The division of the local galaxy stellar mass function by type and structure

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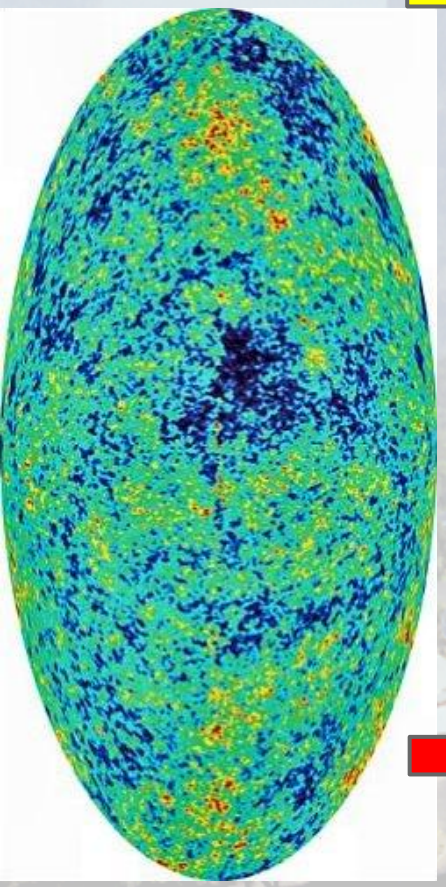
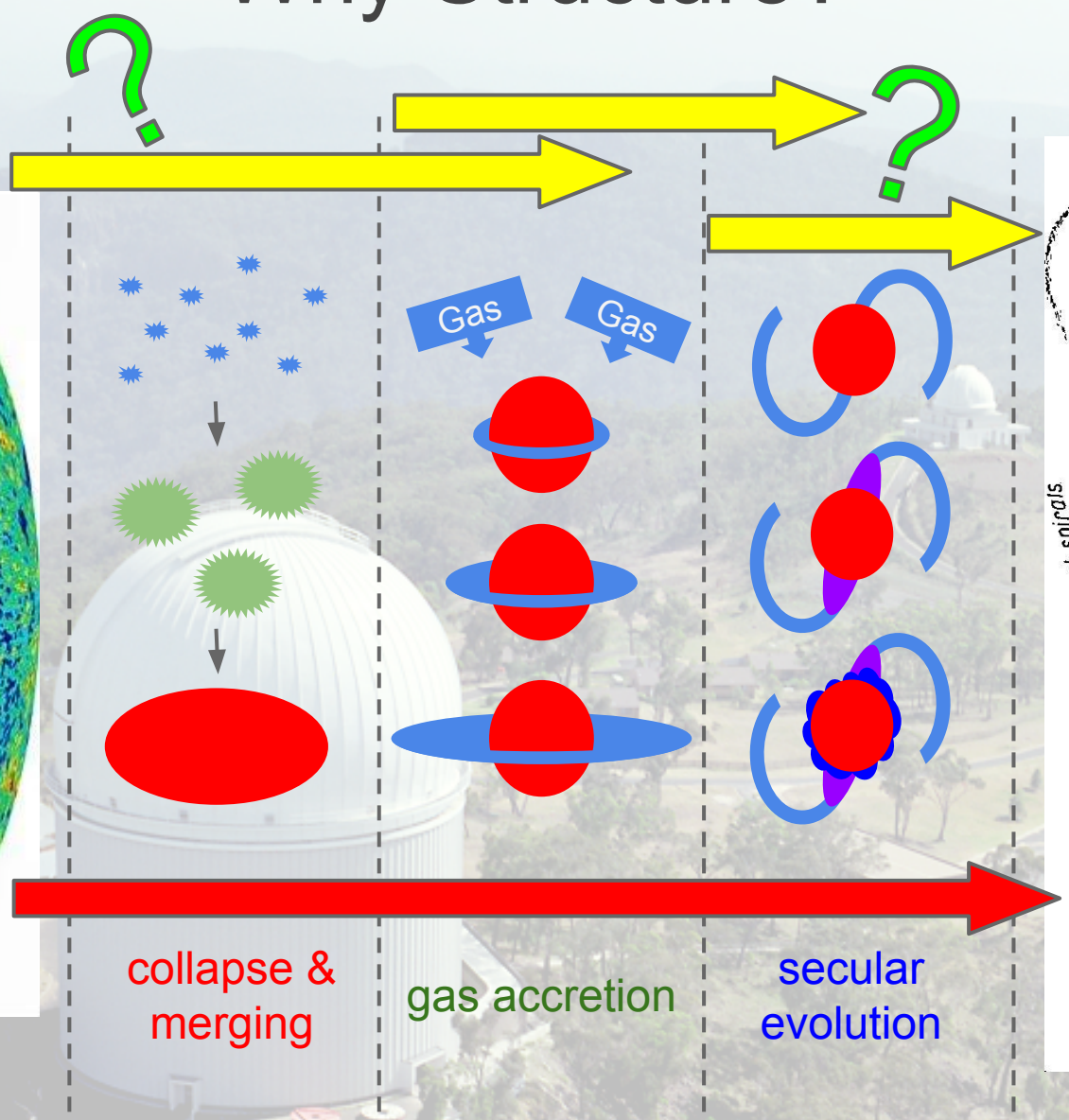
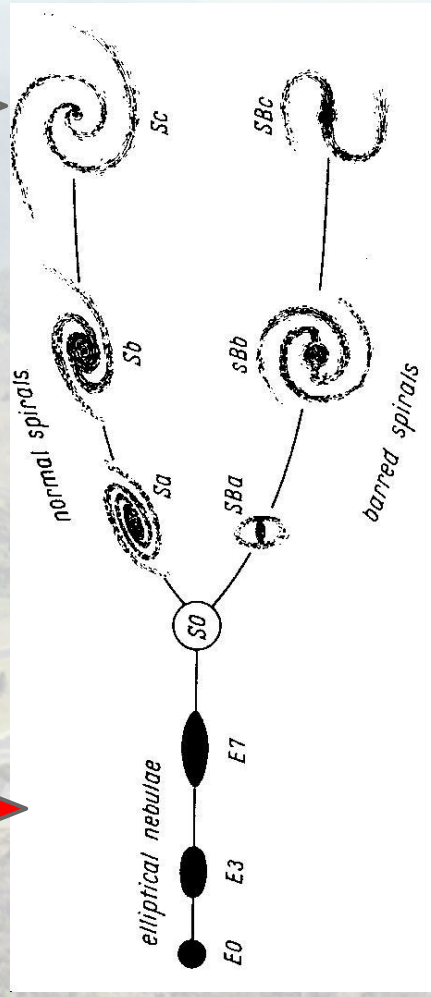
Why Structure?







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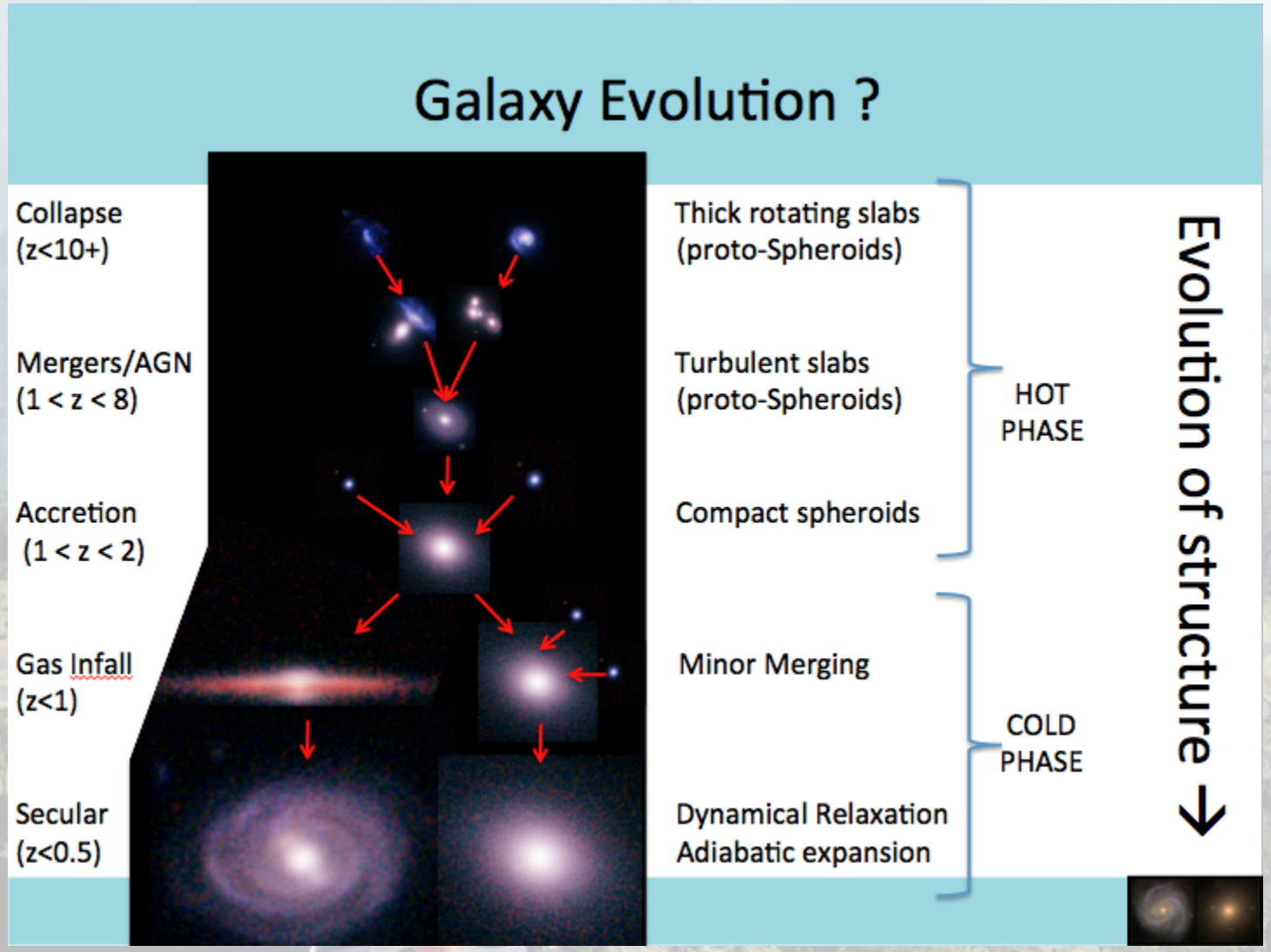
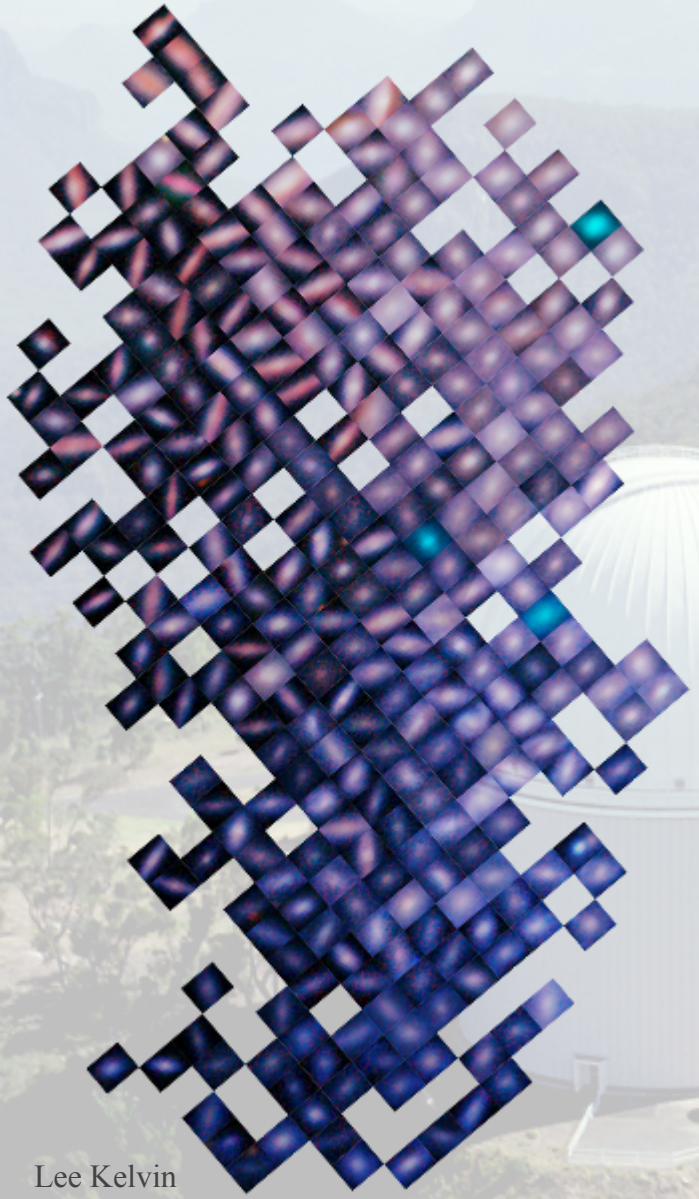


A bimodal galaxy population?



Population 1	Population 2
Early Type	Late Type
Elliptical	Spiral
Red	Blue
Slow rotator	Fast rotator
Absorption line	Emission line
High mass	Low mass
Metal rich	Metal poor
Red sequence	Blue cloud
Red cloud	Blue sequence
High Sérsic index	Low Sérsic index
Cluster galaxy	Field galaxy
Single component	Multi component
Spheroid	Disk/Disc
Spheroid dominated	Disk dominated

A bimodal galaxy population?

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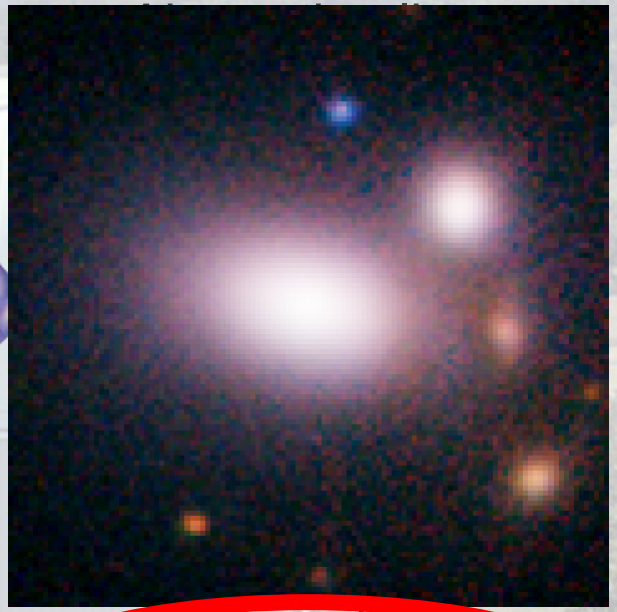
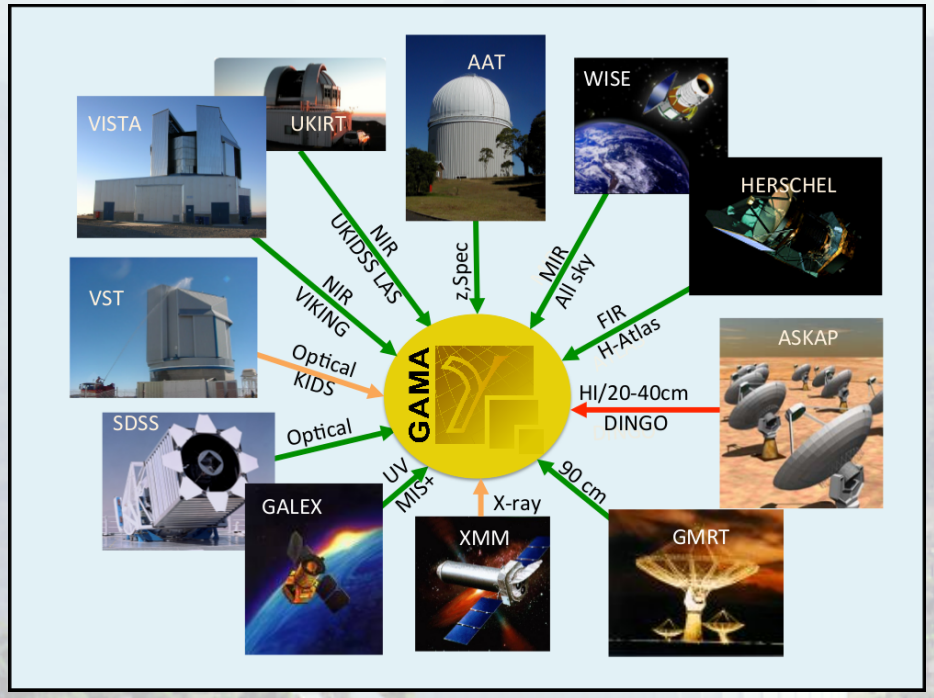
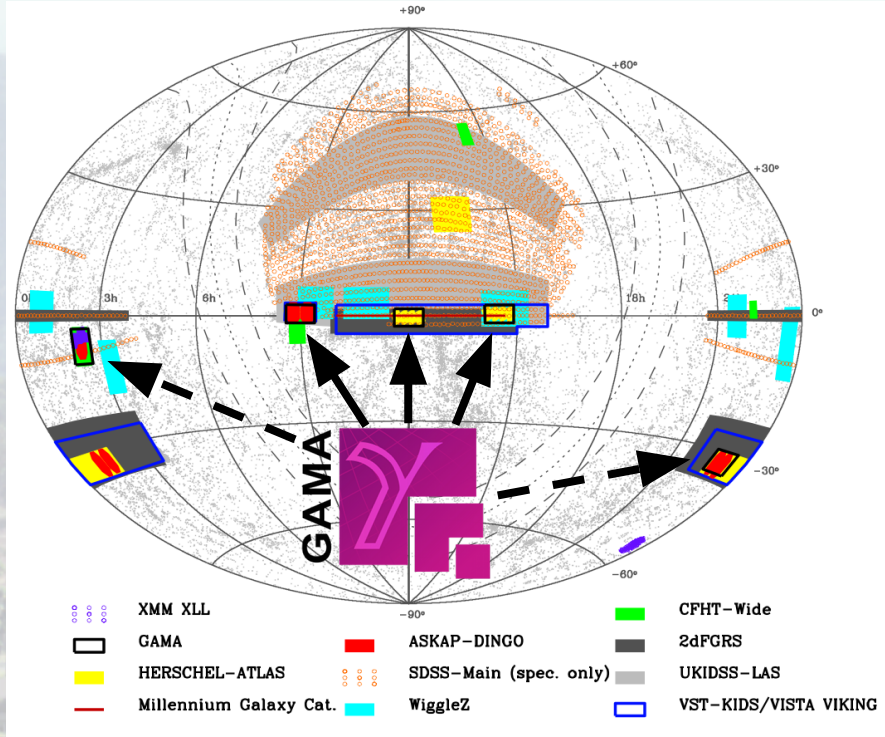


Spheroid
Spheroid dominated

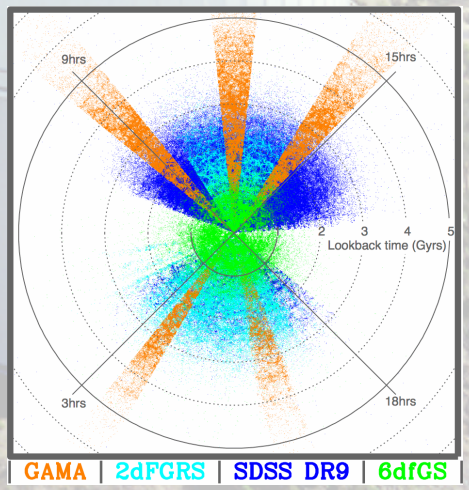
Disk/Disc
Disk dominated

Galaxy and Mass Assembly





- ~300,000 gals
- r < 19.8 mag
- ~290 deg^2
- 27 passbands



"Study structure on scales of 1 kpc to 1 Mpc"

galaxy: clusters, groups, mergers, structure

Sample Definition

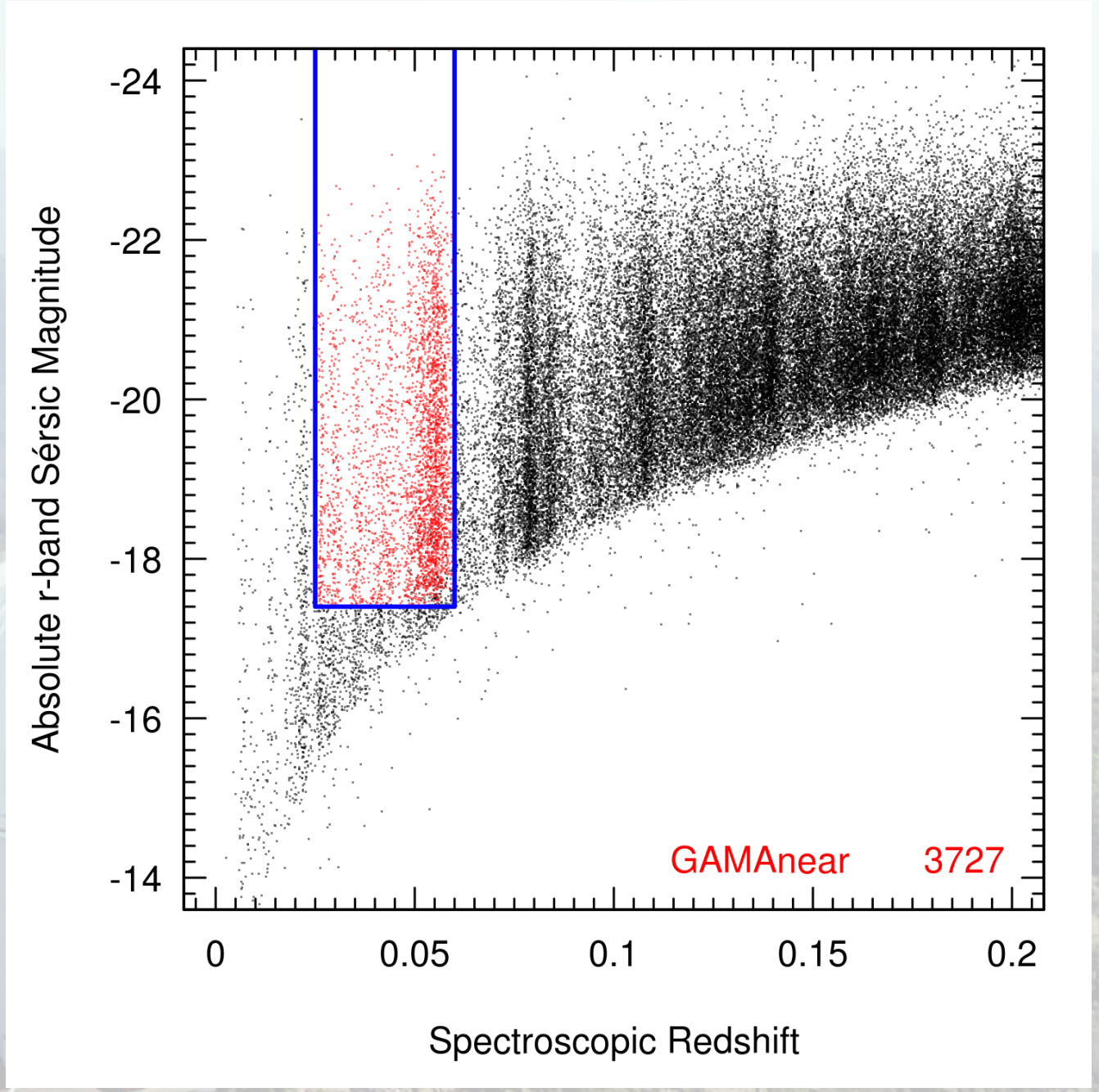
$0.025 < z < 0.06$

$M_{r,Sérsic} < -17.4$

high Q redshifts

'galaxy-like'

$r_{petro} < 19.4$



Sérsic Photometry: Kelvin+ 2012

Sample Definition

$0.025 < z < 0.06$

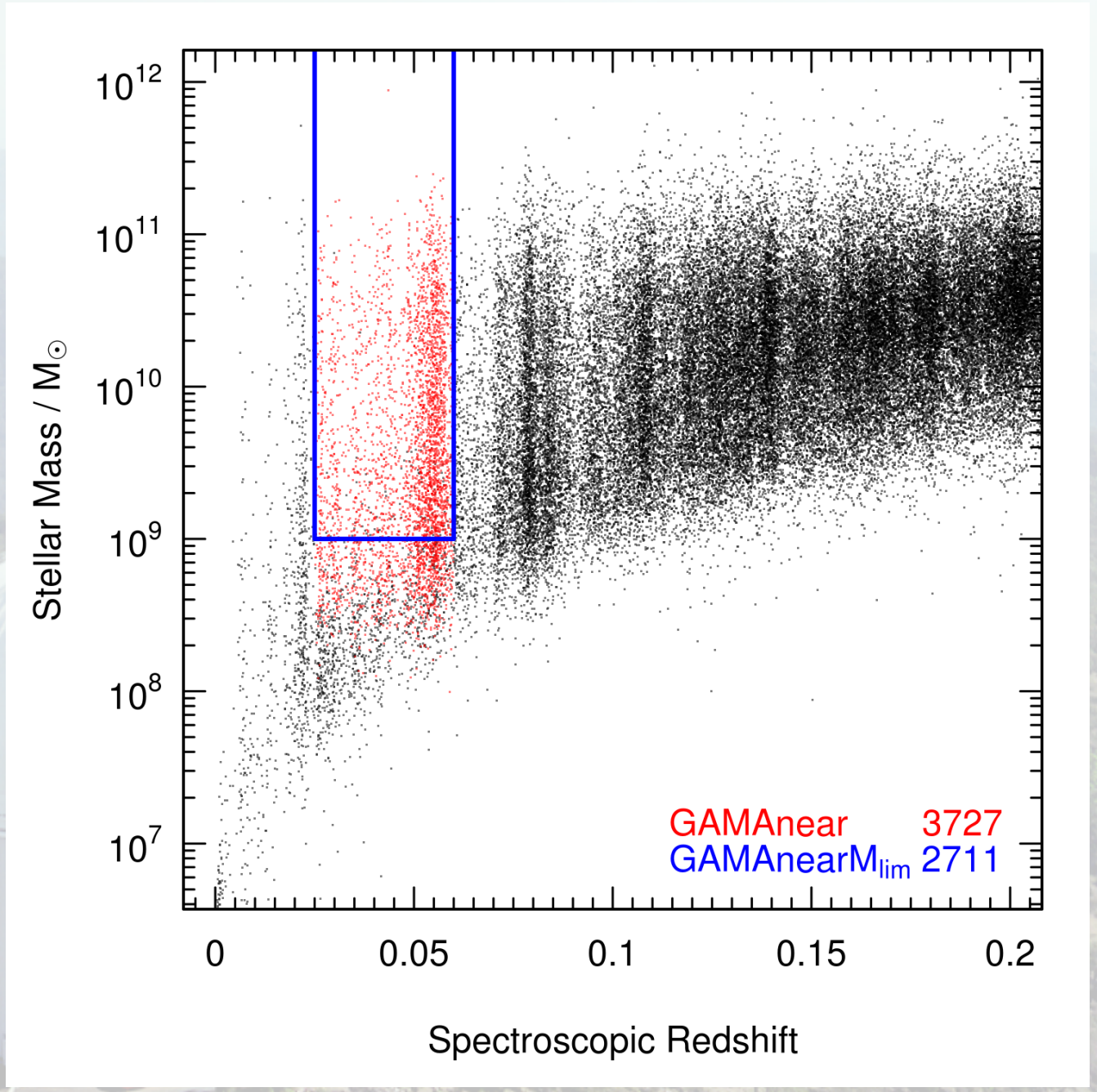
$M_{r,Sérsic} < -17.4$

high Q redshifts

'galaxy-like'

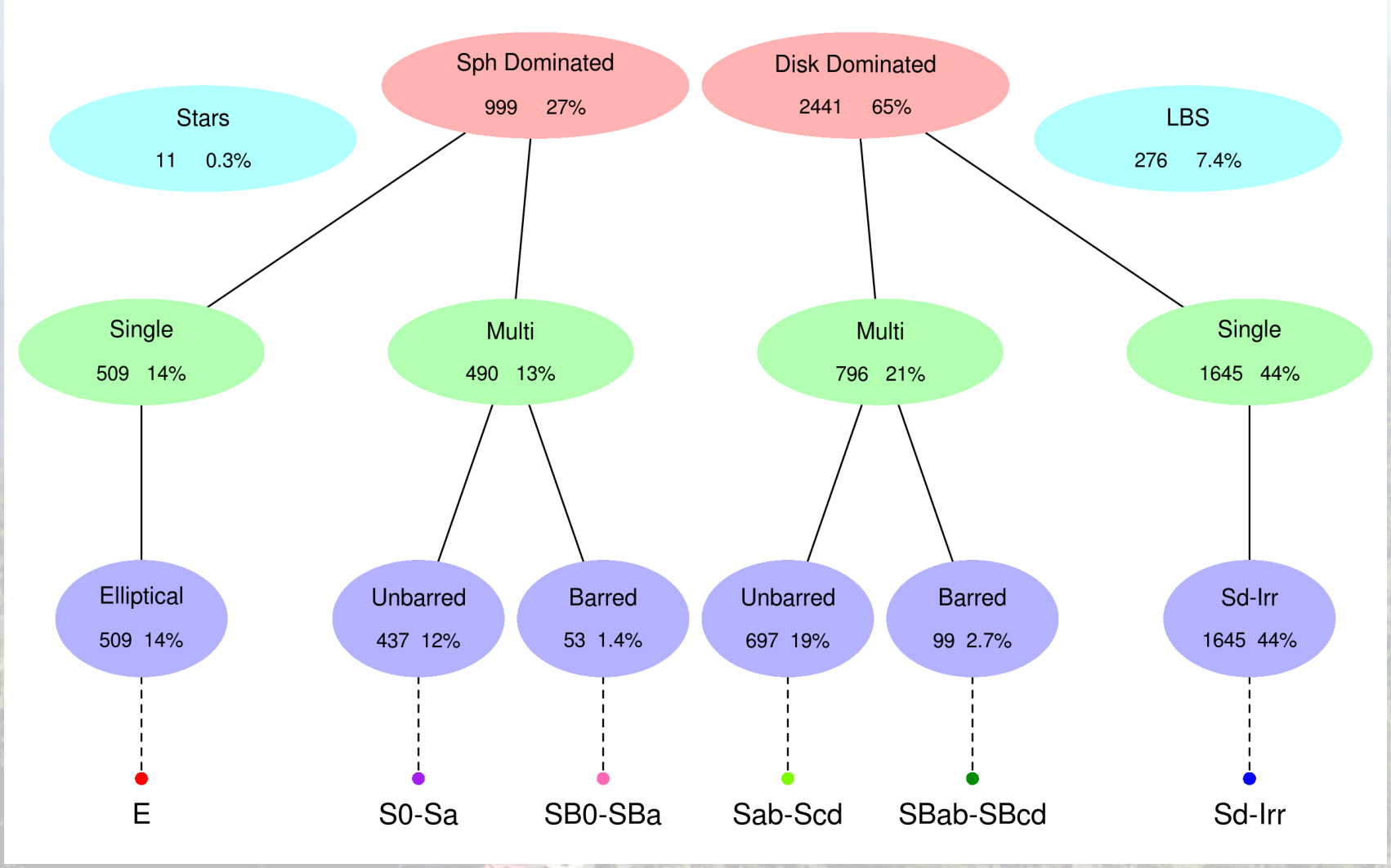
$r_{petro} < 19.4$

$\log(M/M_{\odot}) > 9.0$



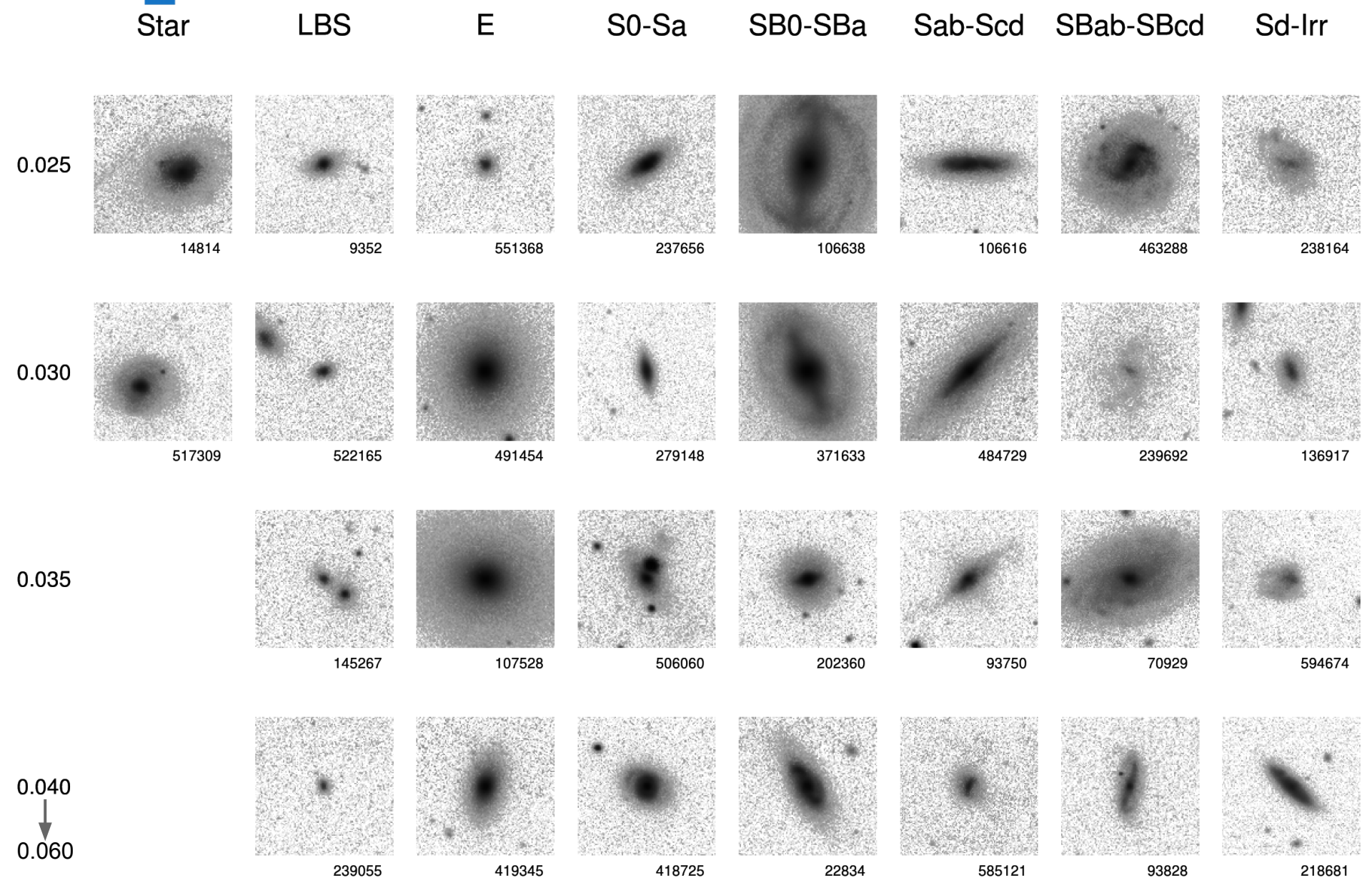
Stellar Masses: Taylor+ 2011

Morphological Classification



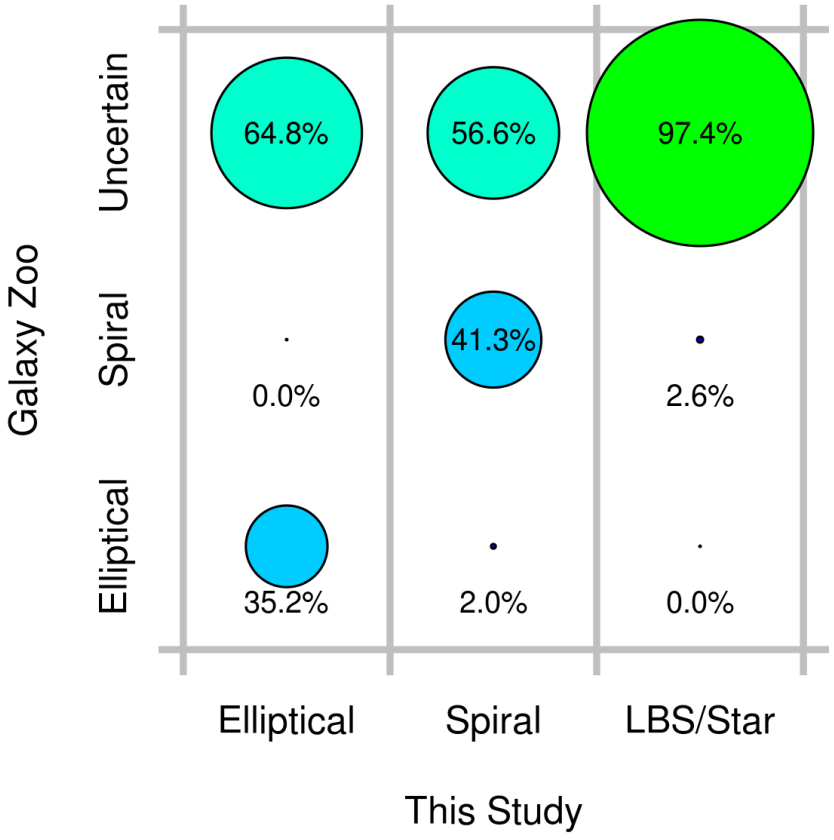
Kelvin+ 2014a

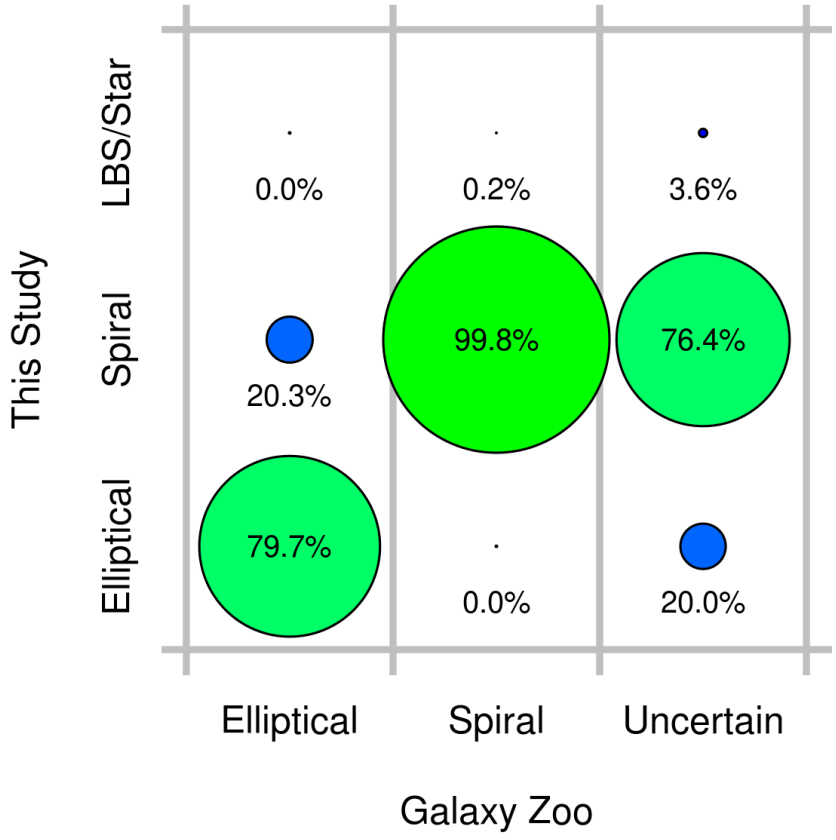
GAMAnear visual classifications



GAMAnear visual classifications

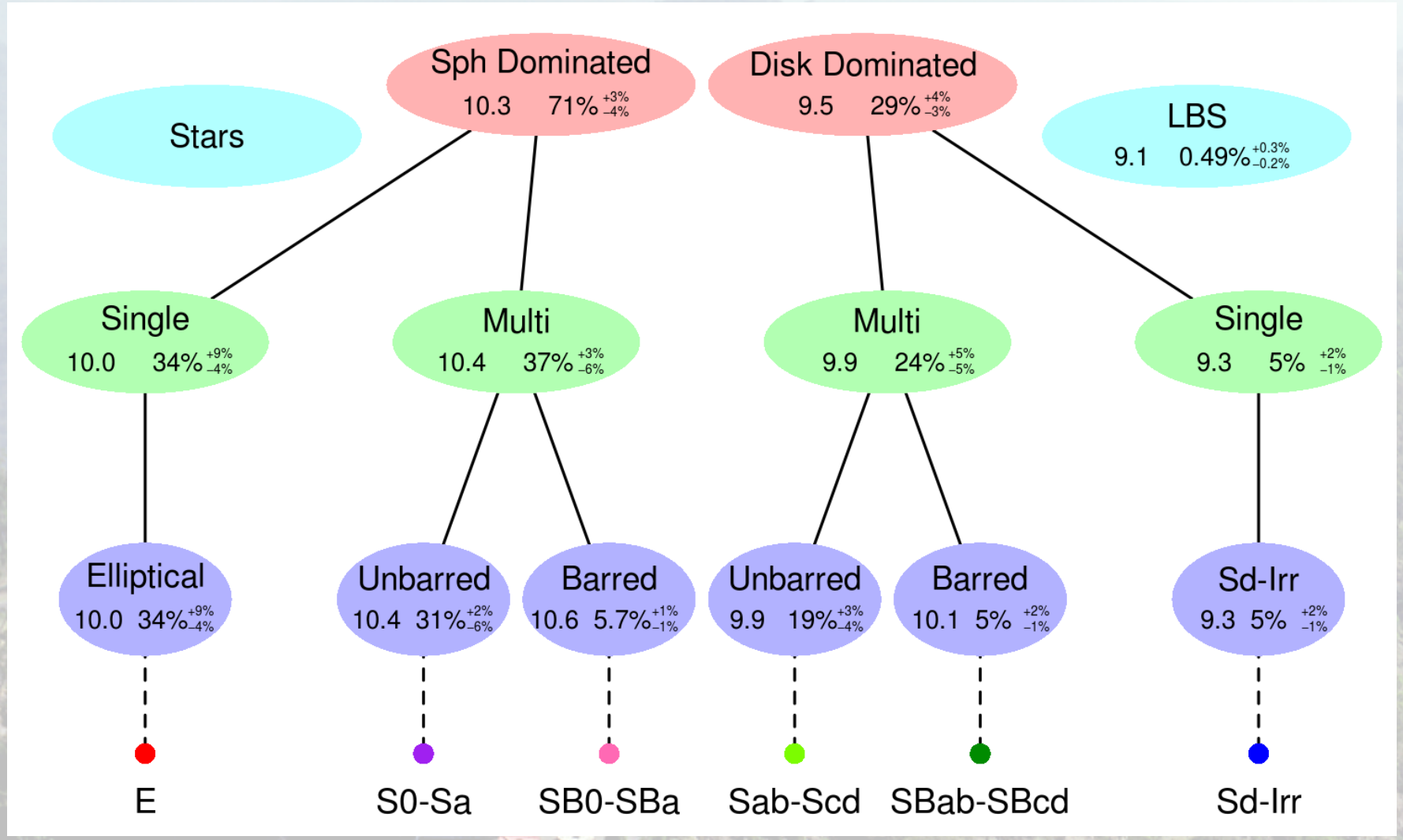
Galaxy Zoo DR1: Lintott+ 2011





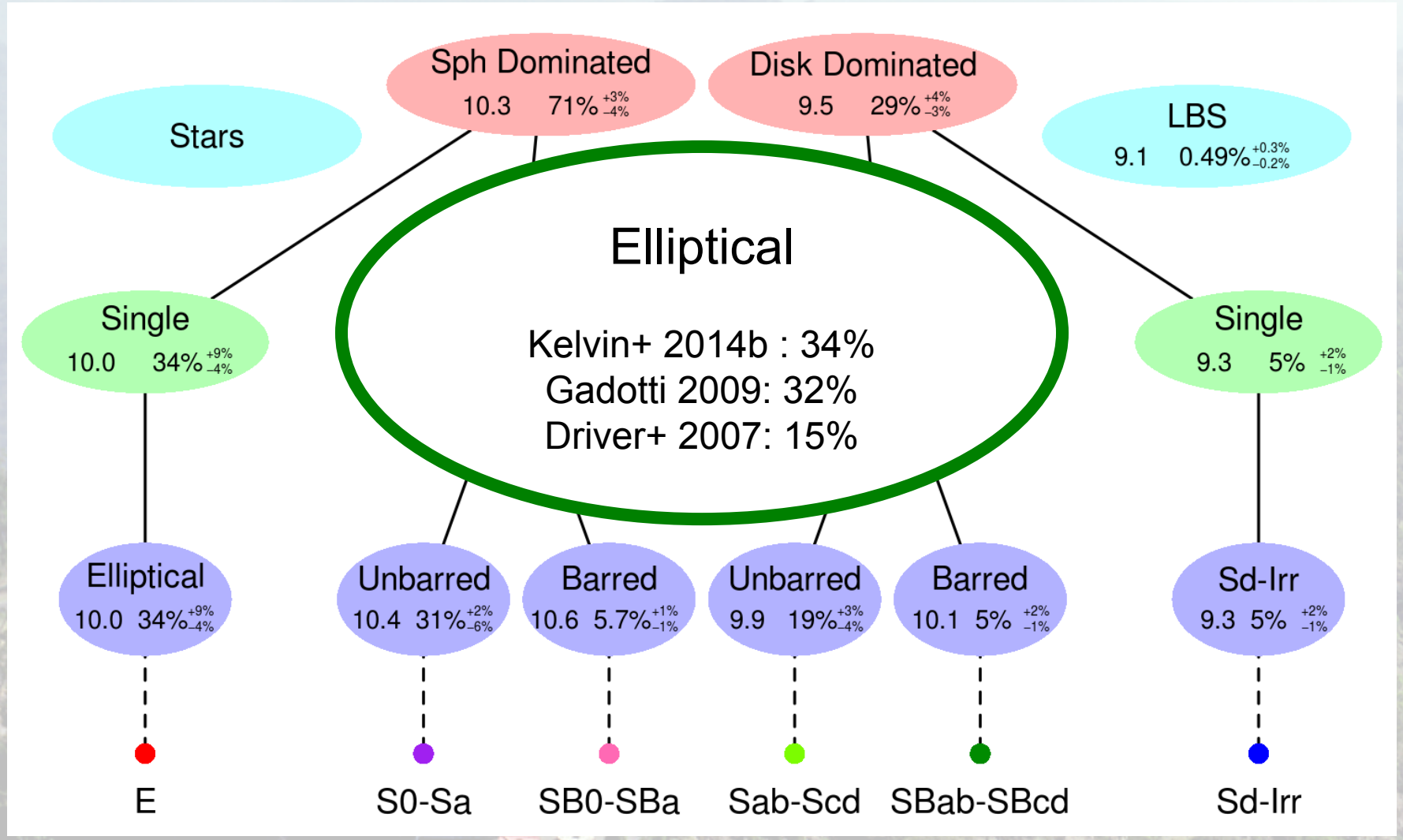
Our classifications are in good agreement with Galaxy Zoo!
Agreement improves if we adopt a lower GZ threshold.

Stellar Mass Breakdown



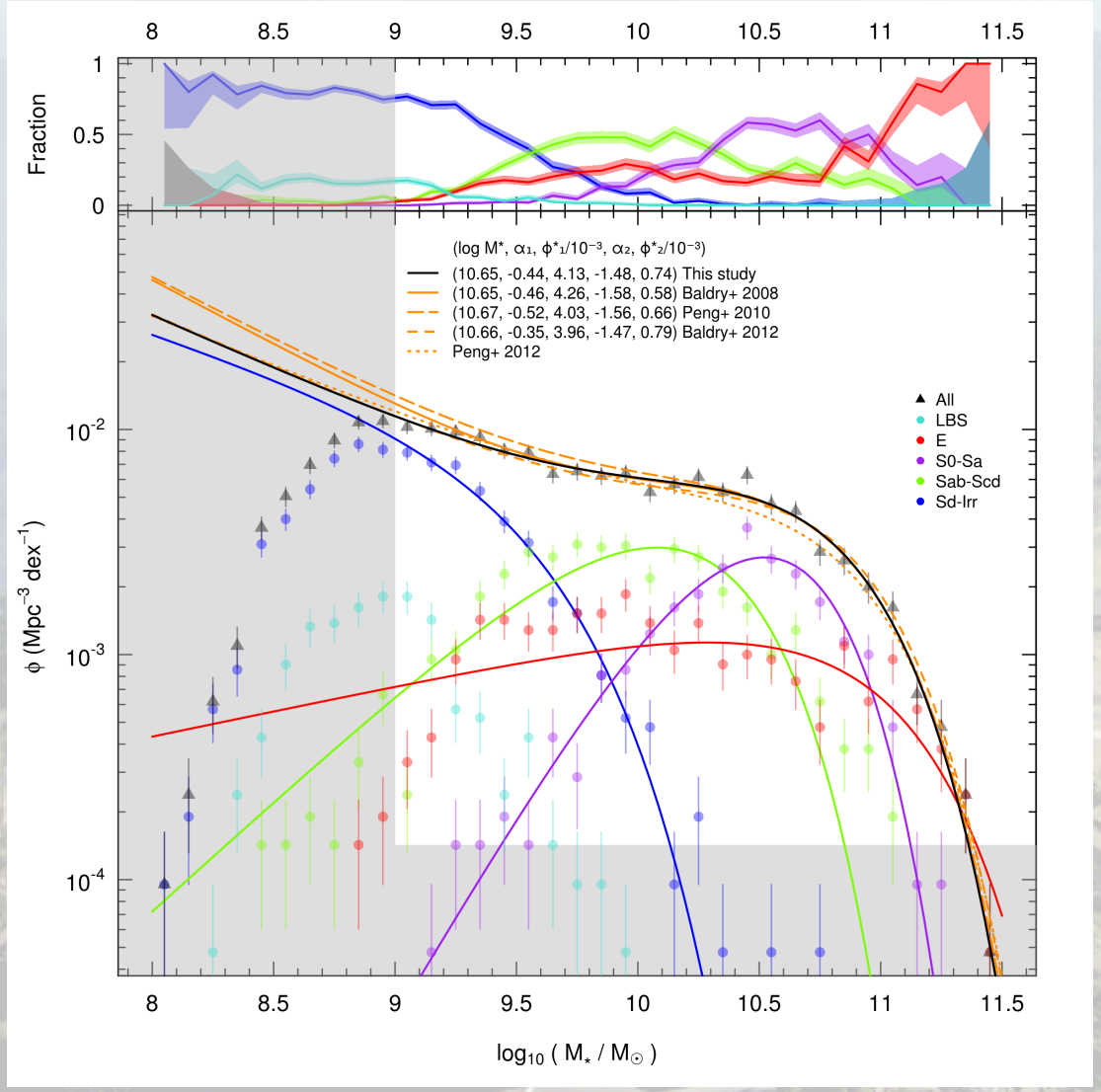
Kelvin+ 2014b

Stellar Mass Breakdown



Kelvin+ 2014b

Stellar Mass Functions by Type



Total: Double Schechter

Morphs: Single Schechter

E mass distribution relatively flat with stellar mass

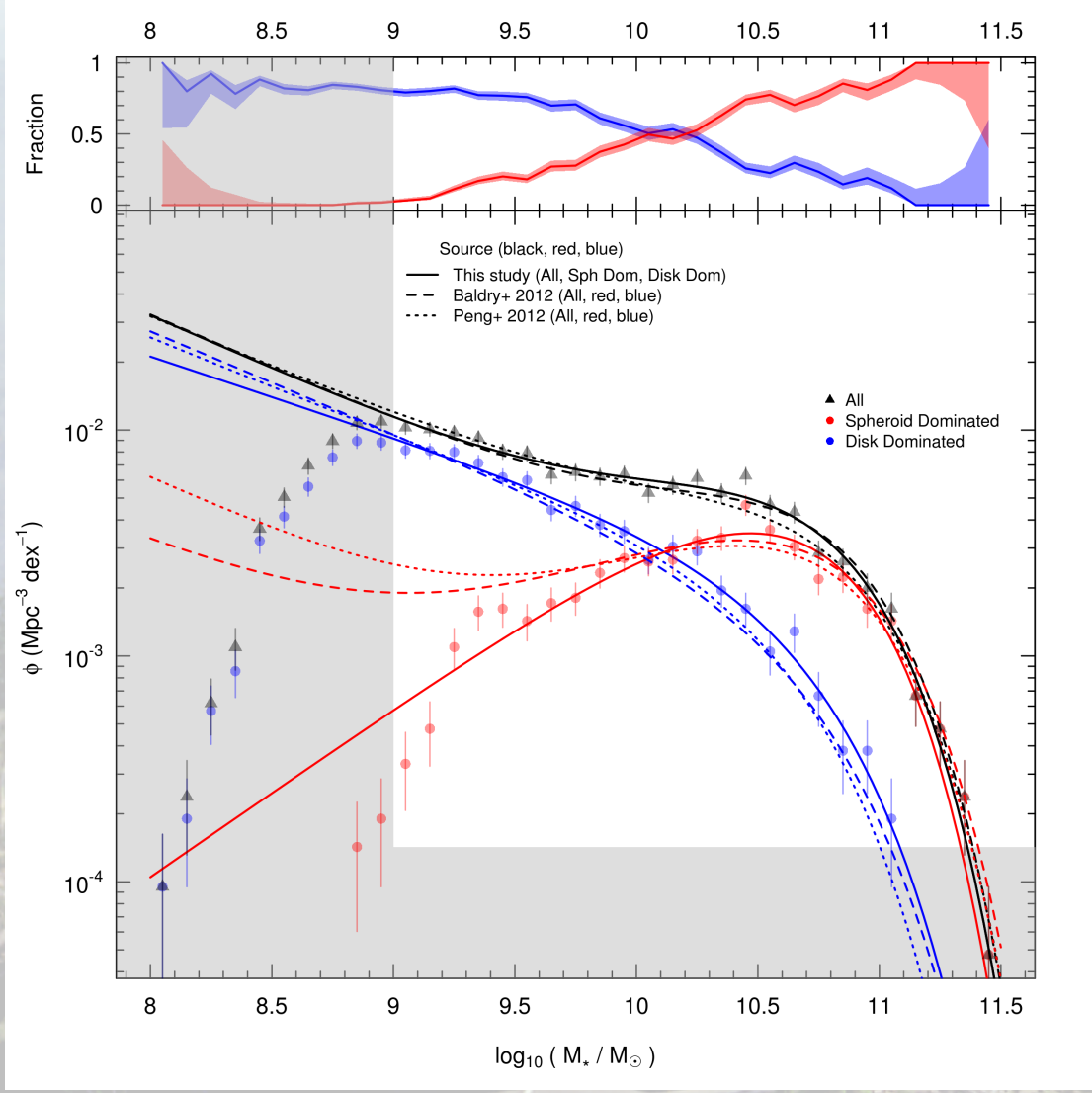
Single Schechter poor fit to E and Sab-Scd pop

Adopting reasonable B/T values (e.g., Graham & Worley 2008)
50:50 spheroids:disks

Driver et al. 2007a,b
Gadotti 2009
Tasca & White 2011

Kelvin+ 2014b

SMFs by Dominant Component



Total: Double Schechter

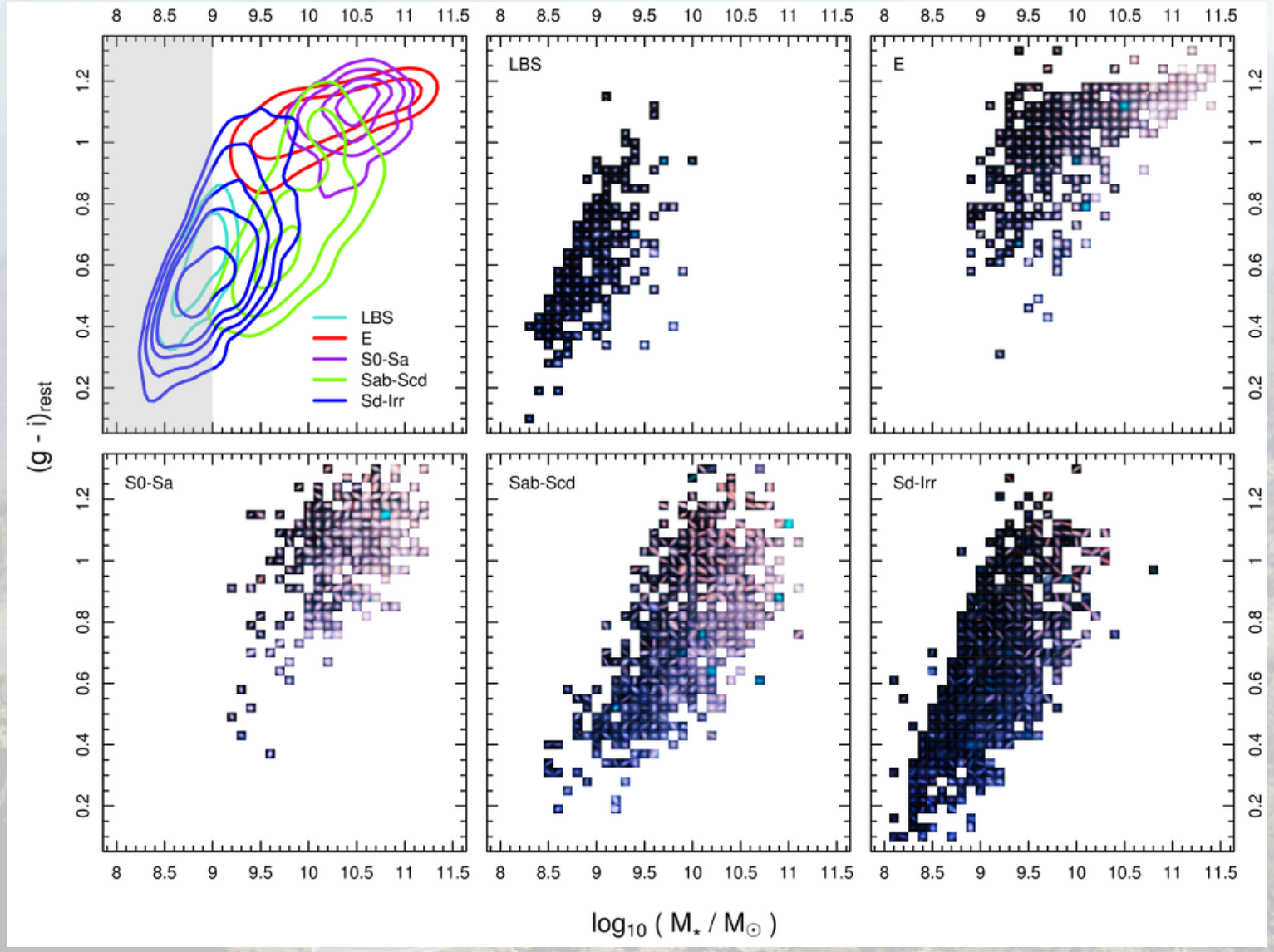
DComp: Single Schechter

Significant low-mass discrepancy between comparison red/blue populations and our Spheroid dominated/disk dominated populations

Late-type contamination of colour selected sample?

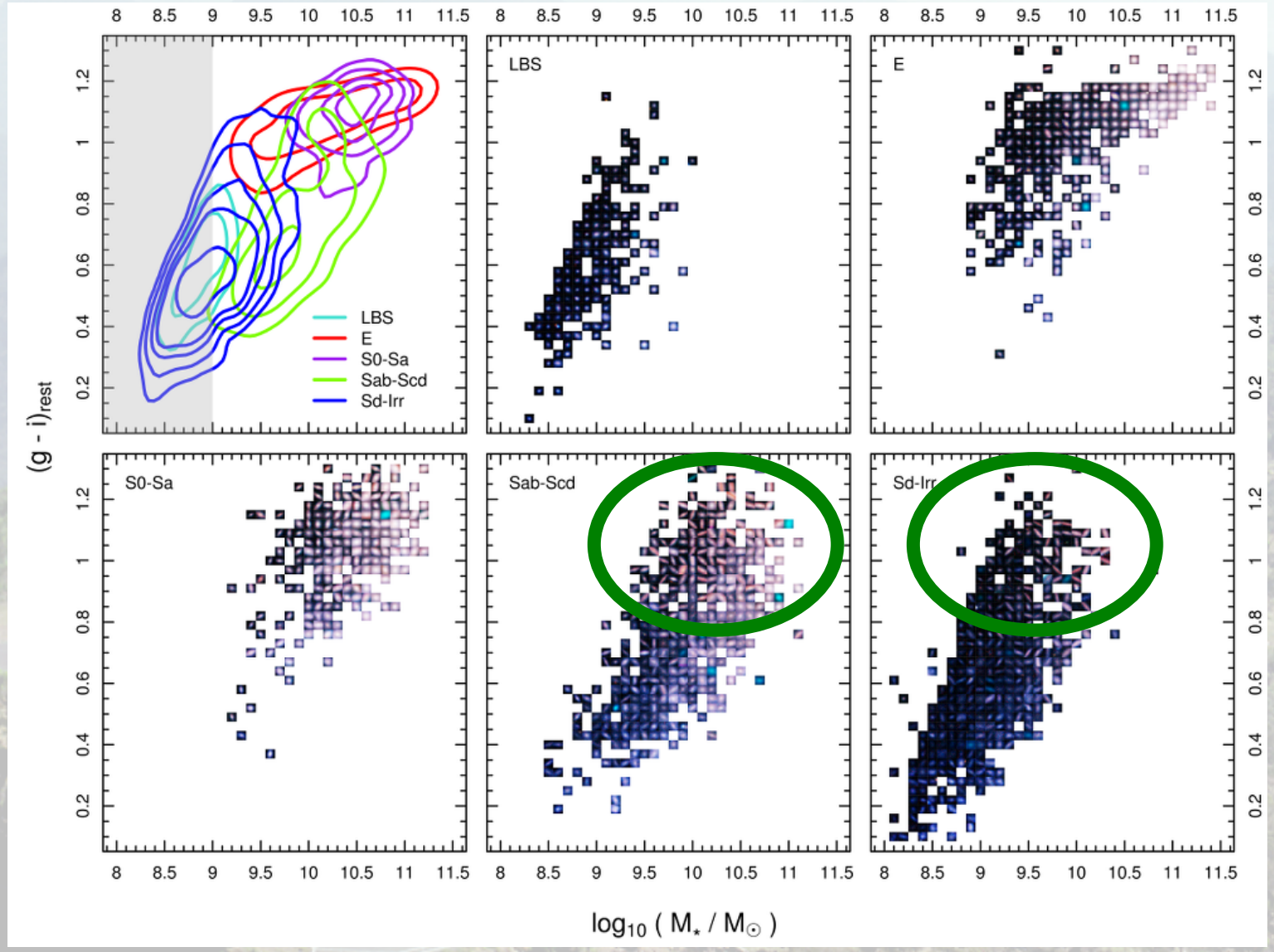
Kelvin+ 2014b

Colour-Mass



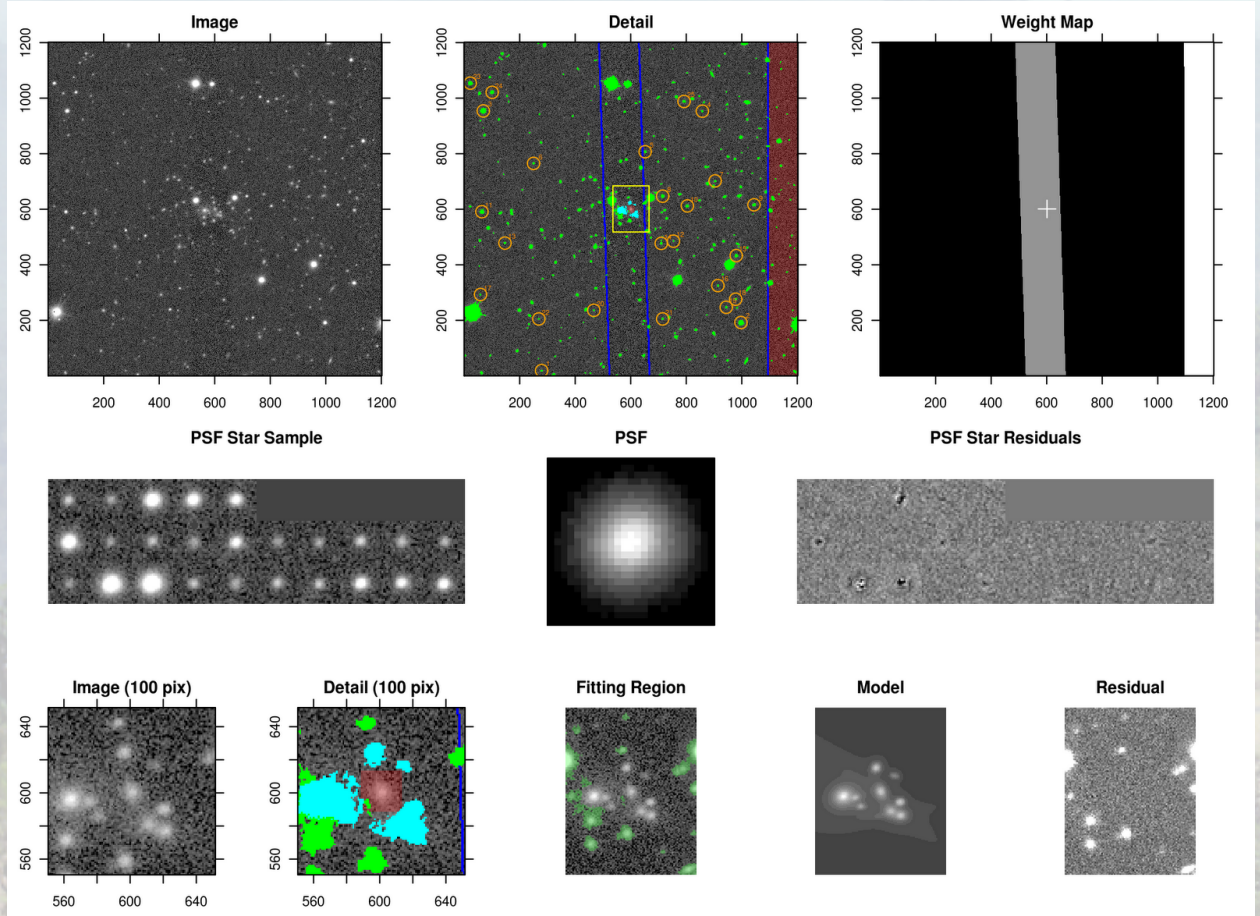
Colour-Mass

Caution!
Colour ≠ structure



SIGMA

Structural Investigation of Galaxies via Model Analysis



Imaging & Pointing Data

400" x 400" cutout

Star identification

Empirical PSF

Galaxy detection

Sérsic modelling

Model self-check

Value added results

Model Fit Parameters

SExtractor Bertin+ 1996

PSFEx Bertin 2011

GALFIT3 Peng+ 2010

José Luis Sérsic

$$I(r) = I_e \exp\left[-b_n\left(\left(\frac{r}{r_e}\right)^{1/n} - 1\right)\right]$$

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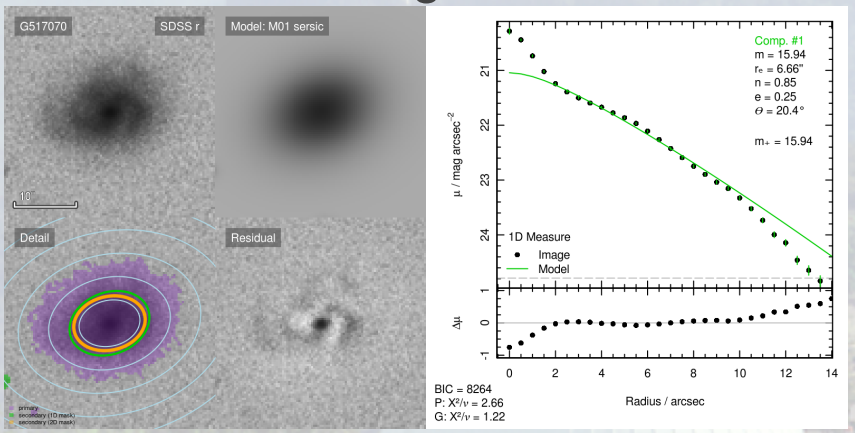
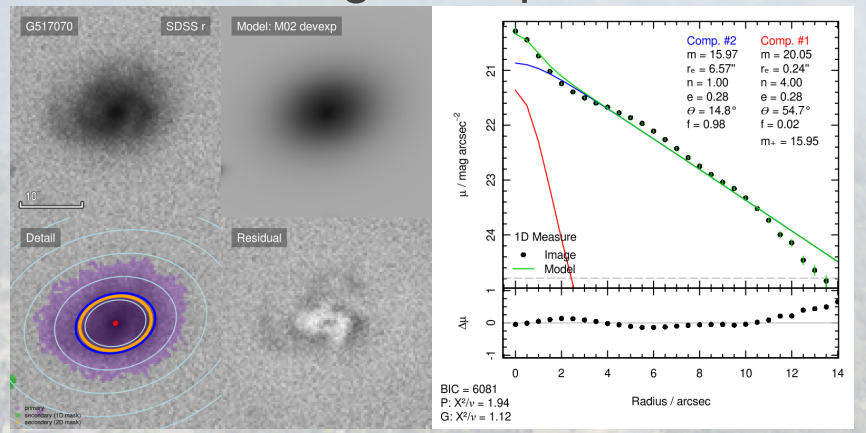
Multi-Component Models

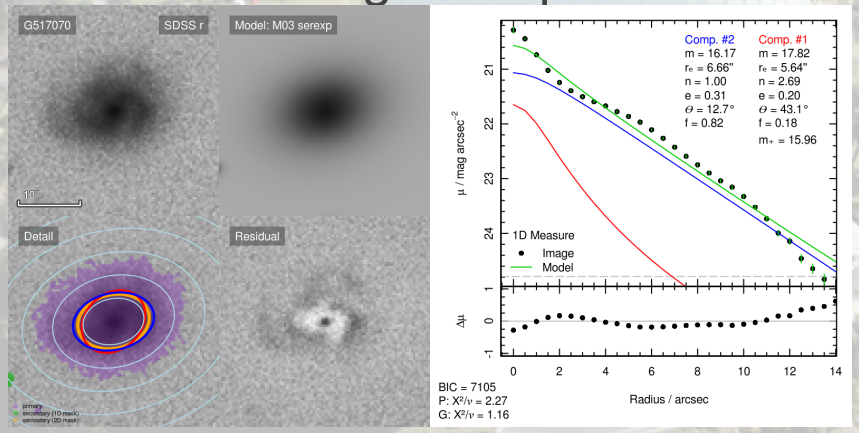
M01: Single-Sérsic



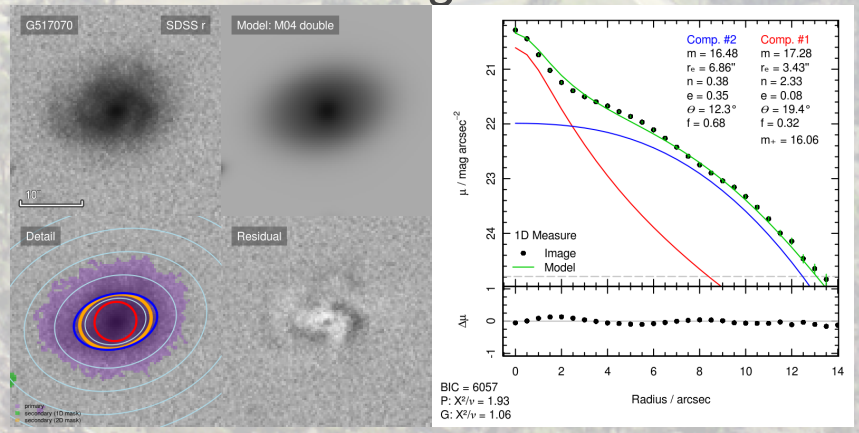
M02: DeV bulge + exponential disk



M03: Sérsic bulge + exponential disk

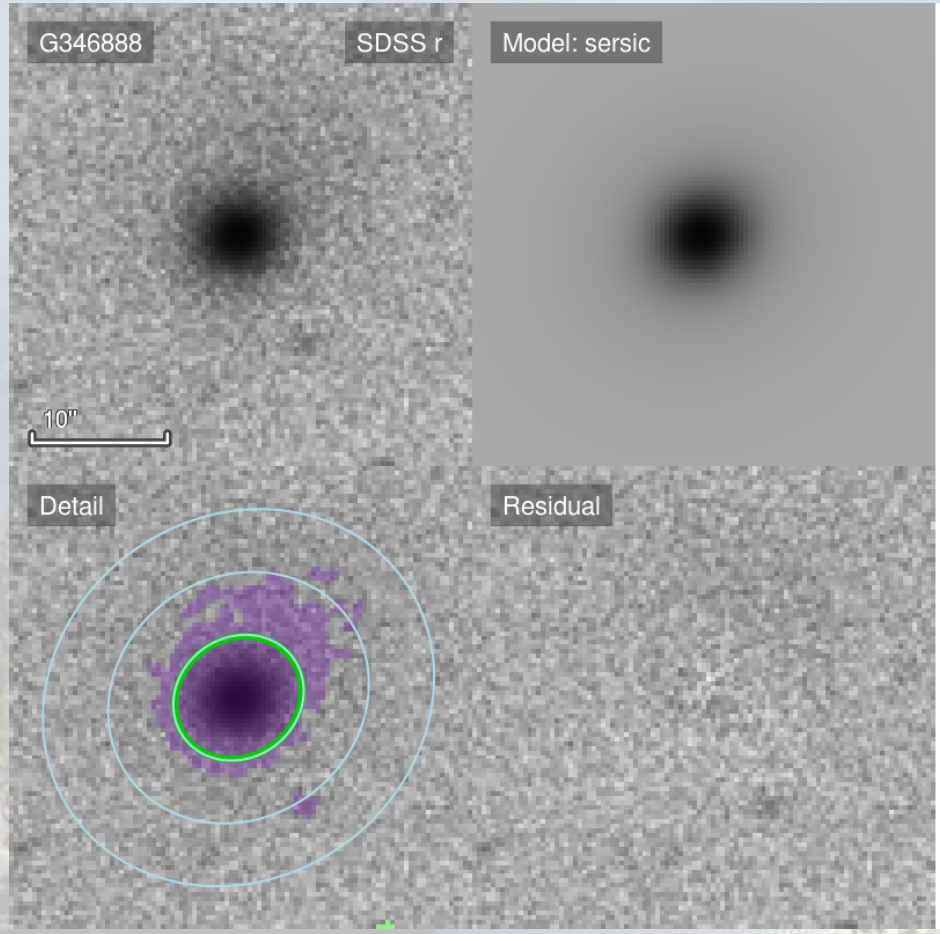


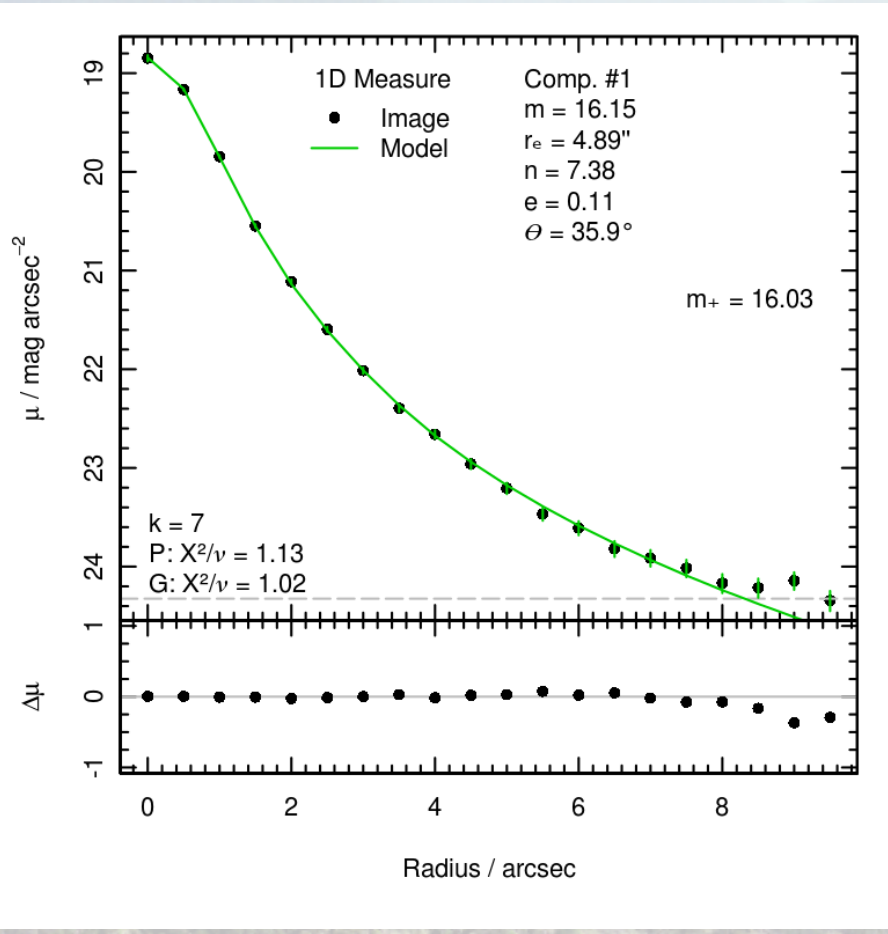
M04: Sérsic bulge + Sérsic disk



Elliptical: G346888

M01: Single-Sérsic





Elliptical: G346888

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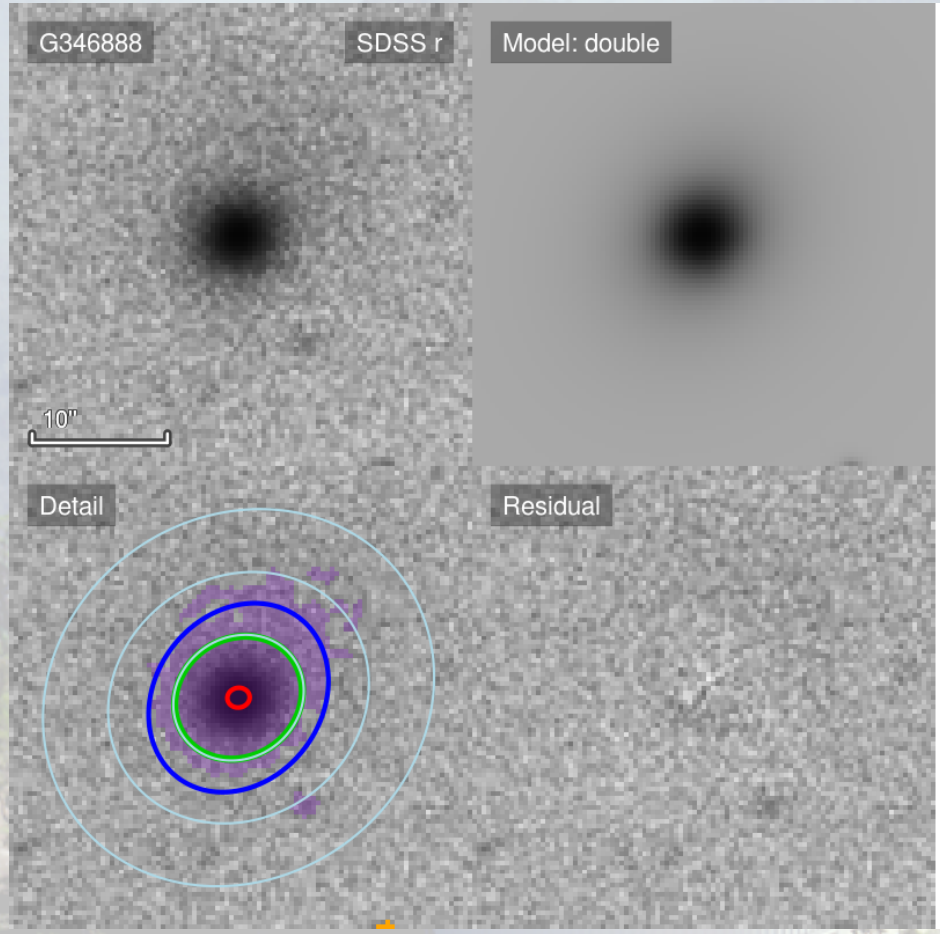

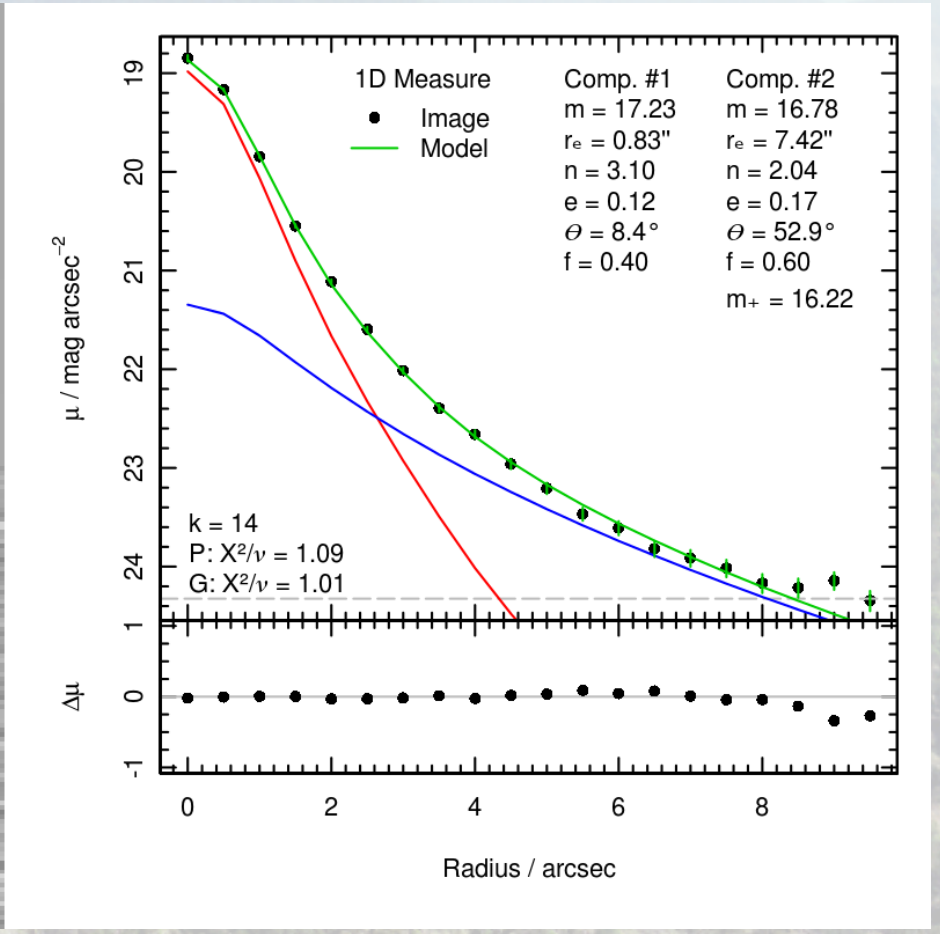

Model Choice

How do we select the 'best' model?

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Bayesian Information Criterion:

$$\mathrm{BIC} = \chi^2 + k \cdot \ln(n)$$

x^2	total goodness of fit
k	number of free parameters
n	number of contributing pixels

Model Choice

How do we select the 'best' model?

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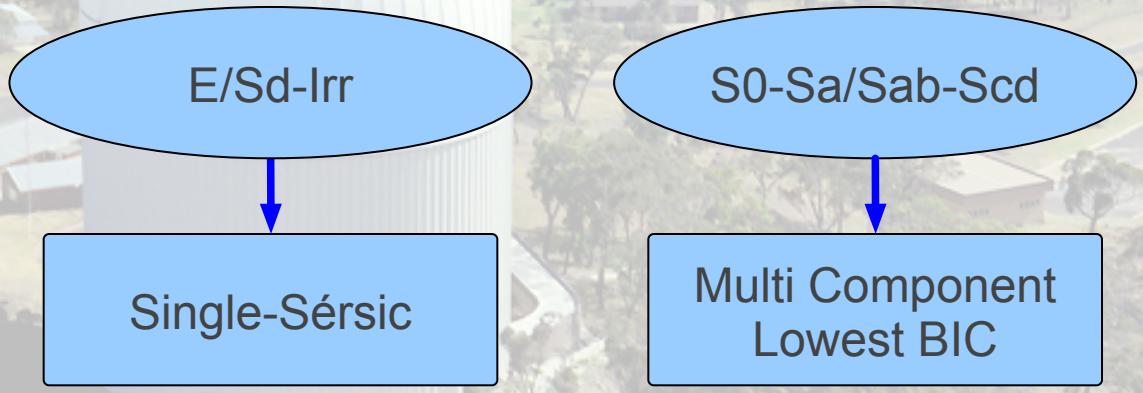
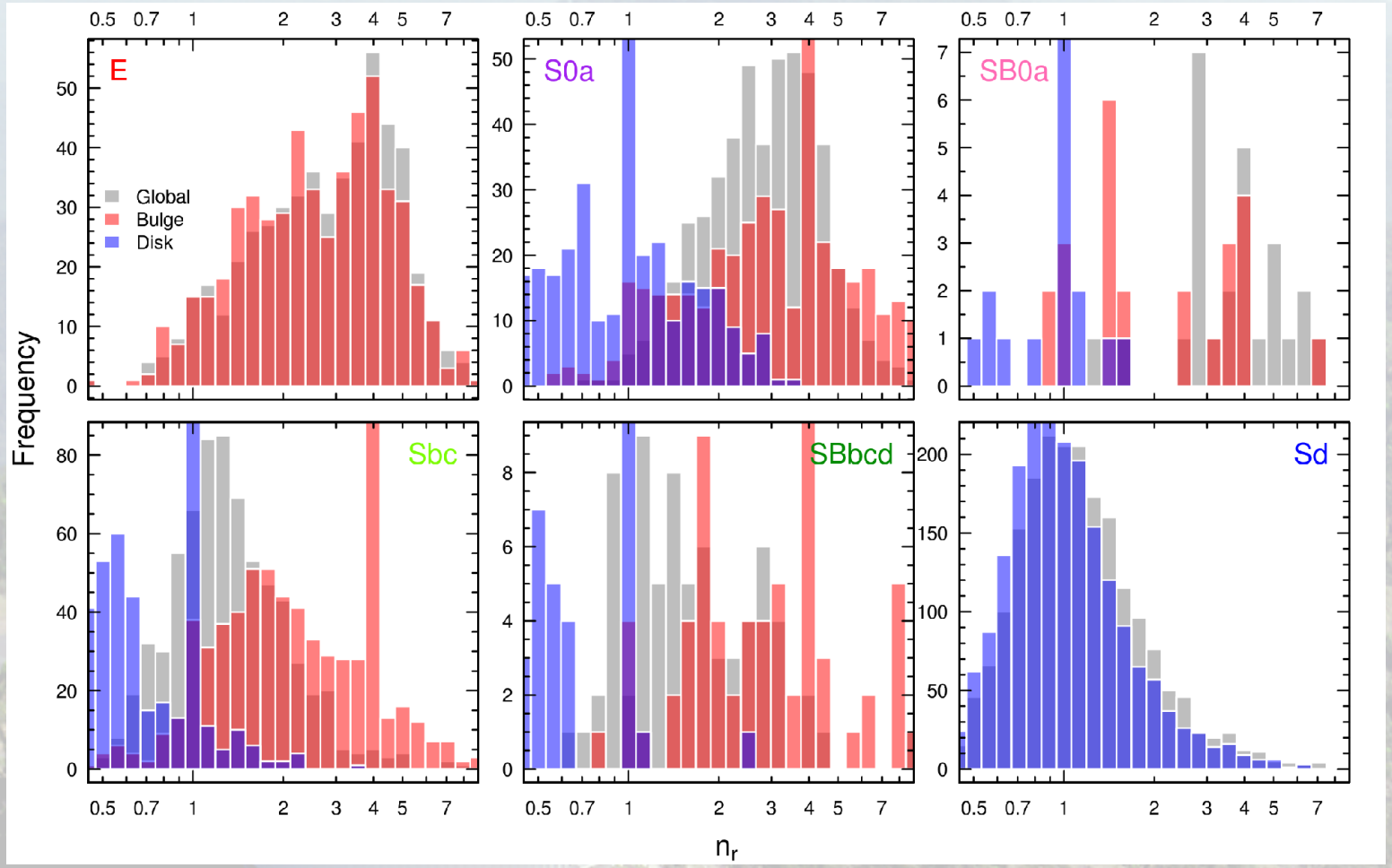
Use visual classifications as a guide:



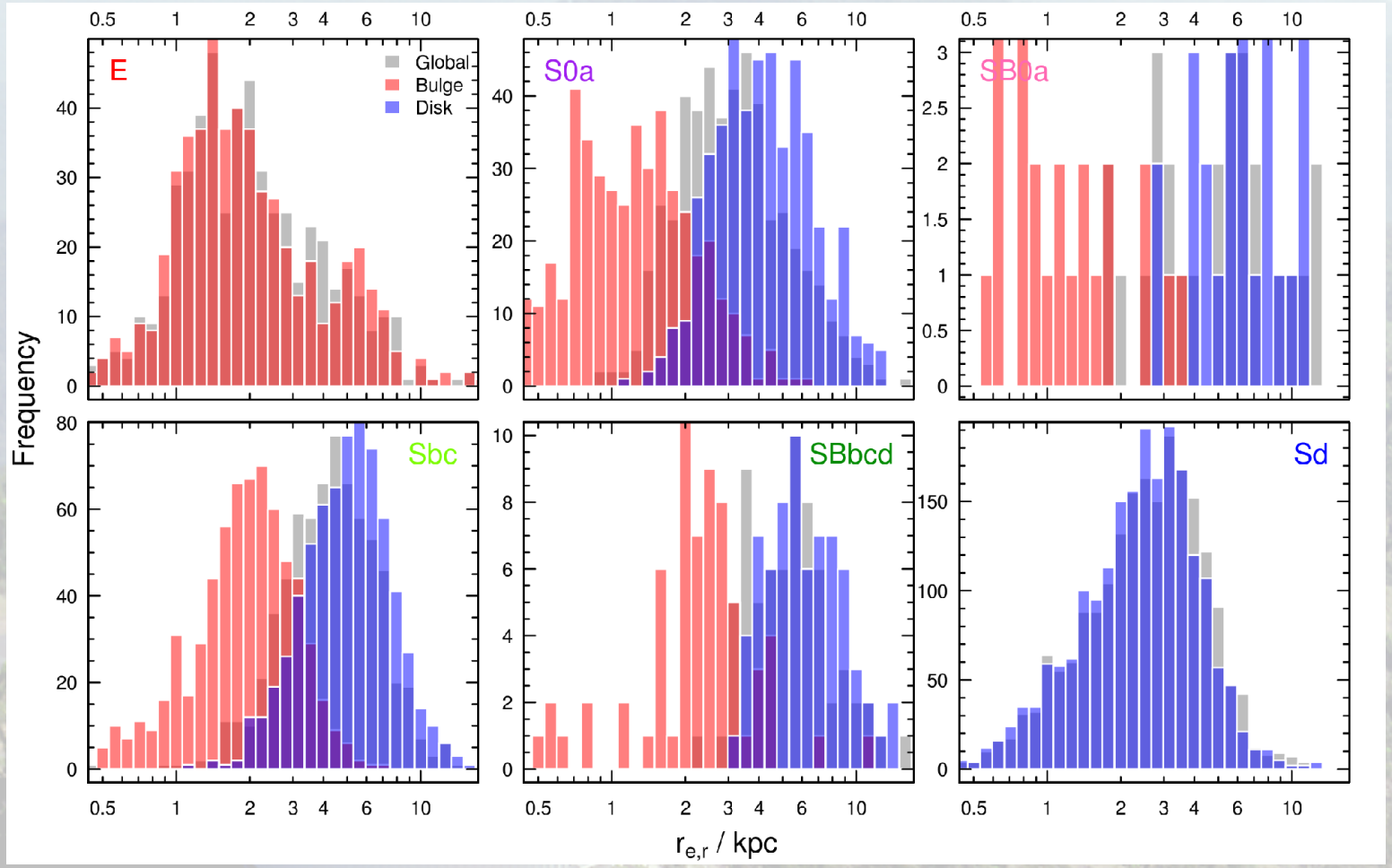
Structural Results

Sérsic Index

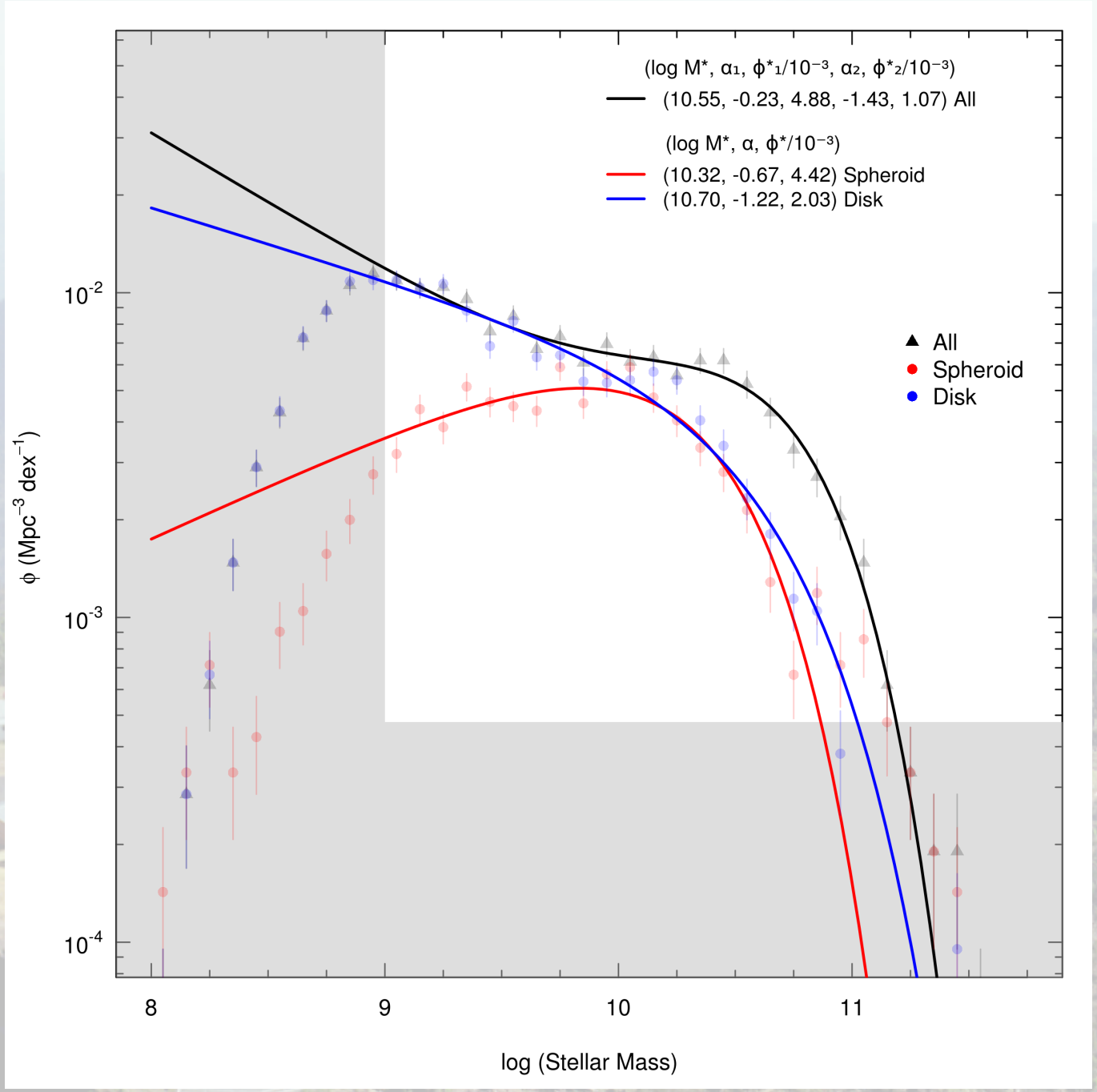


Structural Results

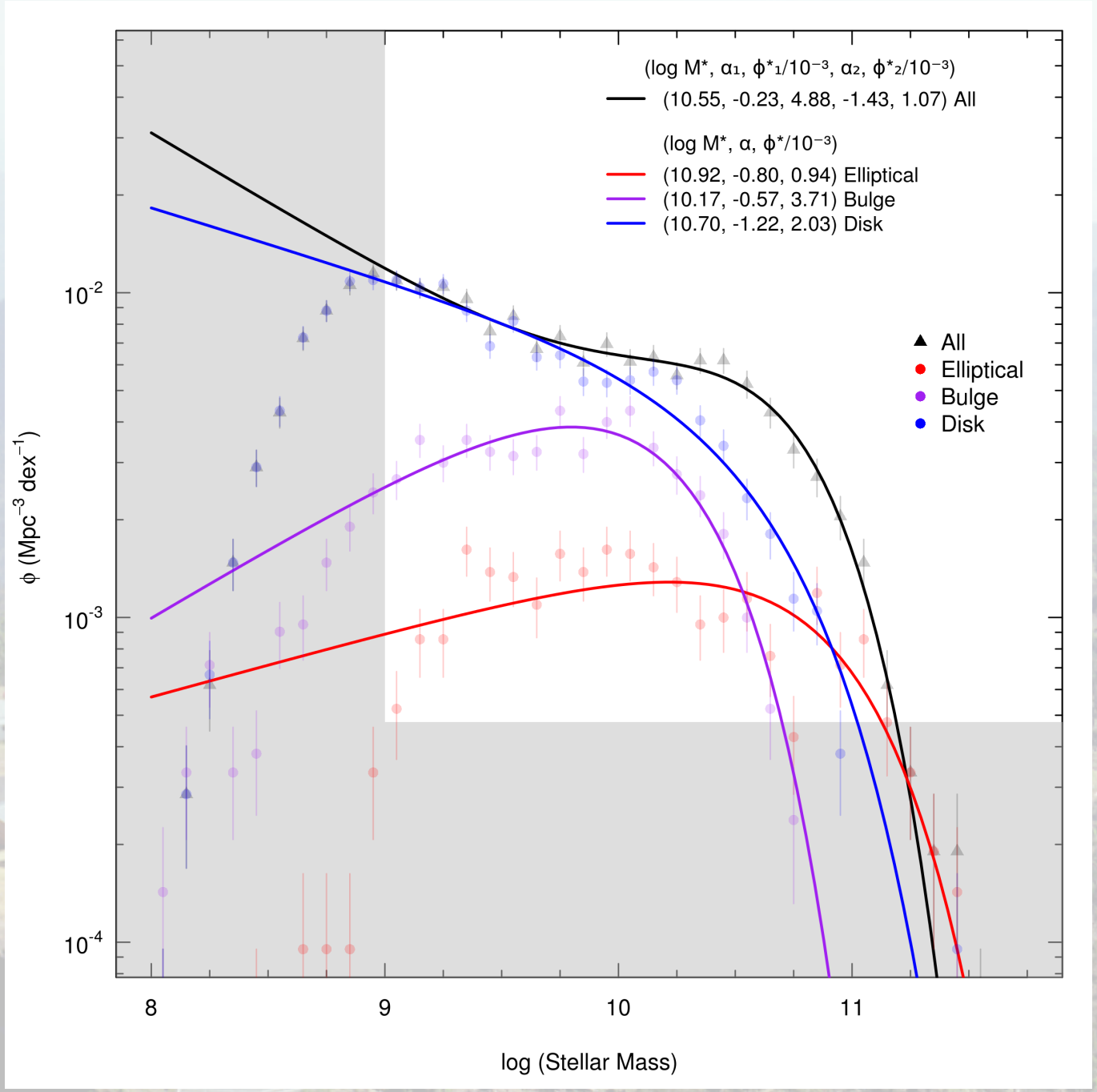
Half-Light Radius



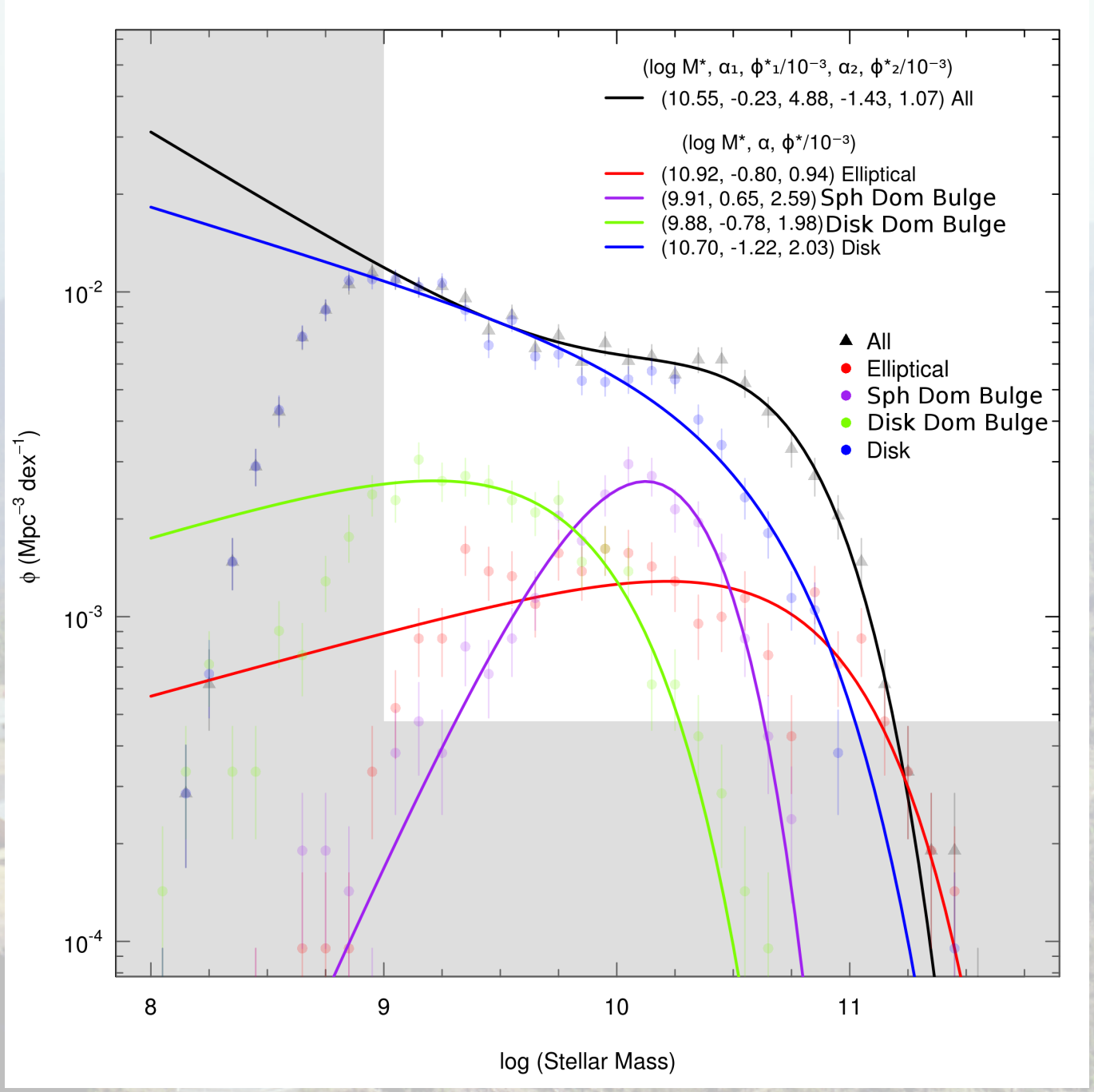
Stellar Mass Fns 3



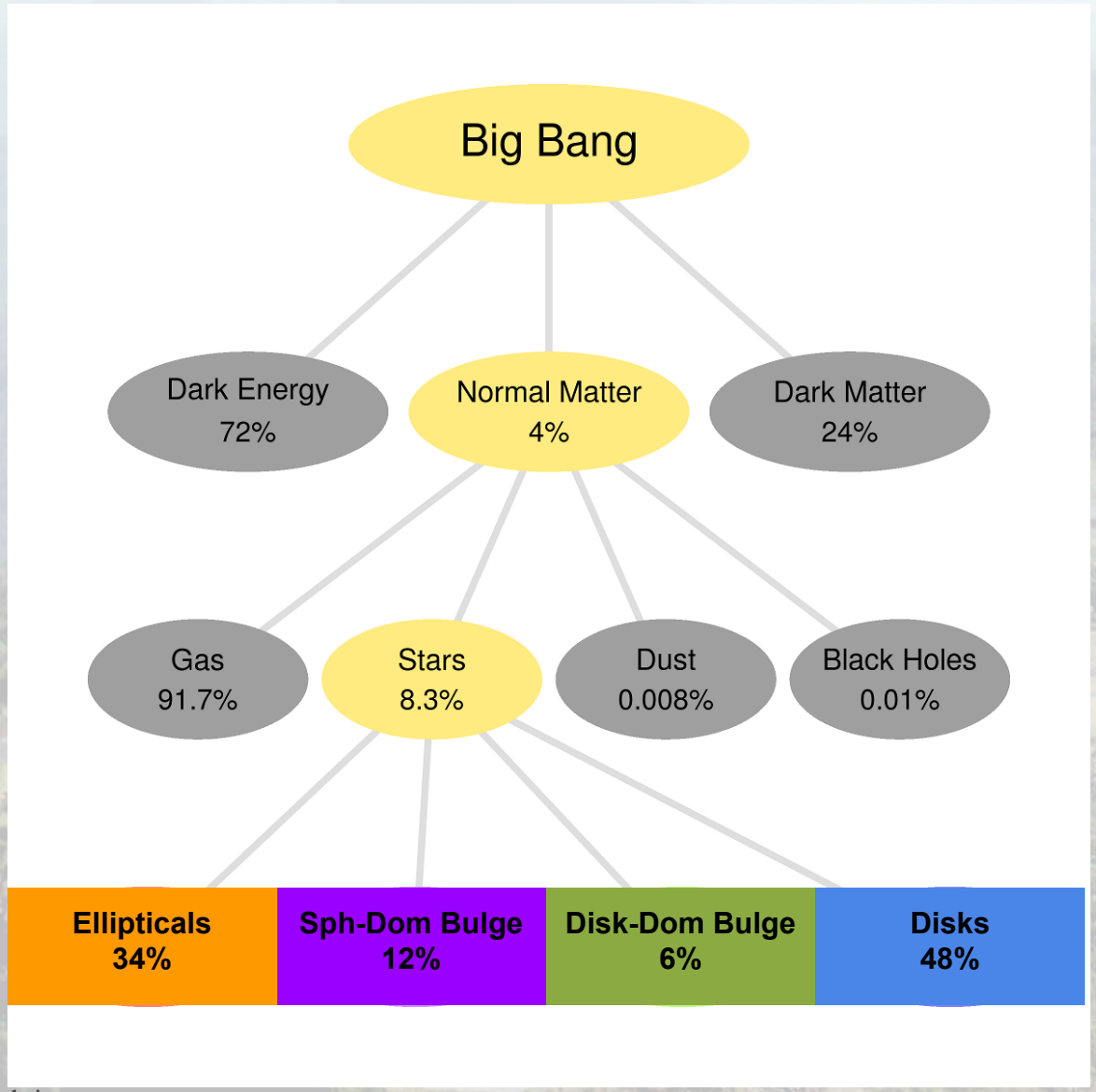
Stellar Mass Fns 4



Stellar Mass Fns 5



Structural Results



Gadotti 2009

E : bulge : disk : bar
32 : 28 : 36 : 4

Summary

Sample: $0.025 < z < 0.06$, $\log M_* > 9.0$

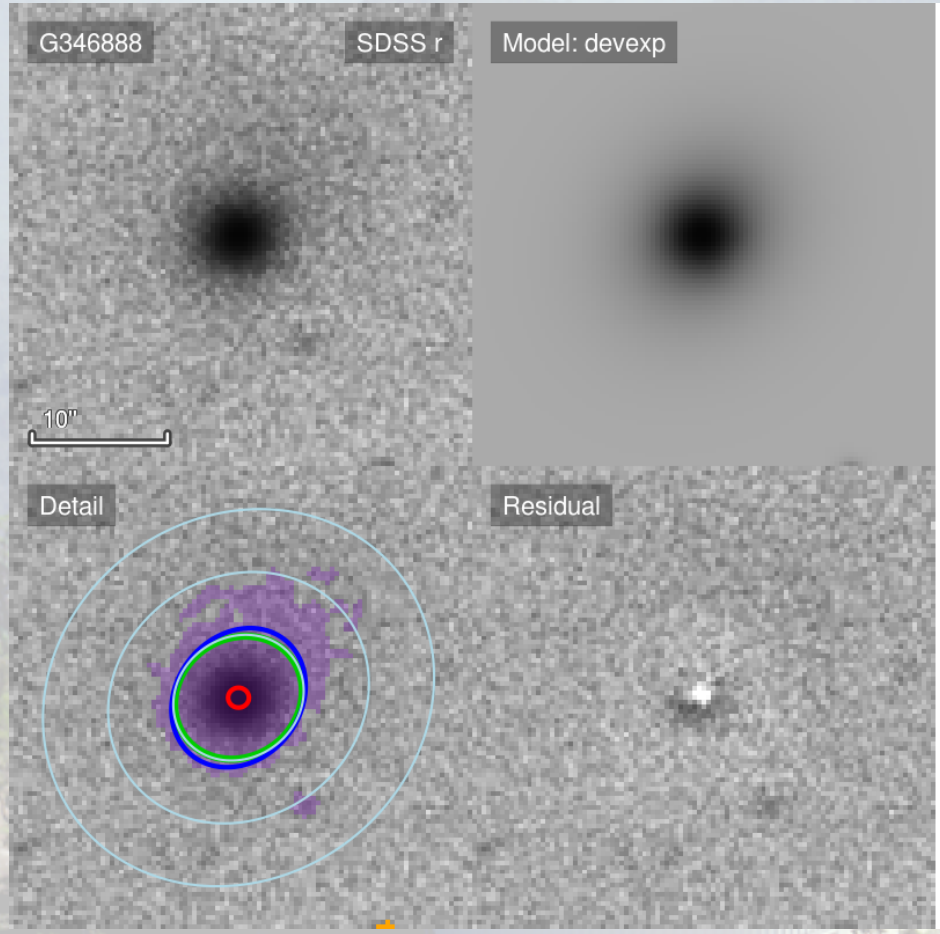
Mass division by **type**
E : S0-Sa : Sab-Scd of Sd-Irr of 34 : 37 : 24 : 5

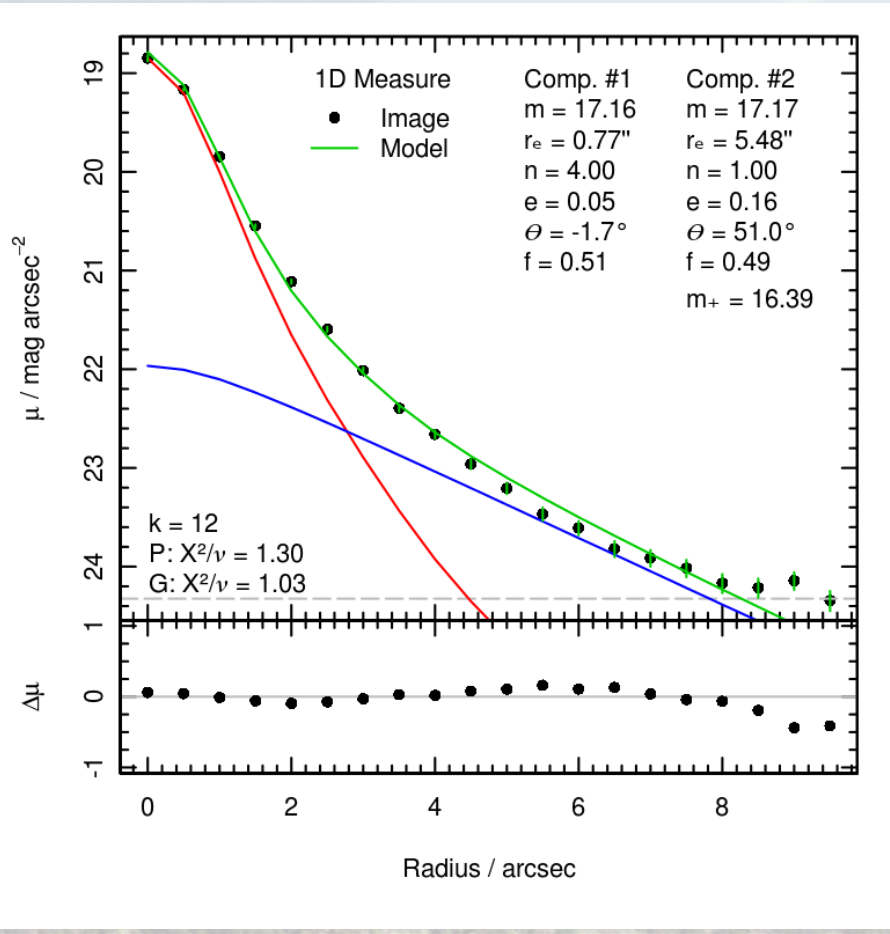
Mass division by **dominant component**
spheroid-dominated : disk-dominated of 71 : 29

Mass division by **structure**
E : bulge : disk of 34 : 18 : 48

Elliptical: G346888

M02: De Vaucouleurs bulge + exponential disk





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