The structure of galactic disks

Studying late-type spiral galaxies using SDSS

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2024/5/17

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6. Summary

1. Introduction

- Galactic edges' traits reflect growth and evolution.
- The surface brightness profile of galaxies declines exponentially with radius.
- This decline is truncated after several radial scalelengths.
- Edge-on galaxy studies face dust and integration issues.
- Erwin et al. (2005a) found antitruncated galaxies with outer upbending trends.

1. Introduction

The main goal：

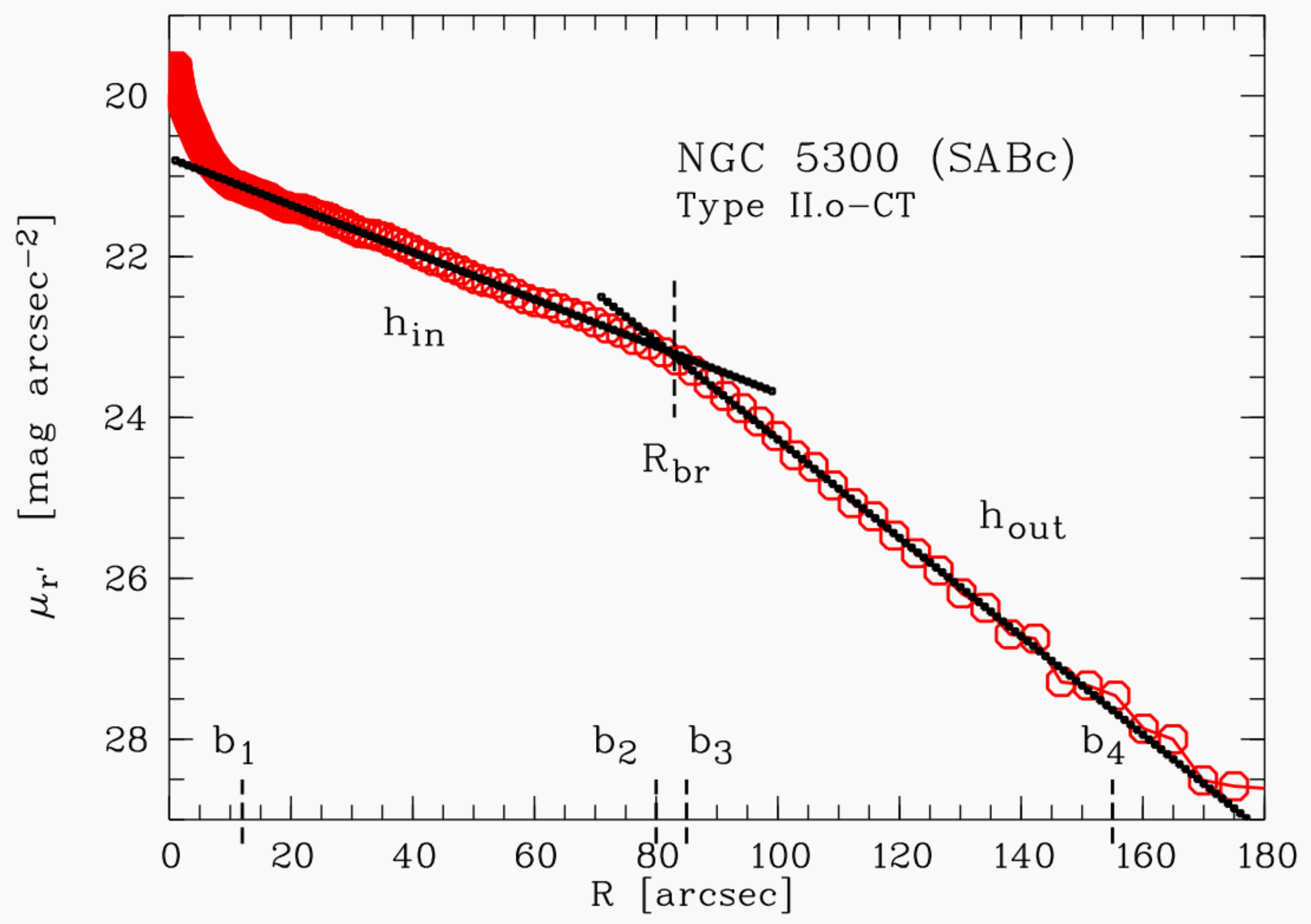
- Complete census of late-type galaxy outer disks in local universe.
- Determine frequencies and correlations of disk brightness profiles and parameters.

2. The sample

- **Hubble Type (T Parameter)**: Between 2.99 and 8.49 (Sb to Sdm galaxies).
- **Axis Ratio (log r_{25})**: Less than 0.301 ($a/b < 2$ or $e < 0.5$).
- **Recession Velocity (v_{vir})**: Less than 3250 km/s.
- **Absolute B-Magnitude (M_{abs})**: Brighter than −18.4 in the B band.
- **Galactic Latitude (b_{II})**: Absolute value greater than 20°.

Initial galaxy sample from Lyon/Meudon Extragalactic Database(LEDA), used g', r' images, finially analyzed 85 galaxies.

3. Analysis

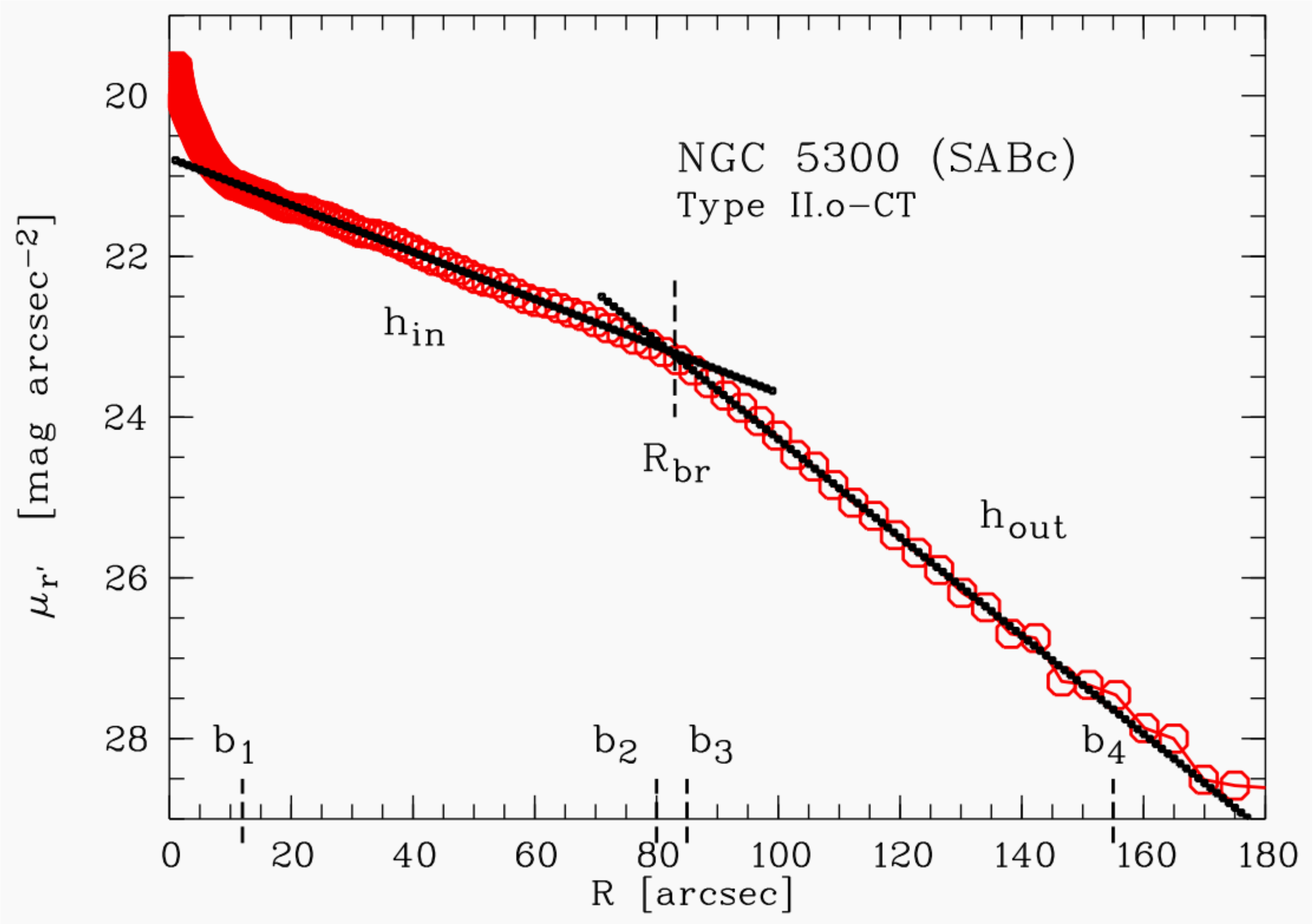


h$_{in}$ and **h**$_{out}$: scalelengths

b$_{1-4}$: the position of the boundaries

R$_{br}$:the break radius

3. Analysis

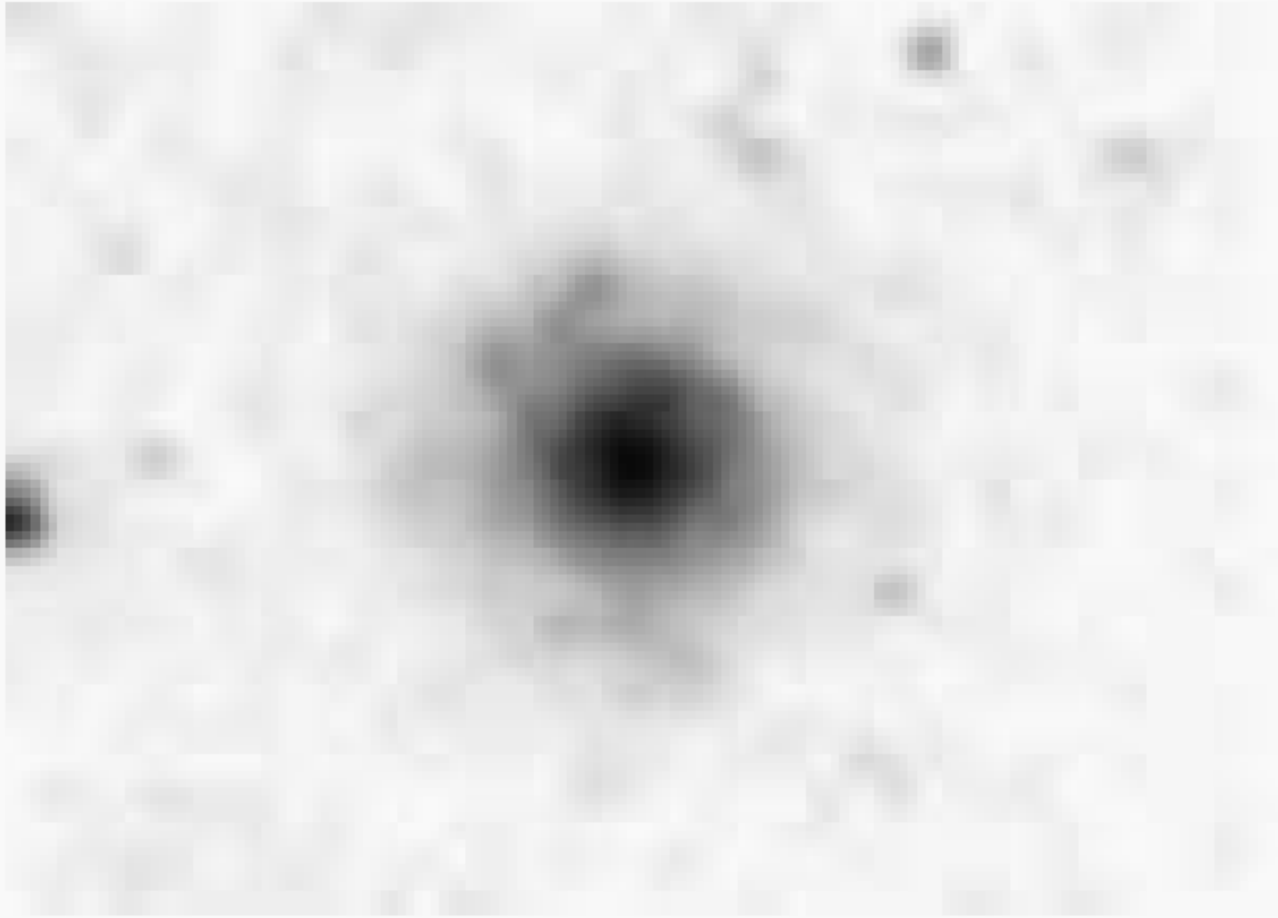


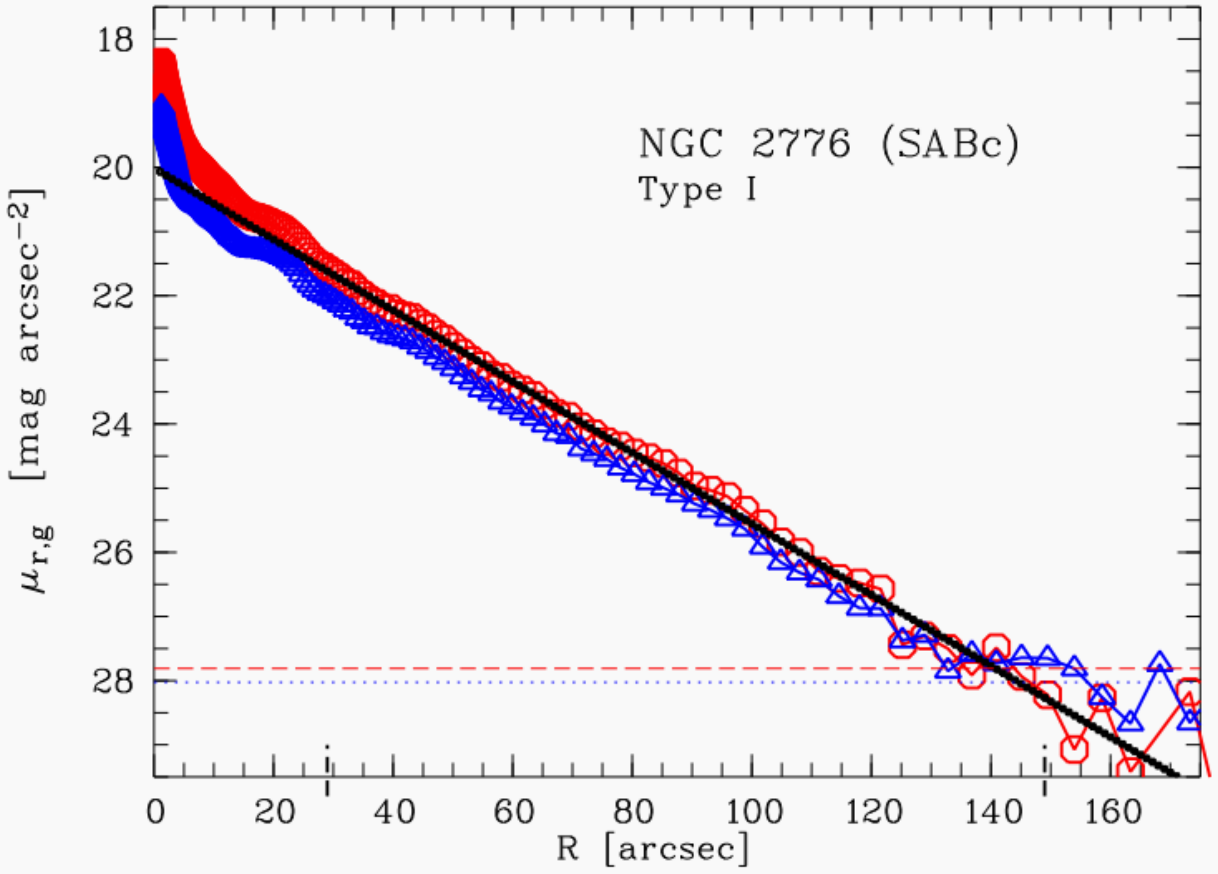
Determining Scale Lengths (h_{in} and h_{out}):

$$\mu(R) = \mu_{0,in} + 1.086 * R/h_{in}$$

$$\mu(R) = \mu_{0,out} + 1.086 * R/h_{out}$$

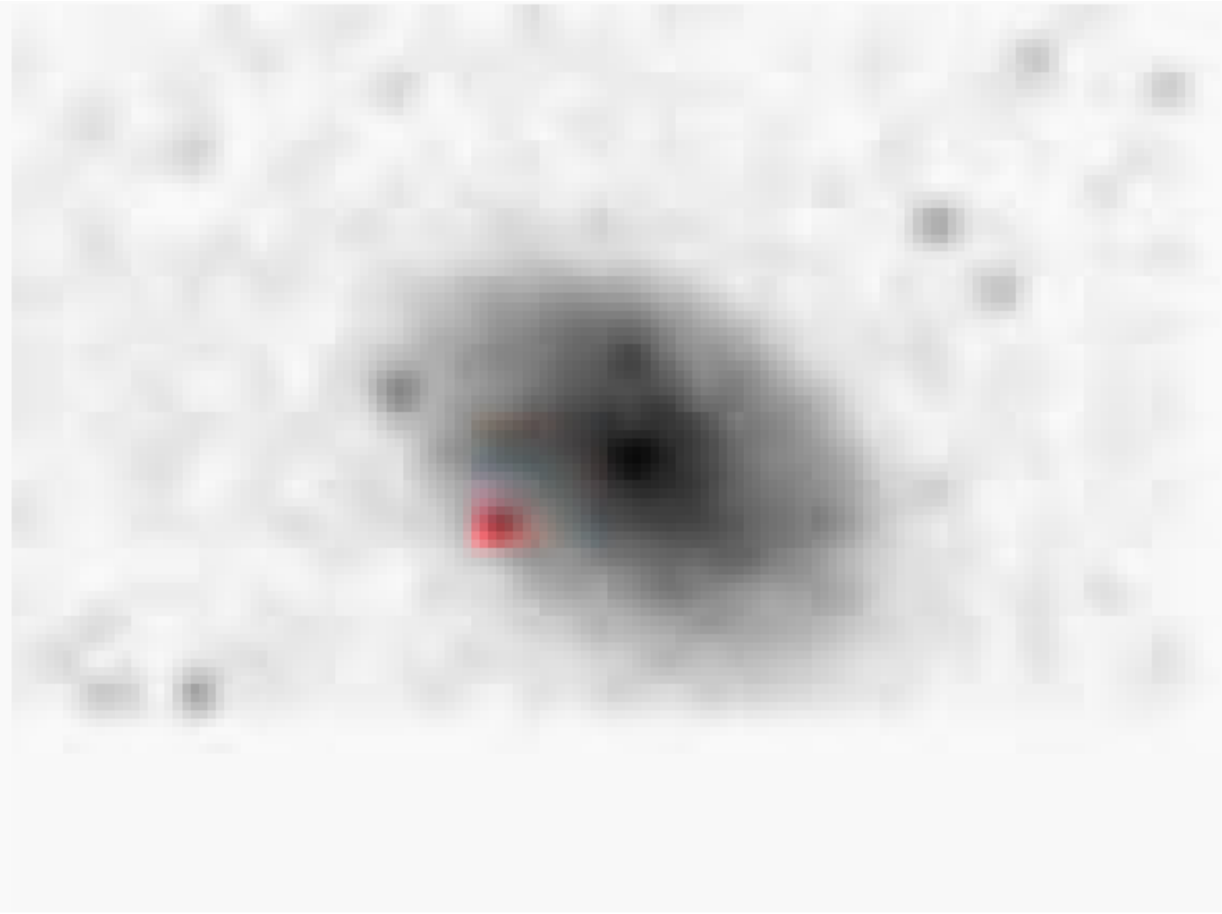
3. Analysis

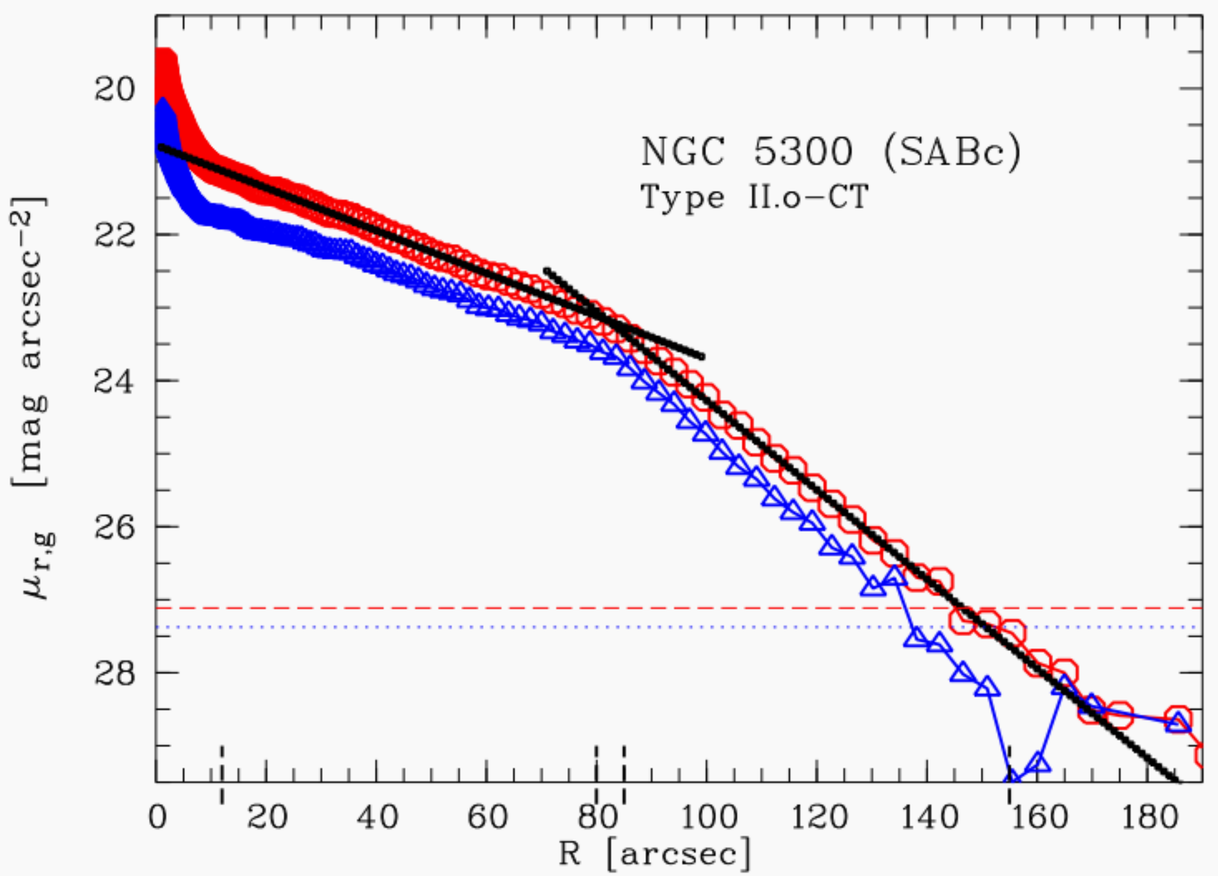




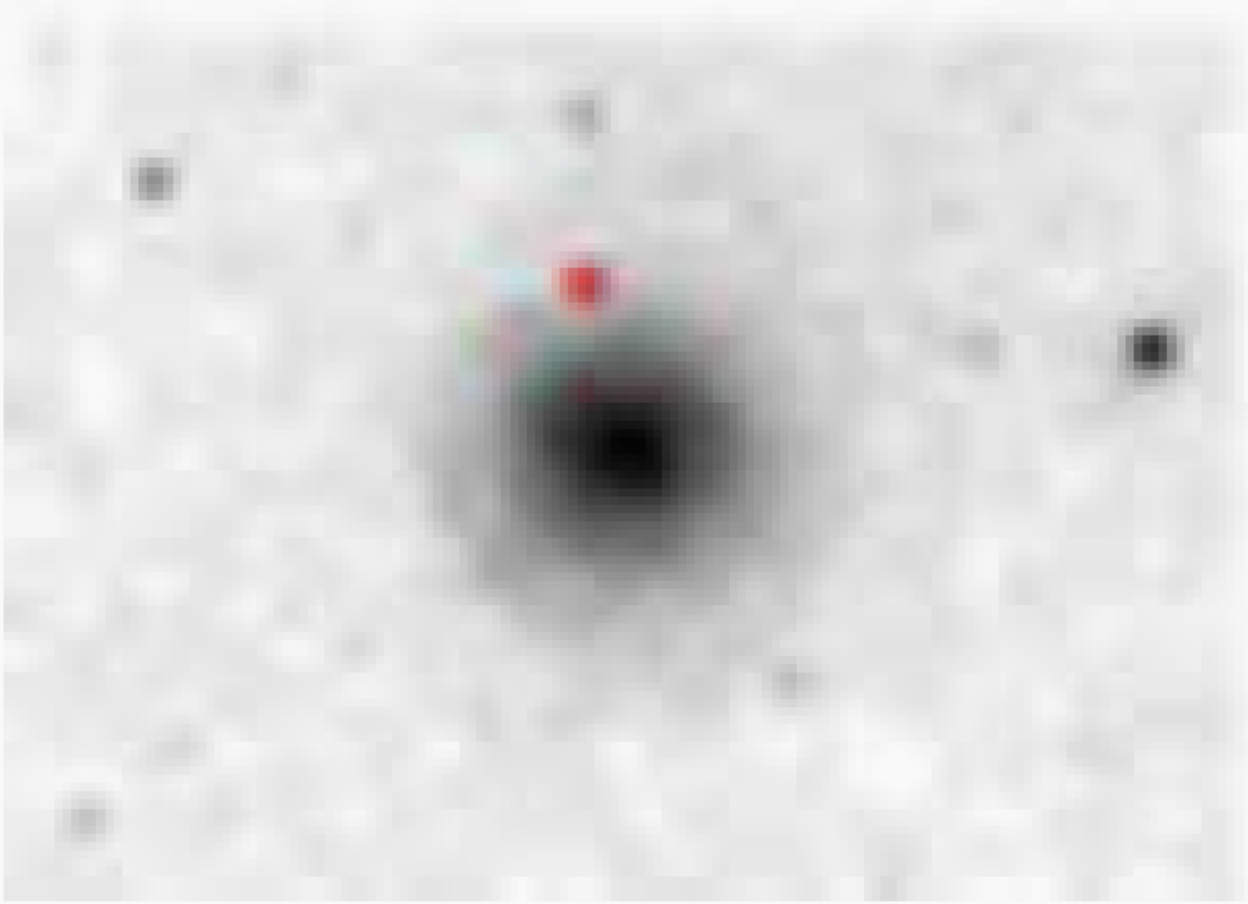
NGC 2776 (SABc)
Type I
$\mu_{r,g}$ [mag arcsec^{-2}]
R [arcsec]
18
20
22
24
26
28
0
20
40
60
80
100
120
140
160

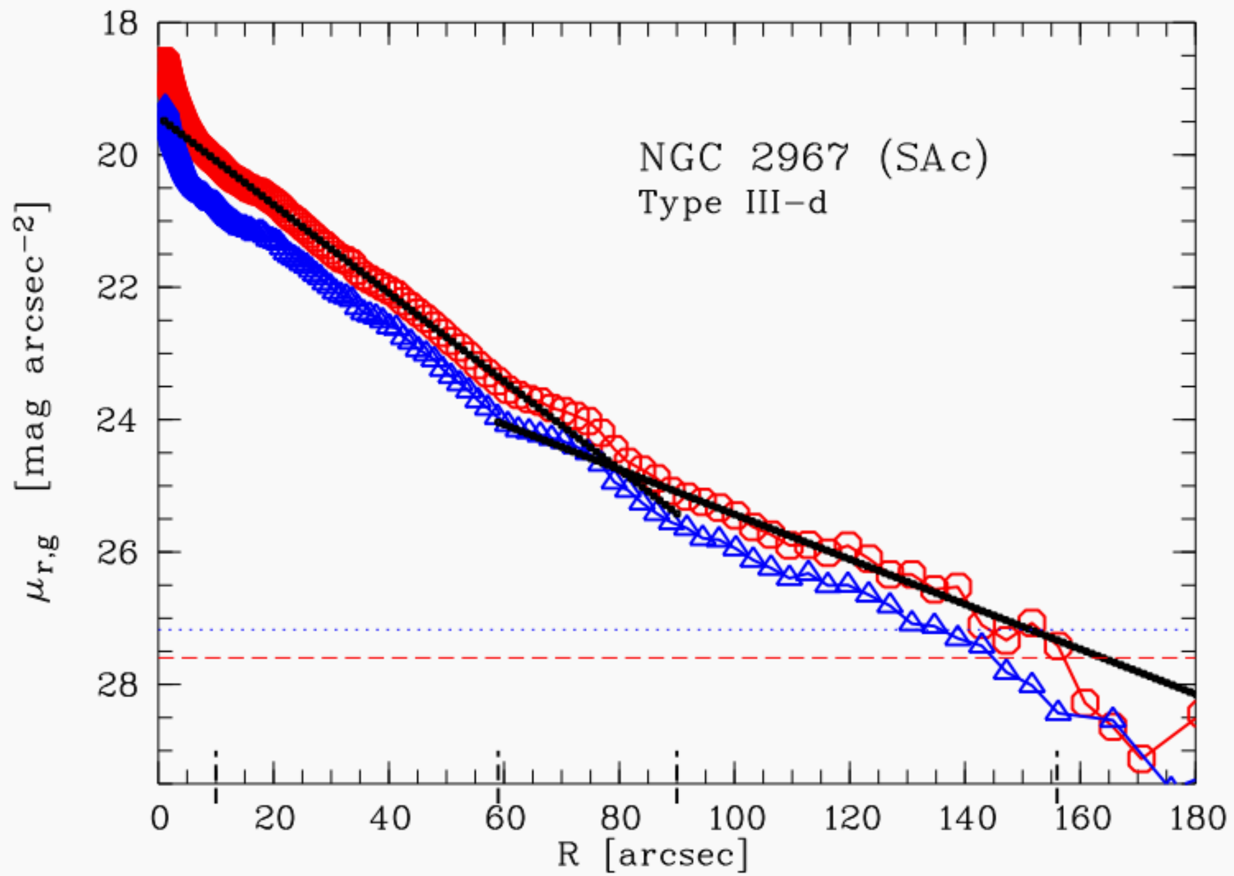
3. Analysis




NGC 5300 (SABc)
Type II.o−CT
$\mu_{r,g}$ [mag arcsec^{-2}]
R [arcsec]
20
22
24
26
28
0
20
40
60
80
100
120
140
160
180

3. Analysis





NGC 2967 (SAc)
Type III-d
$\mu_{r,g}$ [mag arcsec^{-2}]
R [arcsec]
18
20
22
24
26
28
0
20
40
60
80
100
120
140
160
180

4. Results

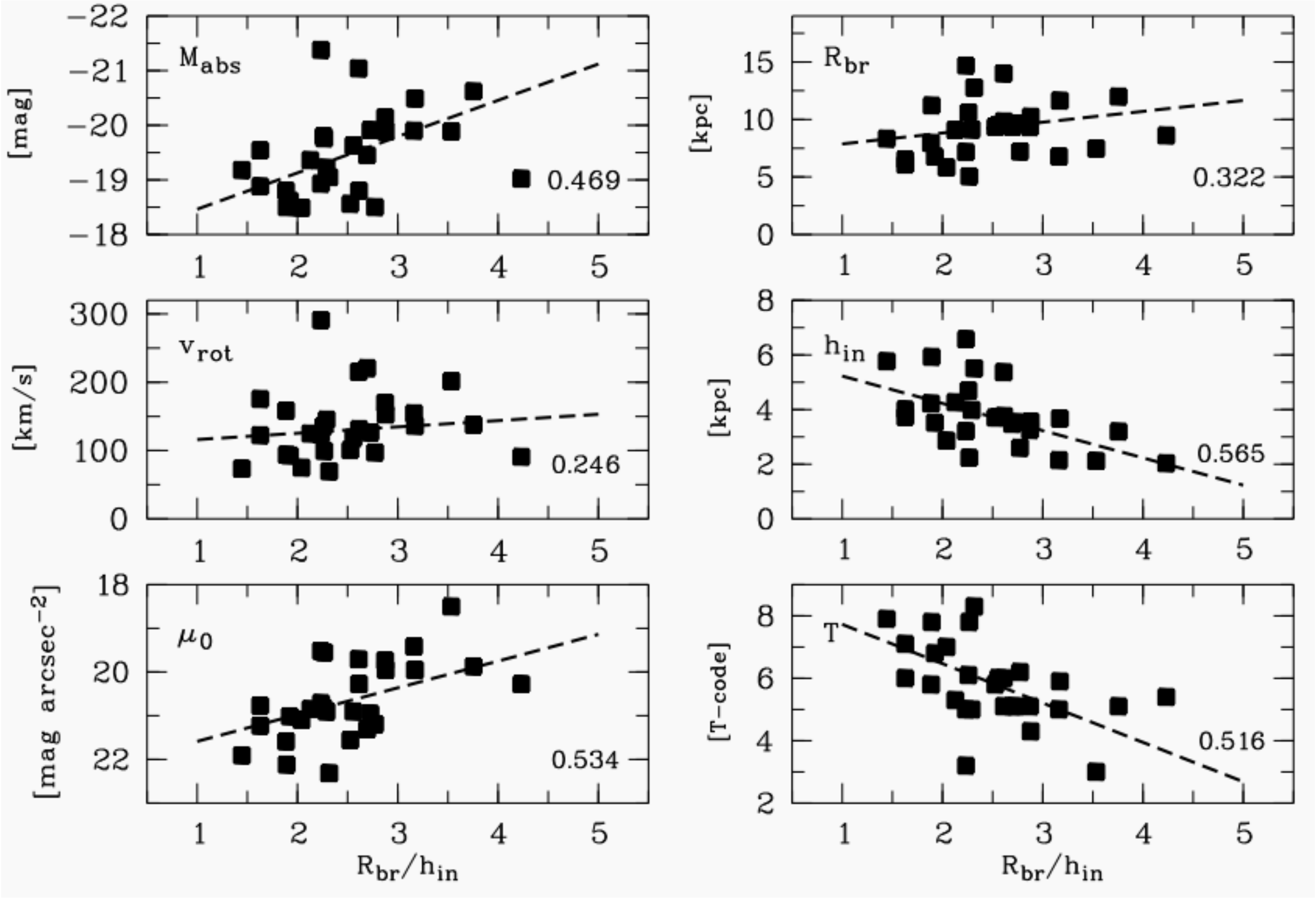
4.1. Frequencies

Type I:11% **Type II:66%** **Type III:32%**

Profile type	Number [#]	Frequency [%]
Type I	9	11 ± 3
Type II	56	66 ± 5
– Type II.i	4 (1)	6 ± 3
– Type II-CT	28 (2)	32 ± 5
– Type II.o-OLR	13 (5)	15 ± 4
– Type II-AB	11 (3)	13 ± 4
Type III	28 (7)	32 ± 5

4. Results

4.2. Parameter distribution



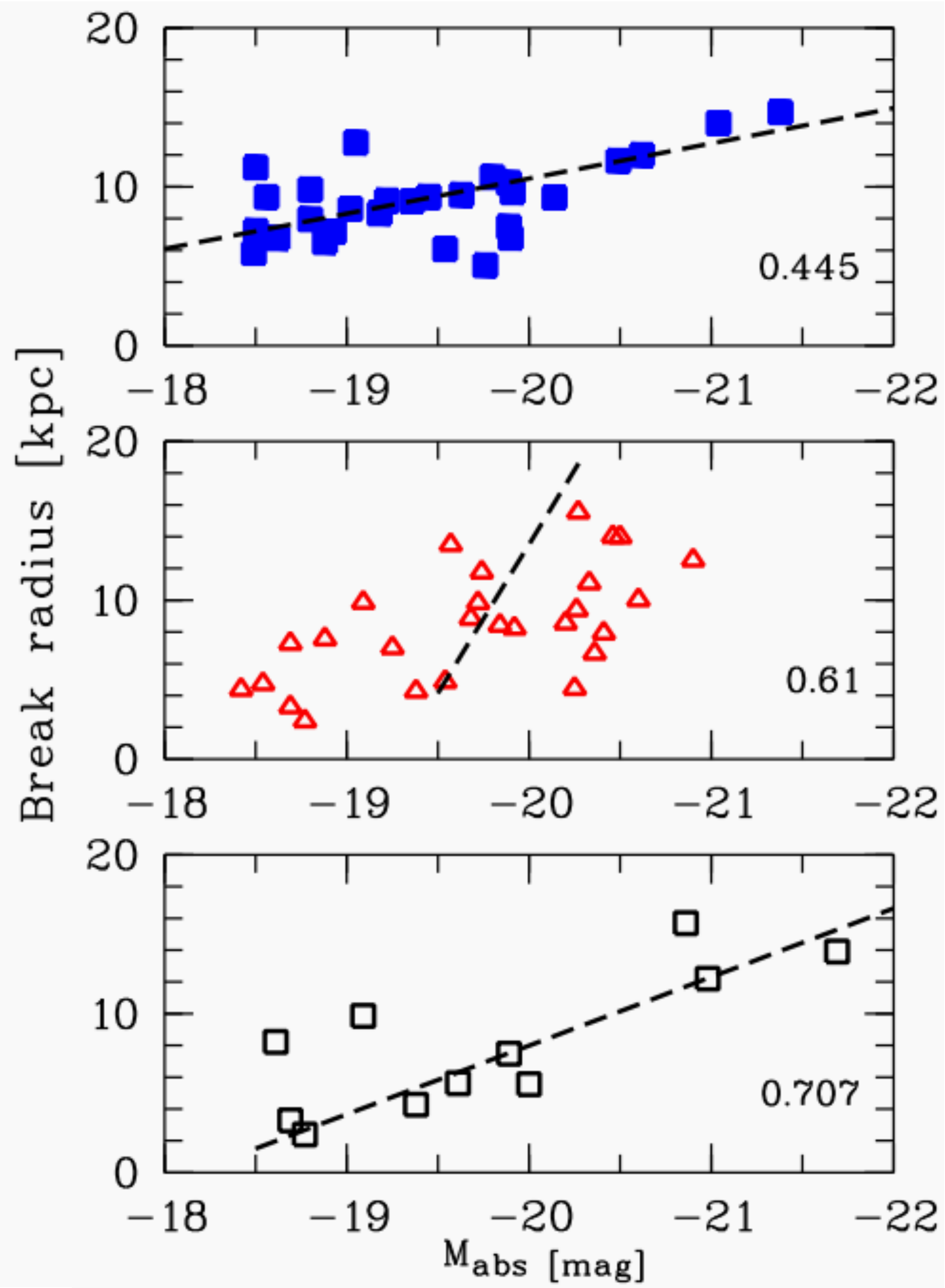
4. Results

4.2. Parameter distribution

Type II-CT(upper row),

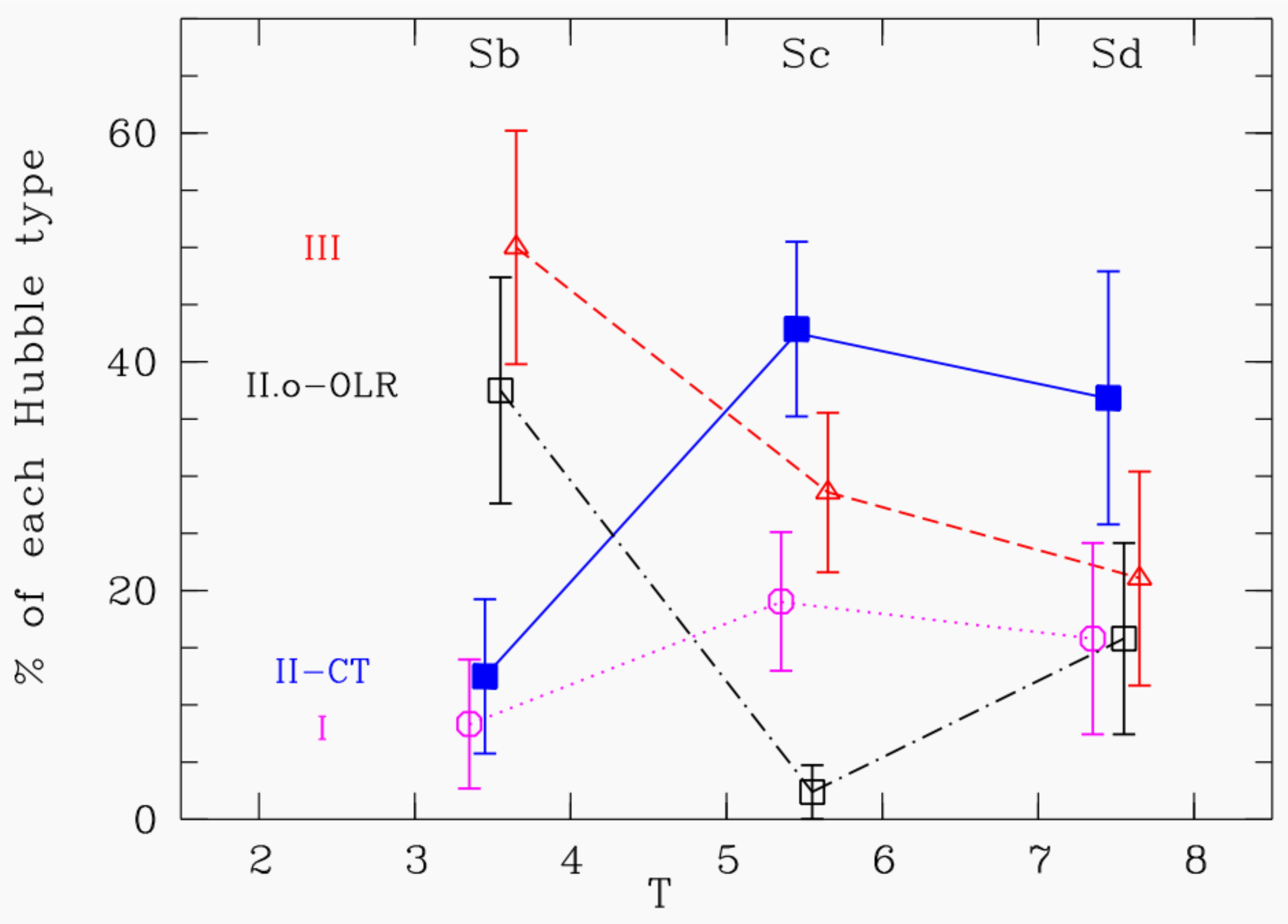
Type III (middle row),

Type II.o-OLR (bottom row).



4. Results

4.3. Correlations



5. Discussion

A significant diversity in the surface brightness profiles of galaxies, encompassing more than just the traditional Type I, Type II, and Type III classifications.

The evident correlation links surface brightness profile types with galaxy evolution stages, showing a prevalence of Type II-CT truncations in late-type galaxies and Type III upbending breaks in early-type galaxies.

Future research should leverage advanced observational tools for detecting finer structures in galactic surface brightness profiles and integrate multi-wavelength data with simulations for a more profound understanding of the evolution-link.

6. Summary

1.90% of Their galaxies could be classified into one of the following classes –Type I (no break), Type II (downbending break), and Type III (upbending break)– extending Freemans original classification.

2.Surprisingly only <~15% of all galaxies have a normal purely exponential disk down to our noise limit.

3.Classical truncations (Type II-CT) are more frequent in later types while the fraction of upbending breaks rise towards earlier types.

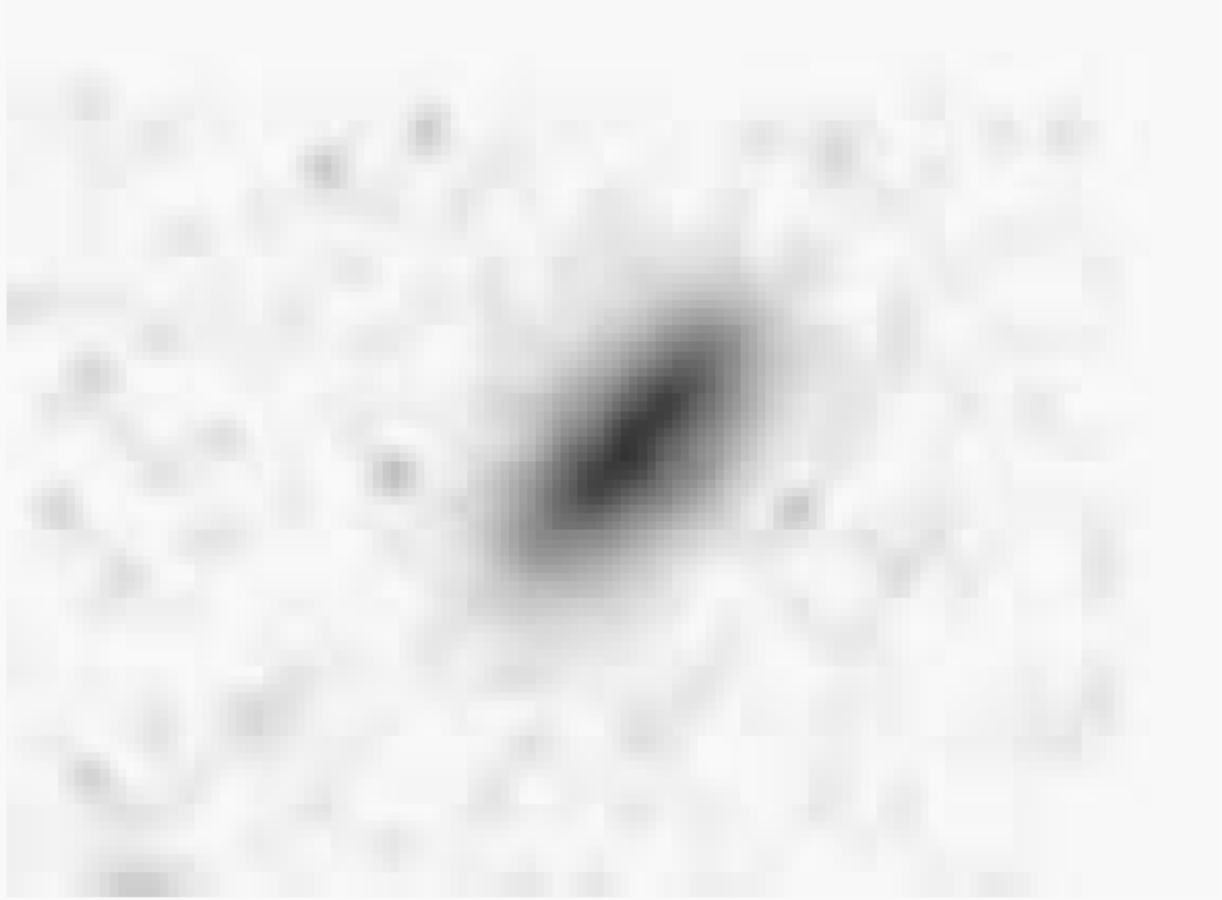
4.Their Type I galaxies seem to be genuinely untruncated.

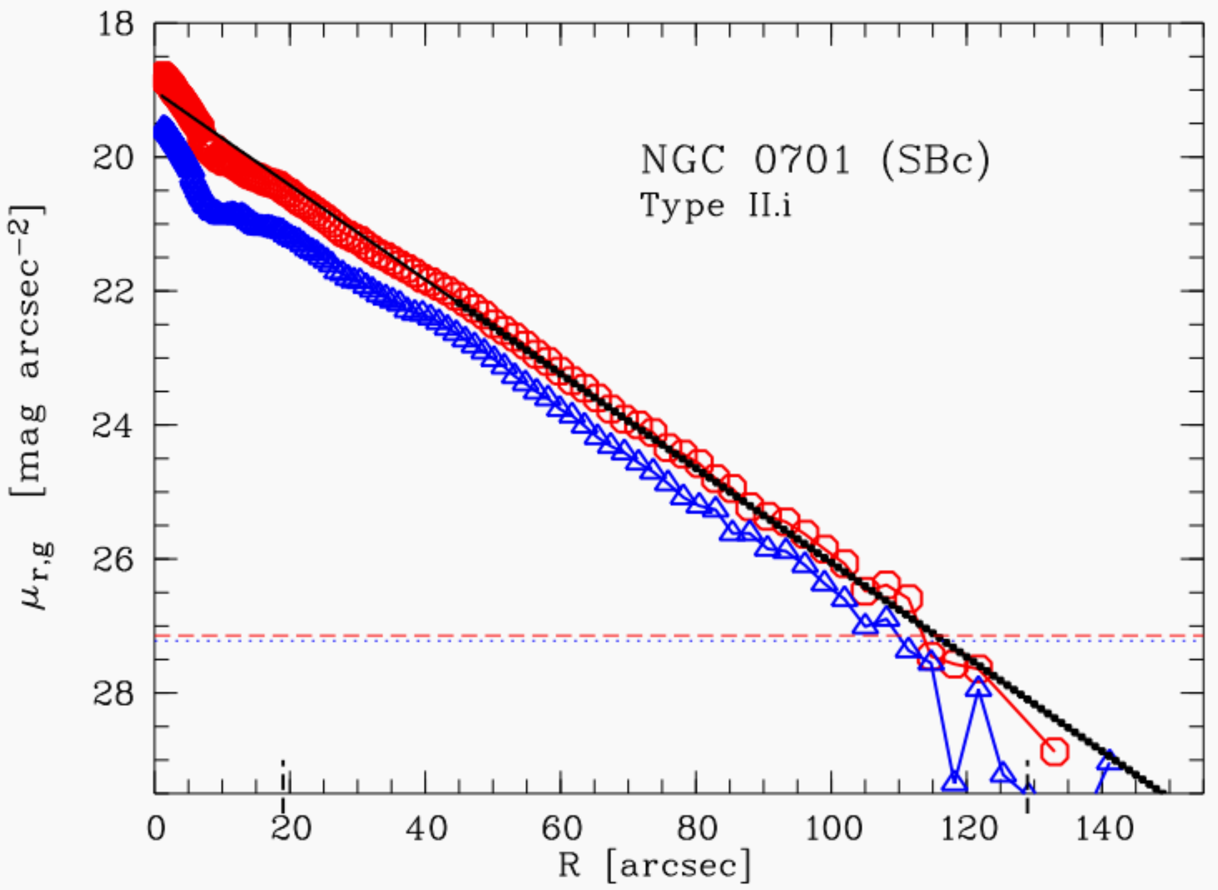
5.They do not find any galaxy with a sharp (or complete) cut-off in the radial light distribution.

6.The position of the break (in kpc) seems to be correlated with absolute magnitude: the more luminous the larger the inner disk of the galaxy.

7.For Type III galaxies the break happens typically further out at 4.9 ± 0.6 times the inner scalelength.

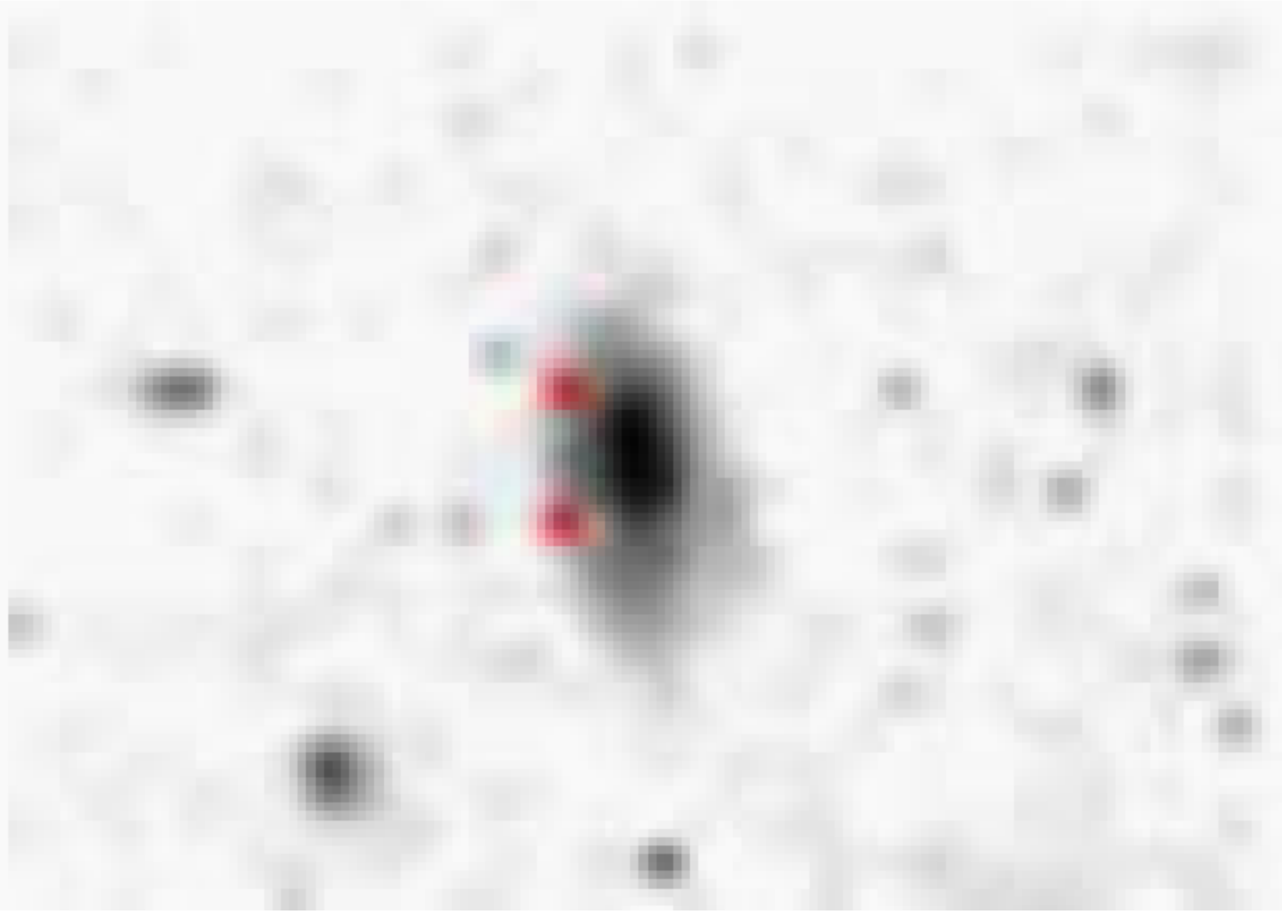
3. Analysis

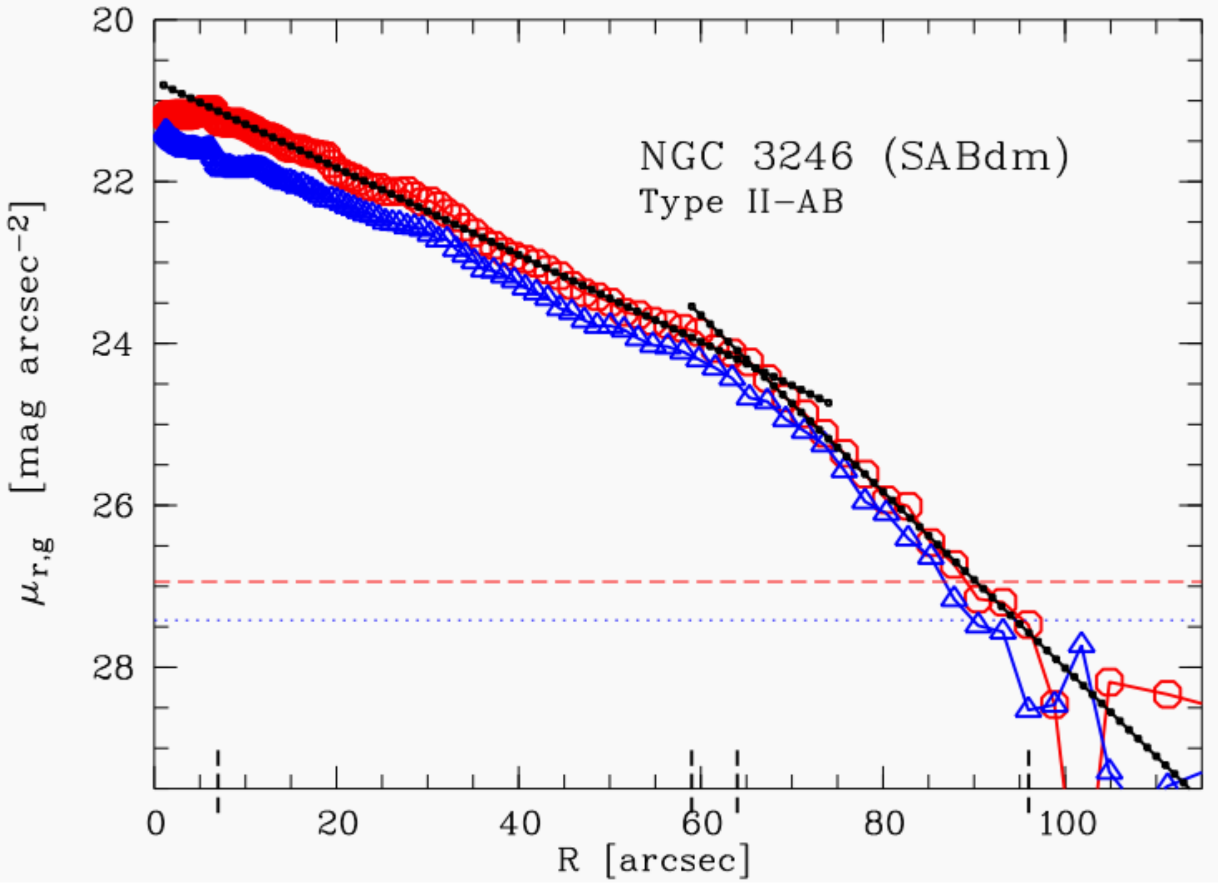




NGC 0701 (SBc)
Type II.i
$\mu_{r,g}$ [mag arcsec^{-2}]
R [arcsec]
18
20
22
24
26
28
0
20
40
60
80
100
120
140

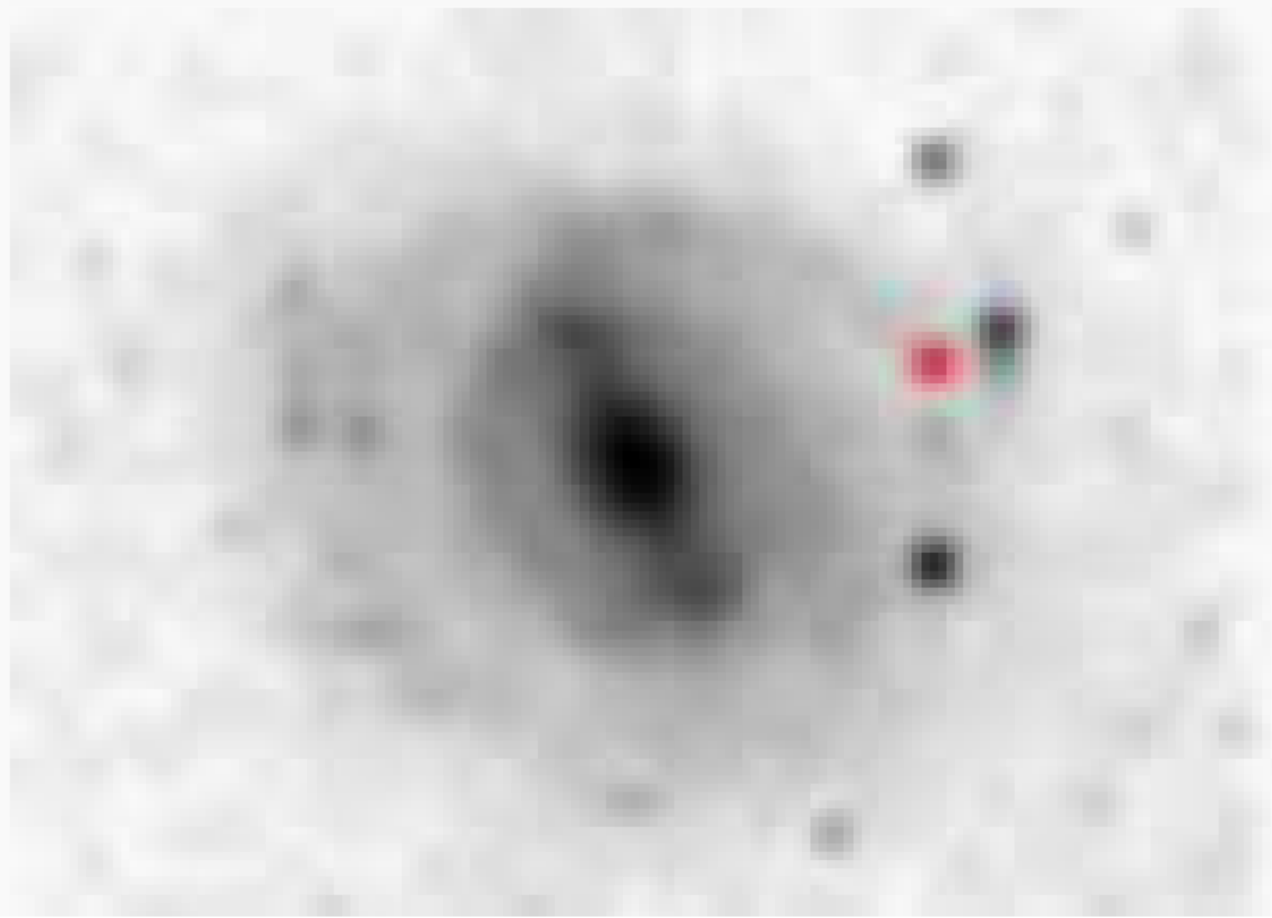
3. Analysis

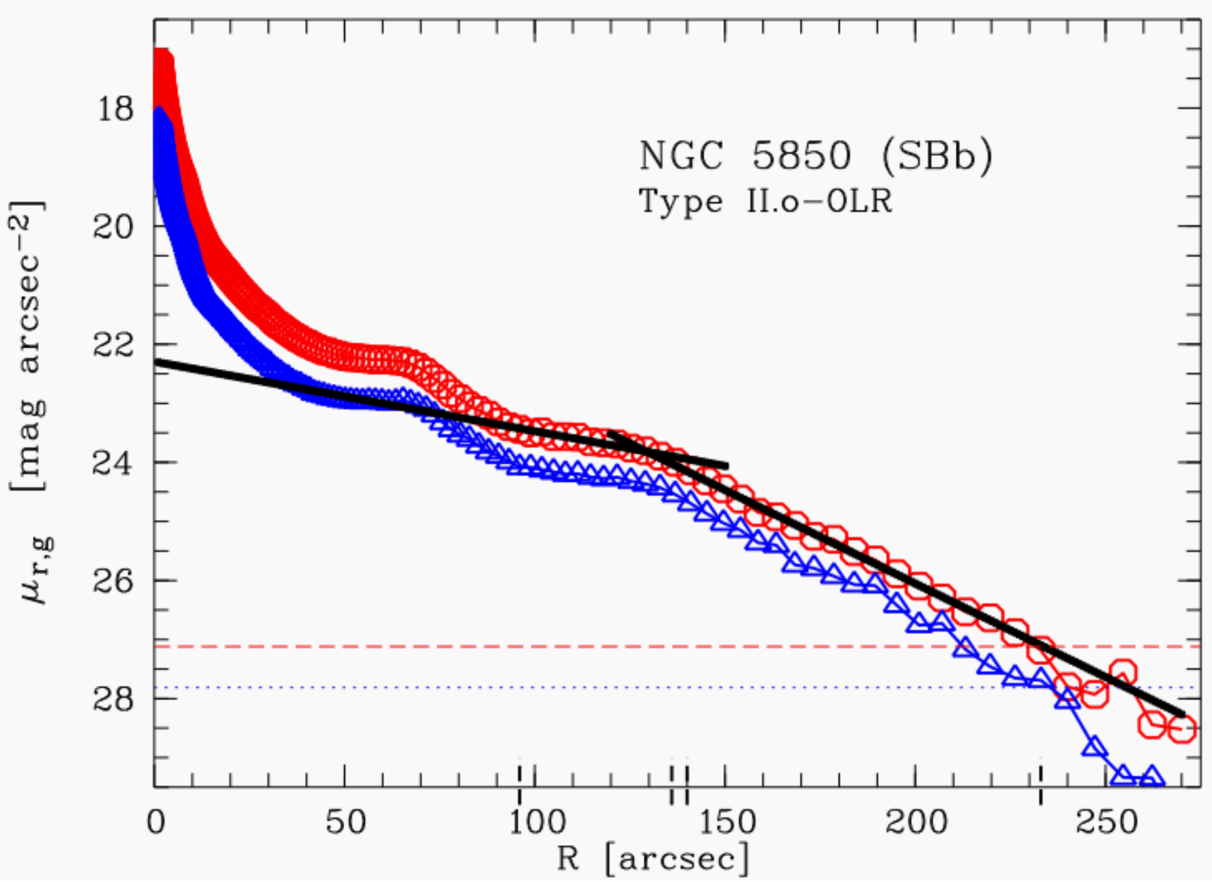




NGC 3246 (SABdm)
Type II-AB
$\mu_{r,g}$ [mag arcsec^{-2}]
R [arcsec]
20
22
24
26
28
0
20
40
60
80
100

3. Analysis





NGC 5850 (SBb)
Type II.o-OLR
$\mu_{r,g}$ [mag arcsec^{-2}]
R [arcsec]
18
20
22
24
26
28
0
50
100
150
200
250