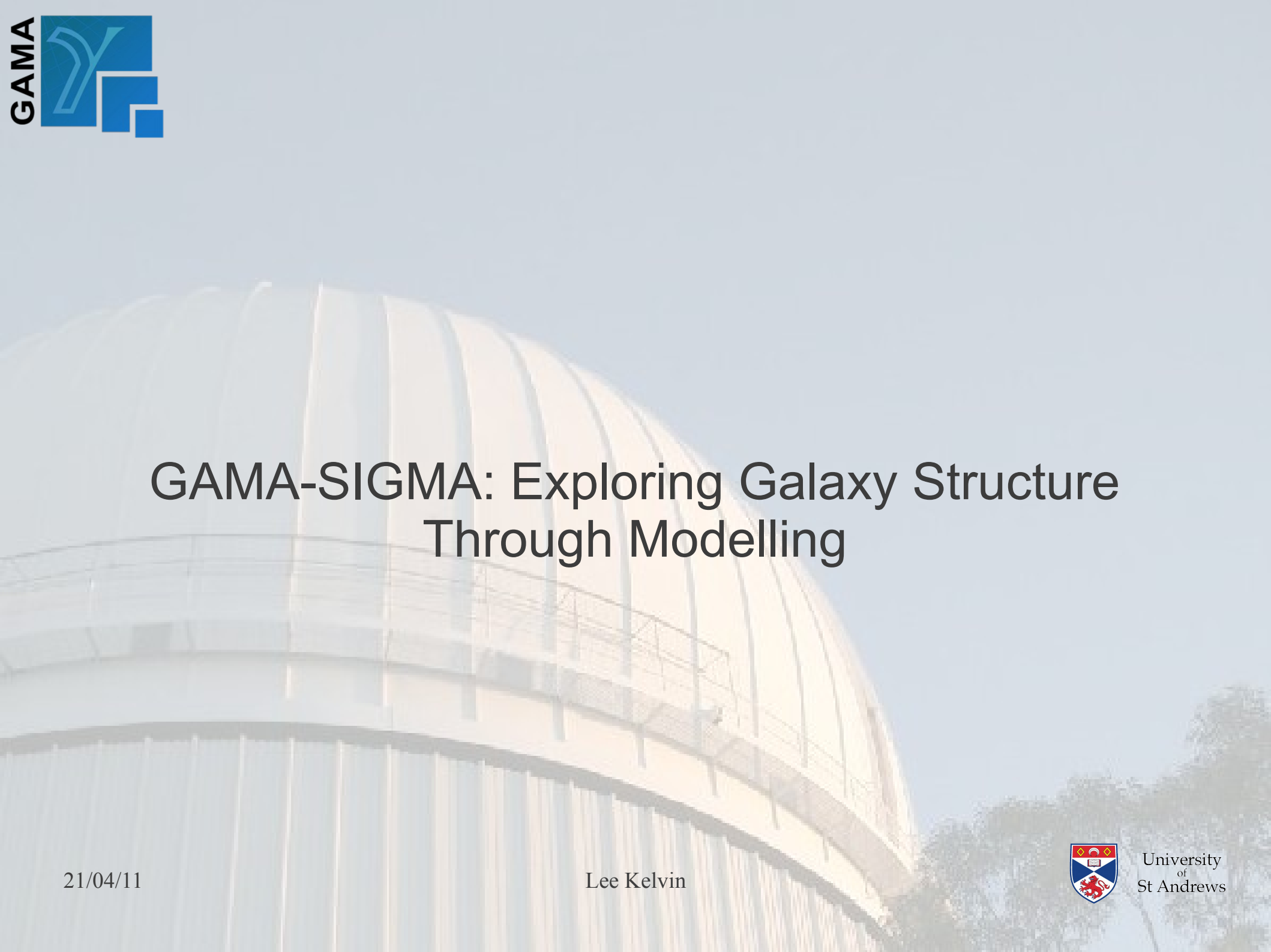


GAMA-SIGMA: Exploring Galaxy Structure Through Modelling

Lee Kelvin

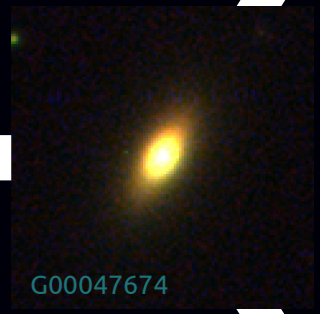
University of St Andrews

Galaxy And Mass Assembly (GAMA)
Hubble Tuning-Fork

Groups/ Mergers

Unbarred Spirals

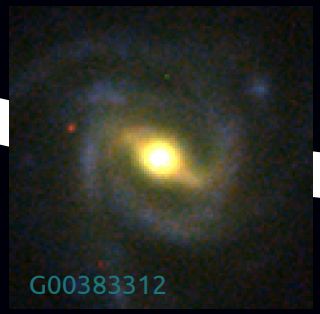
Ellipticals



GAMA

Irregulars

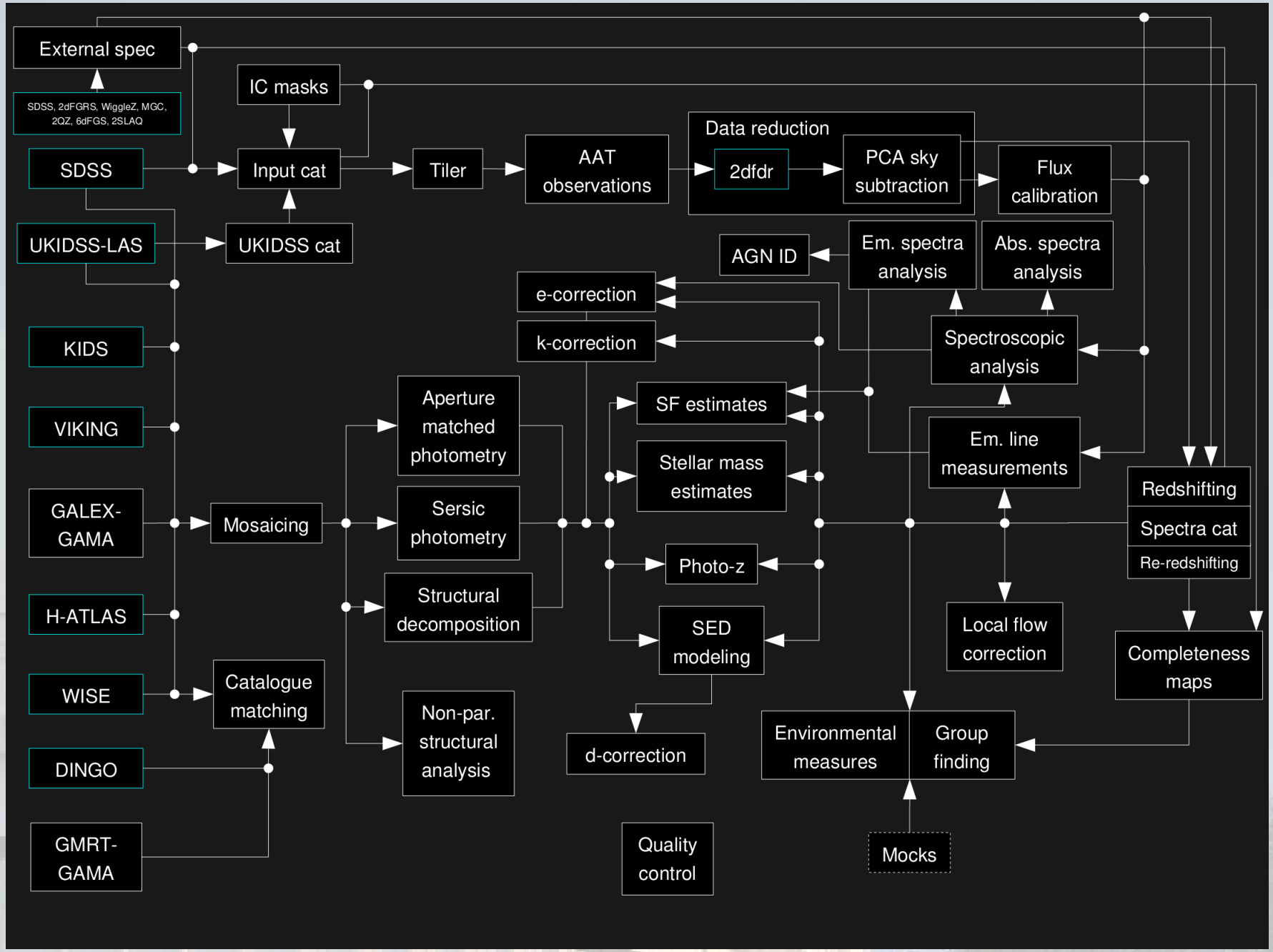
Edge-on Spirals



Barred Spirals

Kru 40"×40"

Dataflow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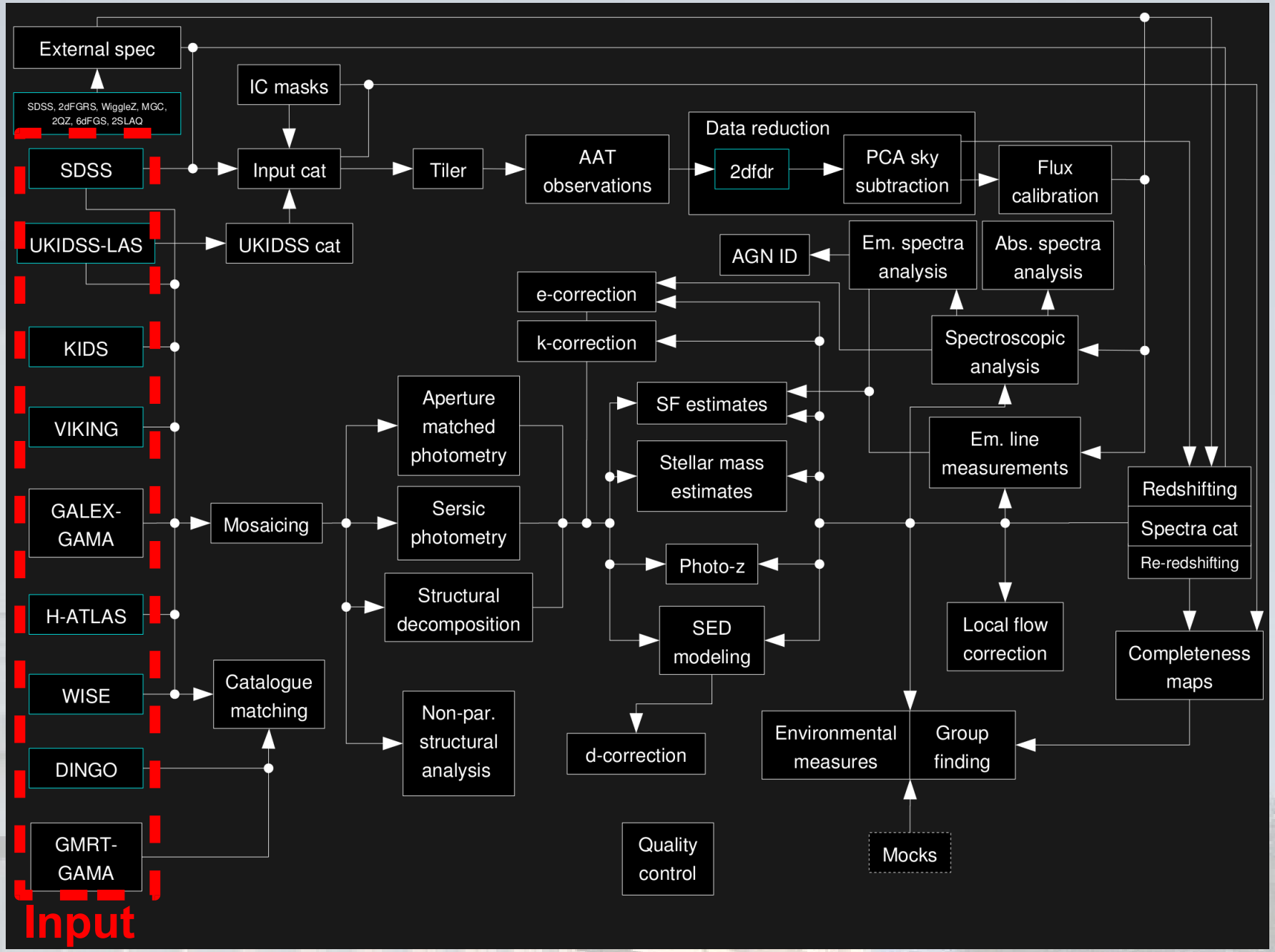
IC masks
SDSS
Input cat
Tiler
AAT observations
Data reduction
2dfdr
PCA sky subtraction
Flux calibration
UKIDSS-LAS
UKIDSS cat
AGN ID
Em. spectra analysis
Abs. spectra analysis
e-correction
k-correction
Spectroscopic analysis
KIDS
VIKING
Aperture matched photometry
SF estimates
Em. line measurements
Stellar mass estimates
GALEX-GAMA
Mosaicing
Sersic photometry
Redshifting
Spectra cat
Re-redshifting
Photo-z
H-ATLAS
Structural decomposition
SED modeling
Local flow correction
Completeness maps
WISE
Catalogue matching
Non-par. structural analysis
d-correction
Environmental measures
Group finding
DINGO
GMRT-GAMA
Quality control
Mocks

Dataflow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GMRT-GAMA
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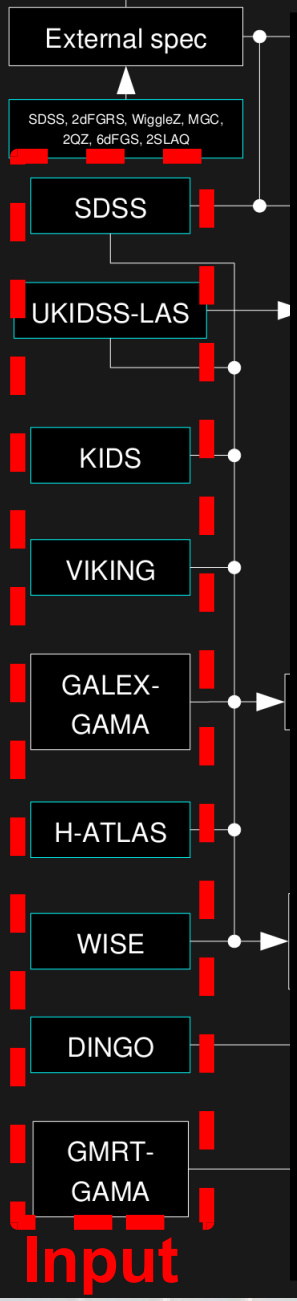
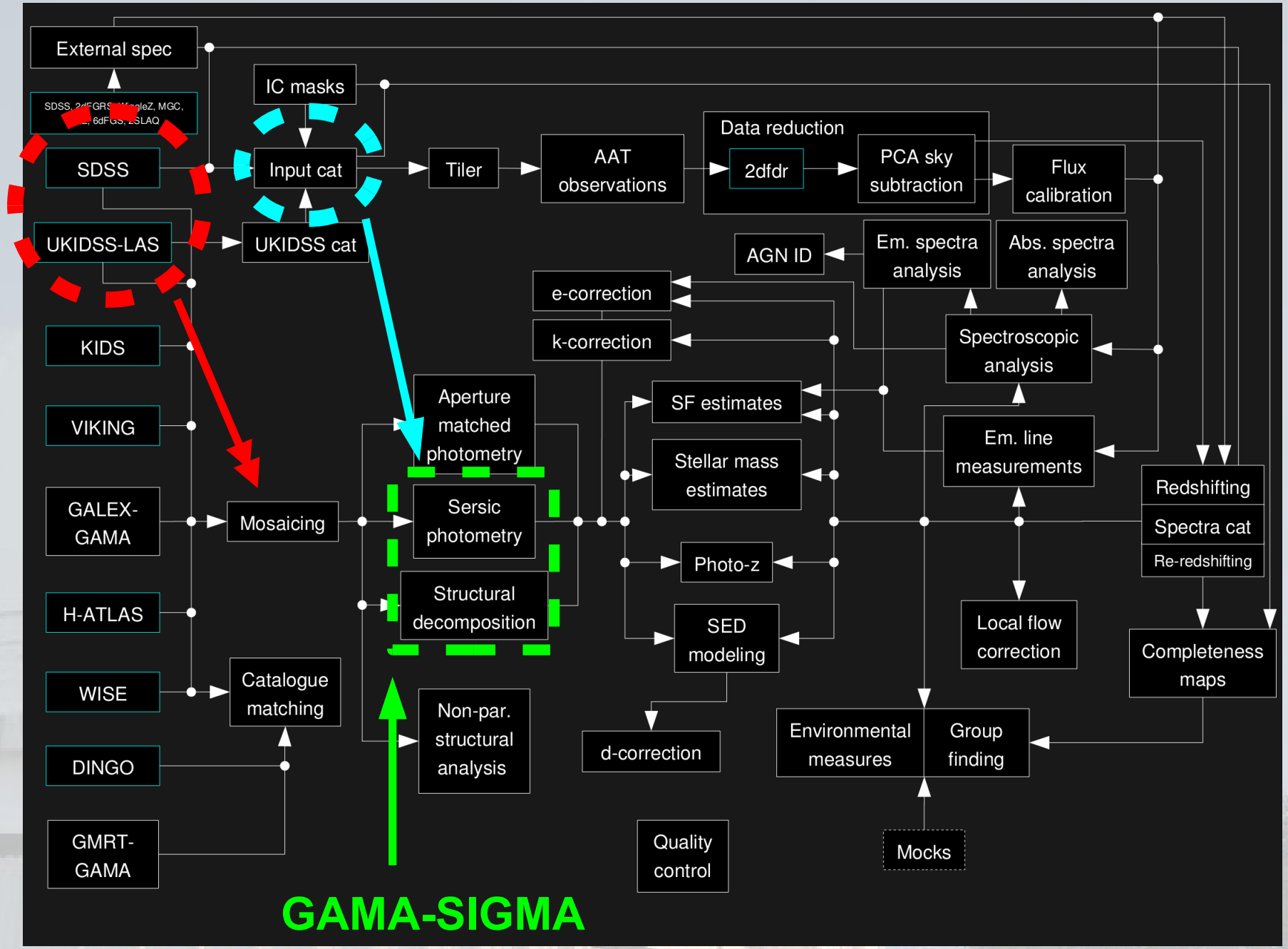
Mocks
Input

Dataflow



- Measure structural properties of a huge number (100,000s) of galaxies in an automated, repeatable, rapid and high fidelity manner.
- Use multi-wavelength data to trace different stellar populations within galaxies.
- This information allows us to infer the underlying dynamical and morphological properties.
- Ultimately we want to understand the evolution and formation of galaxies.

Dataflow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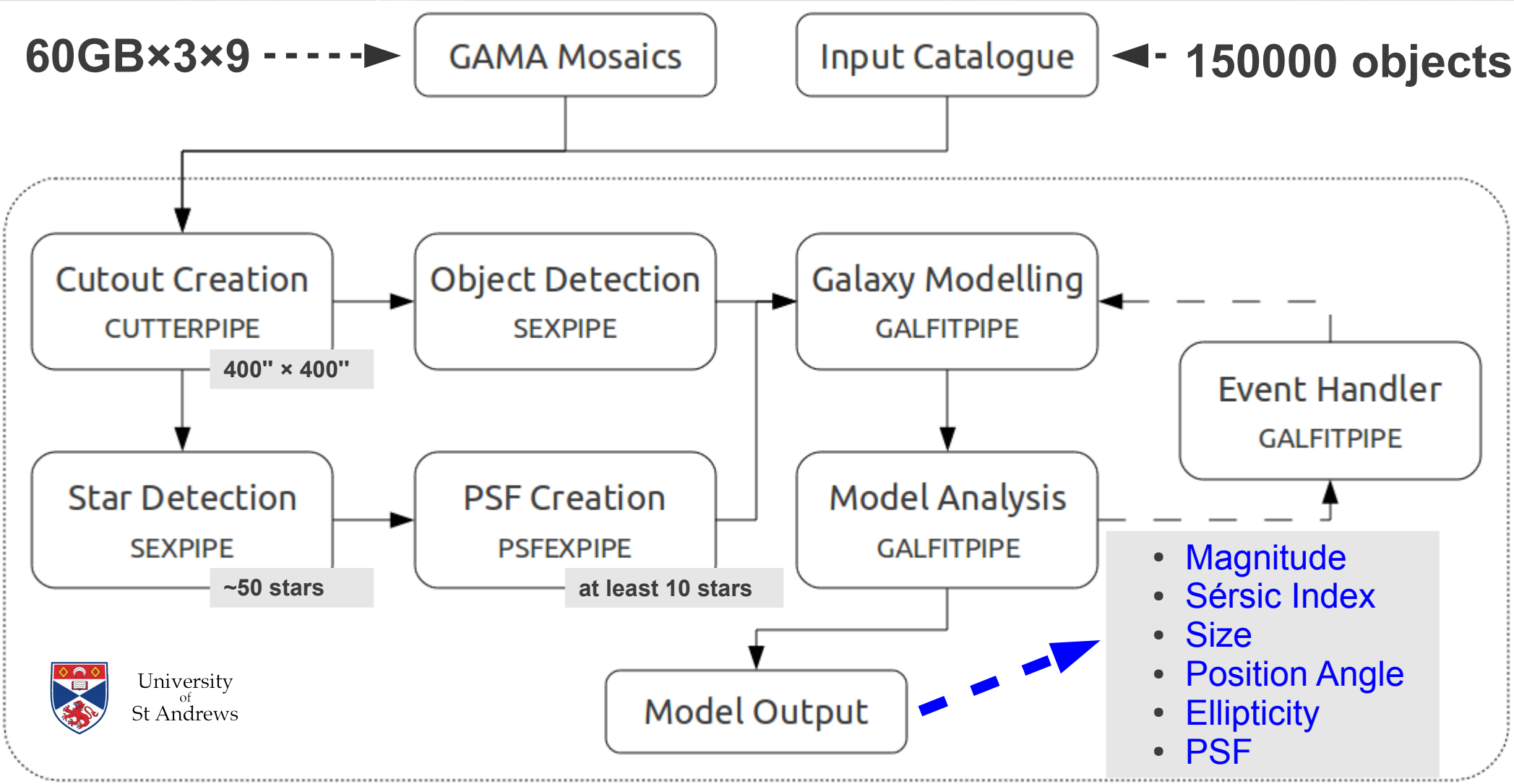
Group finding
DINGO
GMRT-GAMA
Quality control
Mocks
GAMA-SIGMA

GAMA-SIGMA

SIGMA: *Structural Investigation of Galaxies via Model Analysis*

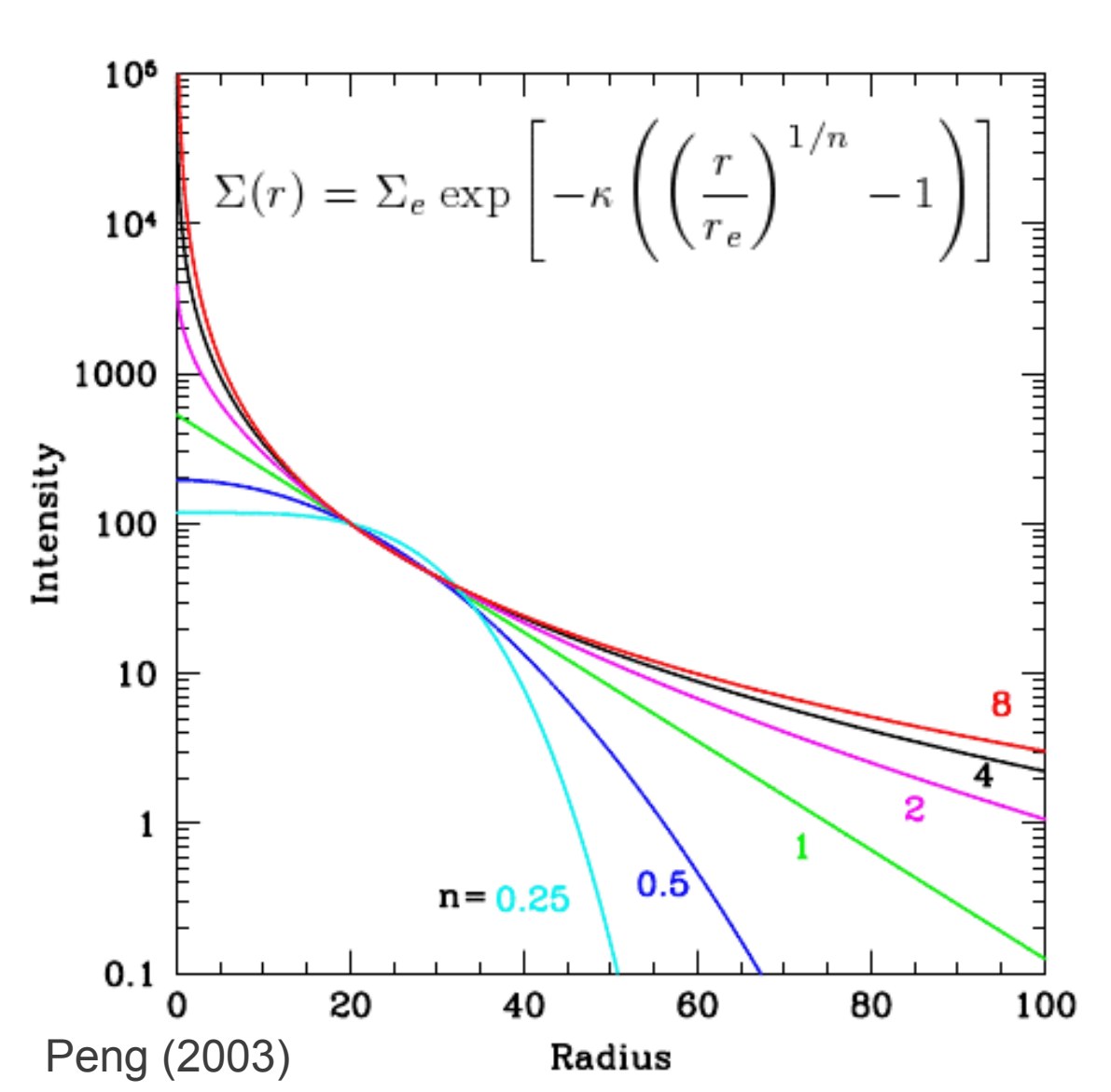
→ Written in R

→ Run time: 20 sec!



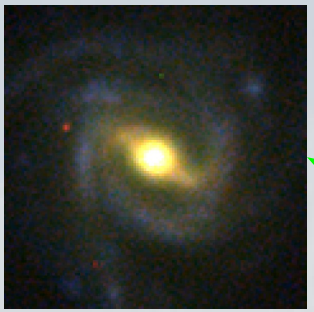
University of St Andrews

The Sérsic Profile



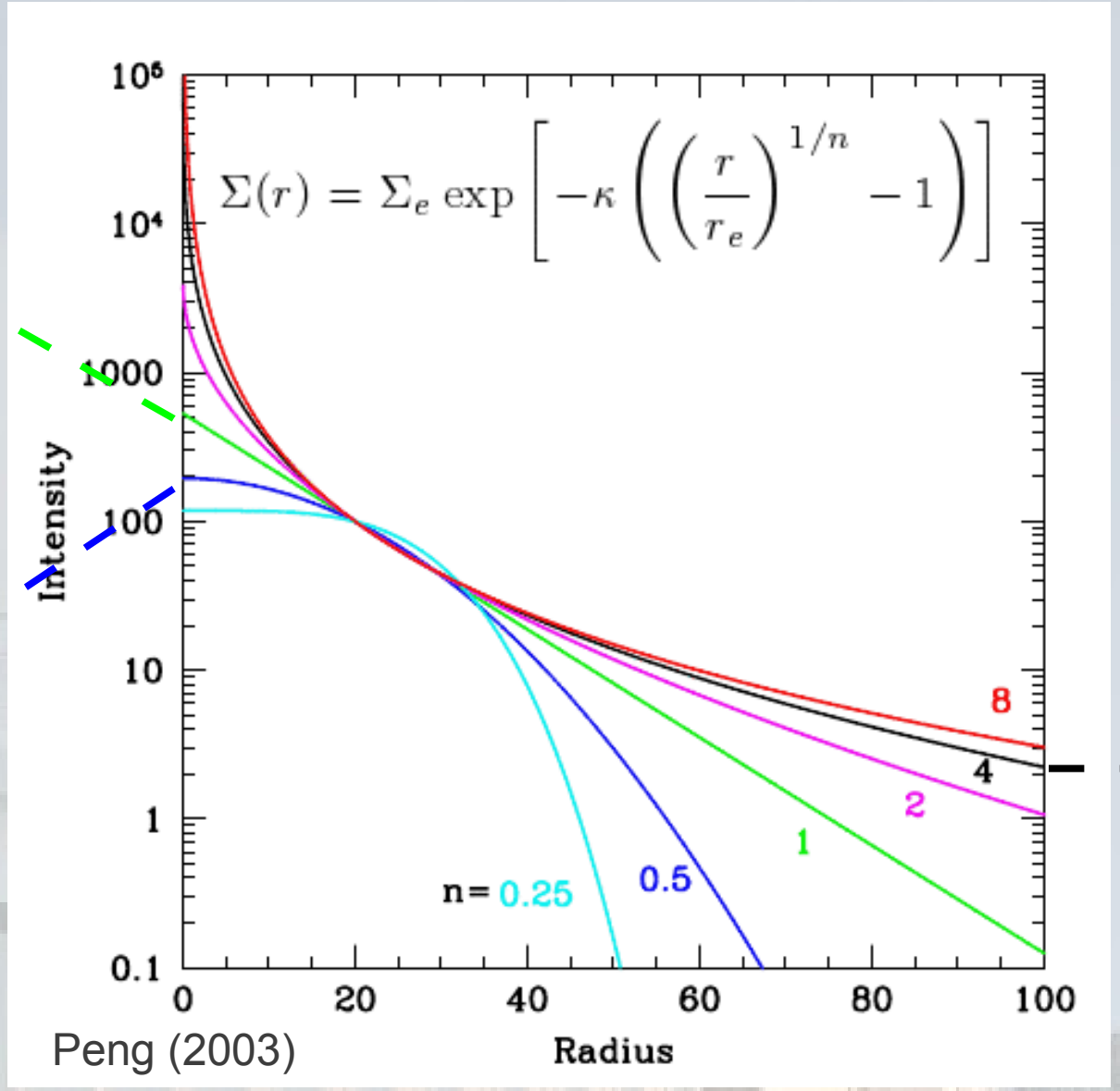
Jose Luis Sérsic, 1963

The Sérsic Profile



Exponential (eg – disks)

Gaussian (eg - stars)

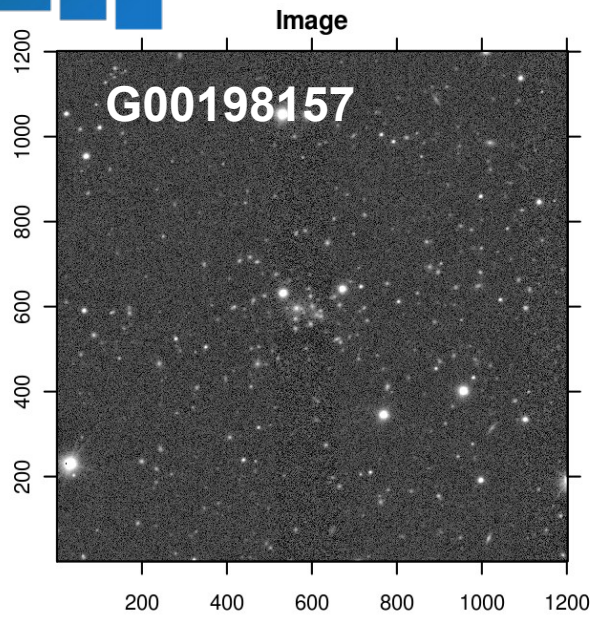


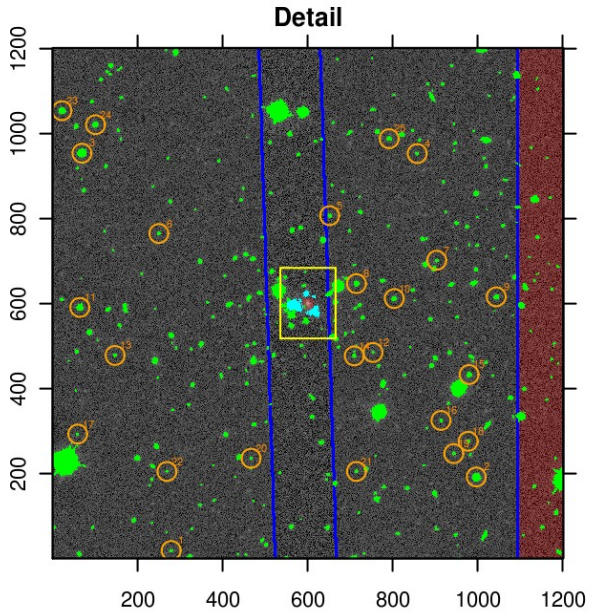
Peng (2003)

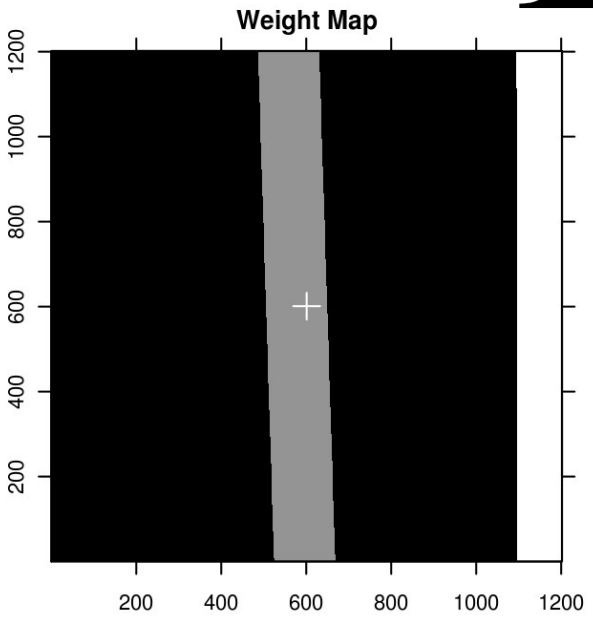
Jose Luis Sérsic, 1963

de Vaucouleur (eg – ellipticals/ bulges)

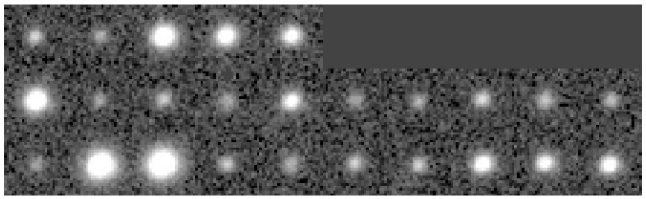
SIGMA



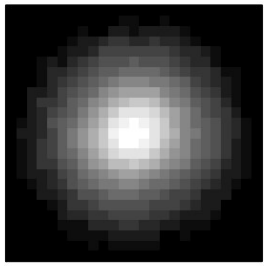




PSF Star Sample



PSF



PSF Star Residuals

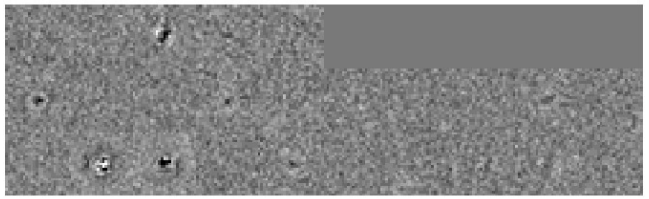
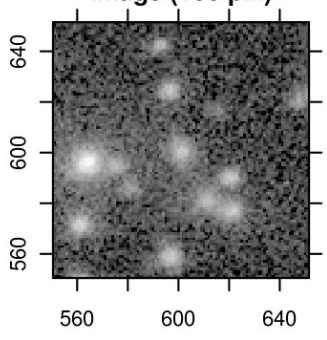
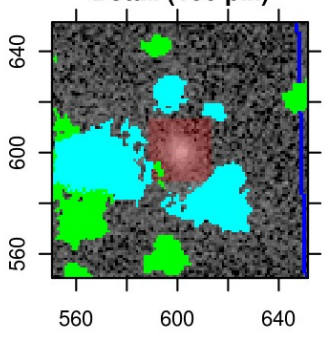


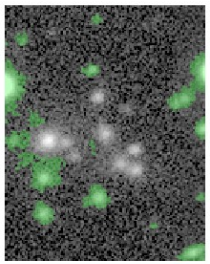
Image (100 pix)



Detail (100 pix)



Fitting Region



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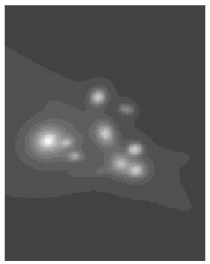
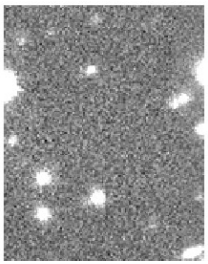


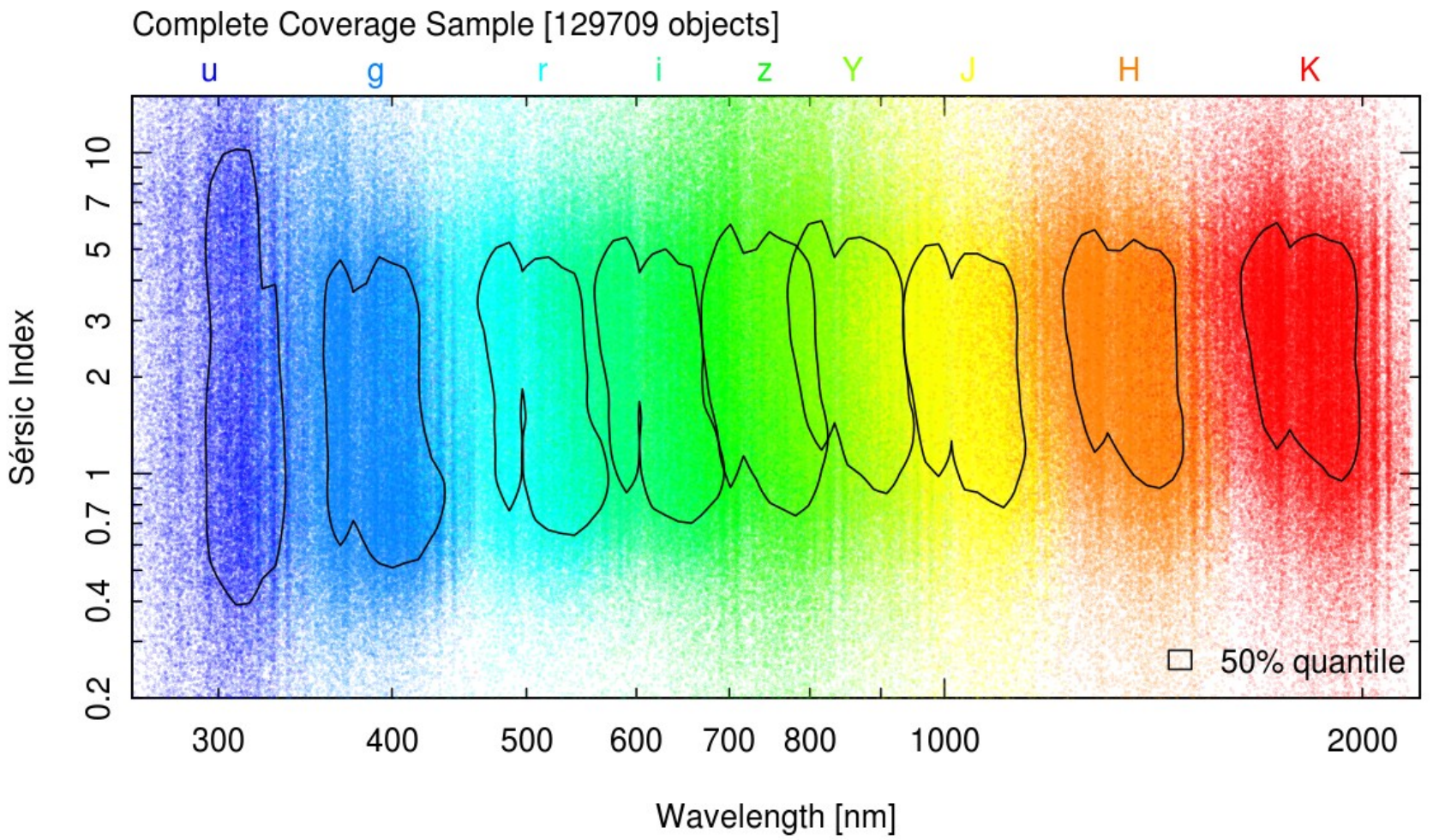
Residual



SIGMA: Global Distributions

u → K:

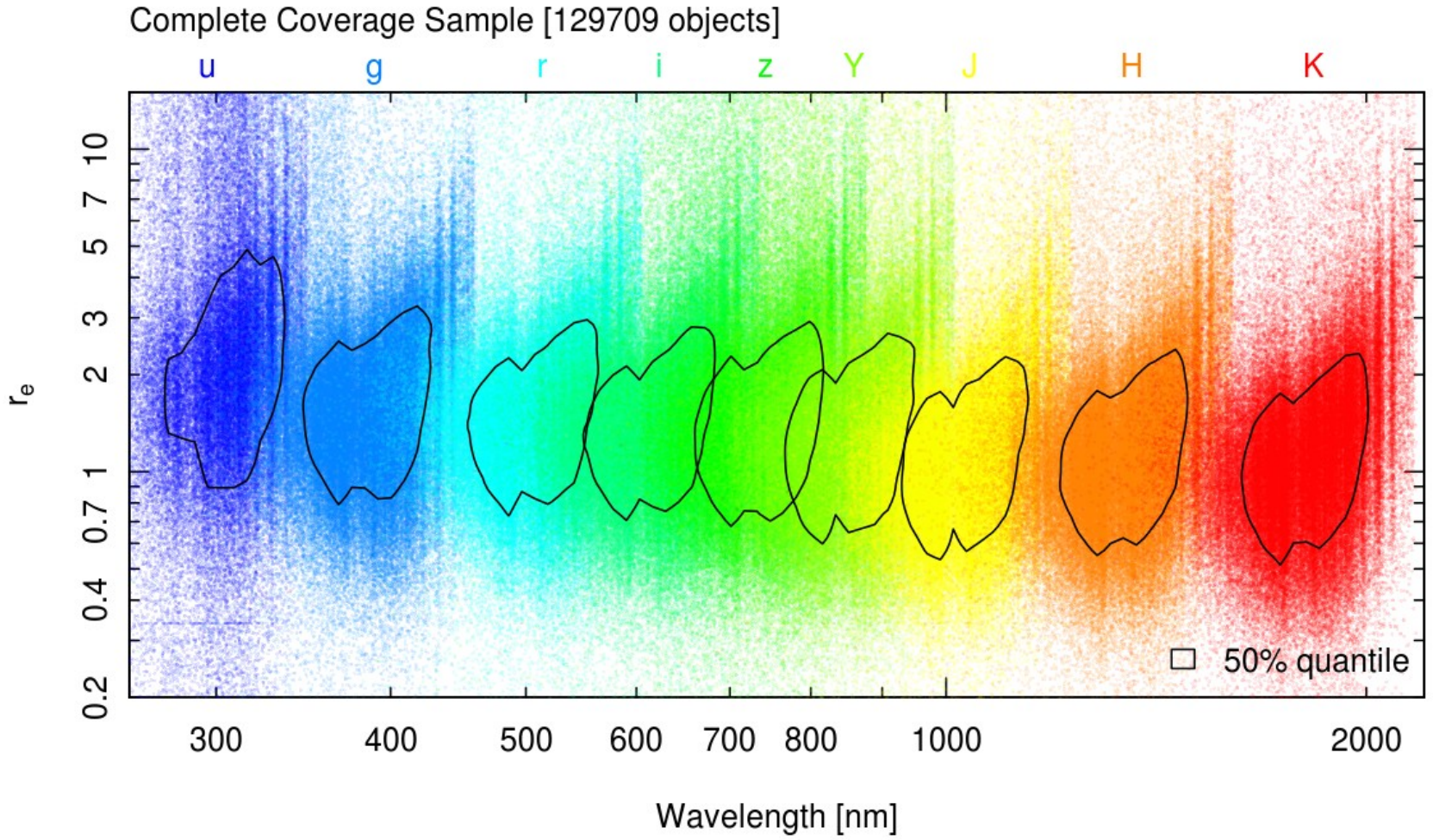
- Increasing n



SIGMA: Global Distributions

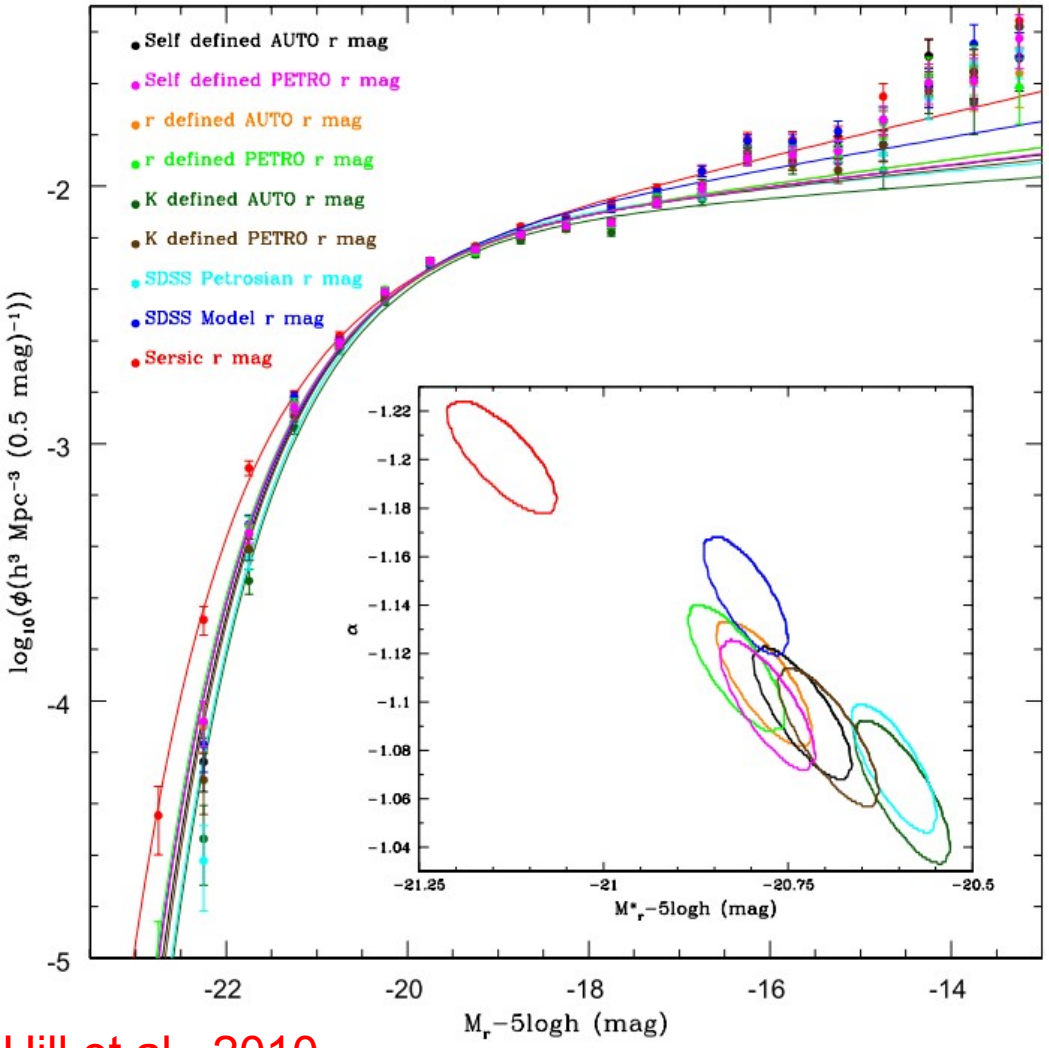
u → K:

- Decreasing r_e



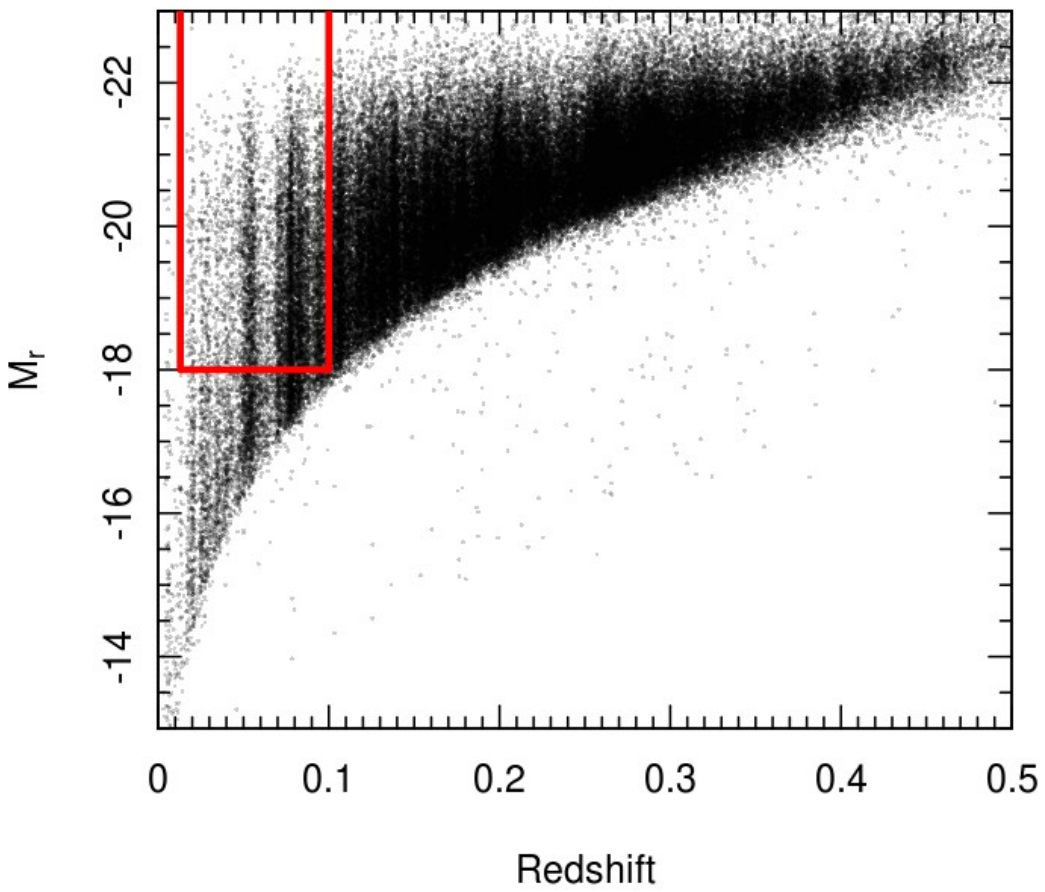
SIGMA: Motivation

- Sérsic photometry accounts for 'missing' light in the wings of galaxies not usually picked up by other aperture definitions.



Hill et al., 2010

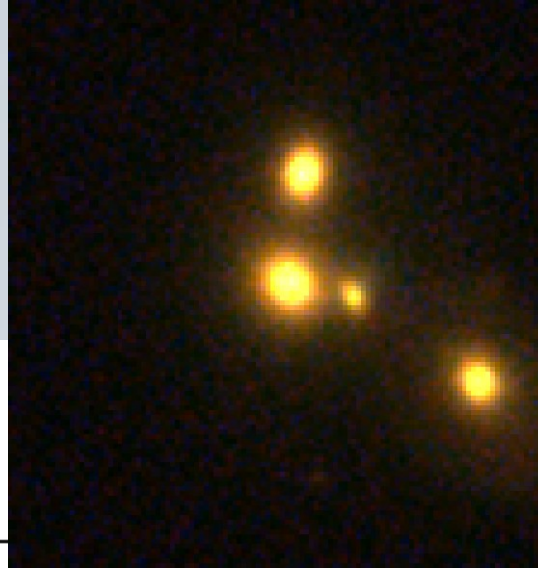
SIGMA: Volume Limited Sample

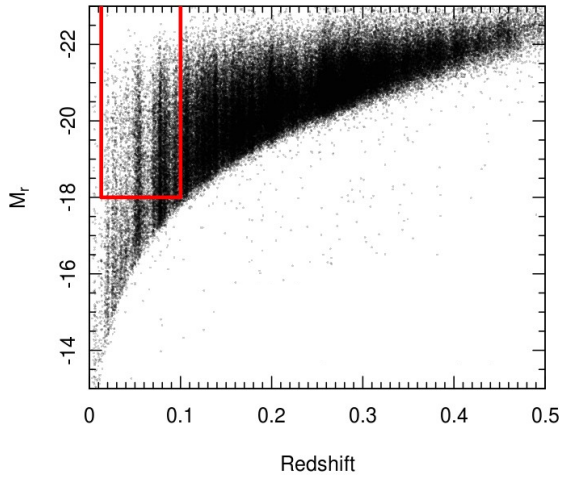


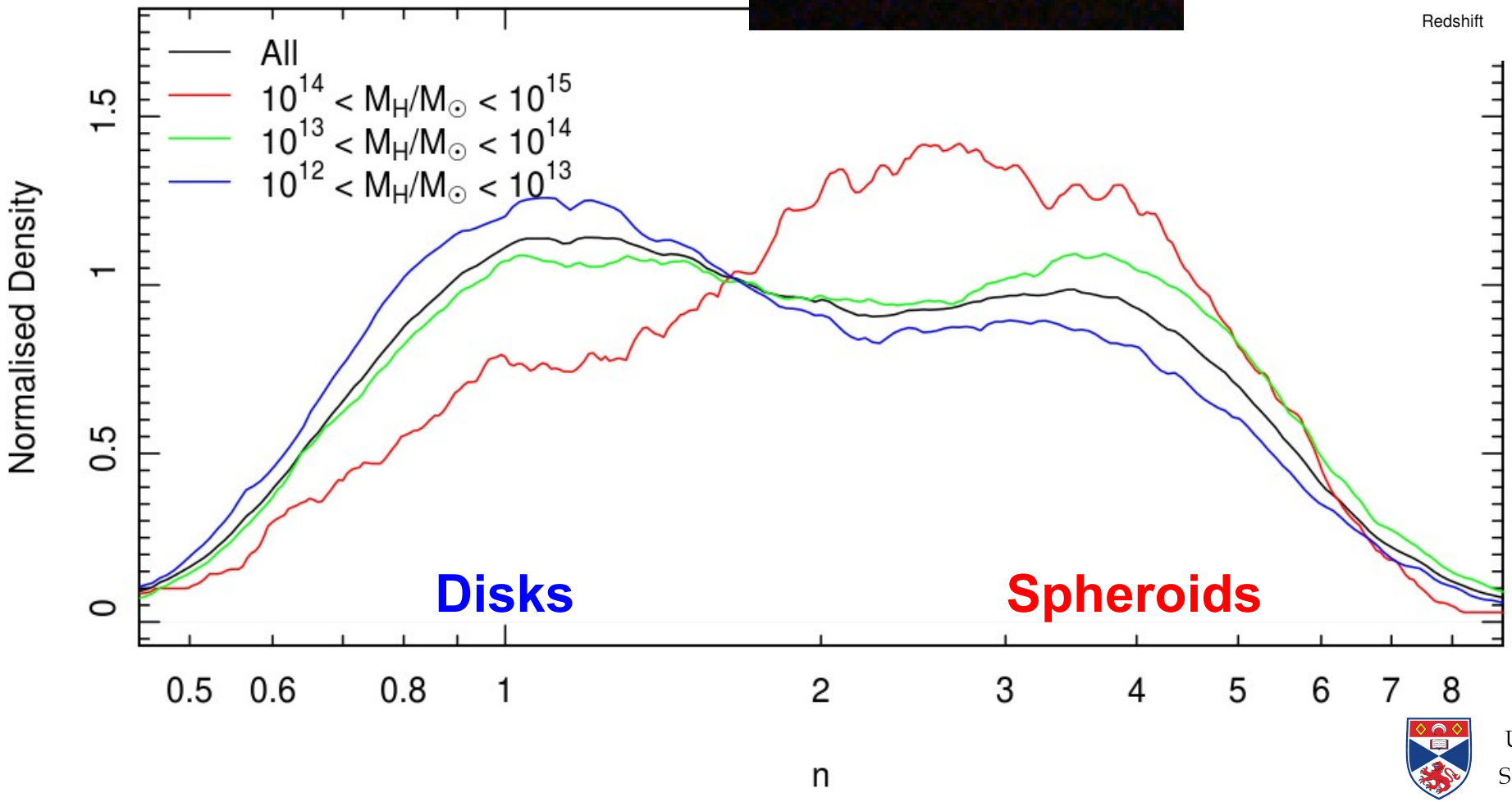
- Mr < -18
- 0.013 < z < 0.1
- nQ > 3
- r < 19.4
- Coverage = ugrizYJHK

→ ~8,500 galaxies

SIGMA: Group Mass



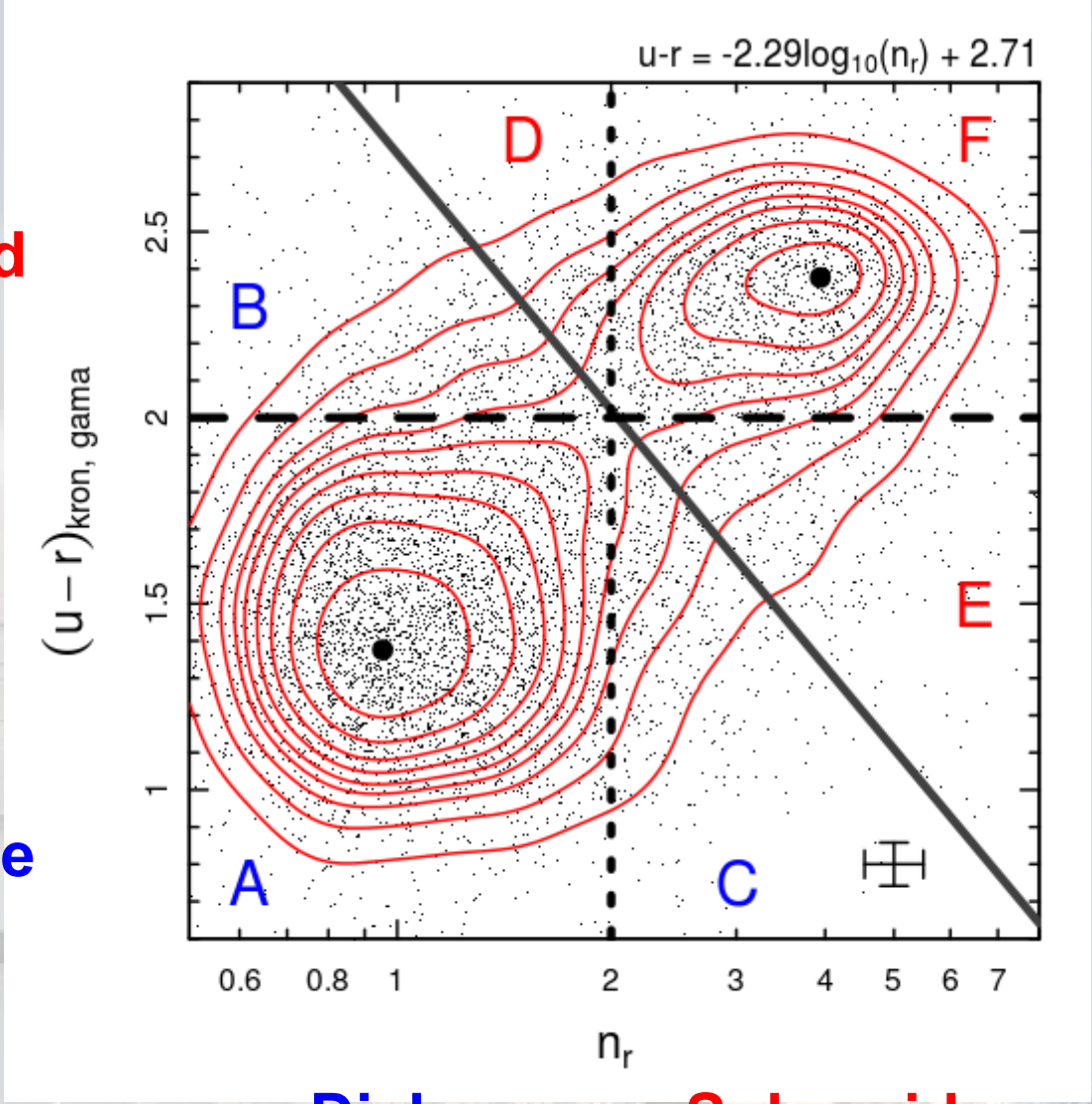




University of St Andrews

Group Masses: Aaron Robotham

SIGMA: Automated Classification



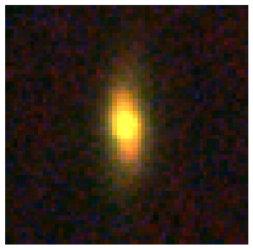
Red

Blue

Disks **Spheroids**

SIGMA: Automated Classification

G00252005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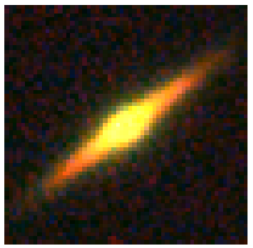
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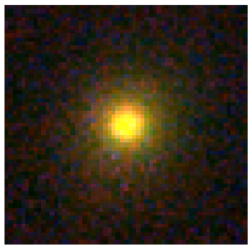
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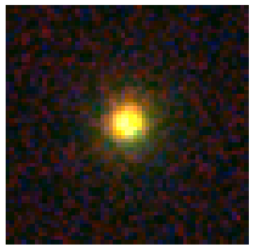
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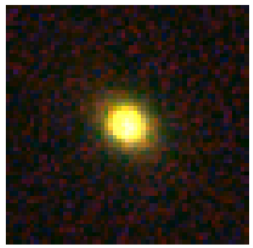
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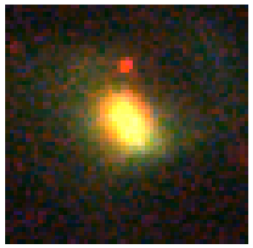
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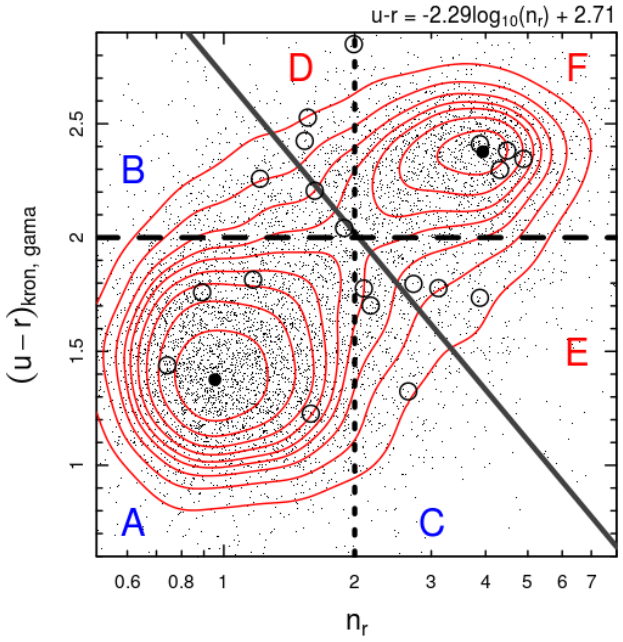

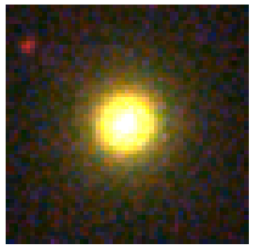
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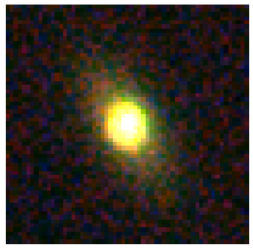
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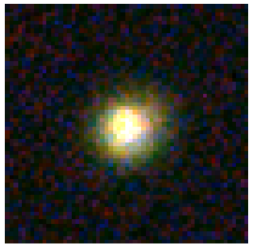
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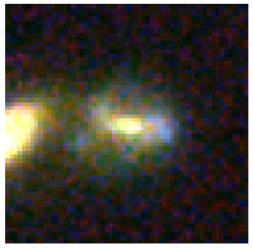
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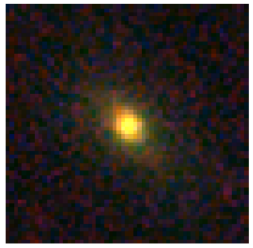
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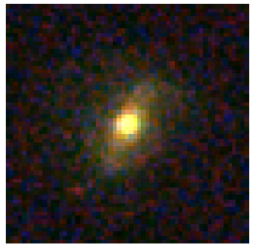
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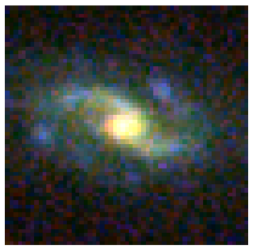
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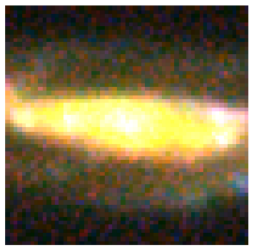
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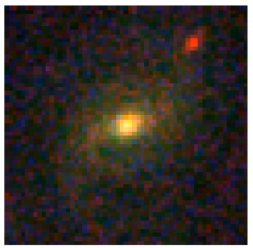
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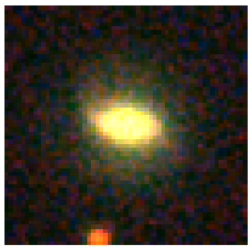
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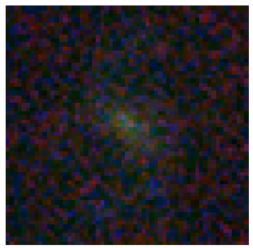
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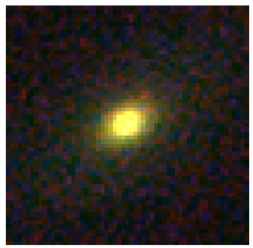
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SIGMA: Automated Classification

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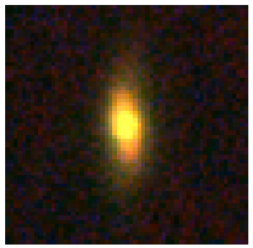
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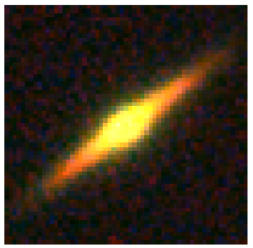
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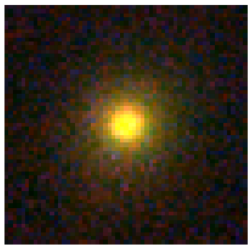
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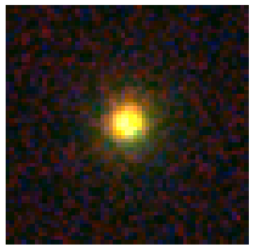
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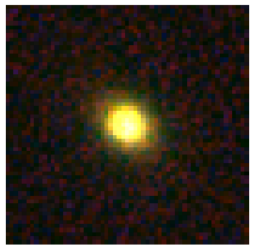
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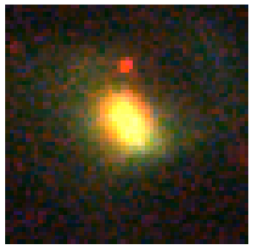
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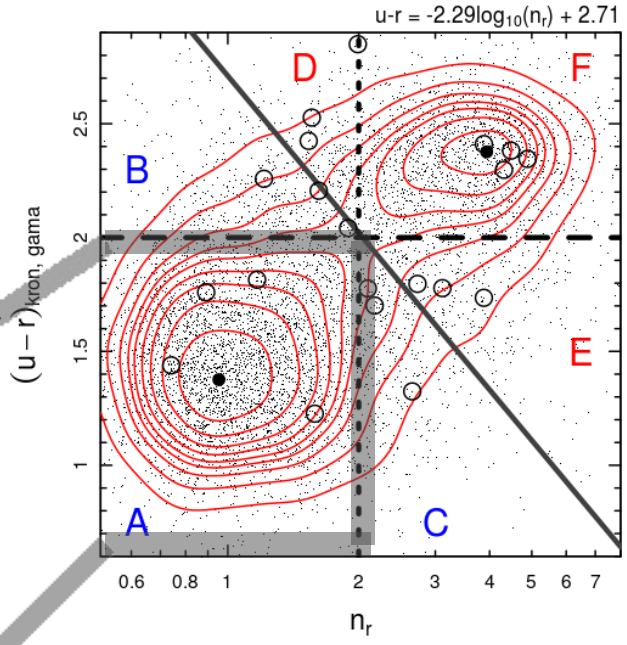

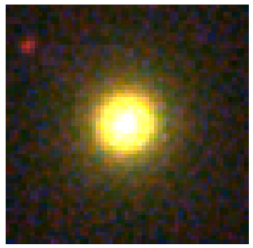
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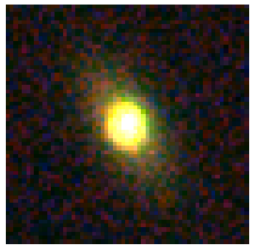
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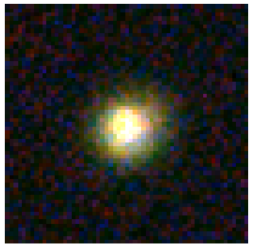
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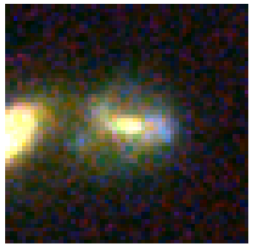
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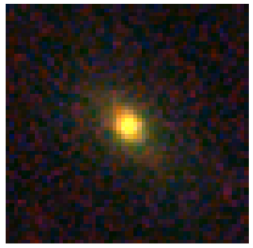
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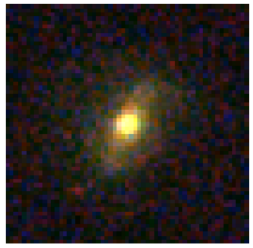
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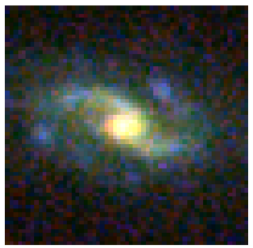
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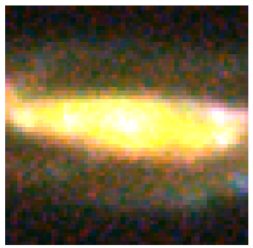
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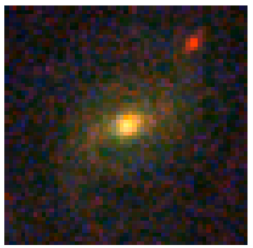
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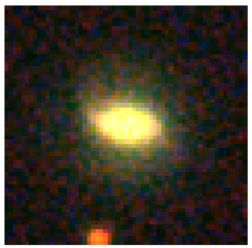
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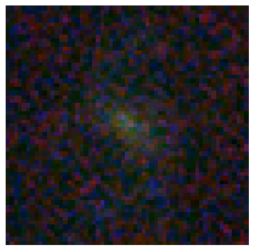
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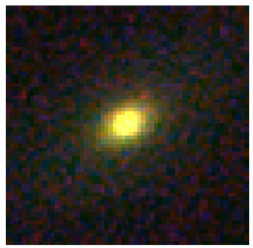
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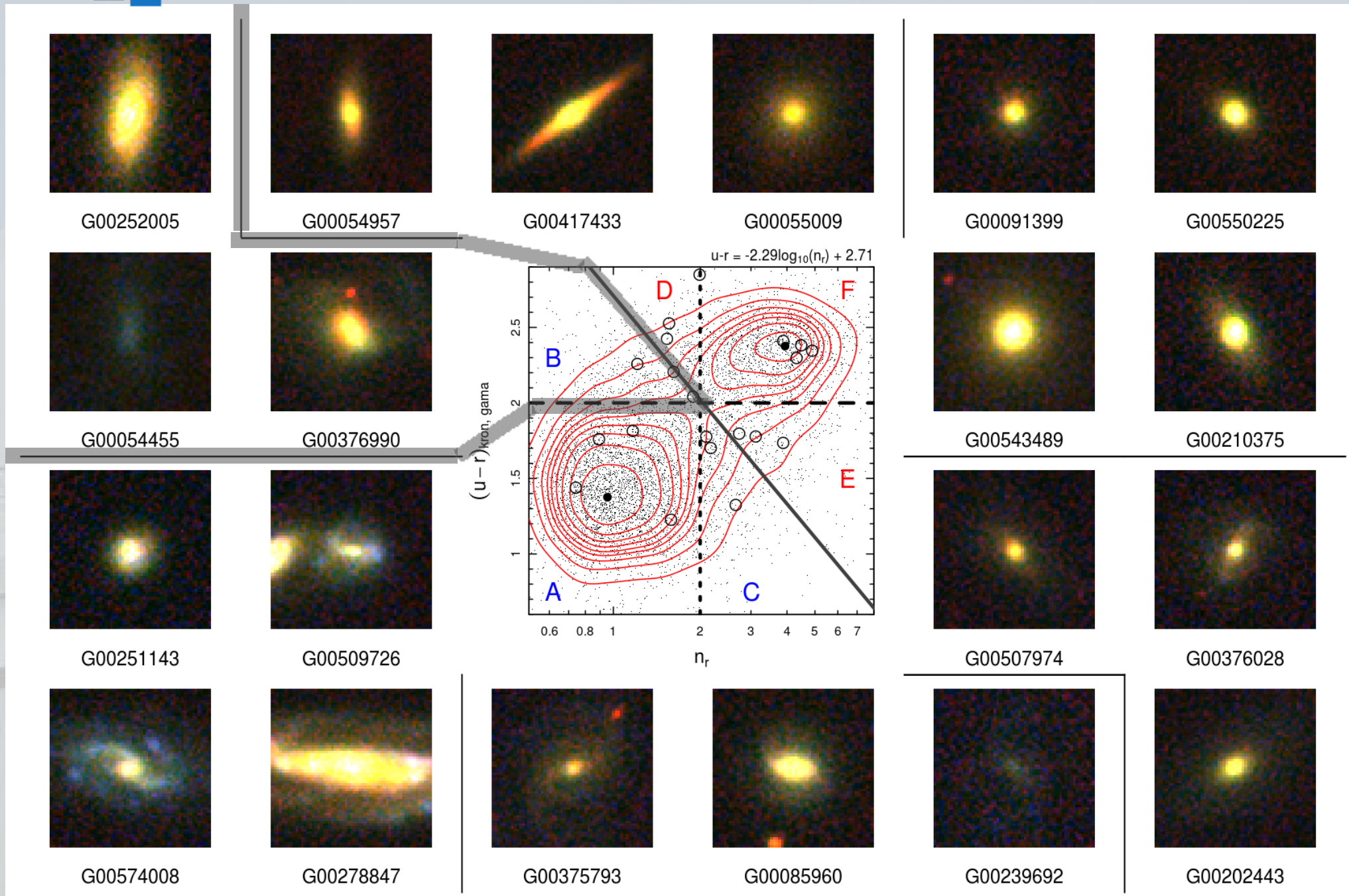

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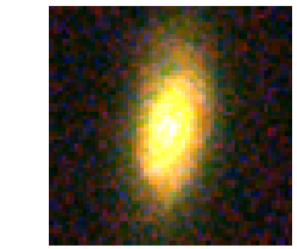
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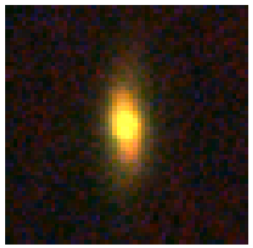
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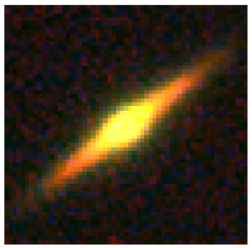
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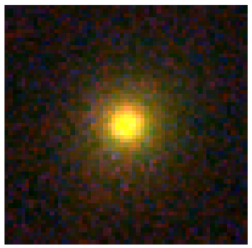
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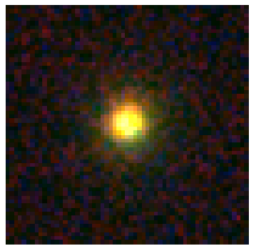
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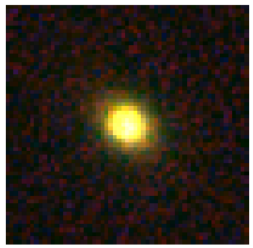
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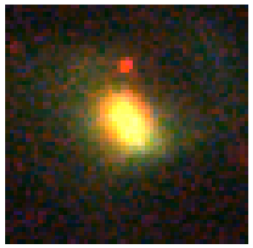
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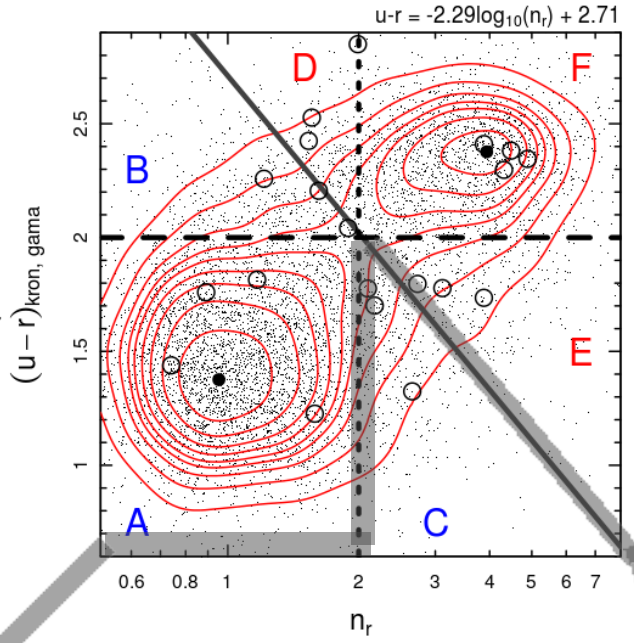

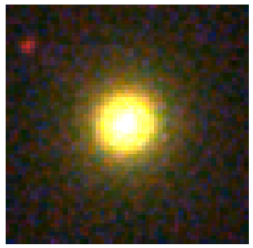
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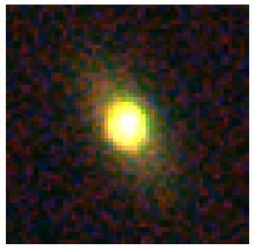
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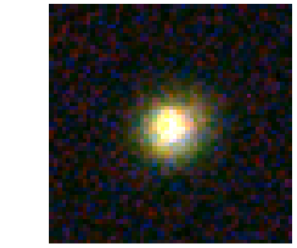
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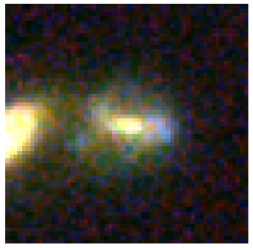
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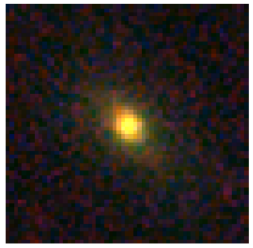
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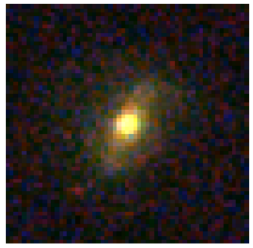
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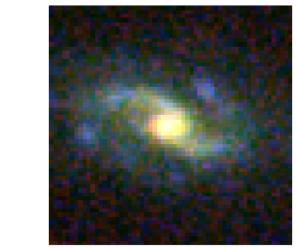
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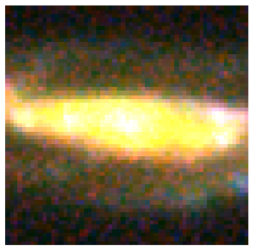
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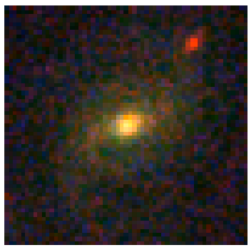
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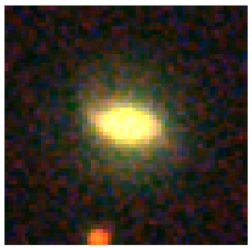
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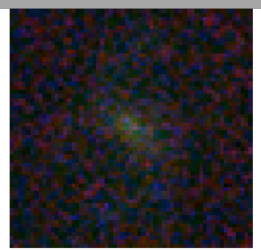
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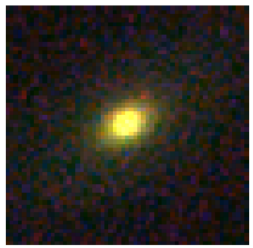
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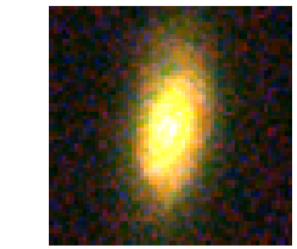
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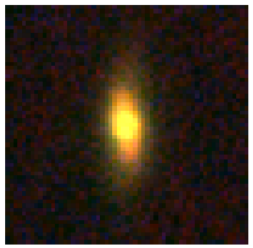
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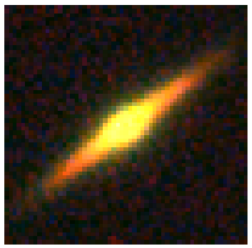
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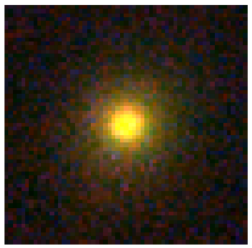
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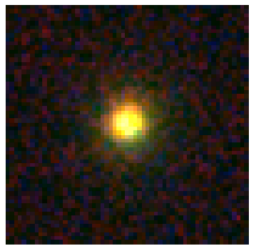
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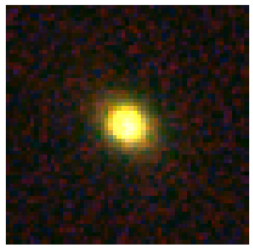
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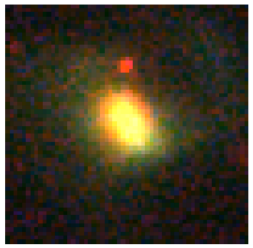
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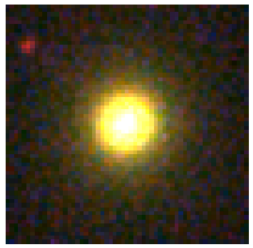
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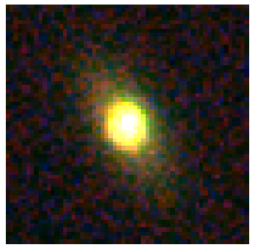
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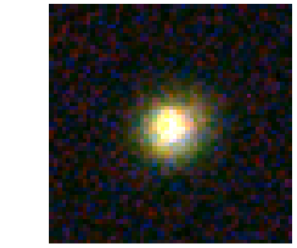
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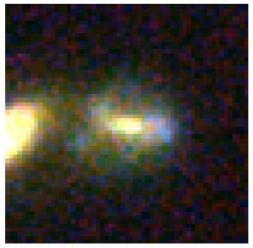
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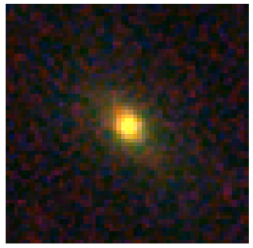
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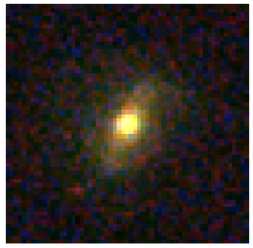
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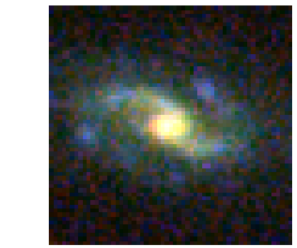
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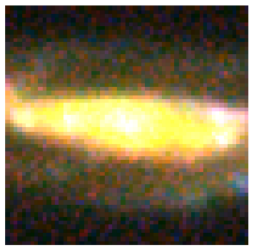
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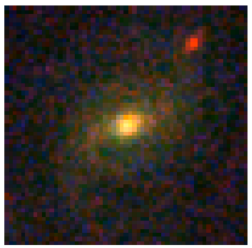
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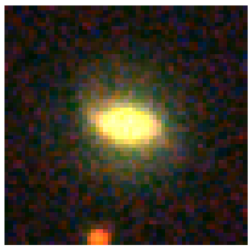
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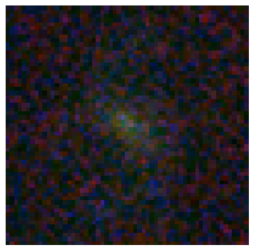
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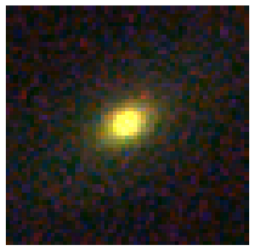
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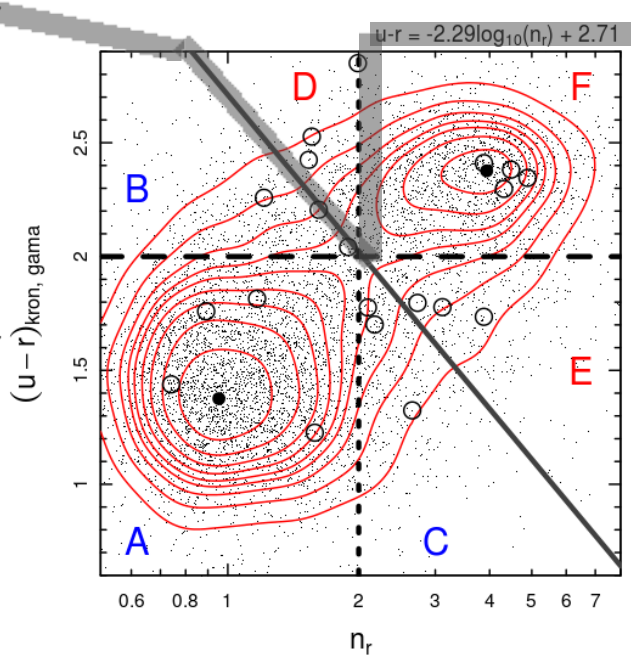

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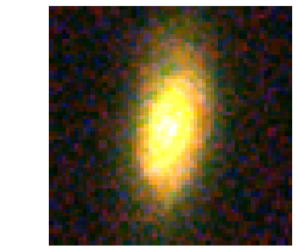
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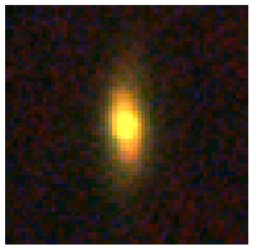
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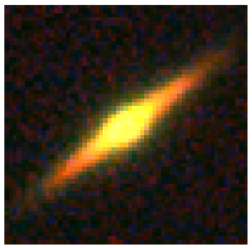
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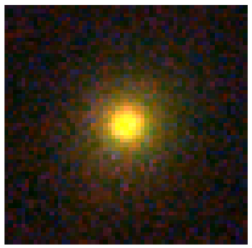
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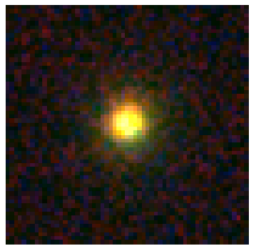
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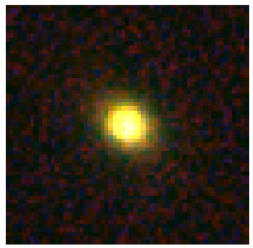
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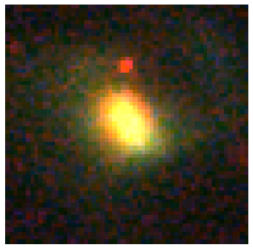
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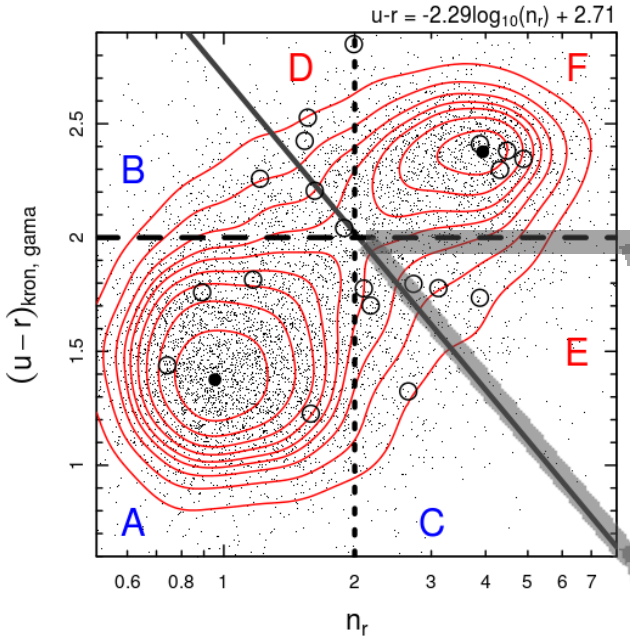

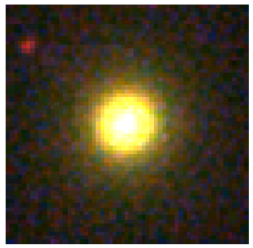
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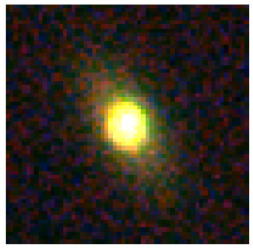
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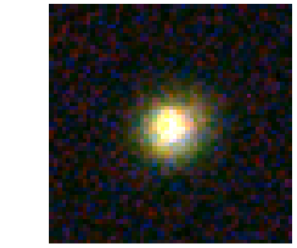
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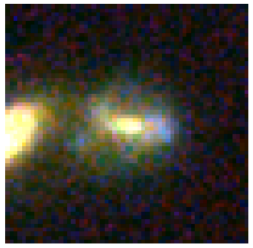
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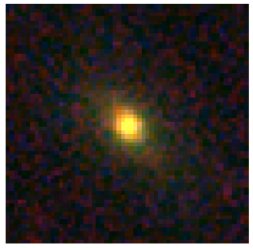
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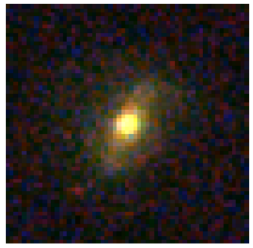
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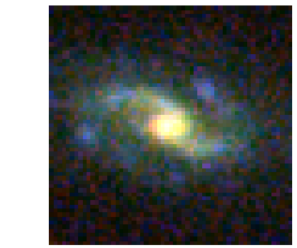
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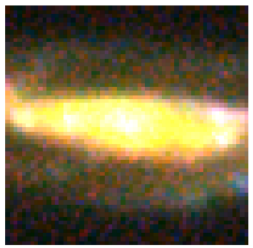
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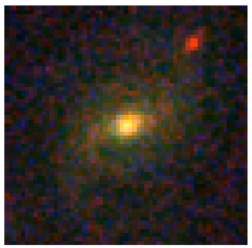
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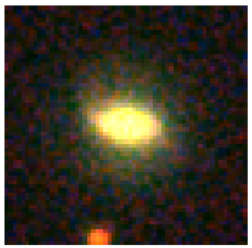
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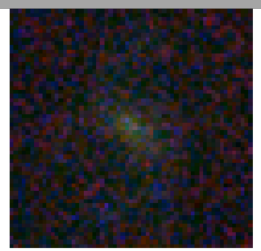
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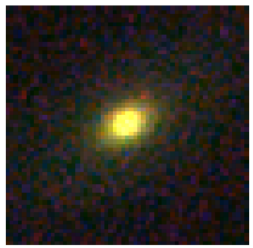
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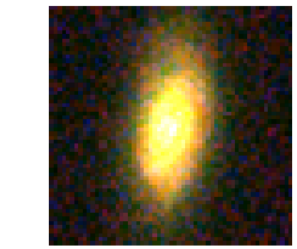
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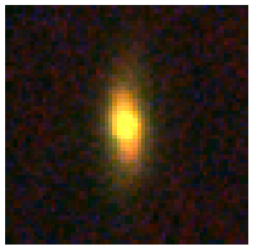
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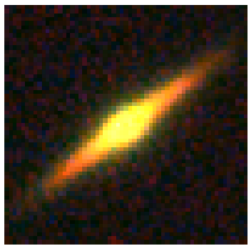
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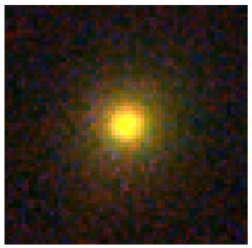
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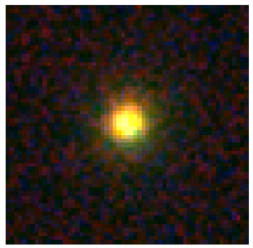
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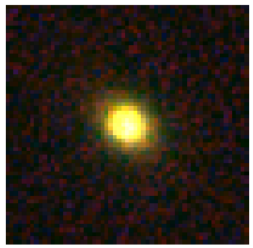
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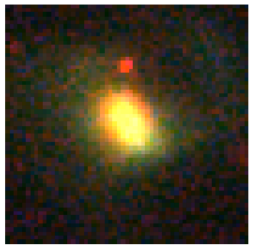
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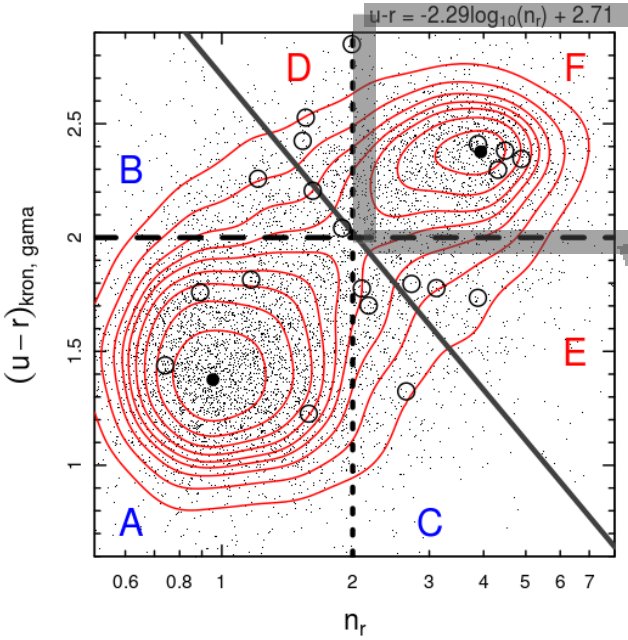

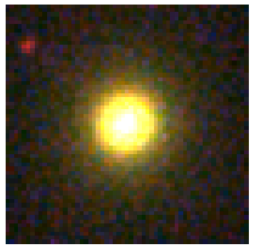
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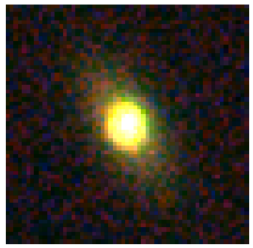
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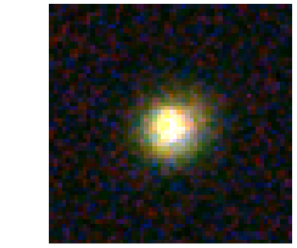
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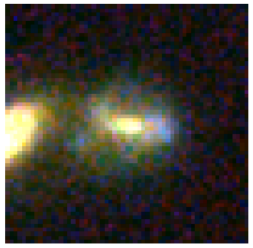
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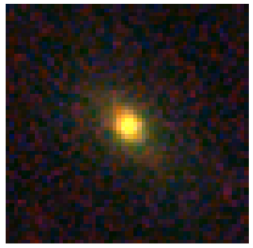
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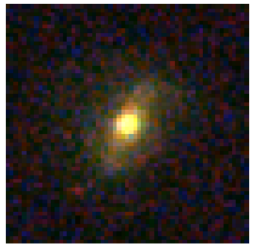
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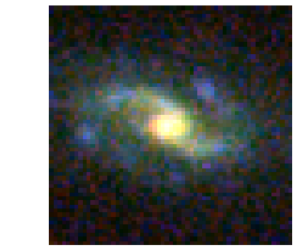
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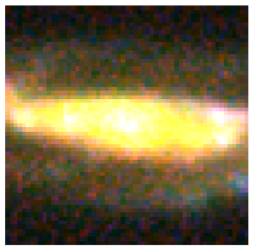
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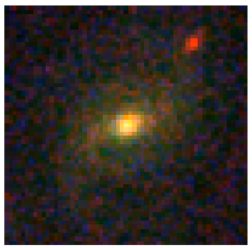
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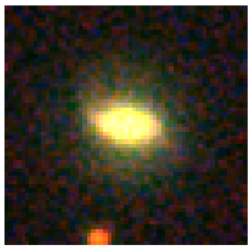
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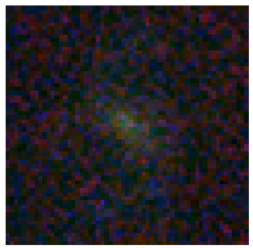
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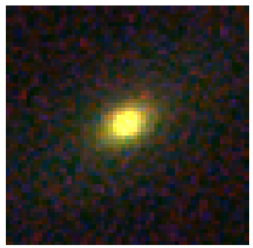
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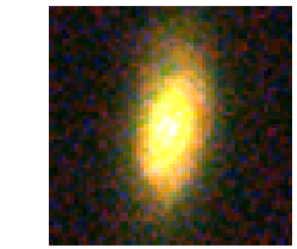
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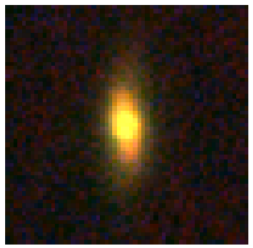
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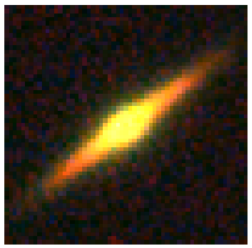
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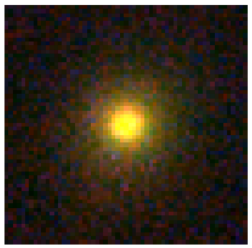
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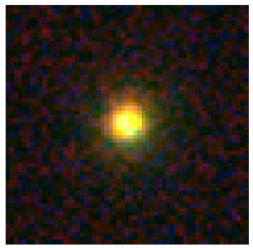
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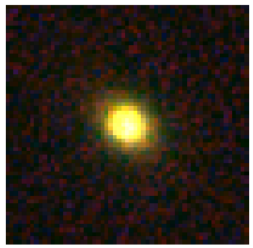
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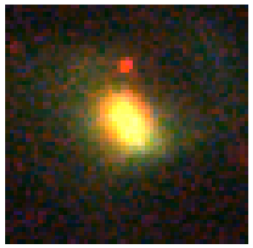
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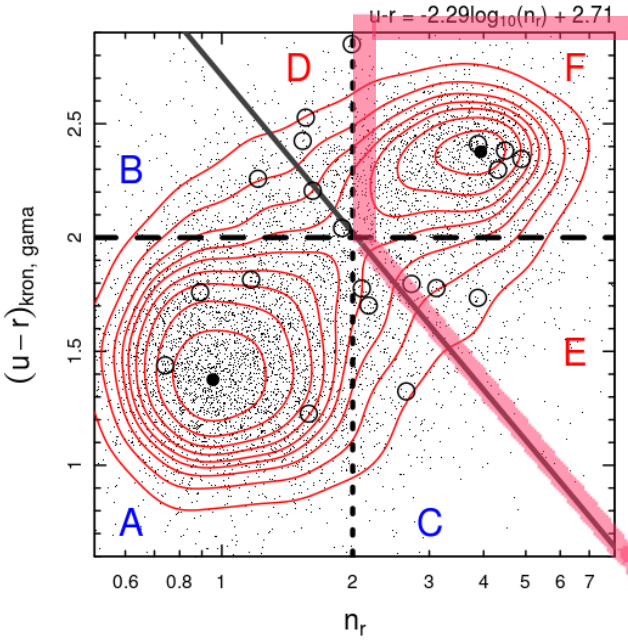

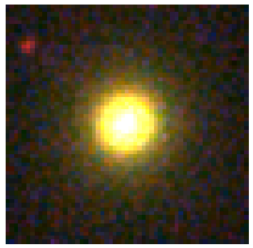
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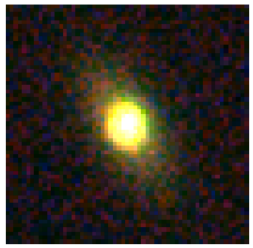
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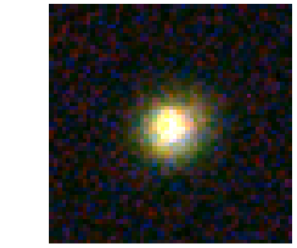
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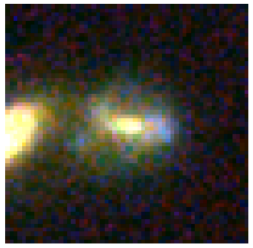
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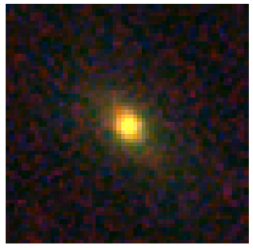
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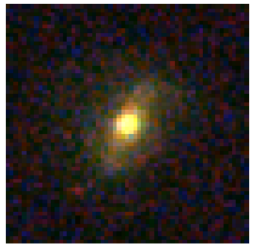
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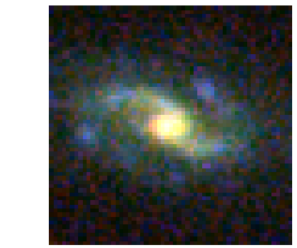
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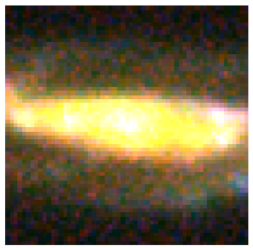
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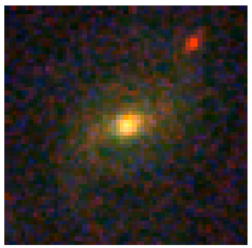
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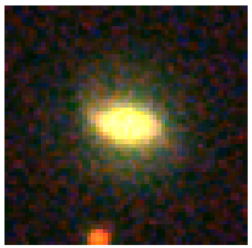
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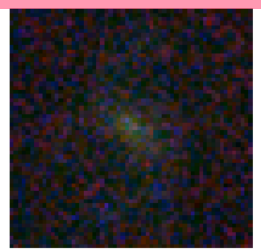
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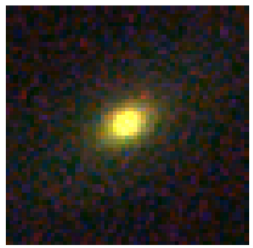
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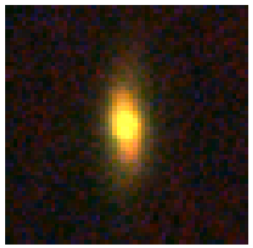
SIGMA: Stellar Mass Distribution



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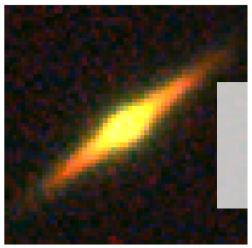
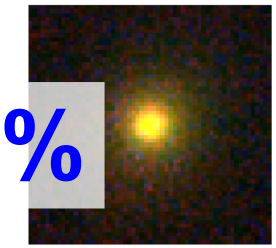

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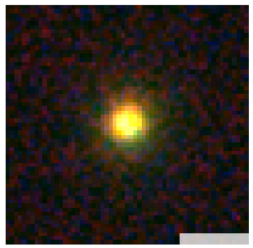
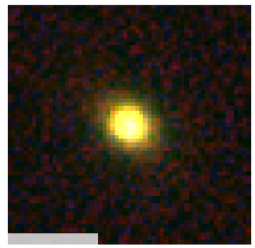

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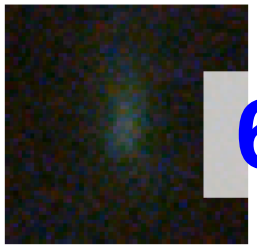
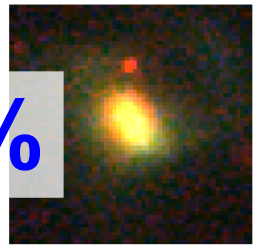

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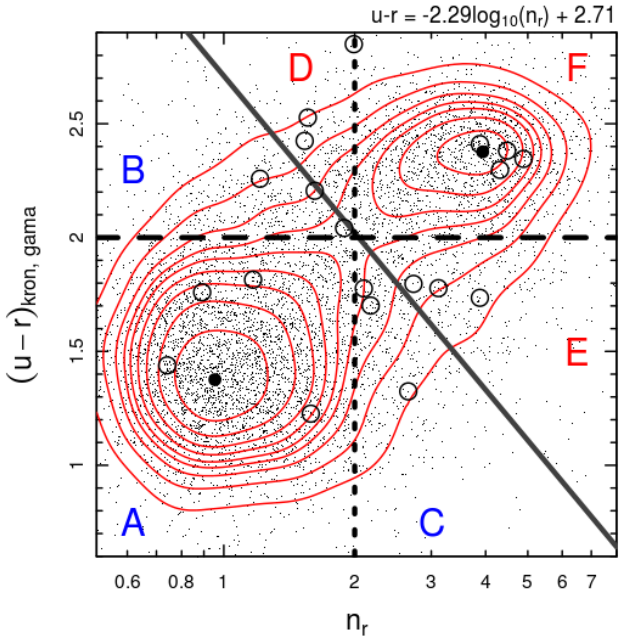

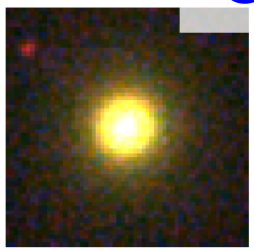
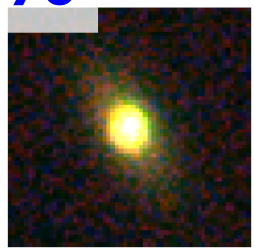

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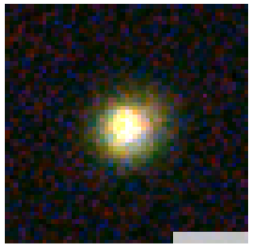
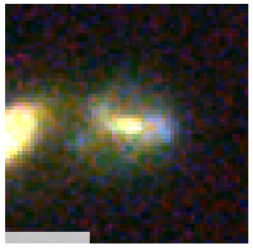

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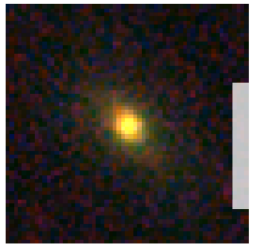
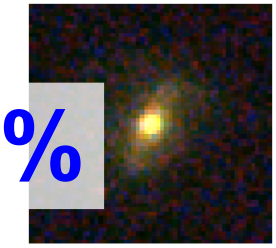

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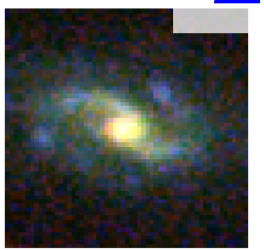

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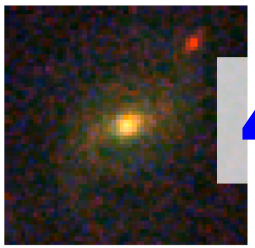
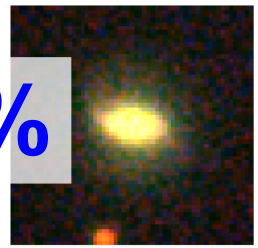

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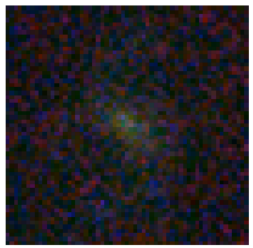
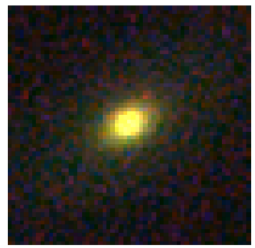

Stellar Masses: Ned Taylor

Summary

- Single-Sérsic photometry provides a method of producing meaningful structural parameters in a fast and efficient manner.
- A good way of recovering missing light in the wings of galaxies.
- Important to use multi-wavelength data to probe different stellar populations.

What Now?

SersicCatv7:

- A high-fidelity sample of ~150,000 galaxies with measurements of effective radii, Sérsic indices, Sérsic magnitudes and other physical properties.
- > 95% success rate
- Passed GAMA Quality Control! → see **Kelvin et al. 2011** (in prep.)

What Next?

- Full structural decomposition!
  ➔ Which multi-component model is the 'best'?
- Further exploration of how physical properties (e.g.: Sérsic index, size) relate to Stellar Mass/Environment/Morphology.
- Study of the evolution of spheroidal and disk like structures – do bulges have a similar formation mechanism to ellipticals?