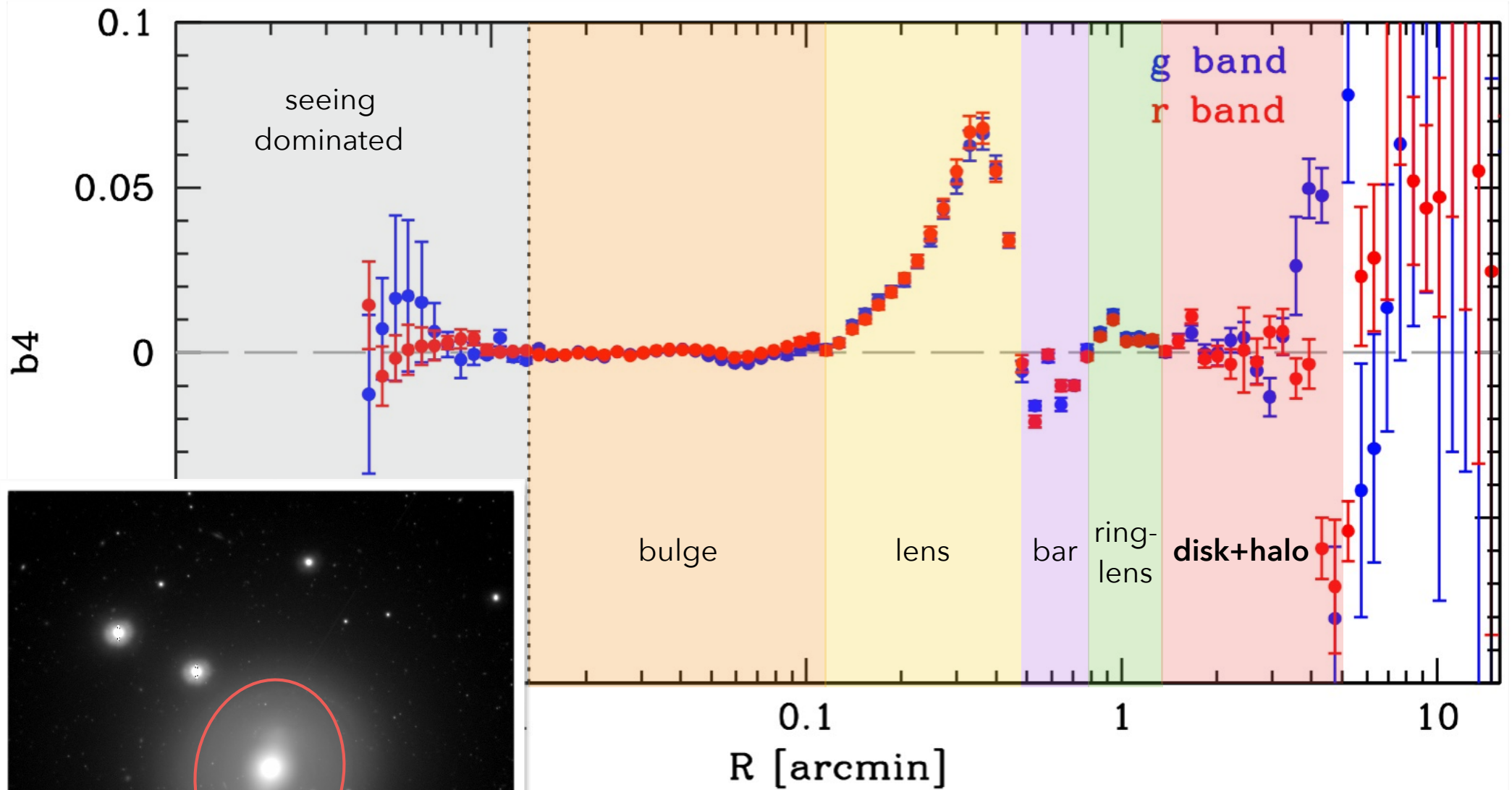
$$29.00 \lesssim R \lesssim 46.70 \text{ arcsec}$$

# Photometry - Geometrical Parameters



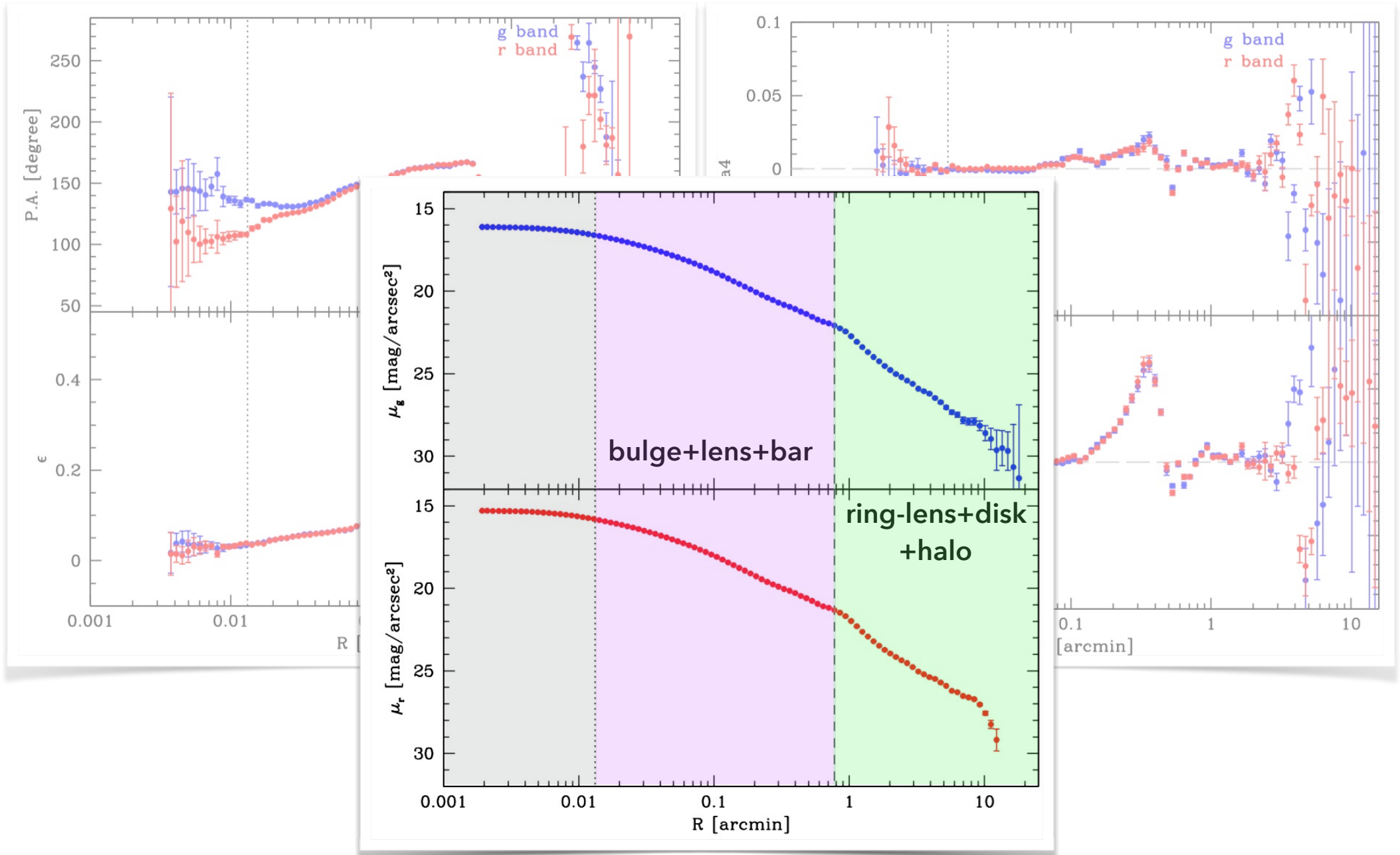
$$46.70 \lesssim R \lesssim 82.58 \text{ arcsec}$$

# Photometry - Geometrical Parameters

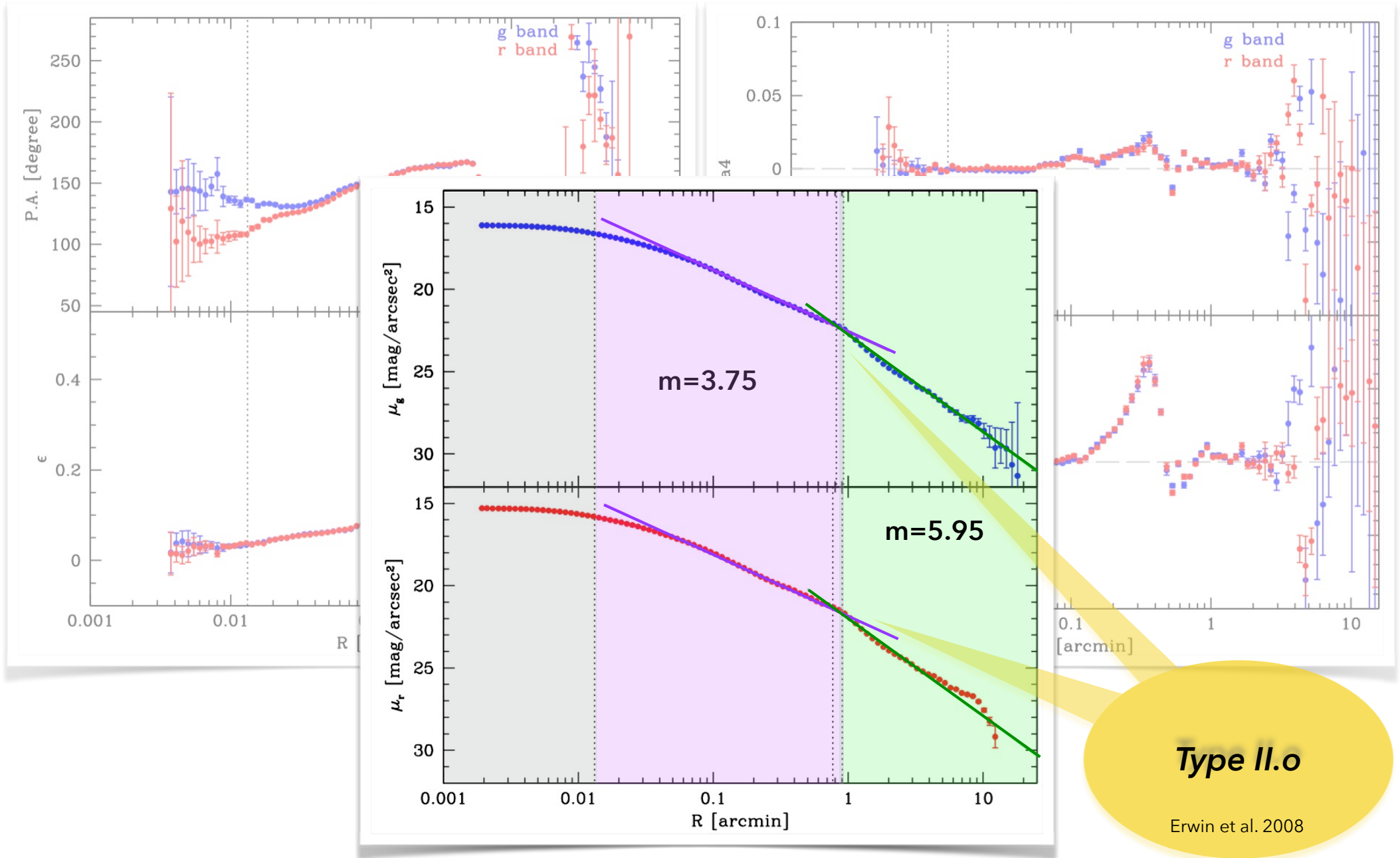


$$82.58 \lesssim R \lesssim 300 \quad \text{arcsec}$$

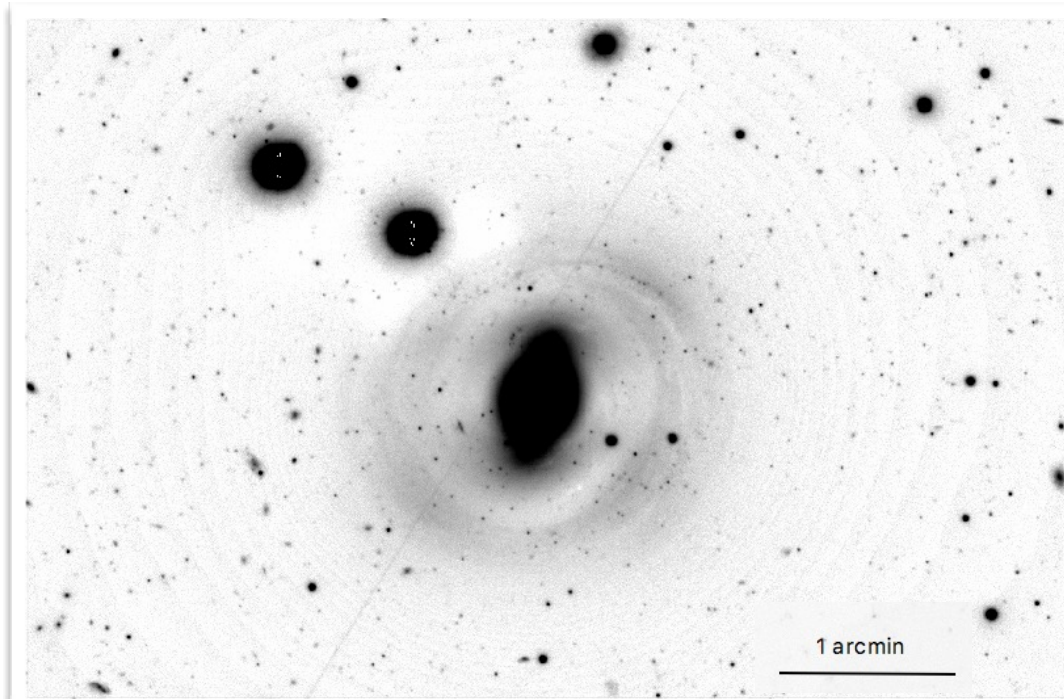
# Photometry - Surface Brightness Profile



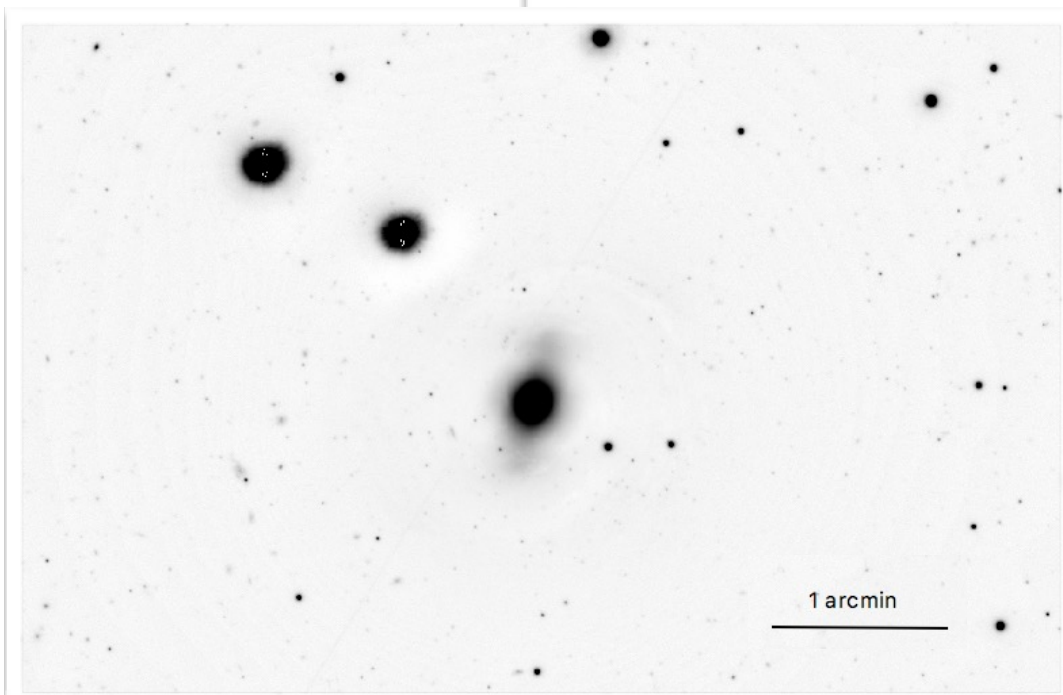
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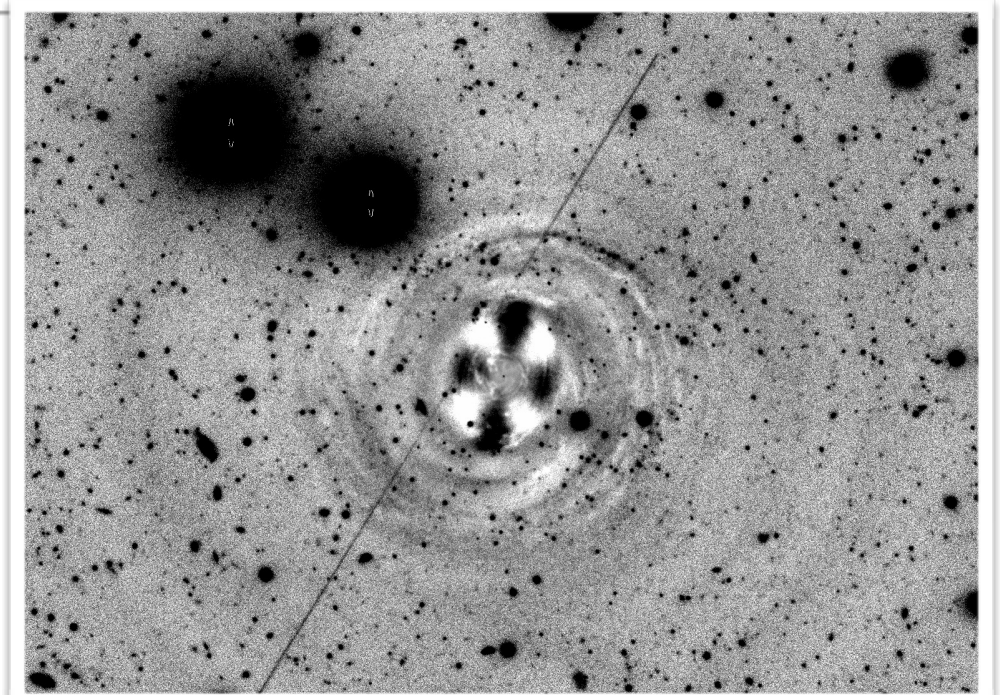
# Photometry - Structures



High frequency image with  
2D window of 300x300 px

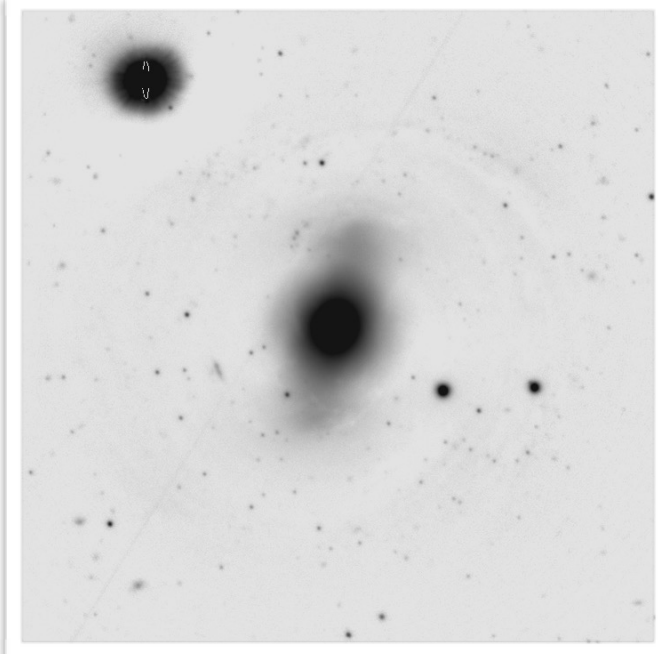
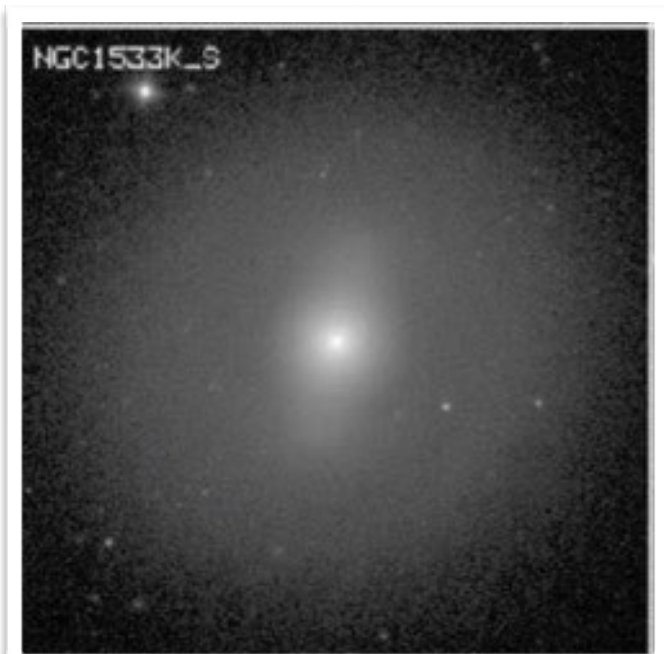


High frequency image with 2D window of 150x150 px

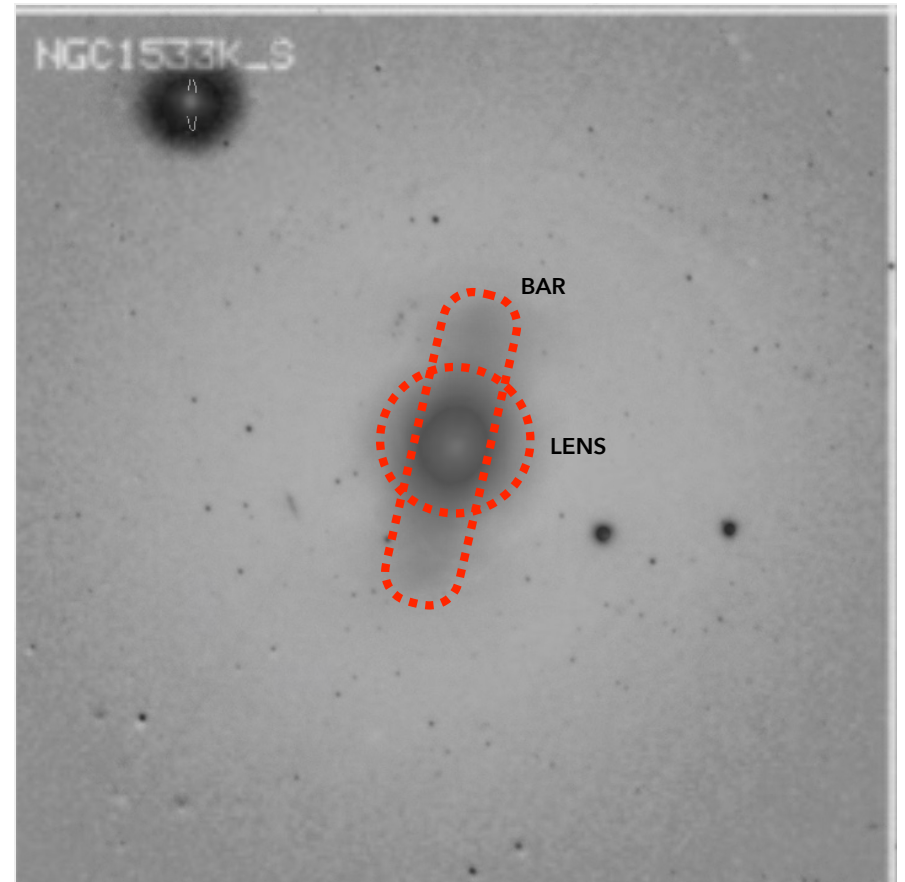


Residual image from 2D model subtraction

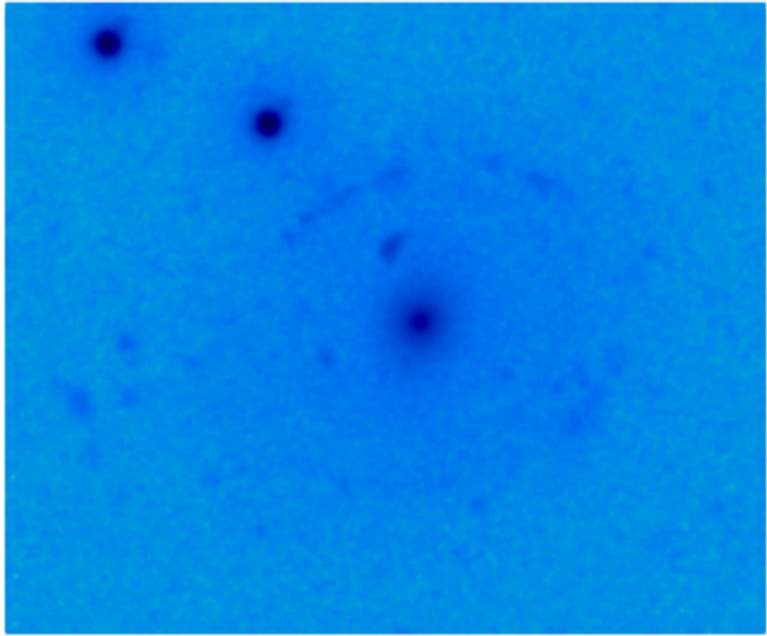
# Photometry - Structures



*NTT  $K_s$  image*  
overlapped by **high frequency image** with 2D window of 150x150 pxs

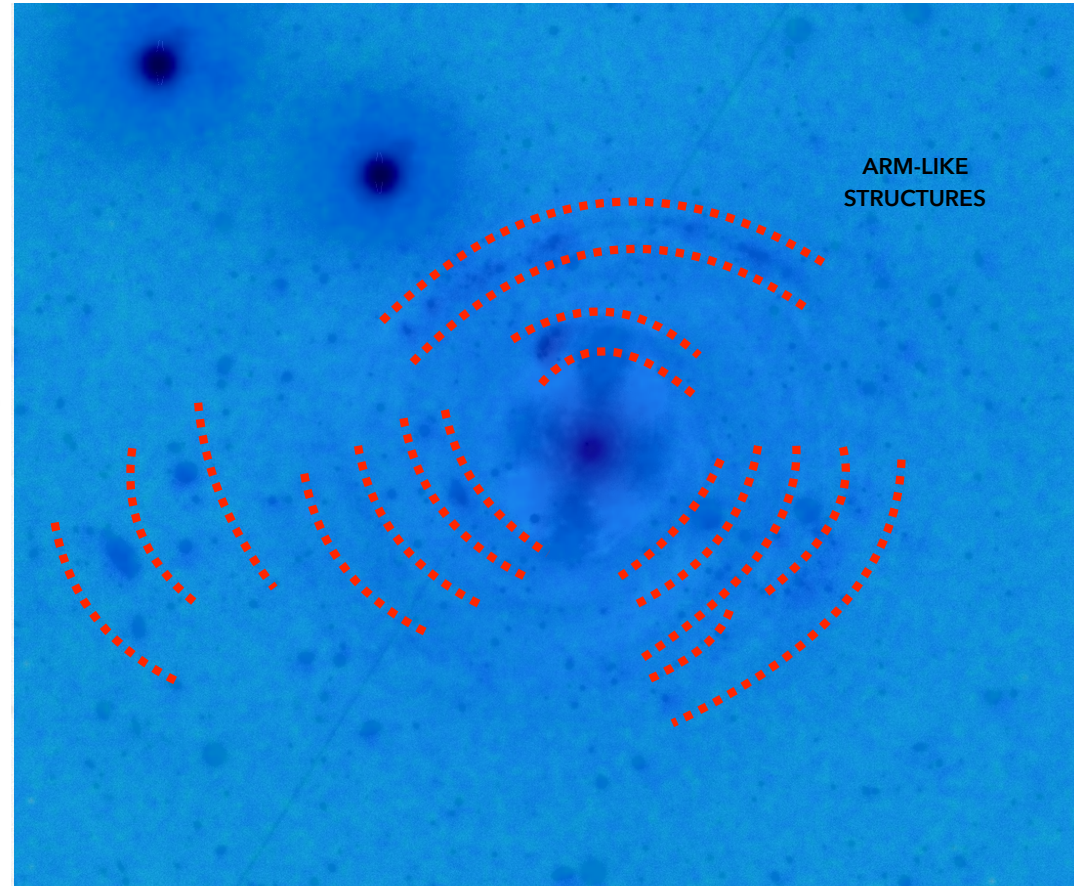
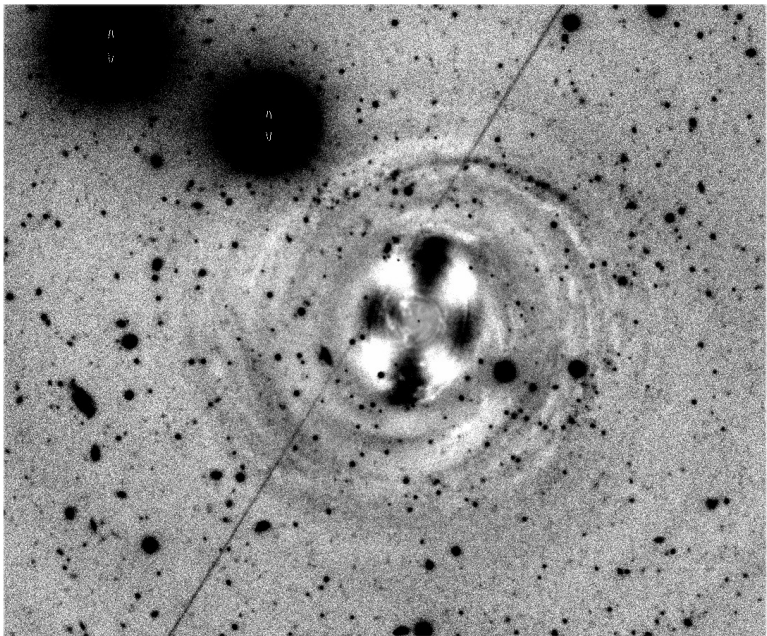


# Photometry - Structures



Swift-UVOT W2 image

overlapped by residual g-band image from subtraction of 2D model

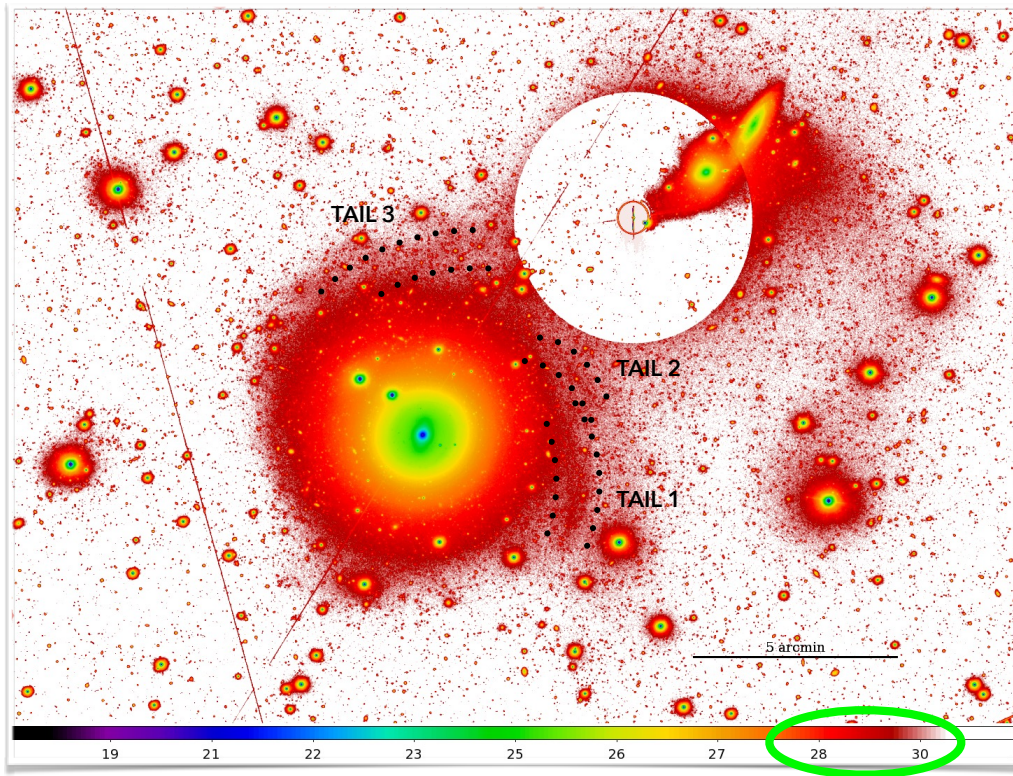


ARM-LIKE  
STRUCTURES

# Photometry - Structures

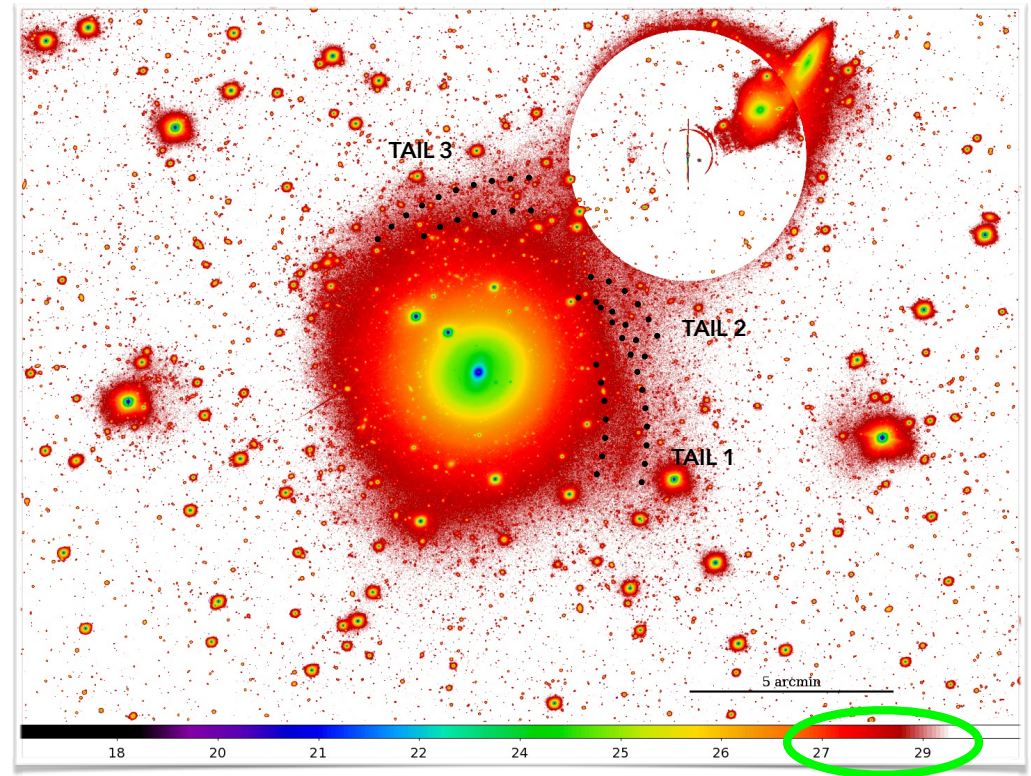
*g band*

image in units of magnitude, with sky subtraction and subtracted star by 2D model



*r band*

image in units of magnitude, with sky subtraction and subtracted star by 2D model

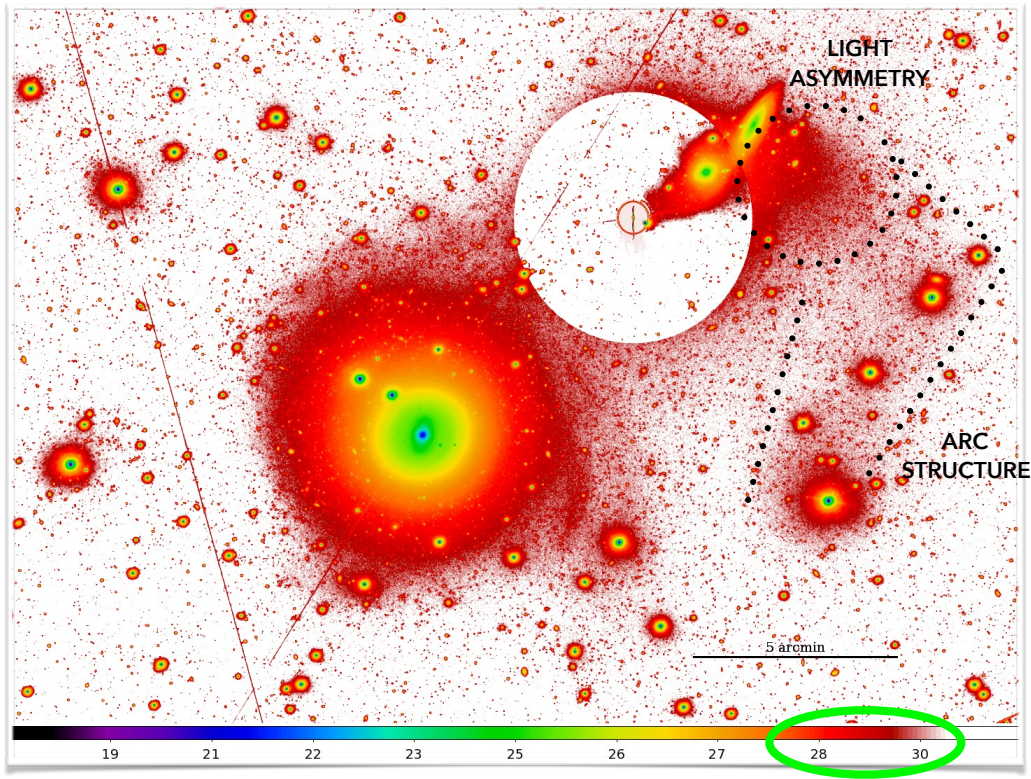


<i>Tail</i>	<i>Centre distance</i> [arcsec]
1	229.27
2	237.02
3	220.34

# Photometry - Structures

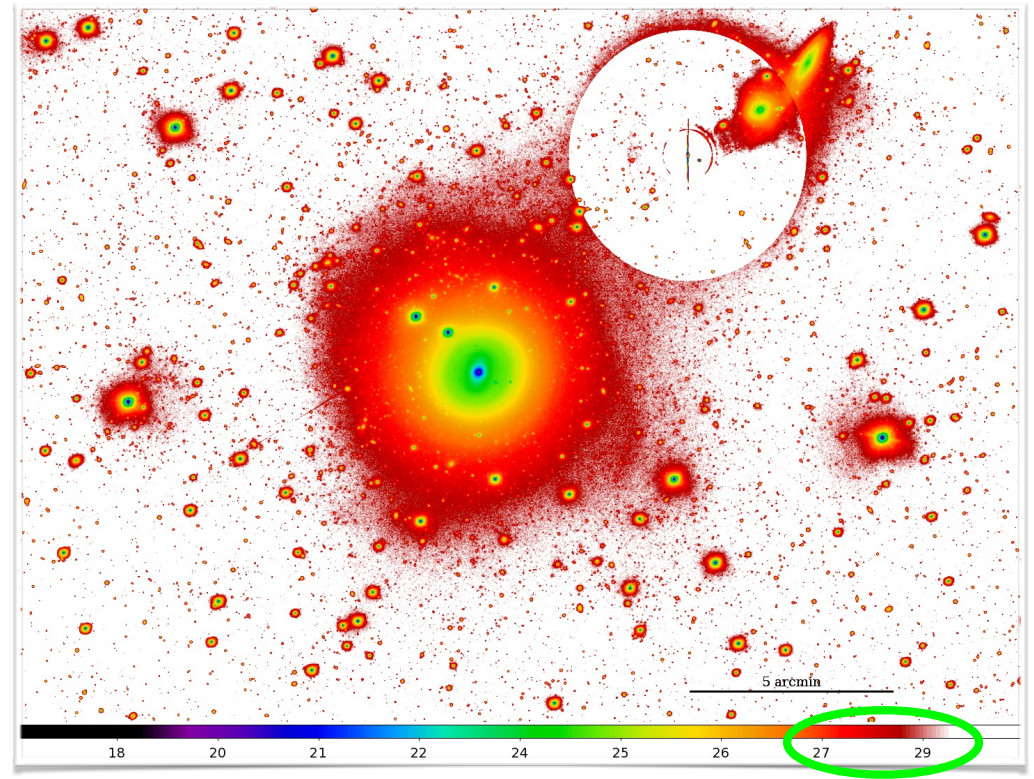
*g band*

image in units of magnitude, with sky subtraction and subtracted star by 2D model

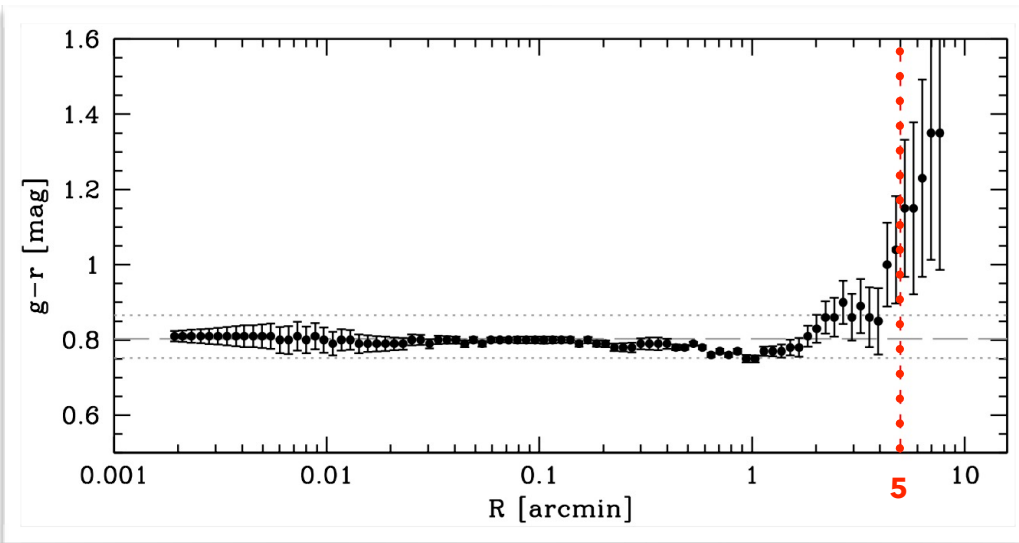


*r band*

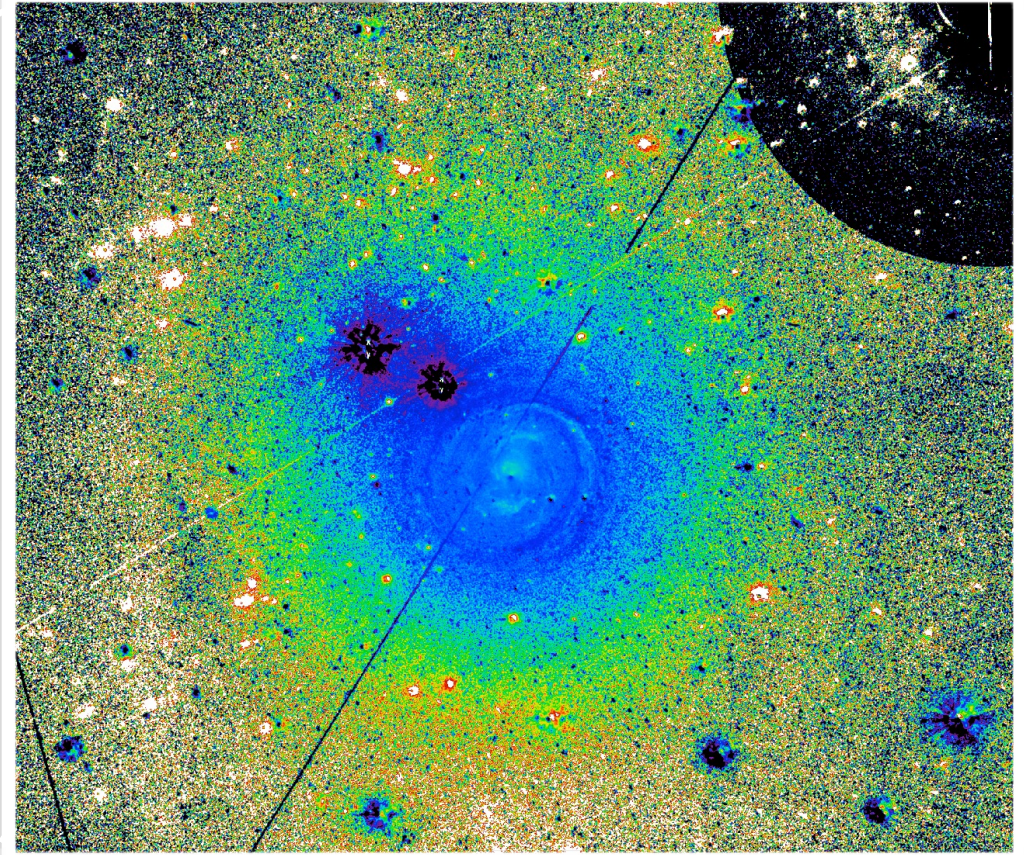
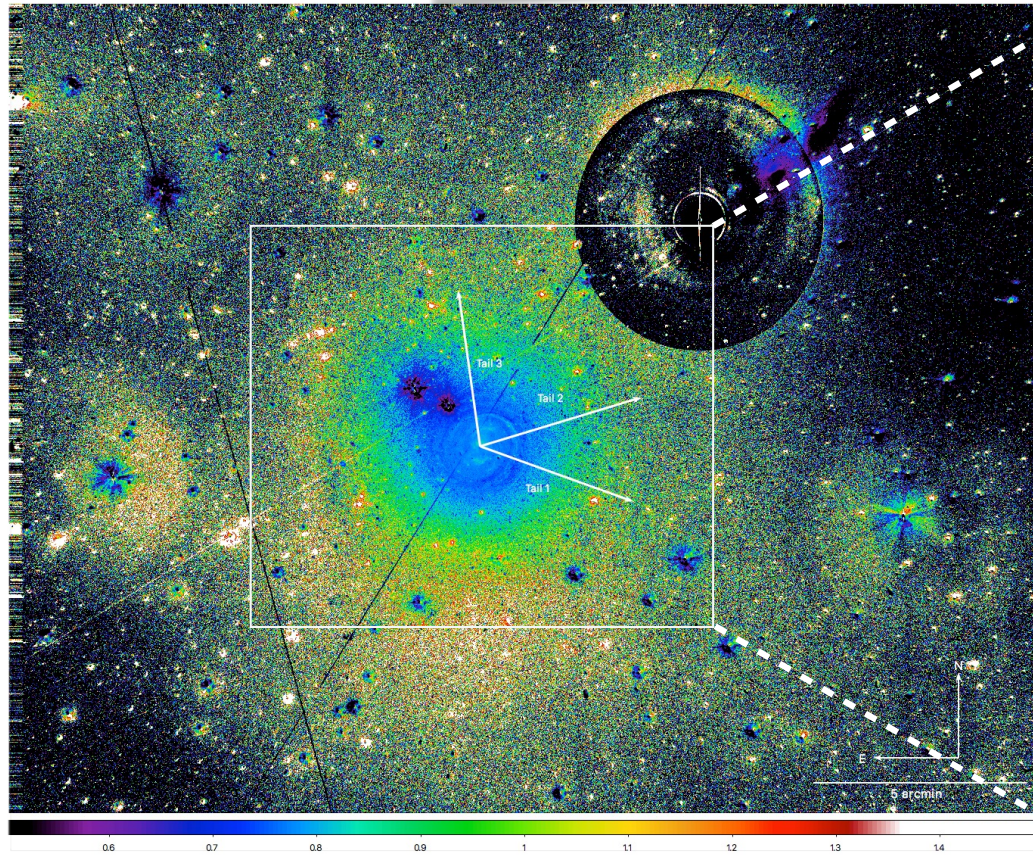
image in units of magnitude, with sky subtraction and subtracted star by 2D model



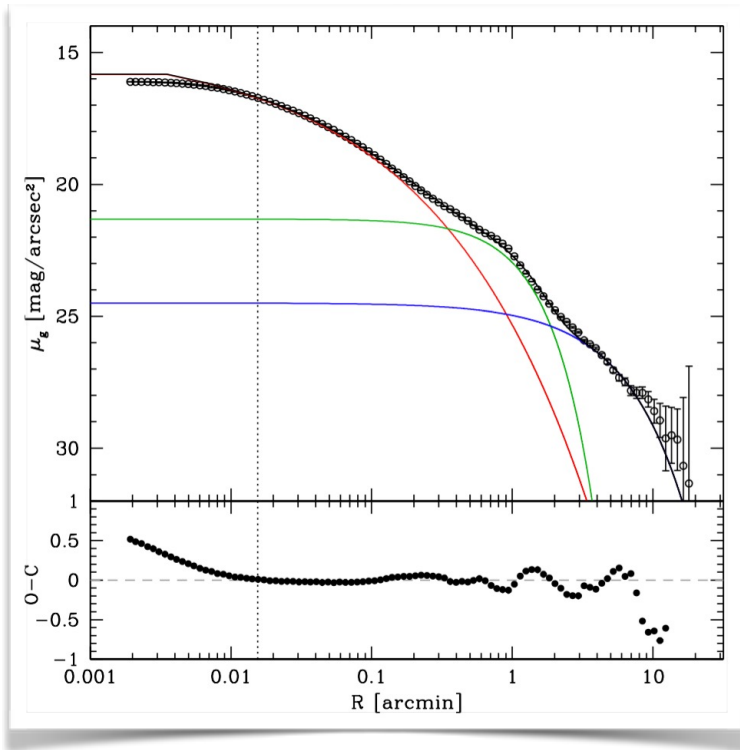
# Photometry - Colour profile



$(g-r) = 0.809 \pm 0.057$  mag



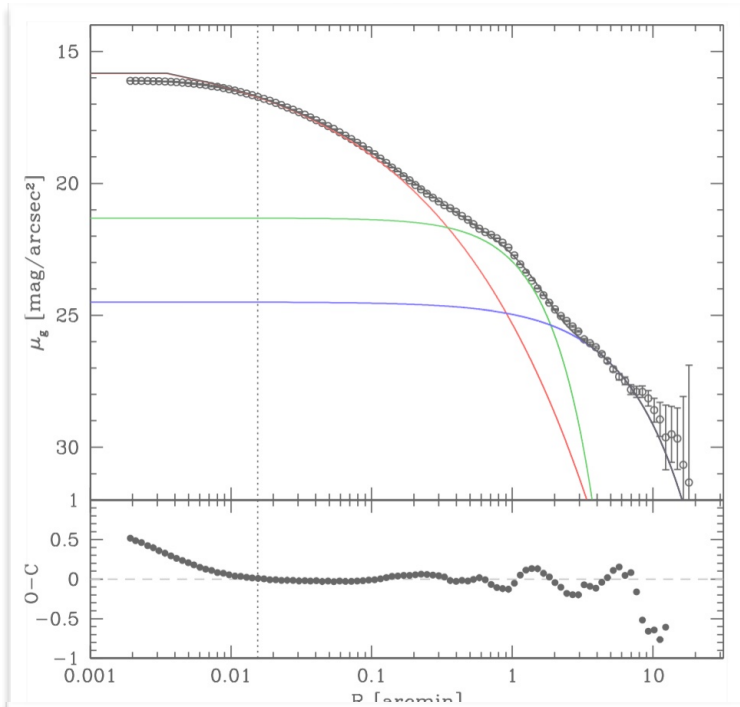
# Decomposition



## 1D decomposition in g band

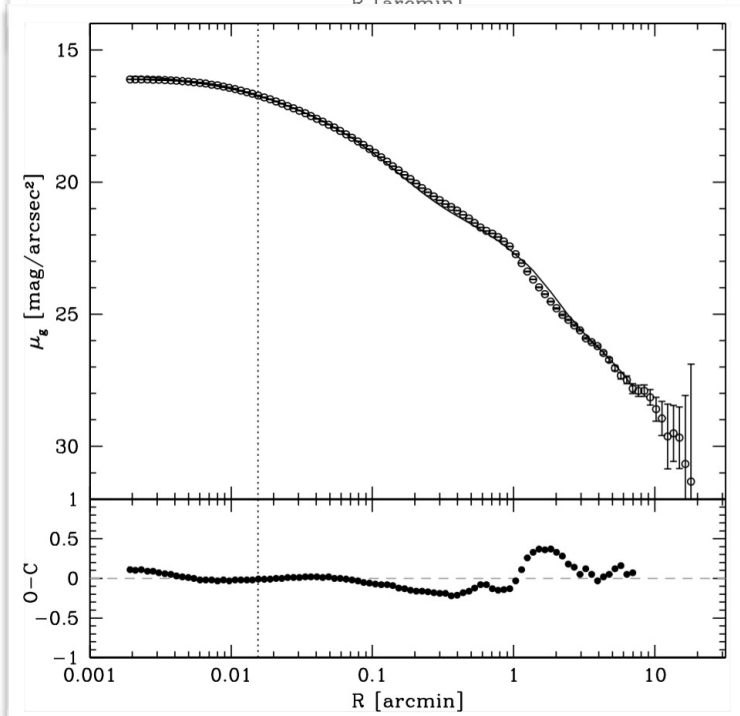
Function	Index	[arcsec]	[mag arcsec <sup>-2</sup> ]
Sérsic	2.5	$r_e=9.5$	$\mu_e=19.8$
Sérsic	0.7	$r_e=47.0$	$\mu_e=22.48$
Exponential		$r_0=140.0$	$\mu_0=24.5$

# Decomposition



1D decomposition in g band

Function	Index	[arcsec]	[mag arcsec <sup>-2</sup> ]
Sérsic	2.5	$r_e=9.5$	$\mu_e=19.8$
Sérsic	0.7	$r_e=47.0$	$\mu_e=22.48$
Exponential		$r_0=140.0$	$\mu_0=24.5$



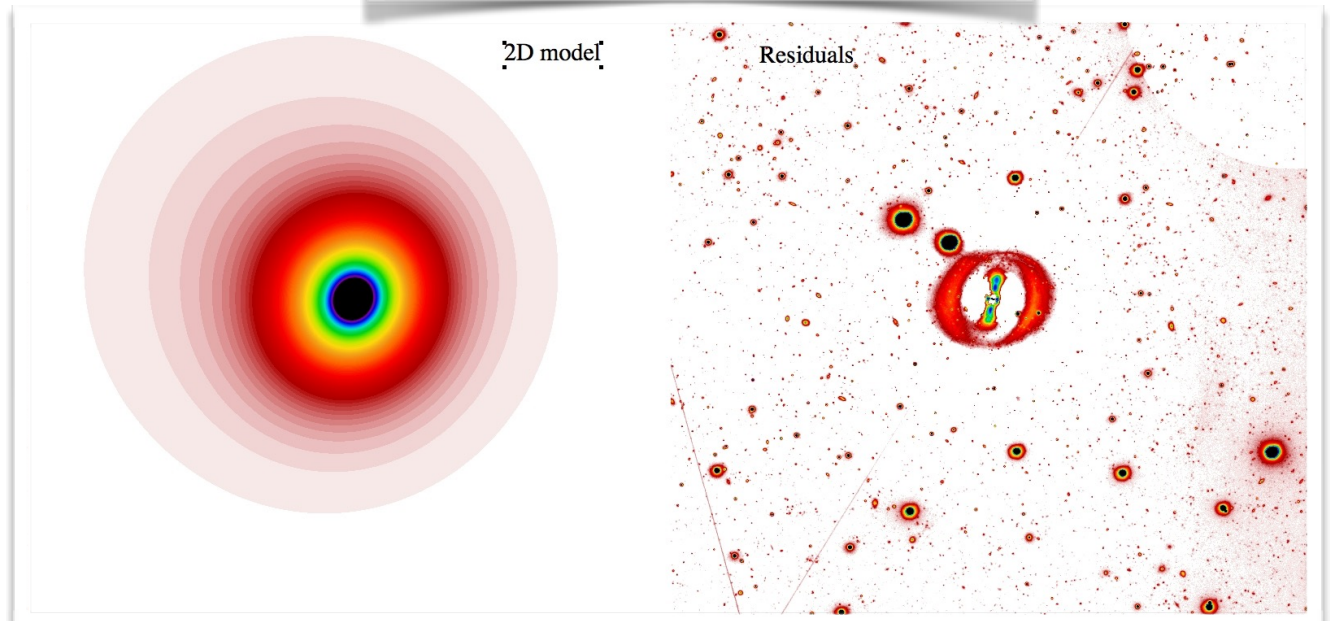
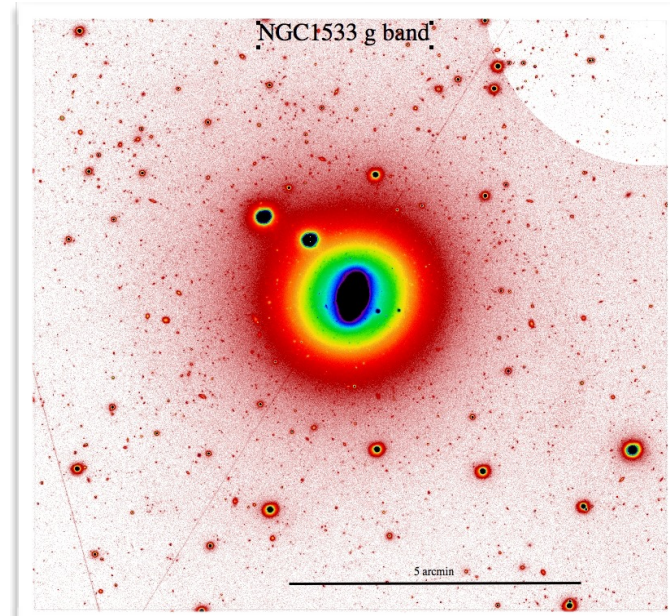
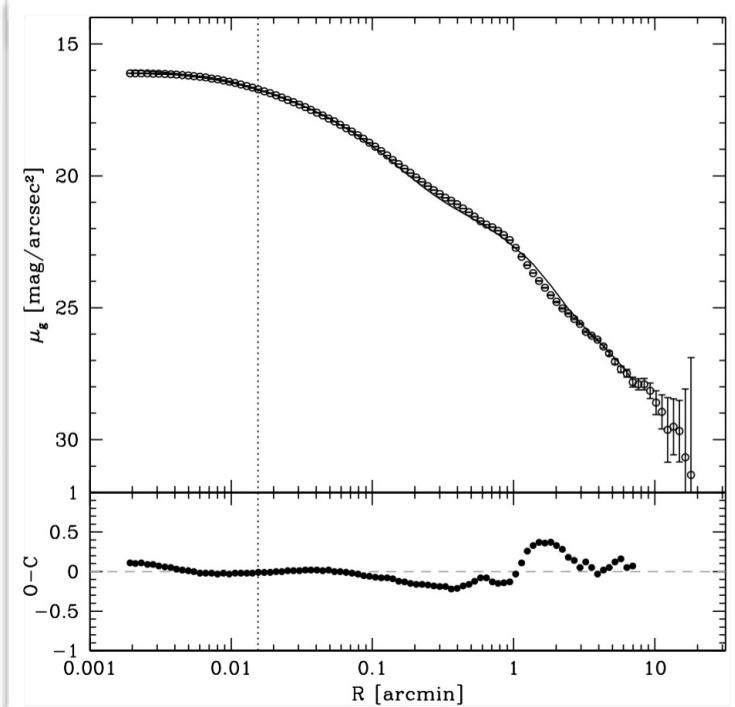
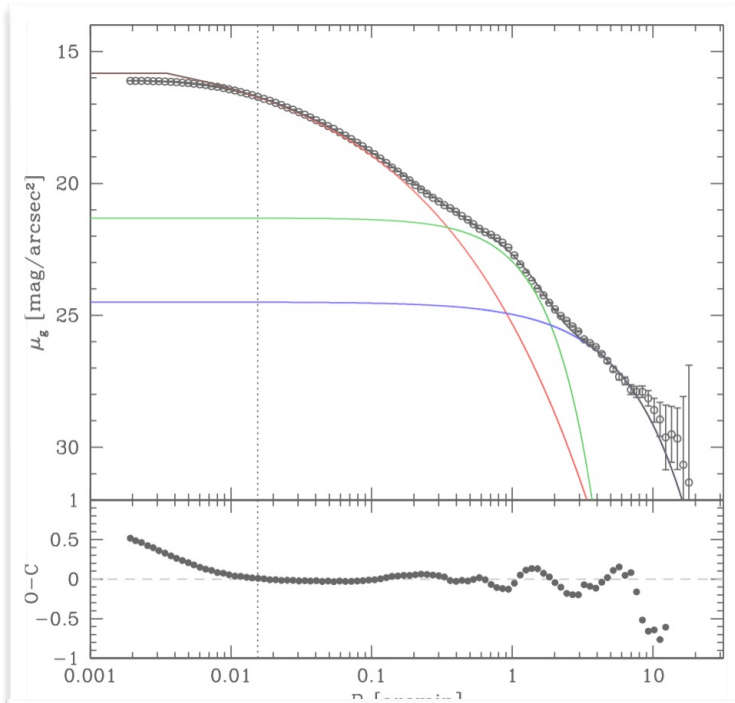
2D decomposition in g band using GALFIT

Function	Index	[arcsec]	[mag]
Sérsic	1.7	$r_e=5.76$	$m_e=12.31$
Exponential		$r_0=30.32$	$m_0=11.32$
Exponential (fix)		$r_0=140.00$	$m_0=11.77$

Using a mask and considering the mean value of the residual sky-subtraction fluctuations

# Decomposition

2D decomposition in g band using GALFIT



# Decomposition

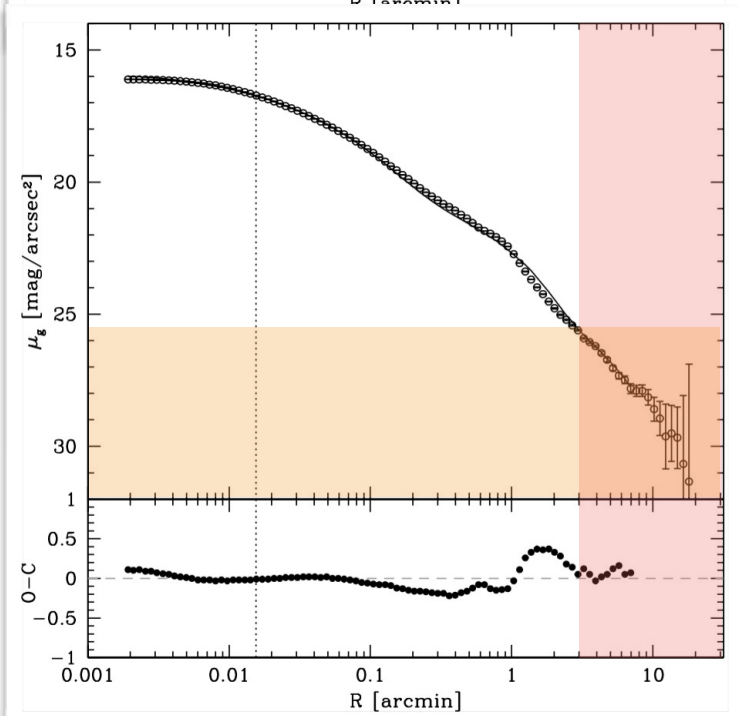
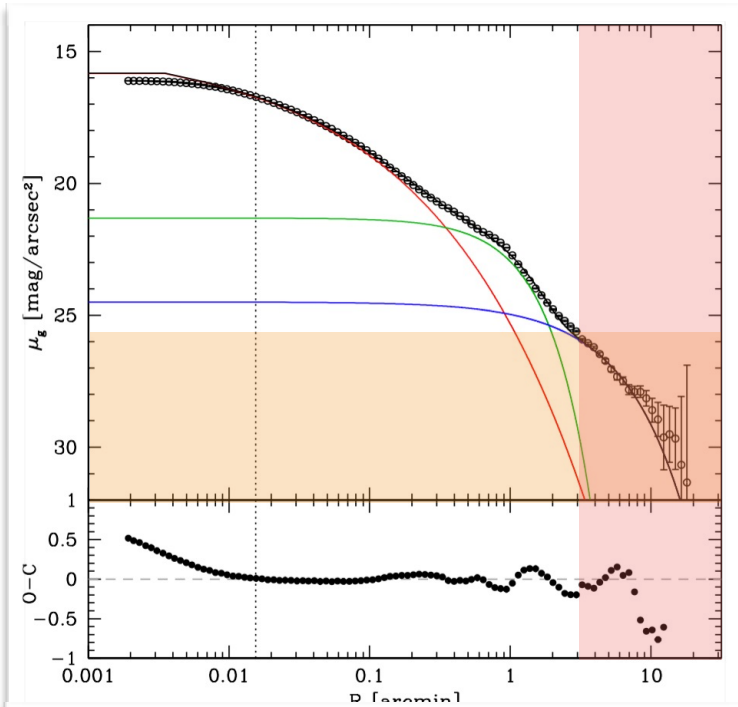
## 1D decomposition in g band

Function	Index	[arcsec]	[mag arcsec <sup>-2</sup> ]
Sérsic	2.5	$r_e=9.5$	$\mu_e=19.8$
Sérsic	0.7	$r_e=47.0$	$\mu_e=22.48$
Exponential		$r_0=140.0$	$\mu_0=24.5$

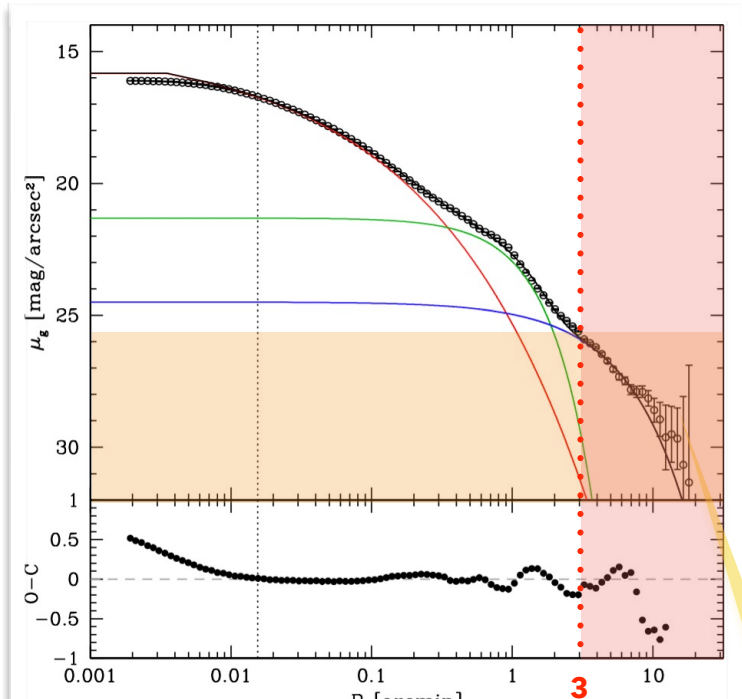
## 2D decomposition in g band using GALFIT

Function	Index	[arcsec]	[mag]
Sérsic	1.7	$r_e=5.76$	$m_e=12.31$
Exponential		$r_0=30.32$	$m_0=11.32$
Exponential (fix)		$r_0=140.00$	$m_0=11.77$

Using a mask and considering the mean value of the residual sky-subtraction fluctuations

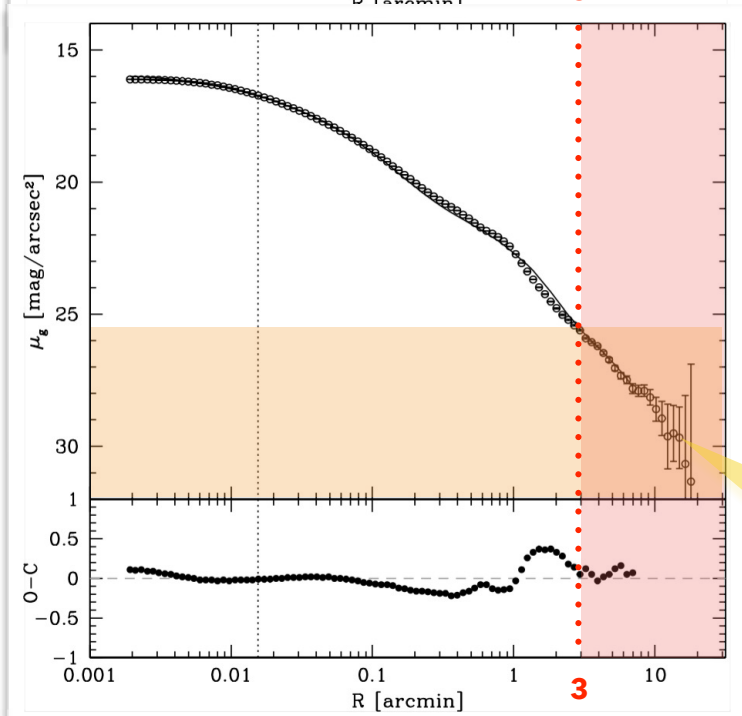


# Decomposition



1D decomposition in g band

Function	Index	[arcsec]	[mag arcsec <sup>-2</sup> ]
Sérsic	2.5	$r_e=9.5$	$\mu_e=19.8$
Sérsic	0.7	$r_e=47.0$	$\mu_e=22.48$
Exponential		$r_0=140.0$	$\mu_0=24.5$



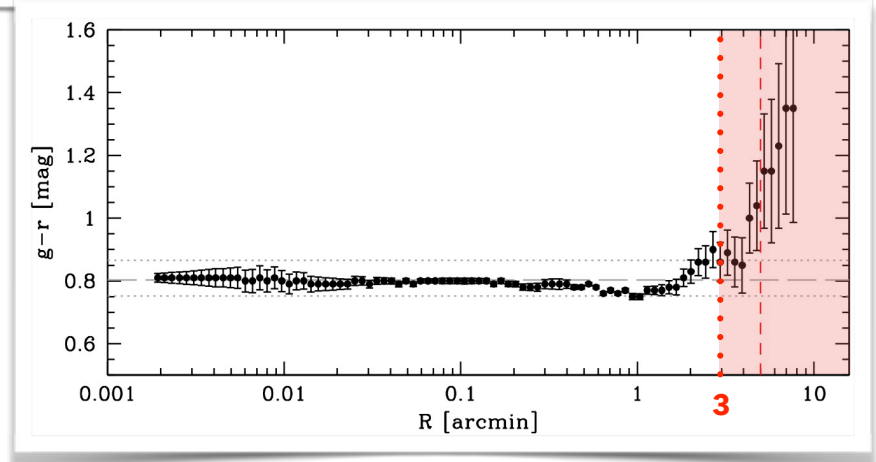
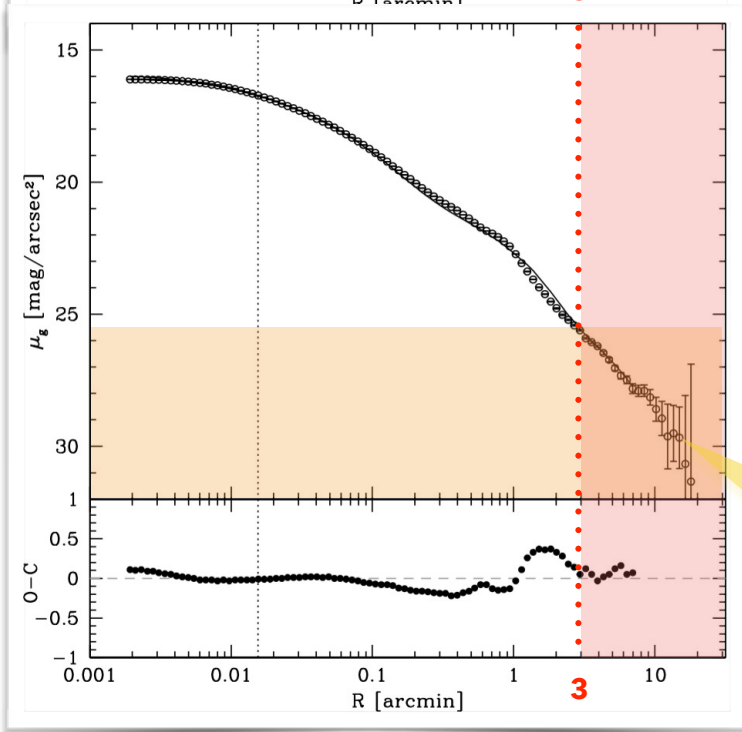
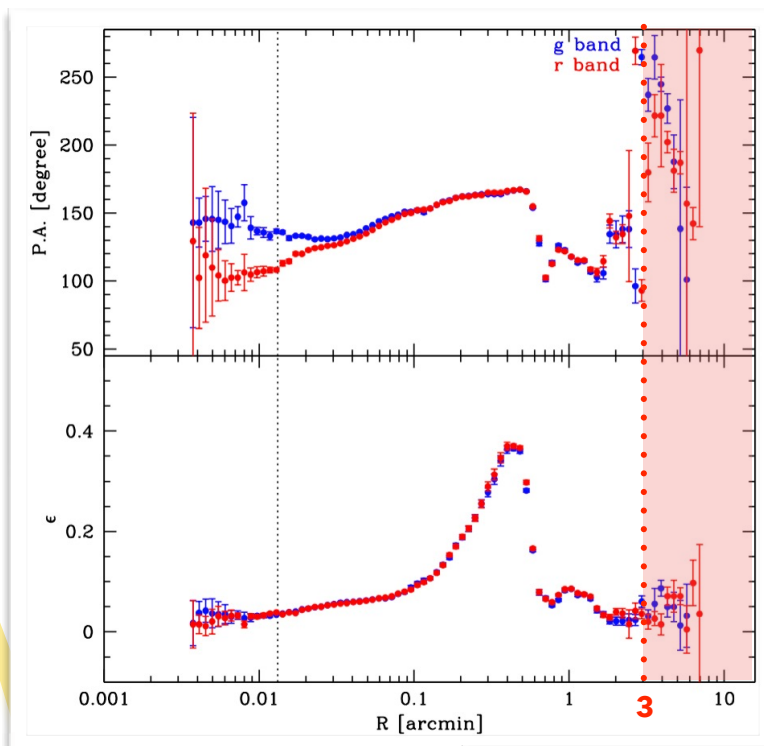
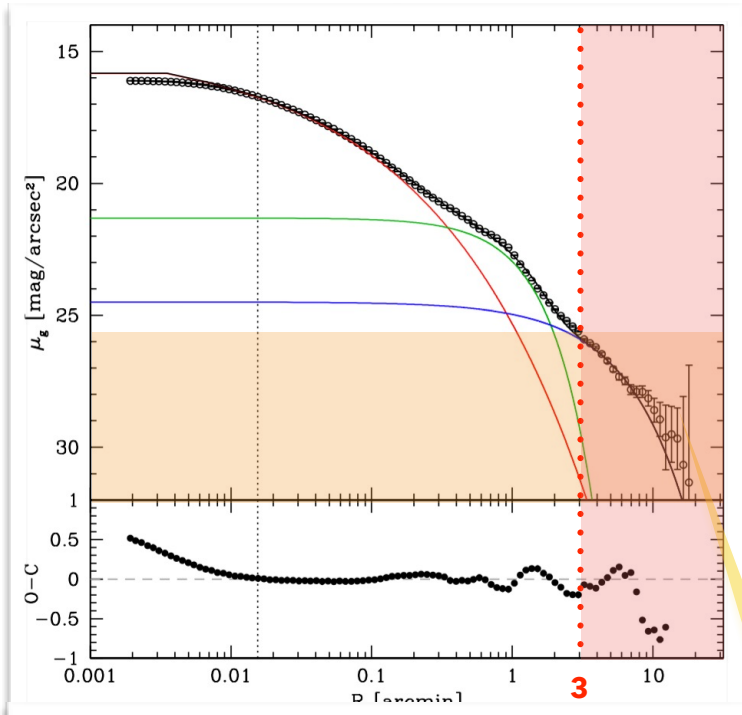
2D decomposition in g band using GALFIT

Function	Index	[arcsec]	[mag]
Sérsic	1.7	$r_e=5.76$	$m_e=12.31$
Exponential		$r_0=30.32$	$m_0=11.32$
Exponential (fix)		$r_0=140.00$	$m_0=11.77$

Using a mask and considering the mean value of the residual sky-subtraction fluctuations

**Stellar halo component!**  
Iodice et al. 2016

# Decomposition

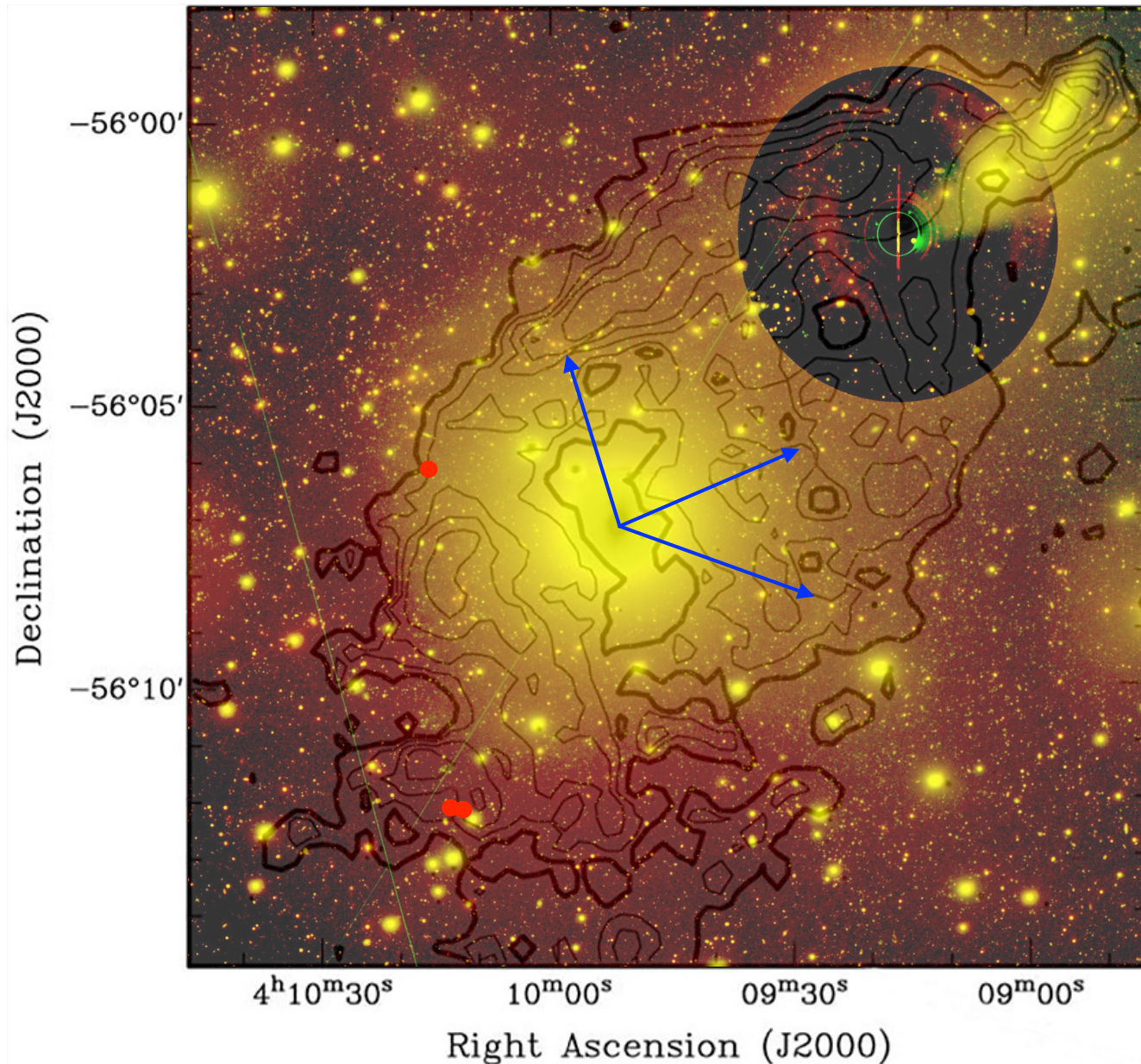


**Stellar halo component!**  
Iodice et al. 2016



~~Type II.o~~ Type II+III-s  
Erwin et al. 2008

# Conclusion - Colour composite and HI map



- NGC 1533 imaged in 21-cm with the ATCA
- HI associates with IC2038 (northern companion)
- NW and SE cloud
- Total HI mass of the system is  $7 \times 10^9 M_{\odot}$
- Radius of HI ring is from 2' to 11.7' from the optical center of NGC 1533
- 3 confirmed  $H\alpha$  very small isolated emission line regions in SE part (red dots); from SINGG

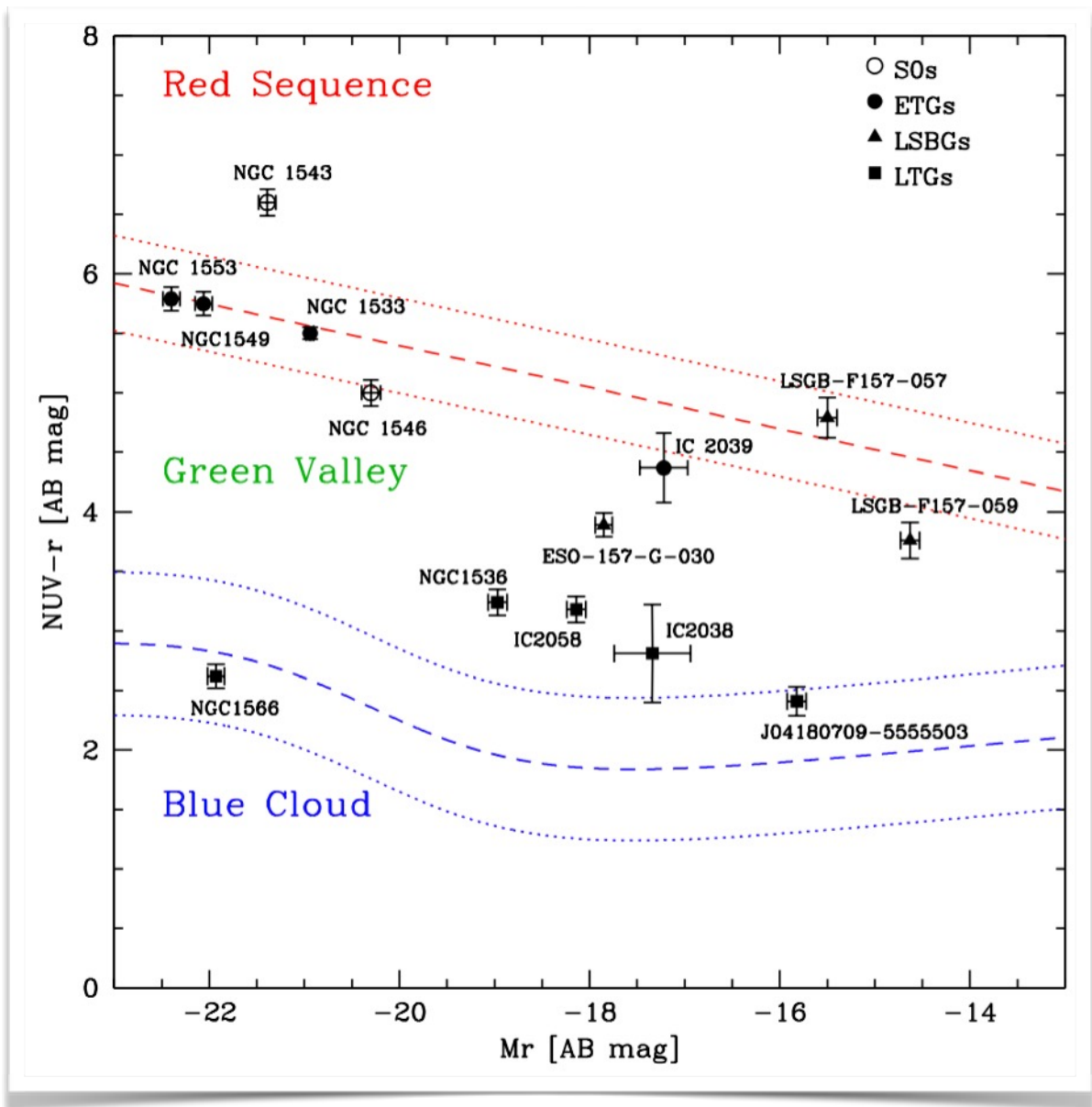
**Galactic recycling:  
the HI ring around NGC 1533**

Ryan-Weber, Webster & Bekki, 2003

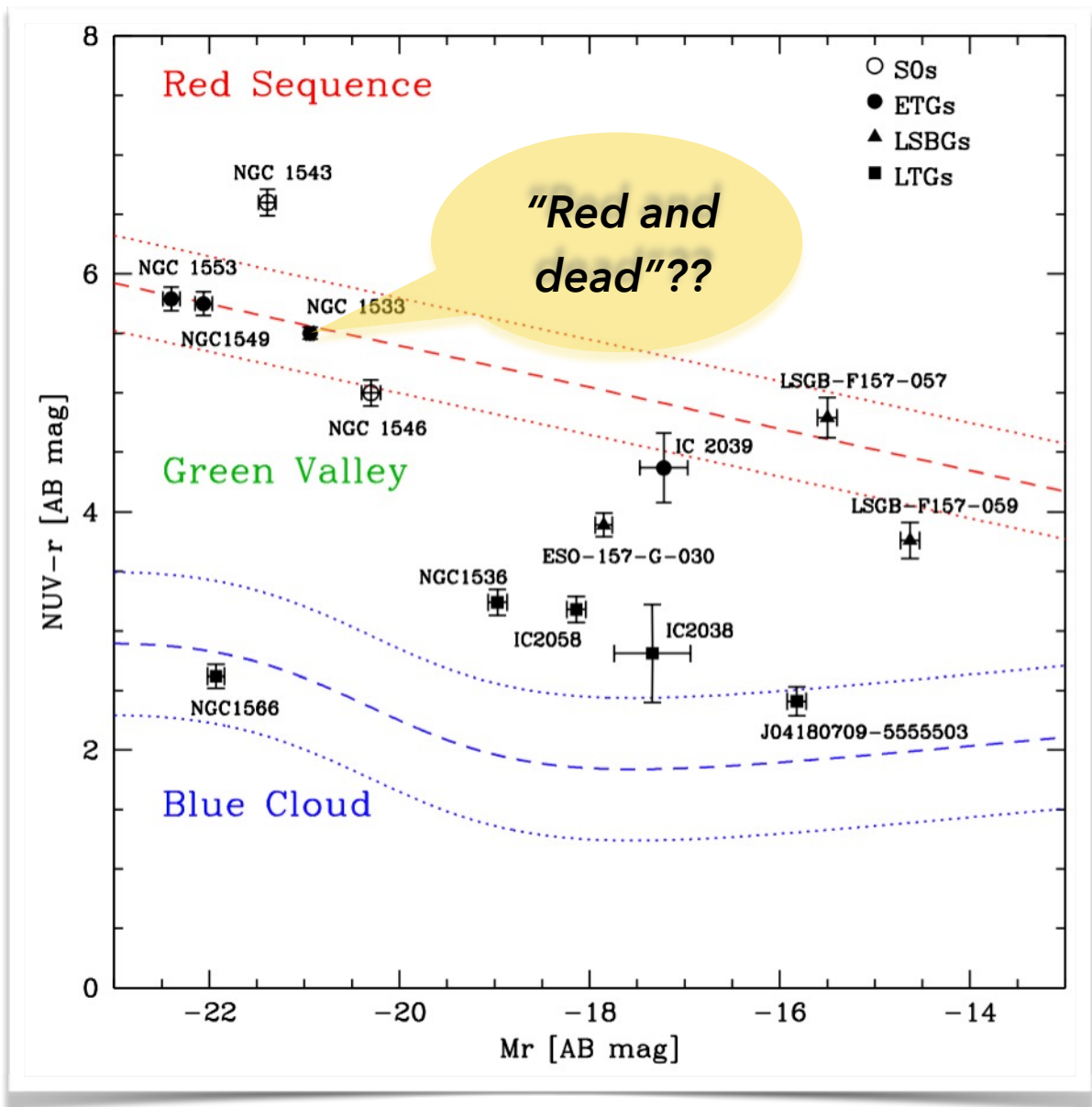
ATCA HI contours are 1.0 (bold), 1.5, 2.0, 2.5 and  $3.0 \times 10^{20} \text{ cm}^{-2}$  and have a resolution of about 1'

Werk et al, 2008

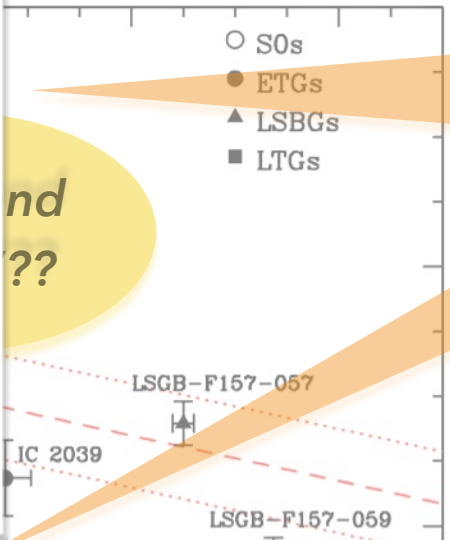
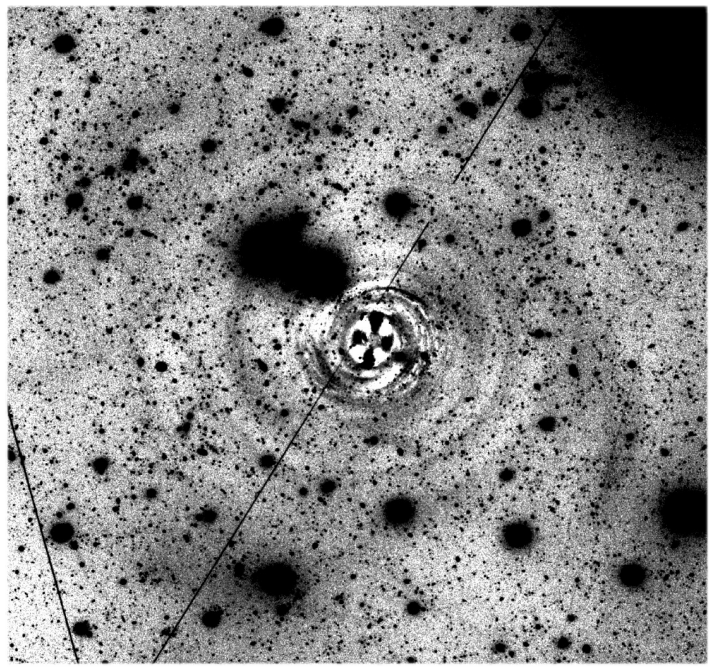
# Conclusion - Colour Magnitude Diagram



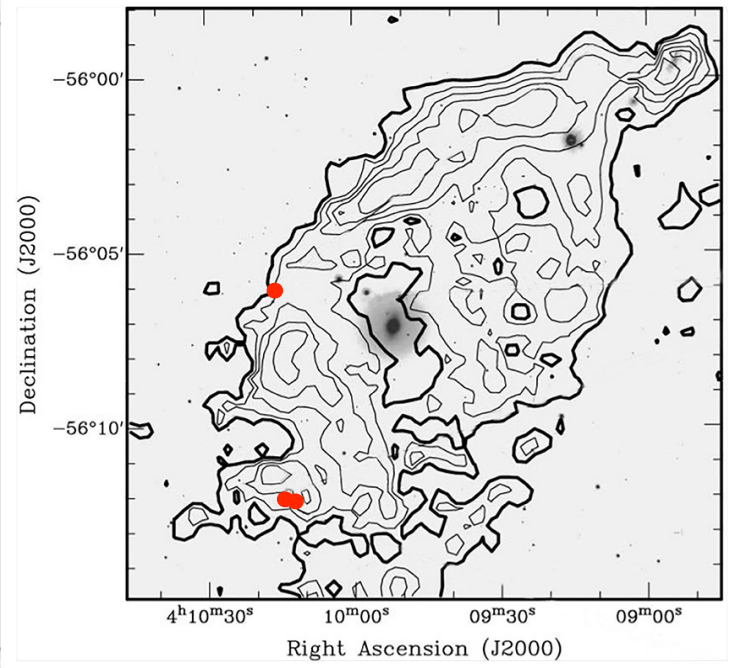
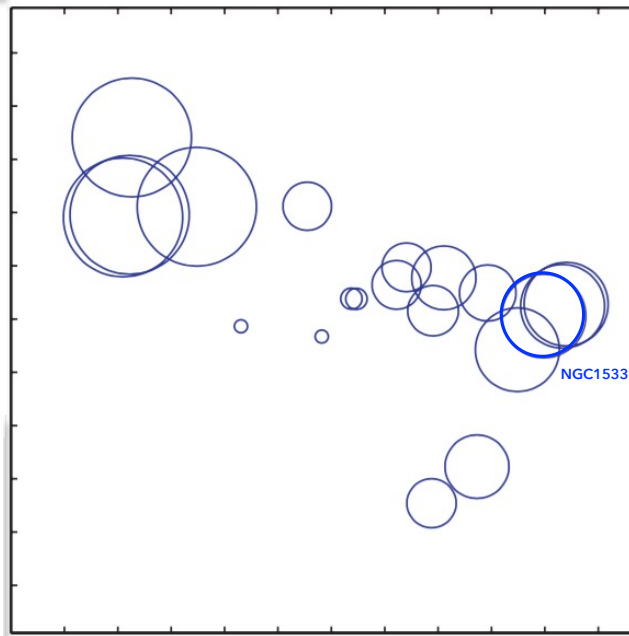
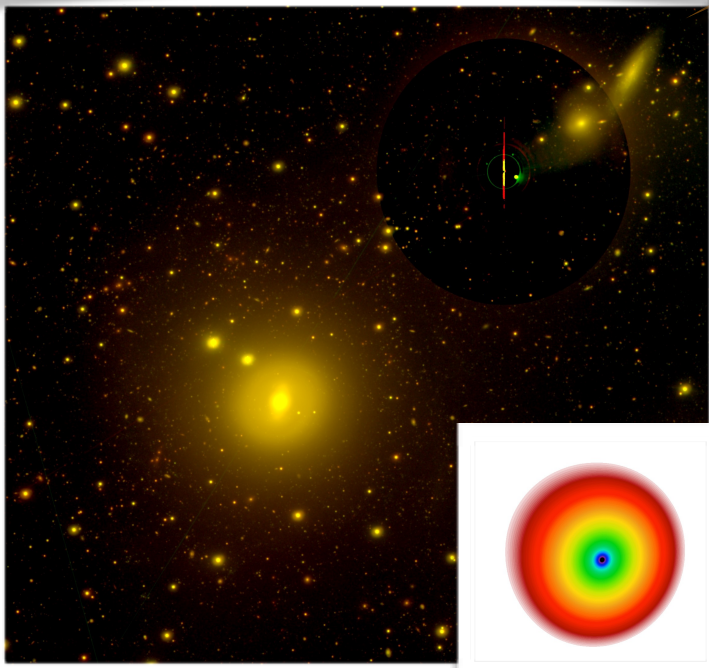
# Conclusion - Colour Magnitude Diagram



# Conclusion - Colour Magnitude Diagram



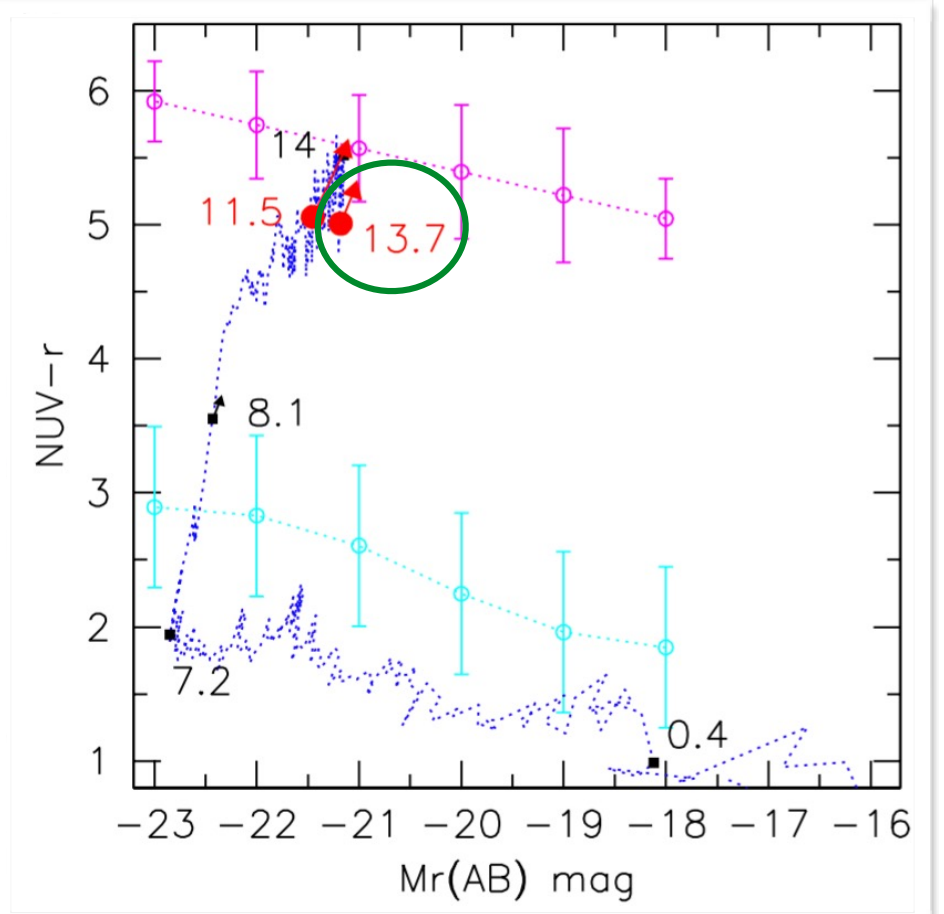
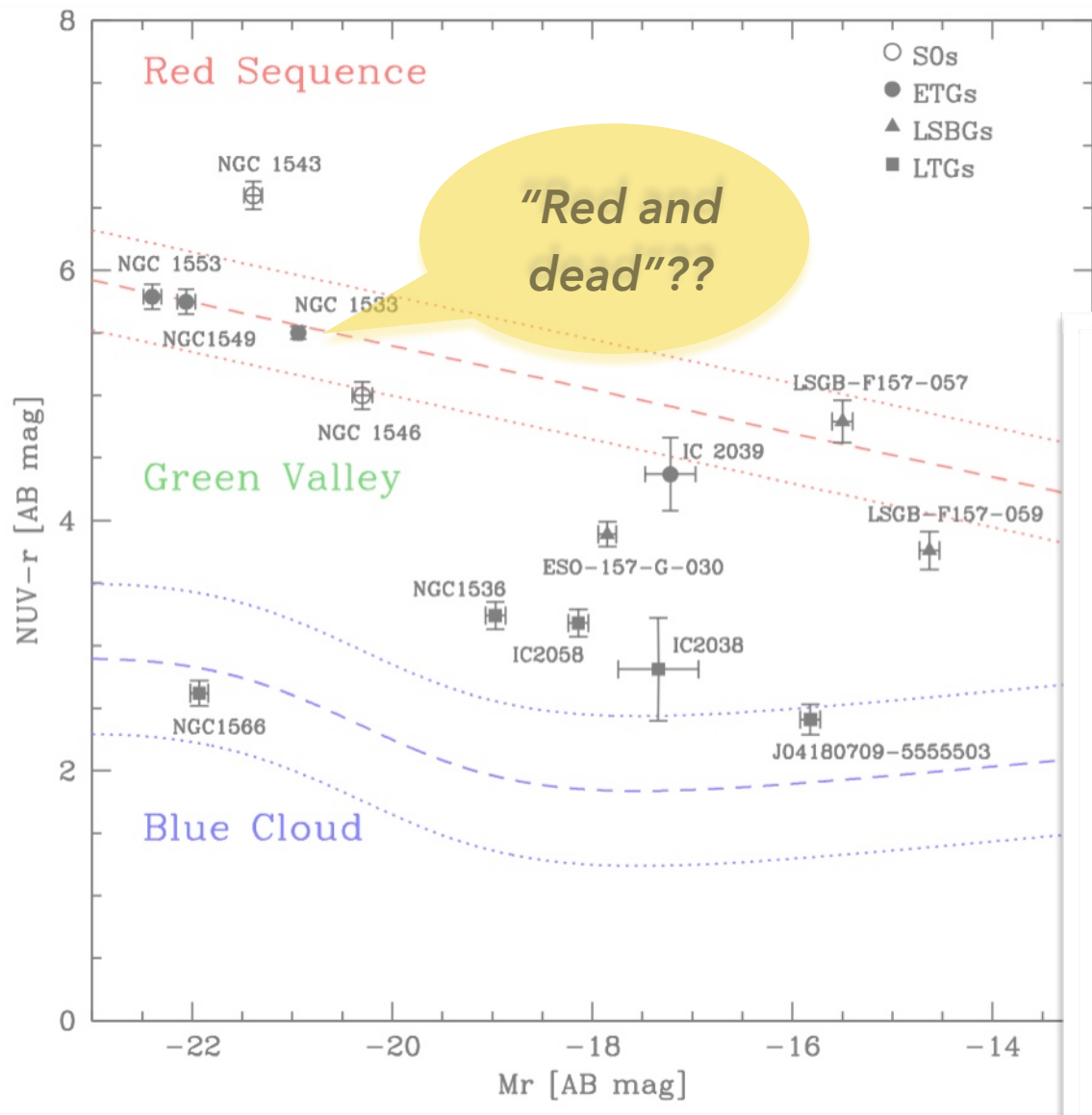
- Light asymmetries
- Faint spiral-like structures
- UV emission regions
- HI ring
- Connection with IC2038



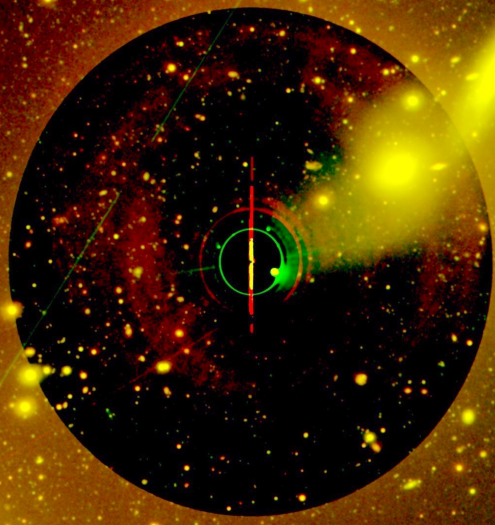
# Conclusion - Colour Magnitude Diagram

Catching Spiral-S0 transition in groups?  
 Insights from SPH simulations with  
 chemo-photometric implementation

Mazzei et al, 2014



*Thanks for*

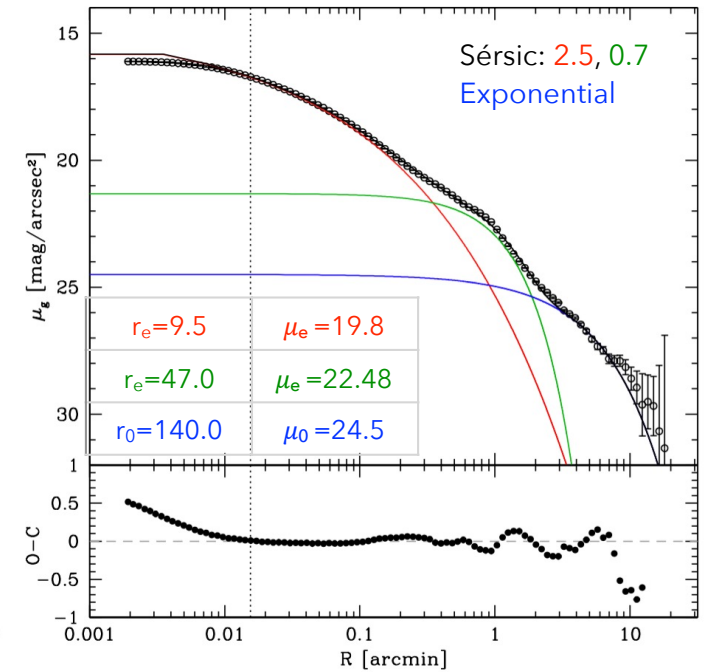
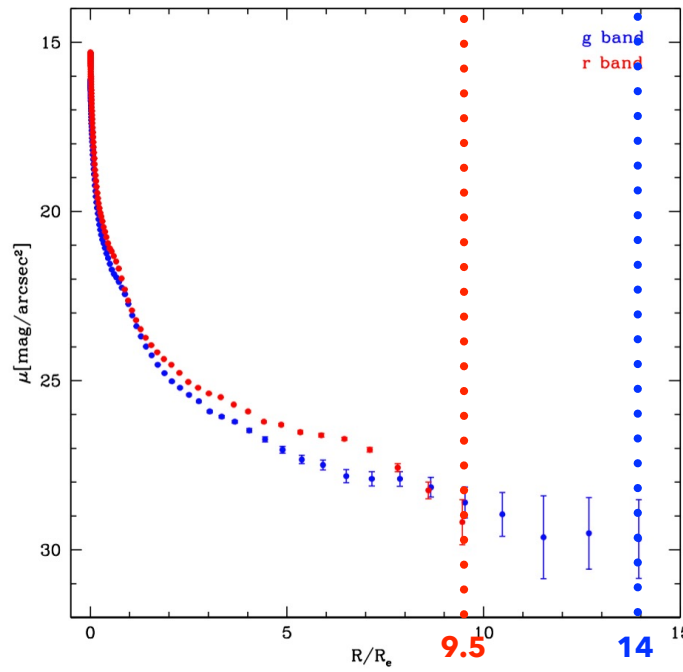
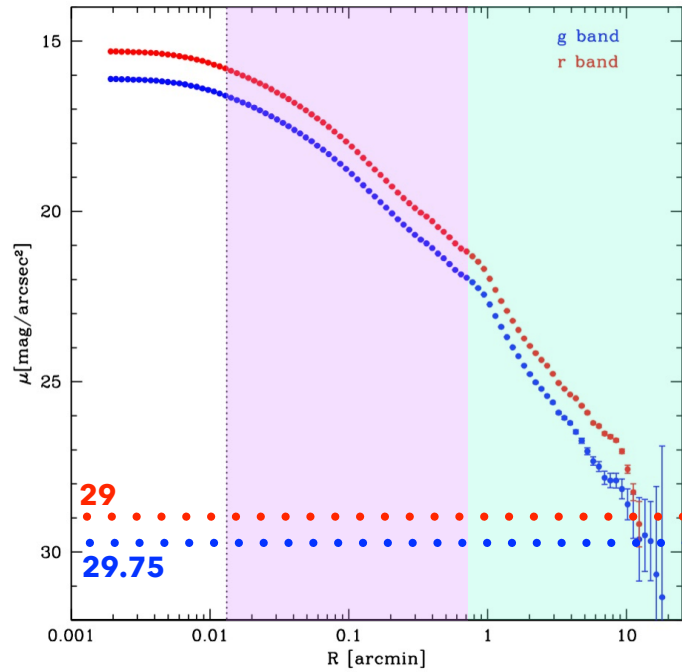
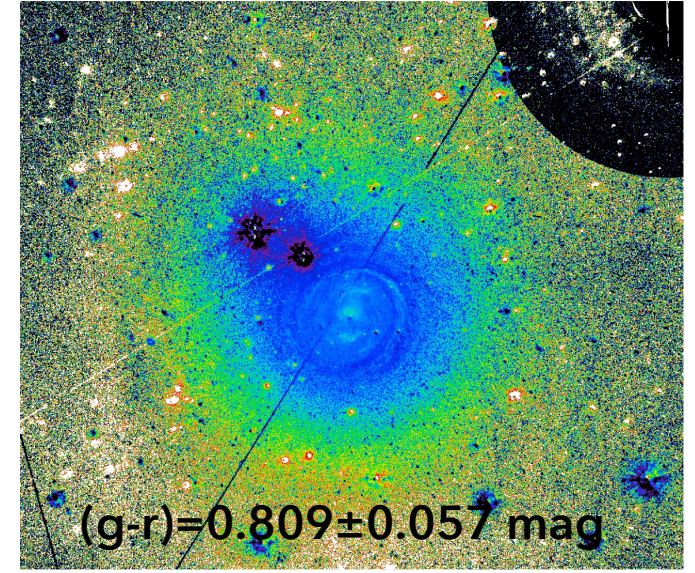
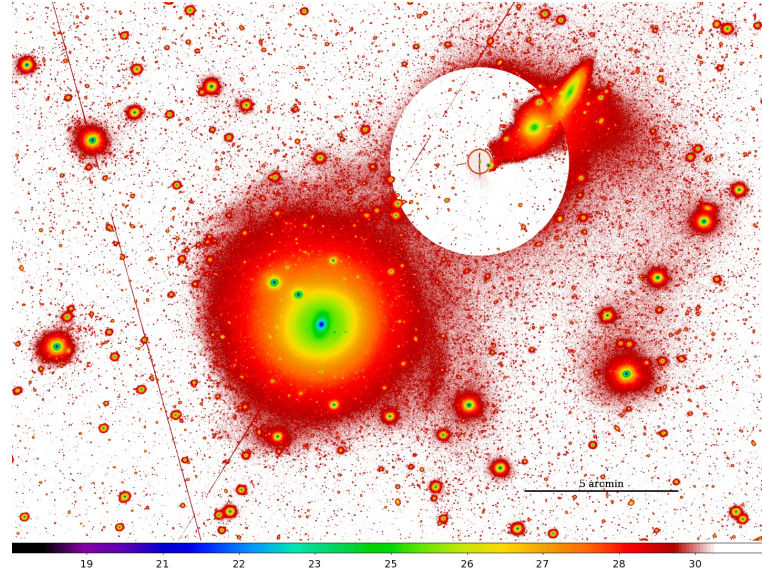
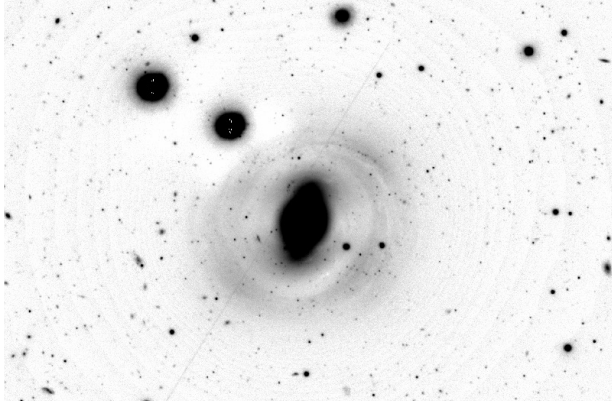


*your attention!*



# Conclusion - Results

(RL)SB0<sup>0</sup>



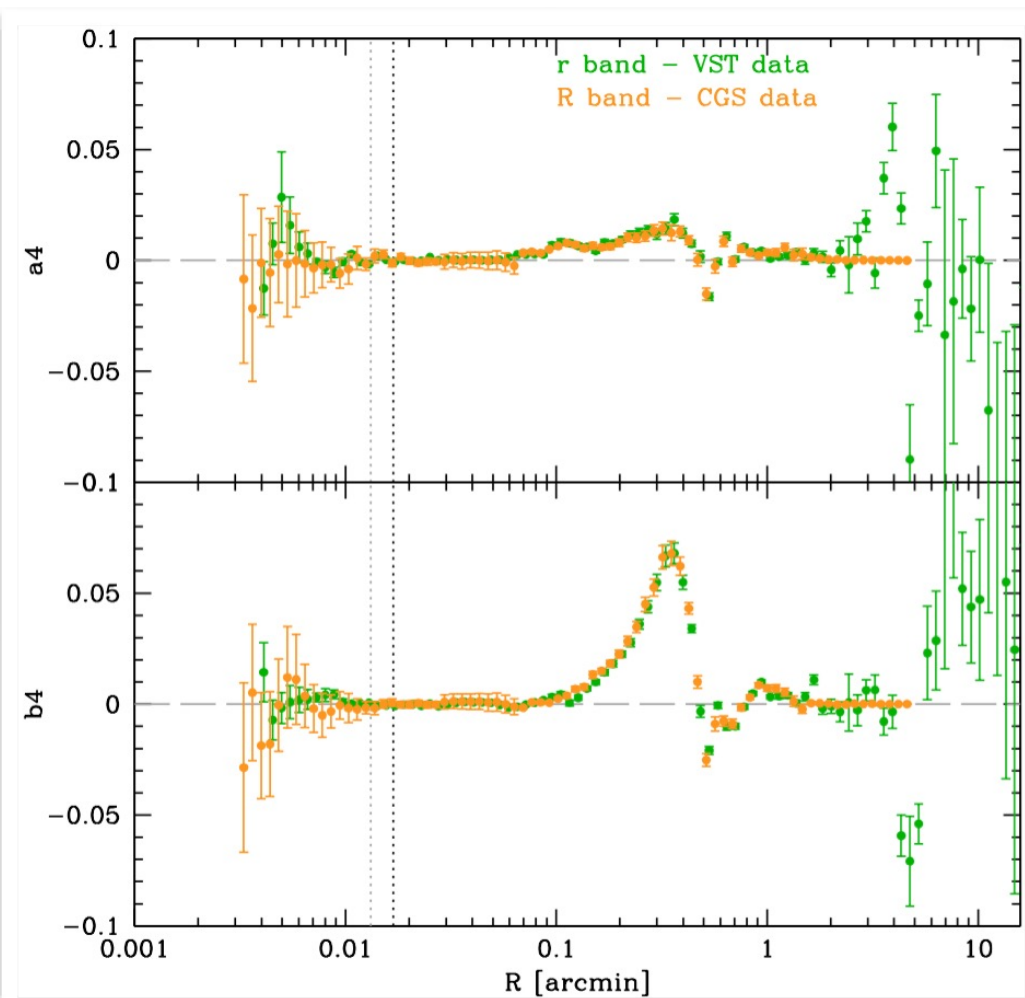
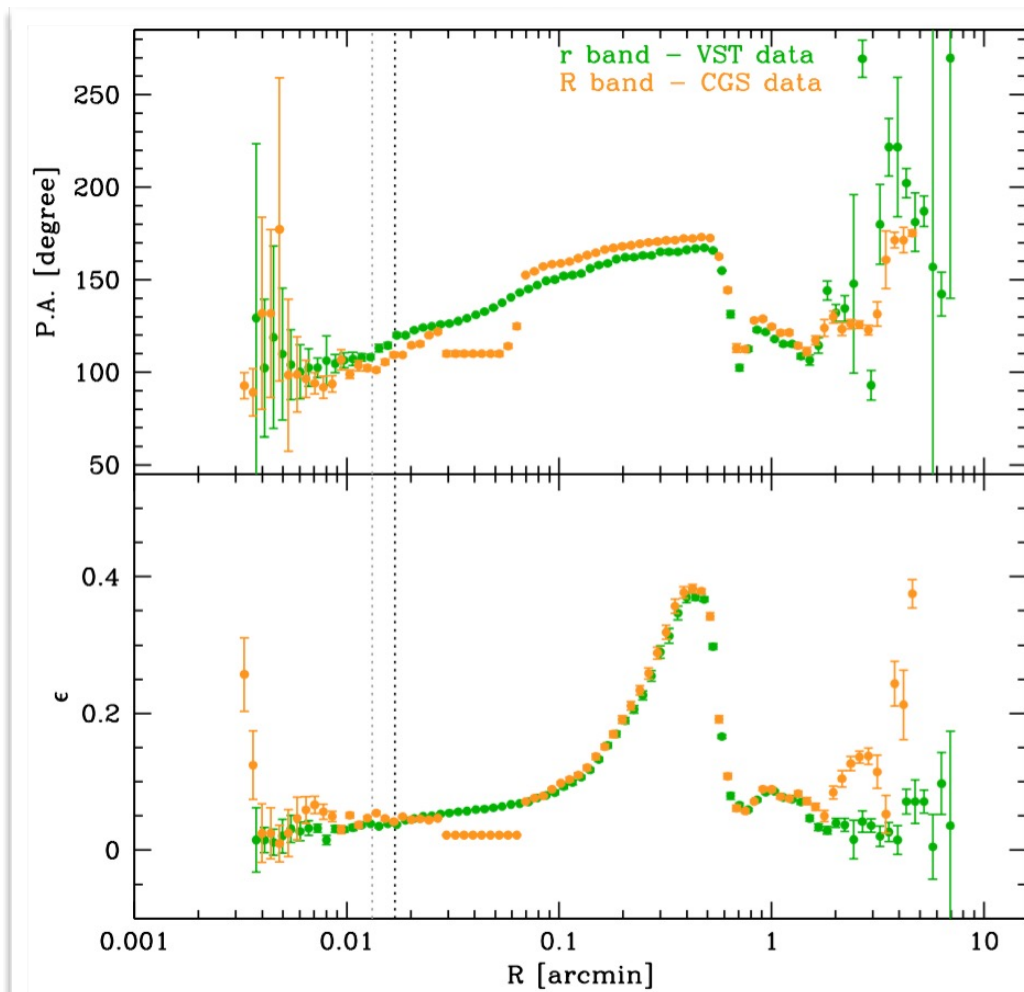
$m_{\text{tot}} = 10.48 \pm 0.05 \text{ mag}$

$m_{\text{tot}} = 9.60 \pm 0.05 \text{ mag}$

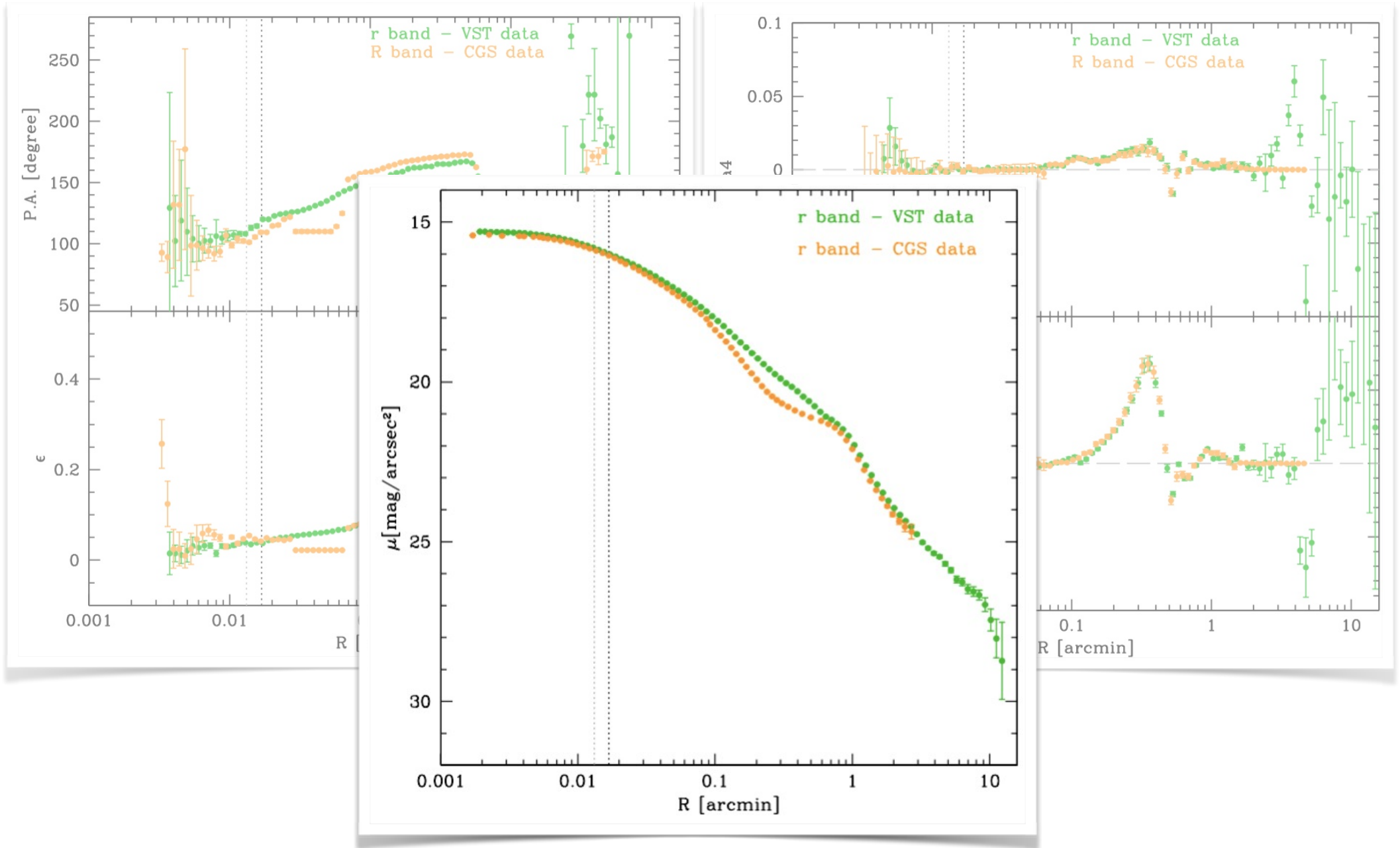
$R_e = 64.17 \pm 0.16 \text{ arcsec}$

$R_e = 78.20 \pm 0.41 \text{ arcsec}$

# Photometry - Geometrical Parameters



# Photometry - Surface Brightness Profile



# Photometry - Surface Brightness Profile

