



Gas accretion and extended disks in the Local Universe from the S4G/DAGAL survey

Wednesday, August 14, 2013
Winthrop Rockefeller Institute
Little Rock, Arkansas

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With Armando Gil de Paz, Samuel Boissier, Juan-Carlos Muñoz-Mateos

Motivation of the work

- understanding the evolution of the outer parts of disks
- understanding the unexpectedly high chemical abundances there
- understanding the mechanism(s) that activate the SF in these rarefied environments

Motivation of the work

HOWEVER, the integrated UV-IR properties of the sample have provided important clues to the evolution of early-type spiral galaxies as a whole in recent epoch. We will focus on this today.

<http://dagalnetwork.eu/>

DAGAL PR

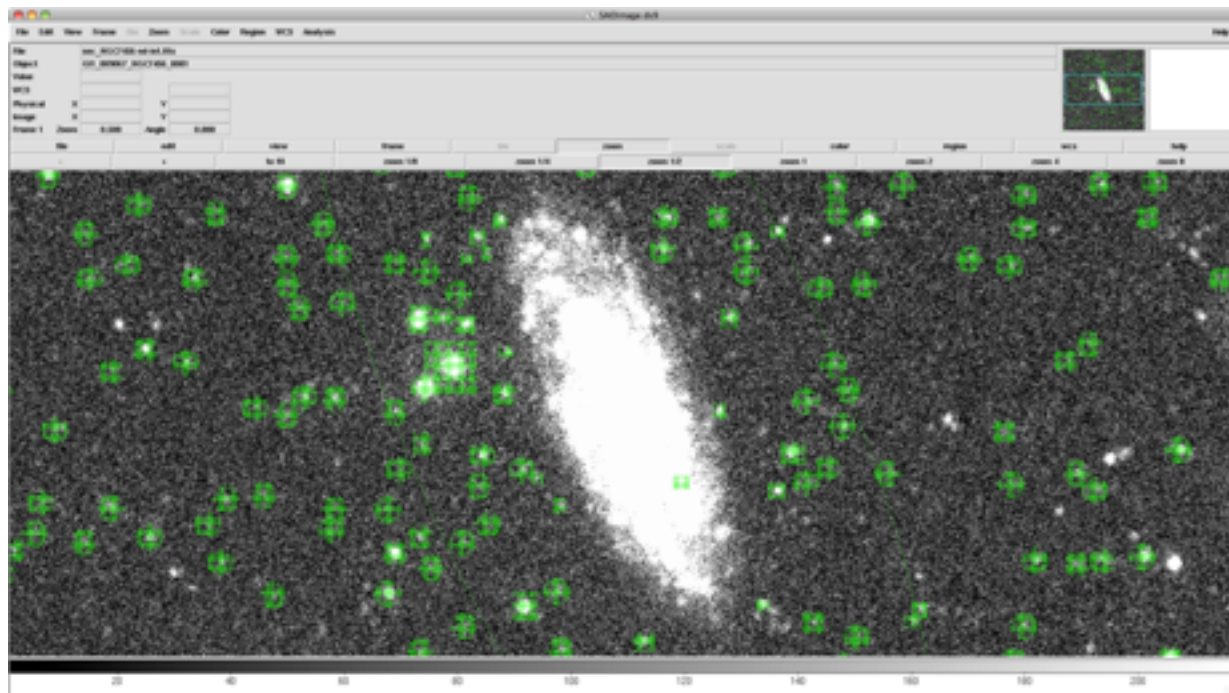
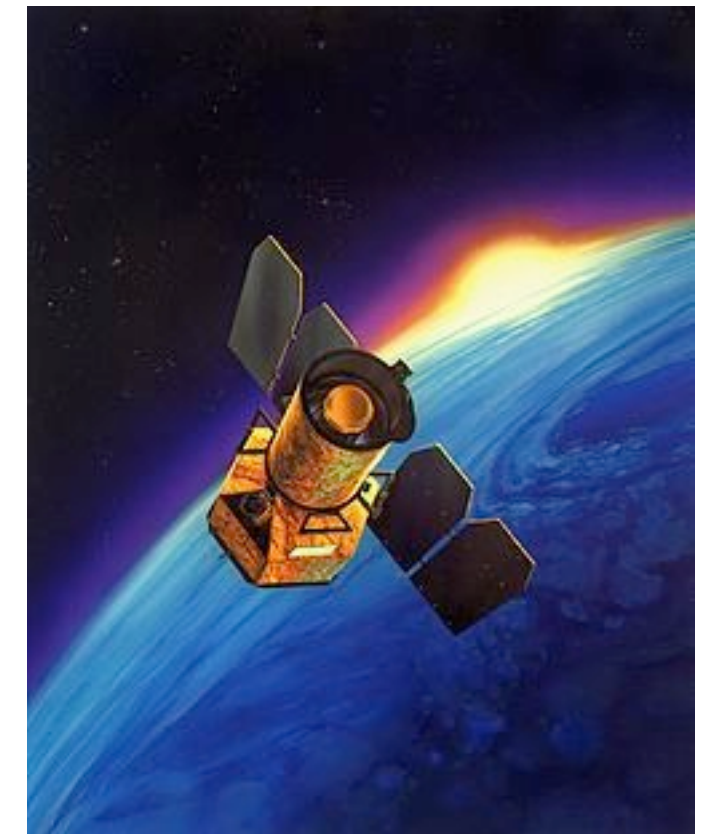
- Logo:



- Goal: using the S4G and adding to it by using Ha, 21 cm HI, UV data from other surveys + simulations
- Structure: 5 universities across Europe, 3 private companies, 8 ESR students, 3 postdocs

My Role in DAGAL

- Perform photometry on GALEX FUV and NUV images
- Compile and analyze the first, large catalogue of XUV-disk galaxies ever
- Investigate disk growth



We have yet to classify the XUV-disk galaxies contained in our sample. But, we can already clearly see interesting trends.

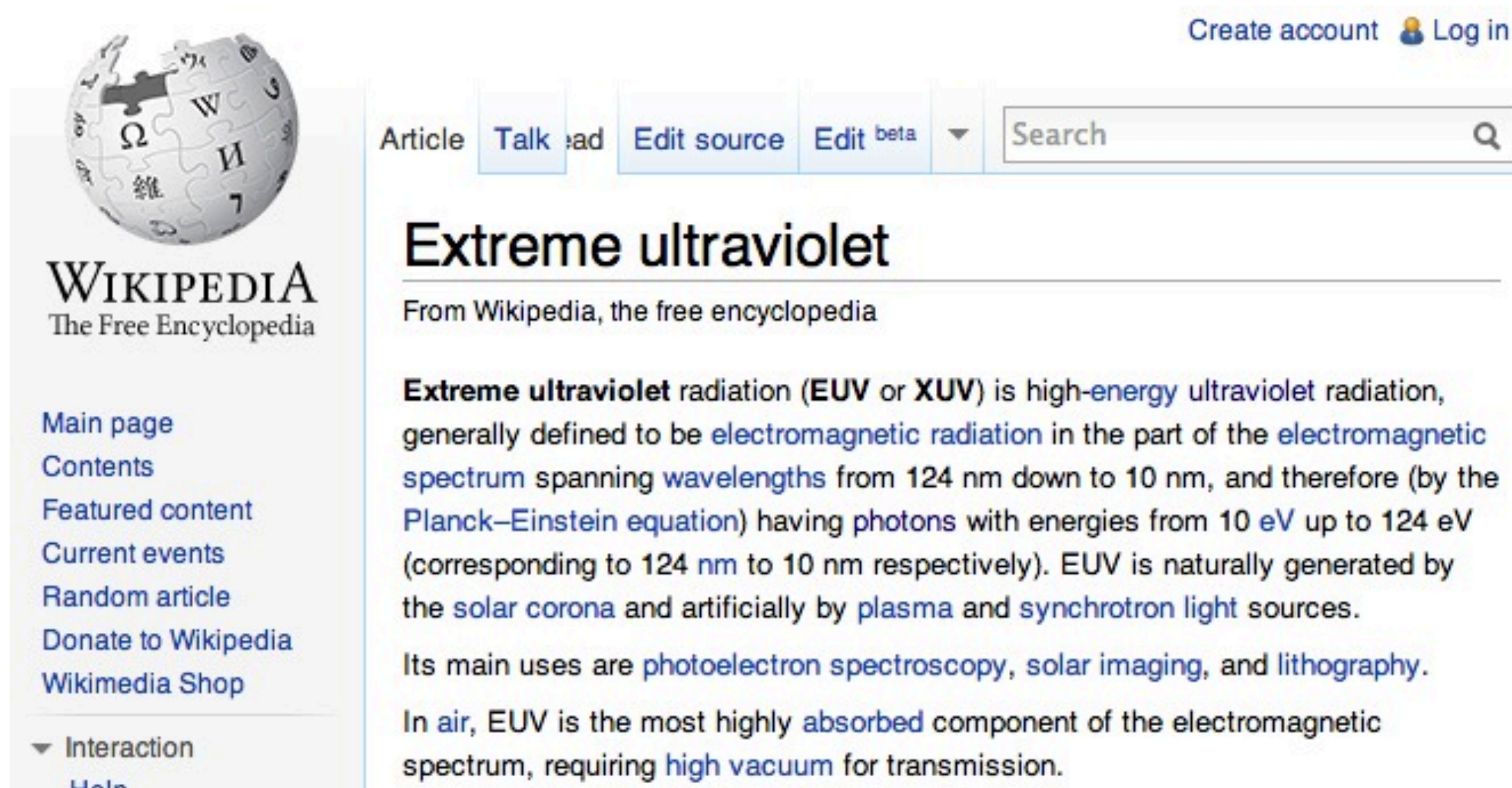
What “XUV” could stand for

(but is not what we’re dealing with)

What “XUV” could stand for

(but is not what we’re dealing with)

- Extreme Ultraviolet (EUV or XUV)



The image shows a screenshot of a Wikipedia article titled "Extreme ultraviolet". The page layout includes a sidebar on the left with the Wikipedia logo and navigation links, and a main content area on the right. The article text defines Extreme ultraviolet (EUV or XUV) as high-energy ultraviolet radiation, spanning wavelengths from 124 nm to 10 nm, with photon energies from 10 eV to 124 eV. It mentions natural sources like the solar corona and artificial sources like plasma and synchrotron light. Applications include photoelectron spectroscopy, solar imaging, and lithography. The article also notes that EUV is highly absorbed in air and requires high vacuum for transmission.

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Extreme ultraviolet

From Wikipedia, the free encyclopedia

Extreme ultraviolet radiation (**EUV** or **XUV**) is high-energy ultraviolet radiation, generally defined to be electromagnetic radiation in the part of the electromagnetic spectrum spanning wavelengths from 124 nm down to 10 nm, and therefore (by the Planck–Einstein equation) having photons with energies from 10 eV up to 124 eV (corresponding to 124 nm to 10 nm respectively). EUV is naturally generated by the solar corona and artificially by plasma and synchrotron light sources.

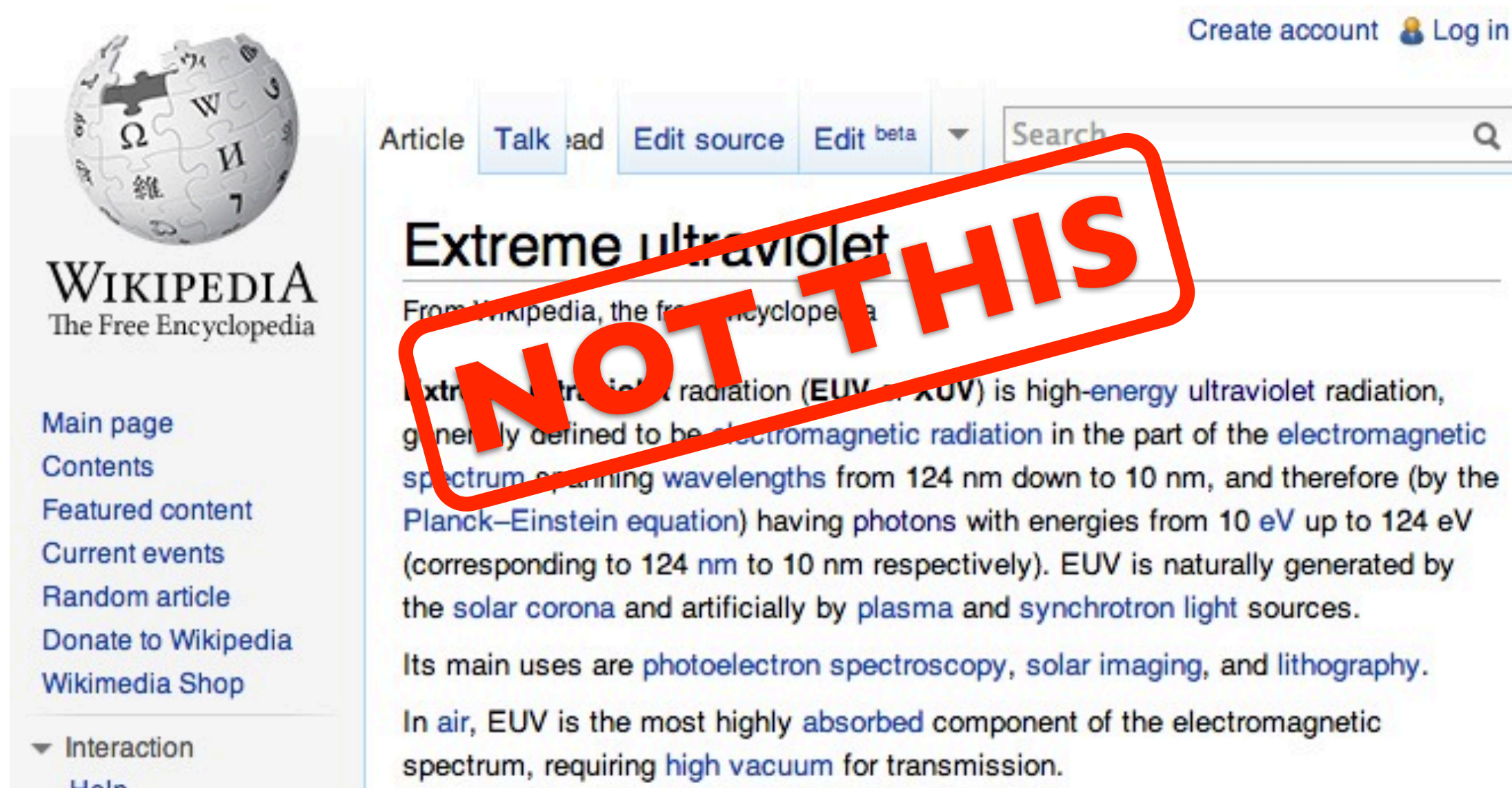
Its main uses are photoelectron spectroscopy, solar imaging, and lithography.

In air, EUV is the most highly absorbed component of the electromagnetic spectrum, requiring high vacuum for transmission.

What “XUV” could stand for

(but is not what we’re dealing with)

- Extreme Ultraviolet (EUV or XUV)



The image shows a screenshot of a Wikipedia article titled "Extreme ultraviolet". A large, red, slanted stamp with the text "NOT THIS" is overlaid on the article's introductory paragraph. The article text describes Extreme Ultraviolet (EUV or XUV) as high-energy ultraviolet radiation, generally defined to be electromagnetic radiation in the part of the electromagnetic spectrum spanning wavelengths from 124 nm down to 10 nm, and therefore (by the Planck–Einstein equation) having photons with energies from 10 eV up to 124 eV (corresponding to 124 nm to 10 nm respectively). It also mentions that EUV is naturally generated by the solar corona and artificially by plasma and synchrotron light sources, and lists its main uses as photoelectron spectroscopy, solar imaging, and lithography. The screenshot also shows the Wikipedia logo, navigation links, and a search bar.

“XUV” does NOT stand for



“XUV” does NOT stand for

2011 Ford Explorer XLT



Crossover Utility Vehicle (CUV or XUV)

“XUV” does NOT stand for

2011 Ford Explorer XLT



Crossover Utility Vehicle (CUV or XUV)

Samsung Galaxy S4



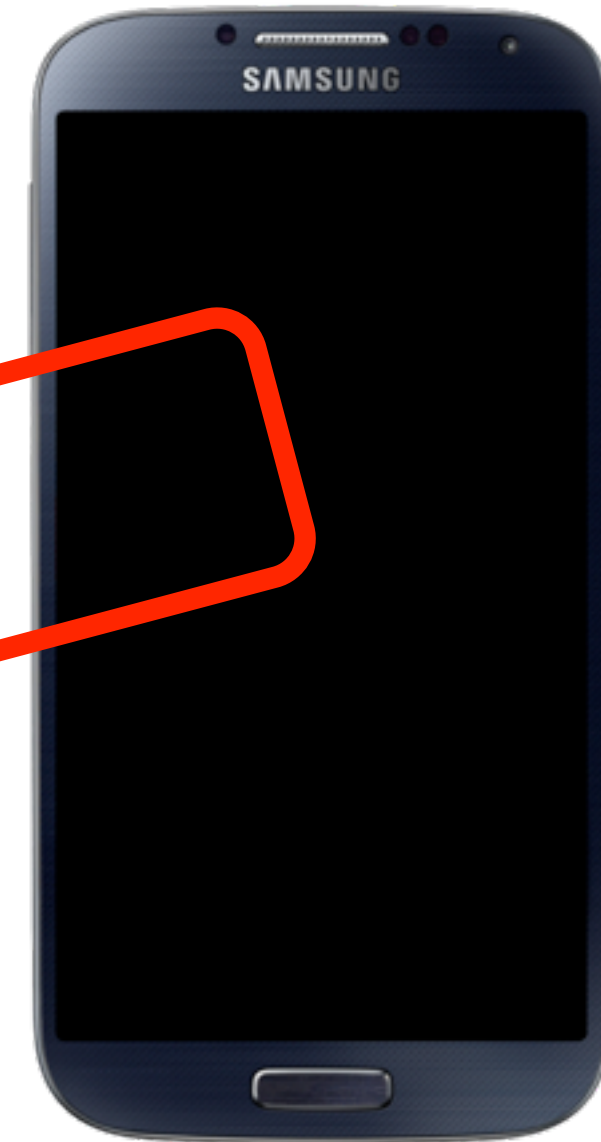
CC
SOME RIGHTS RESERVED

Author: Samsung Belgium

“XUV” does NOT stand for

2011 Ford Explorer XLT

Samsung Galaxy S4

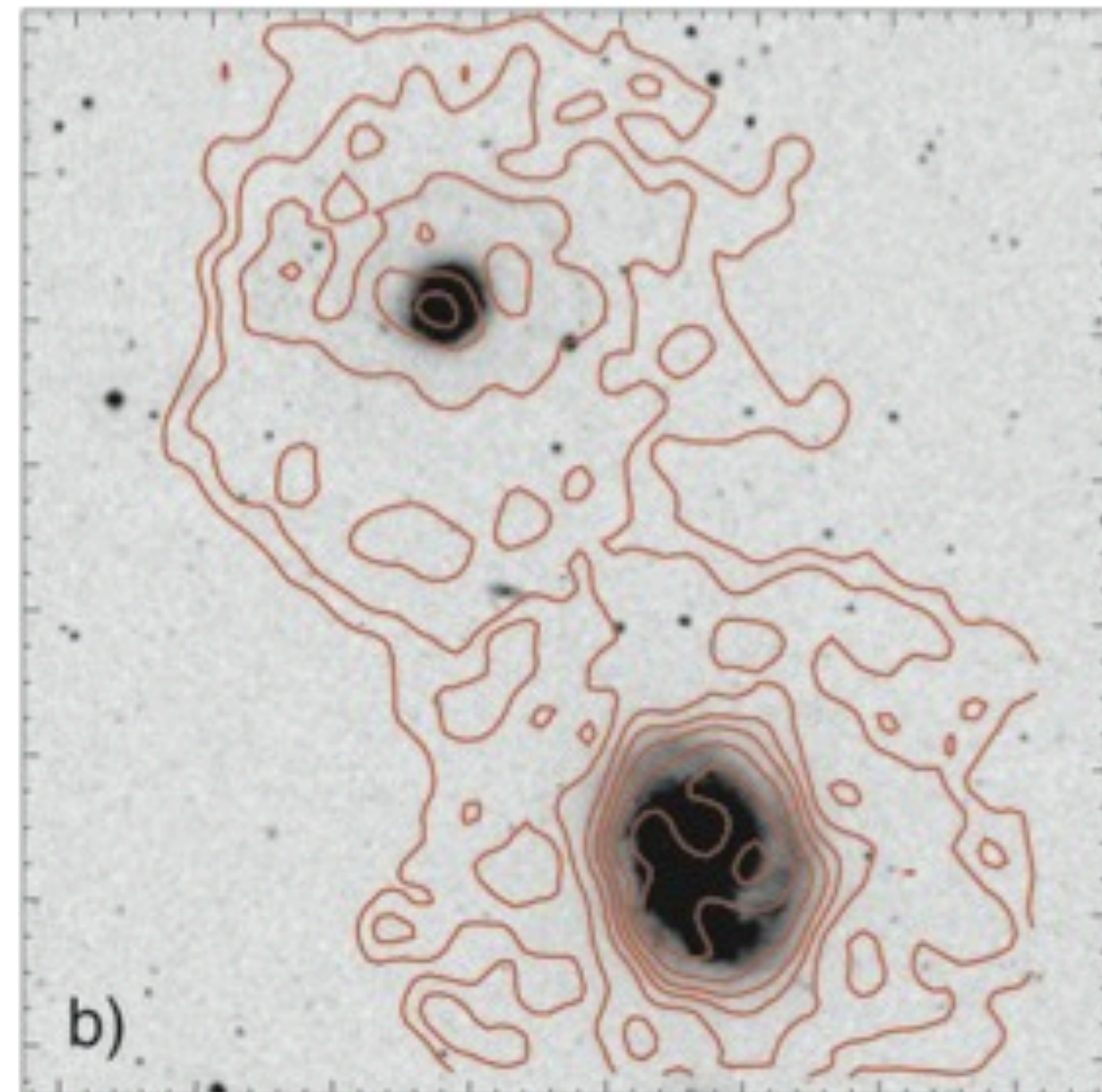
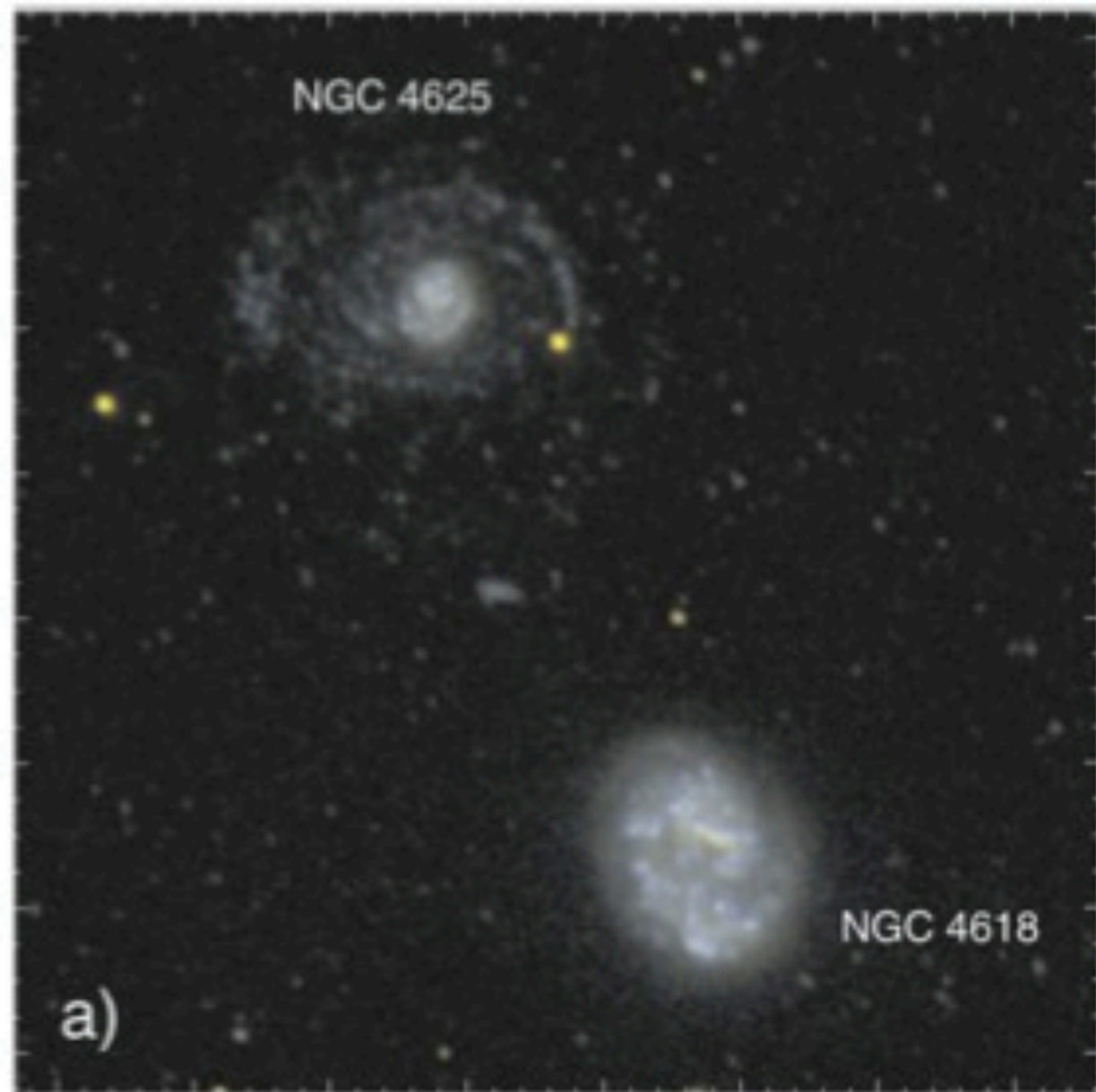


Crossover Utility Vehicle (CUV or XUV)

CC
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Author: Samsung Belgium

XUV stands for “eXtended UV”



- The first XUV discovered:
M83 (Thilker et al., 2005, ApJ, 619, 79) and NGC4625 (Gil de Paz et al., 2005, ApJ, 627, 29)

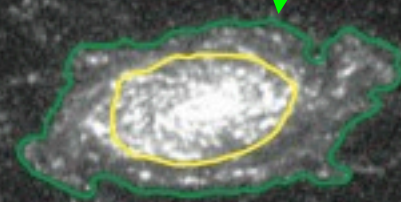
XUV stands for “eXtended UV”

NGC5055 (M63) prototype for Type I XUV

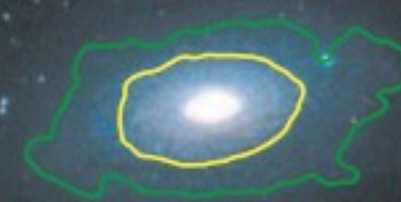
Surf. Bright.

$\mu(\text{FUV})=27.25 \text{ ABmag arcsec}^{-2} \propto$ anticipated SF threshold

GALEX
FUV



2MASS
Ks band+
DSS2red+
DSS2blue

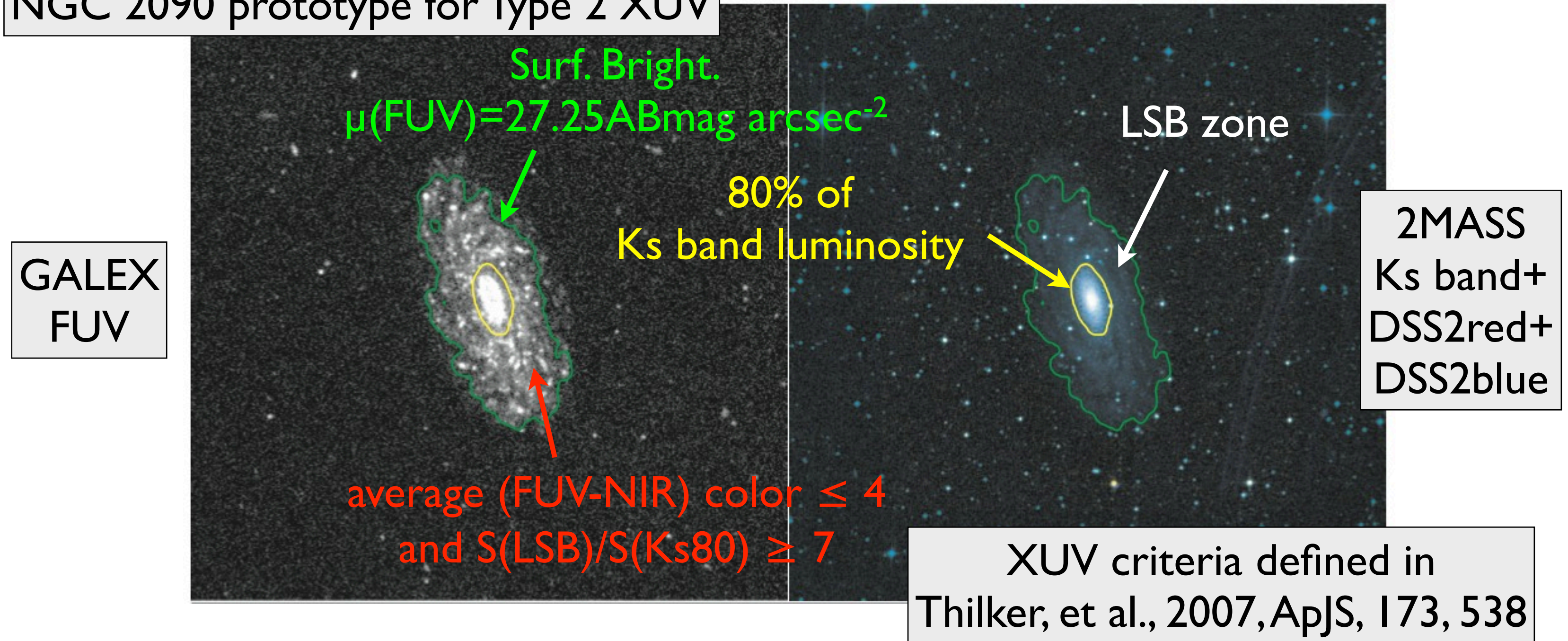


Structures are seen beyond the SF threshold

XUV criteria defined in
Thilker, et al., 2007, ApJS, 173, 538

XUV stands for “eXtended UV”

NGC 2090 prototype for Type 2 XUV

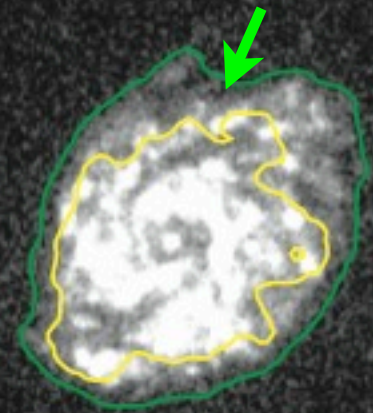


XUV stands for “eXtended UV”

NGC 7418 is not an XUV

GALEX
FUV

Surf. Bright.
 $\mu(\text{FUV}) = 27.25 \text{ ABmag arcsec}^{-2}$



80% of
Ks band luminosity

Not a type2 (nor a type1) XUV
because the $S(\text{LSB})/S(\text{Ks}80) \neq >7$
even though $(\text{FUV}-\text{Ks})=2.8$

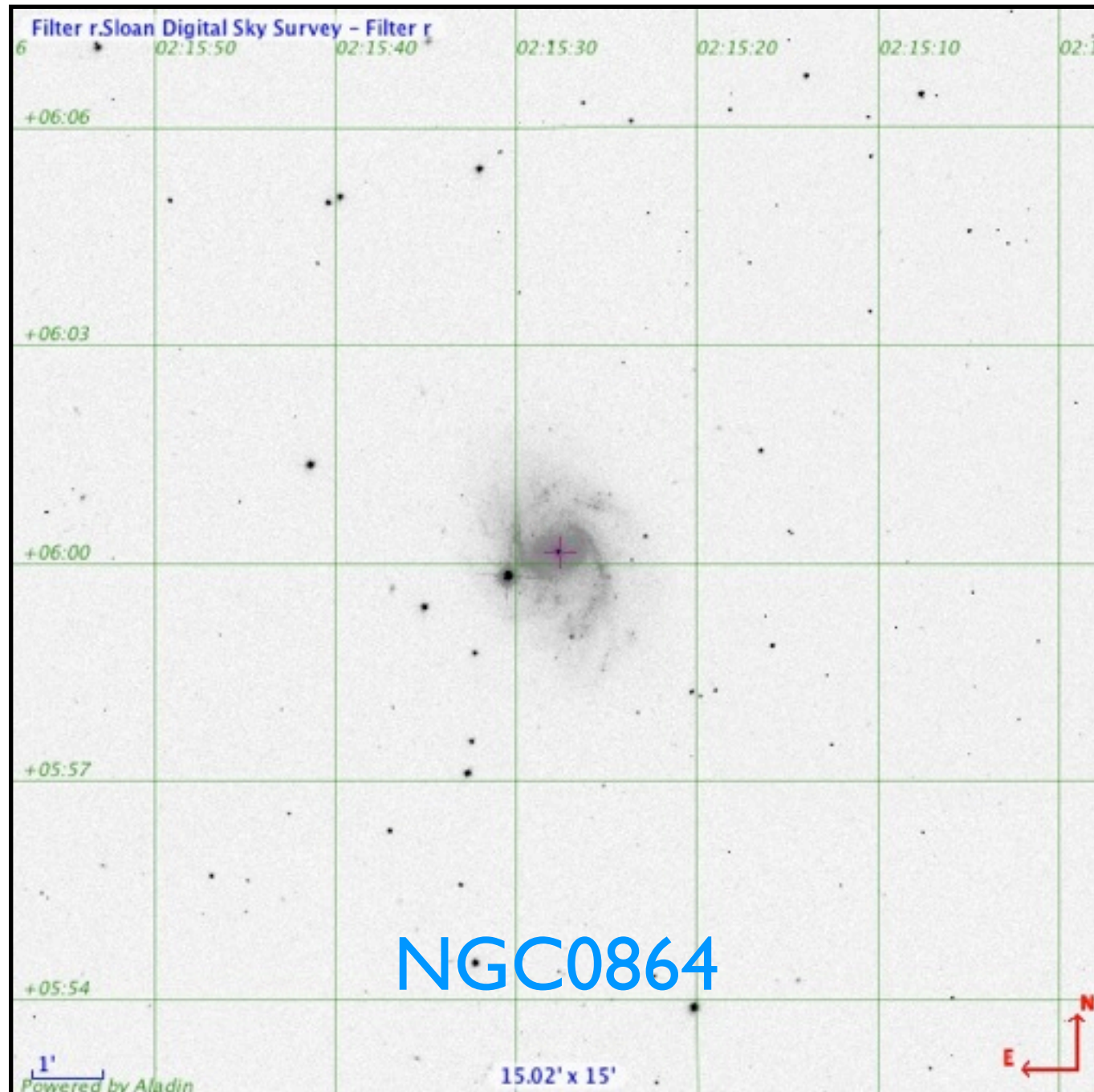
LSB zone



2MASS
Ks band+
DSS2red+
DSS2blue

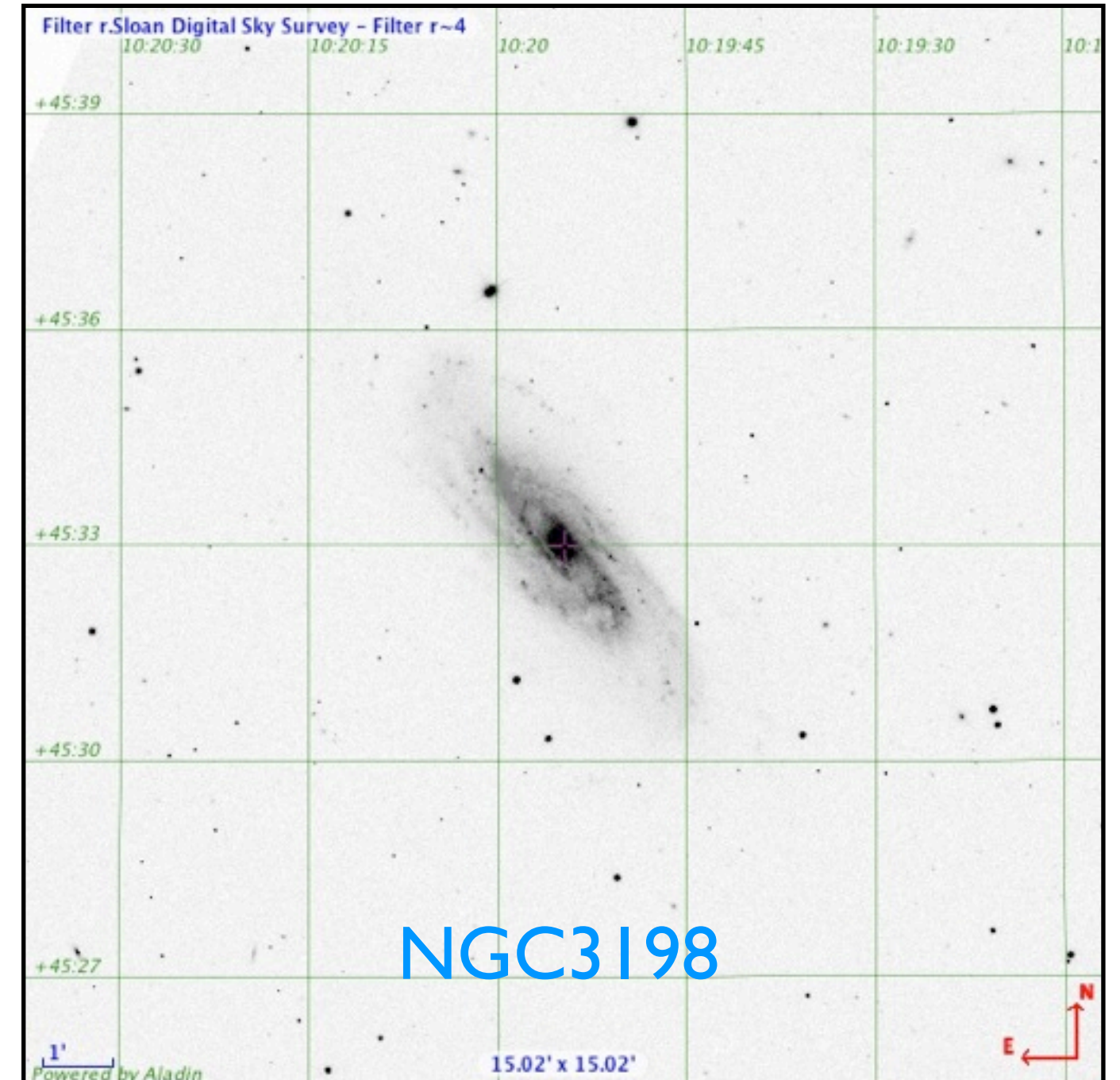
XUV criteria defined in
Thilker, et al., 2007, ApJS, 173, 538

XUV galaxies are... extended



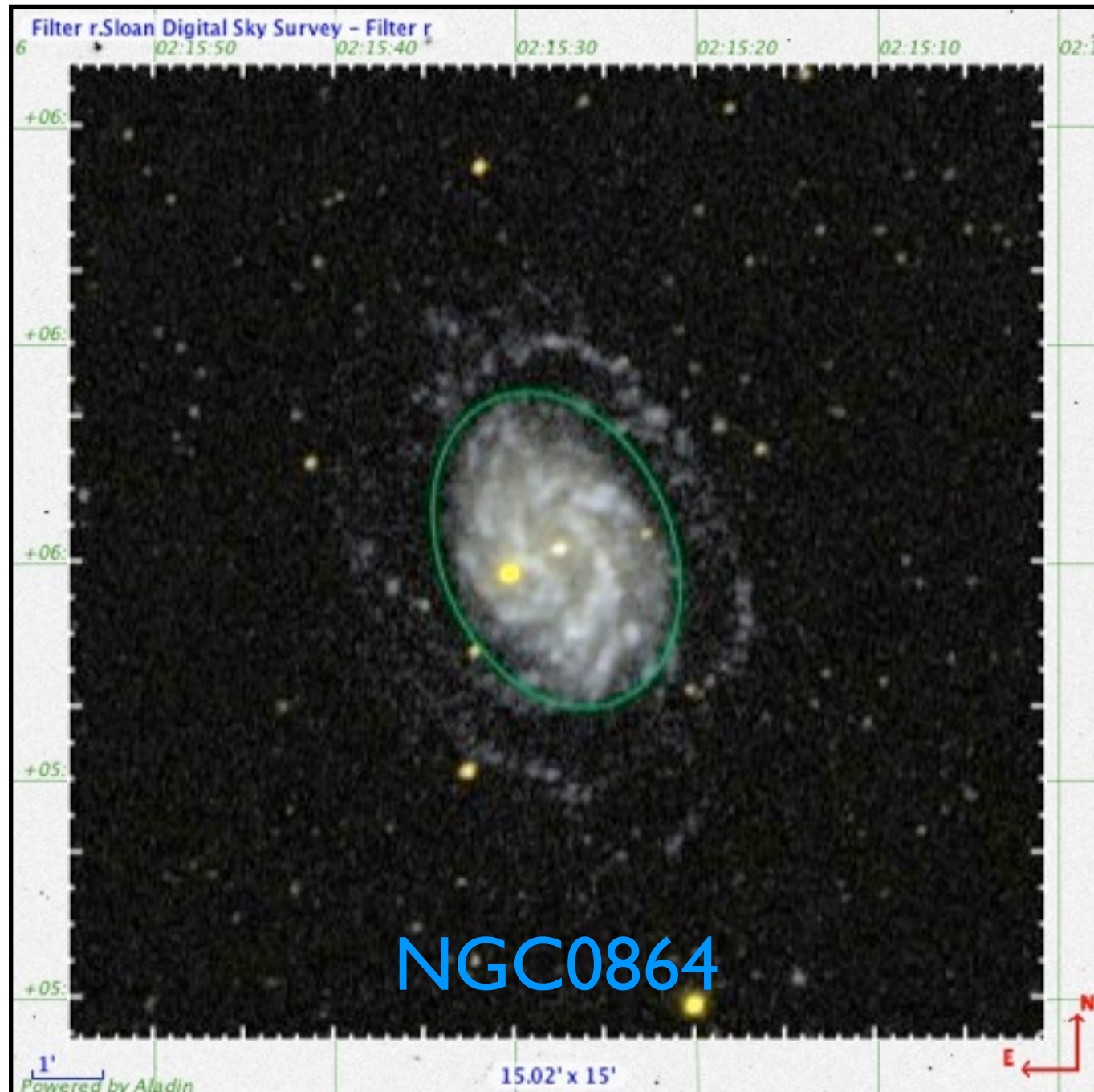
SDSS
Filter r

FOV
15' x 15'



NGC3198

XUV galaxies are... extended

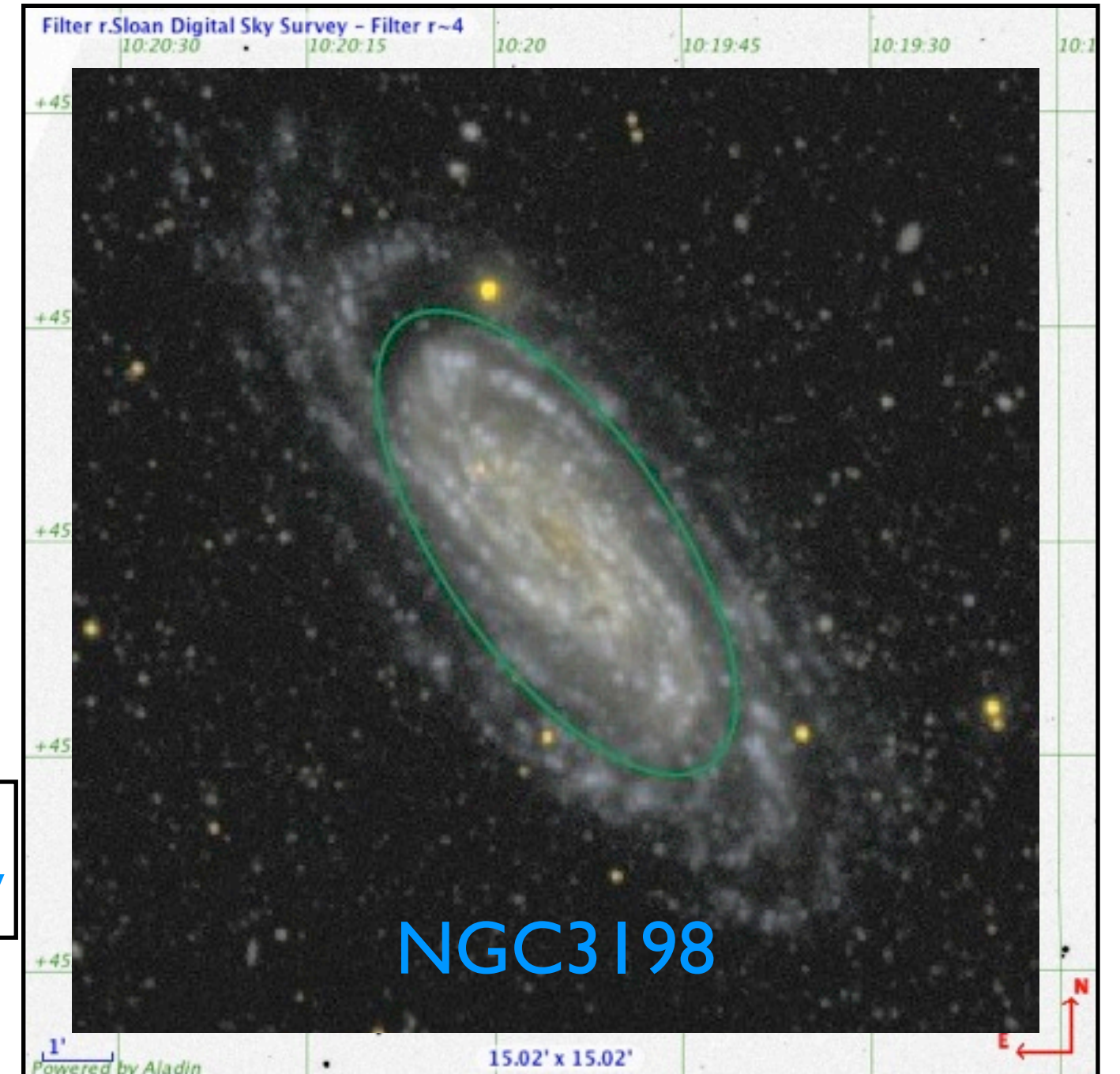


SDSS
Filter r

FOV
15' x 15'

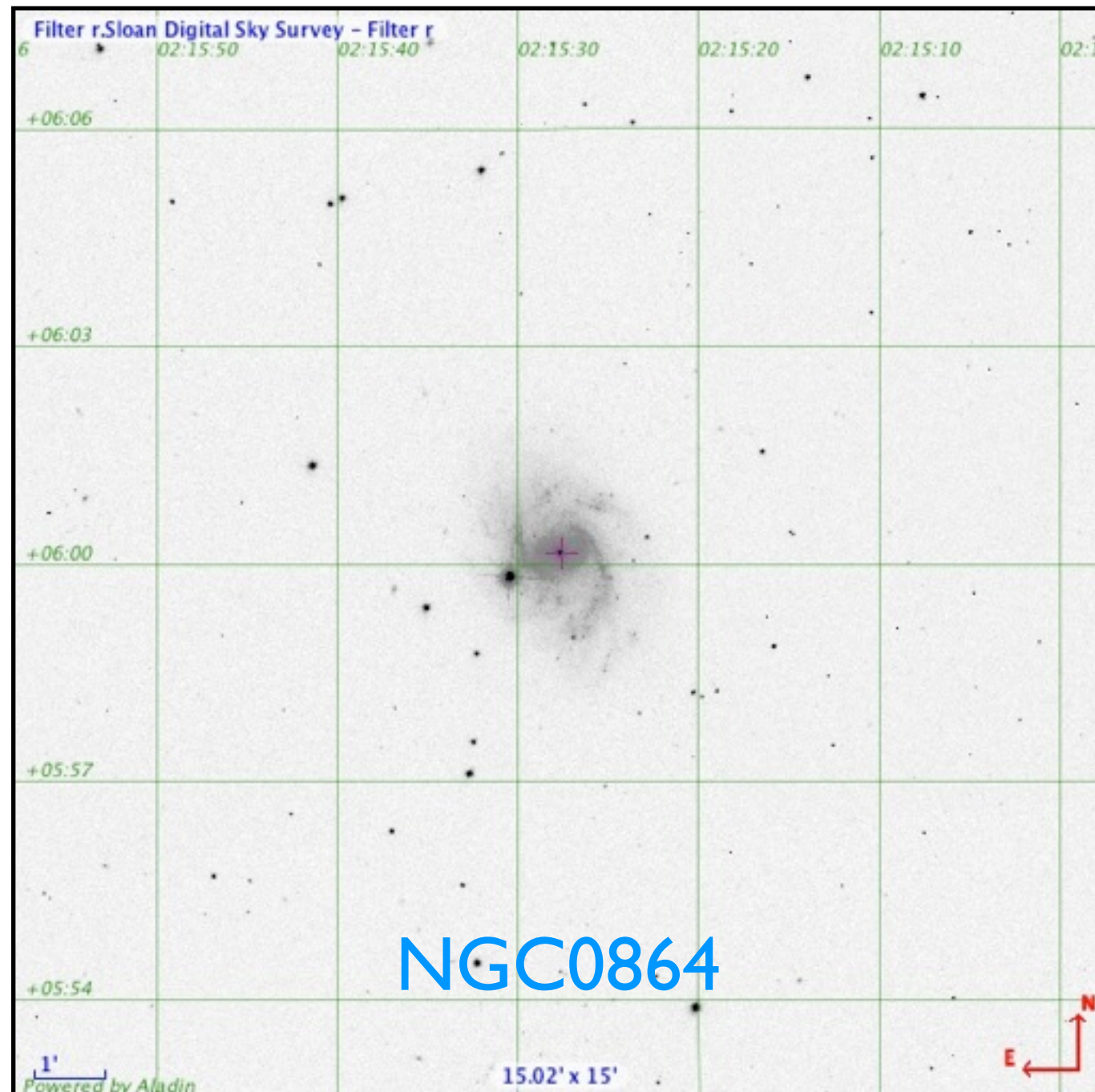
GALEX
FUV+NUV

NGC0864



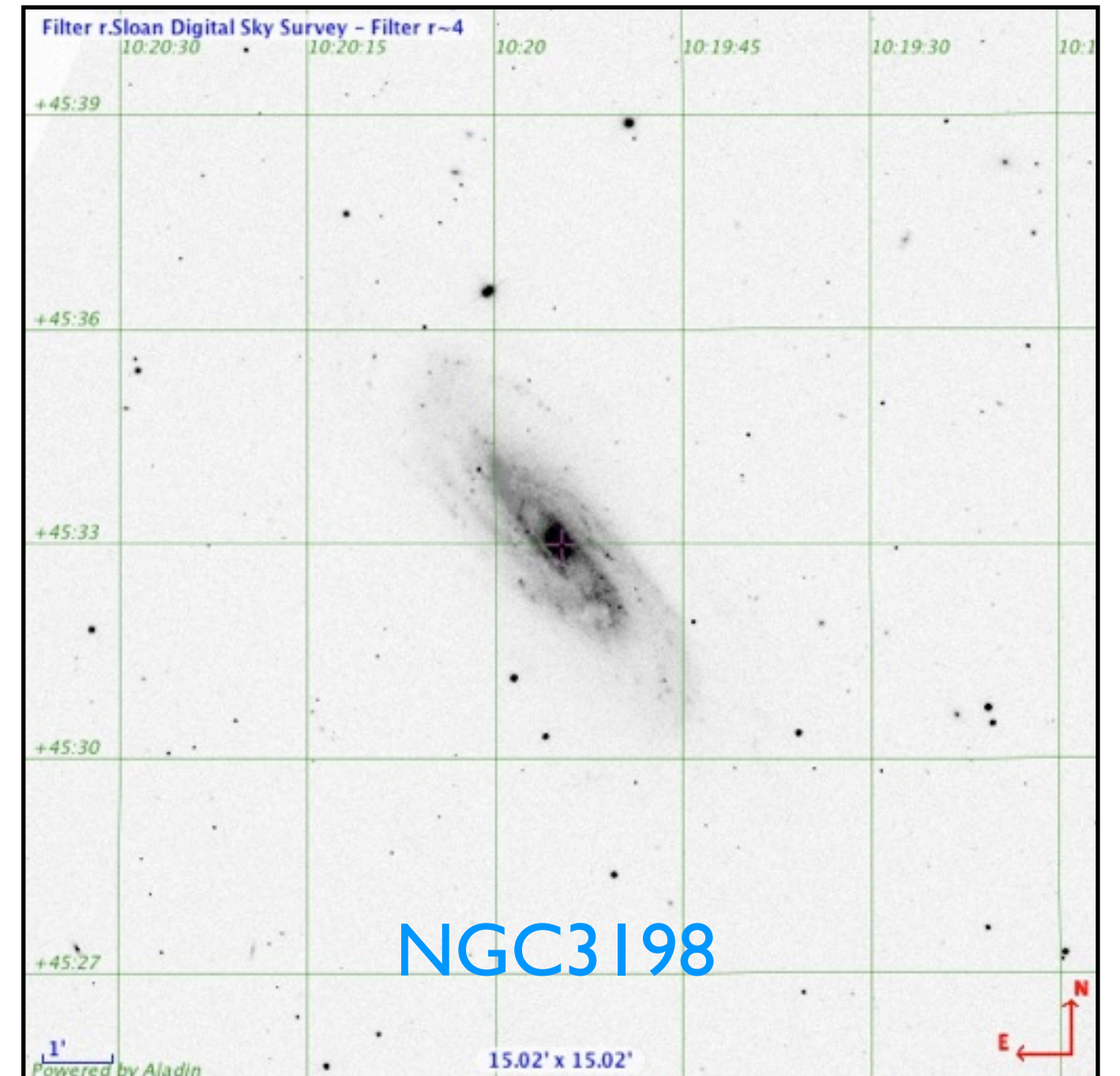
NGC3198

XUV galaxies are... extended



SDSS
Filter r

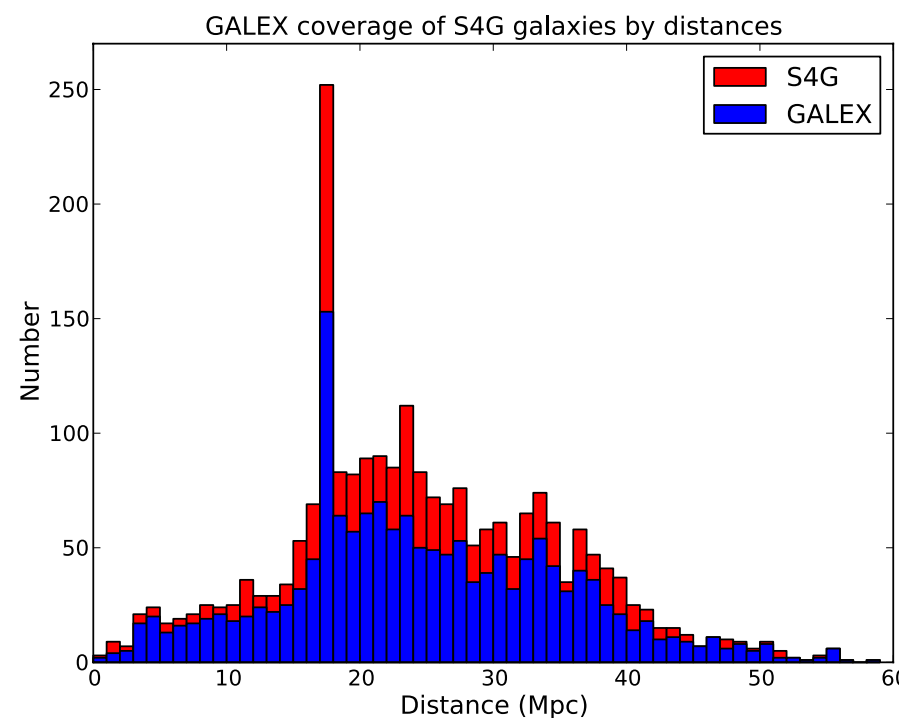
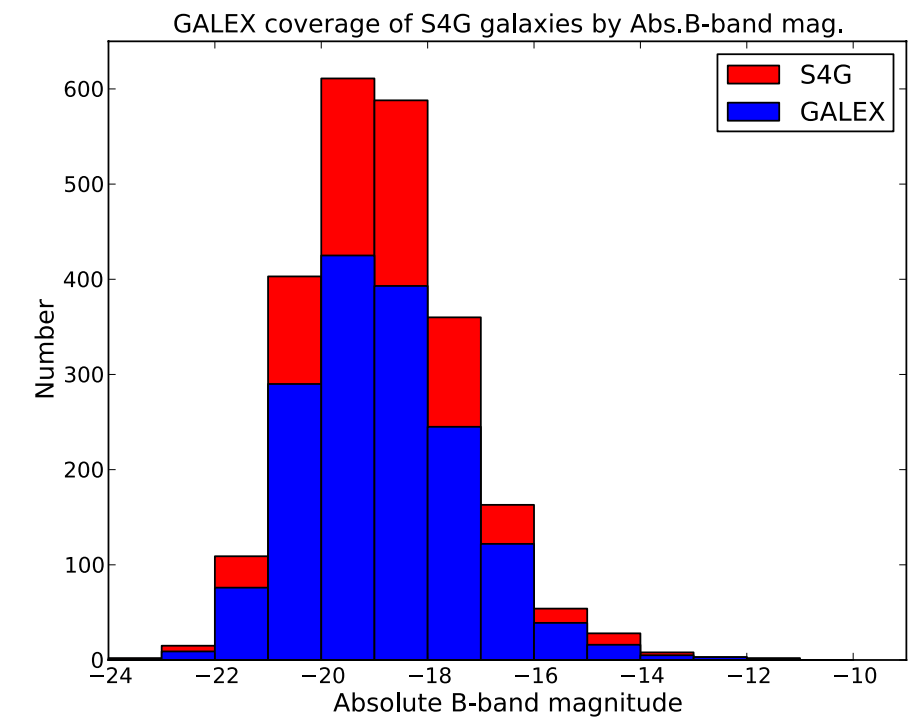
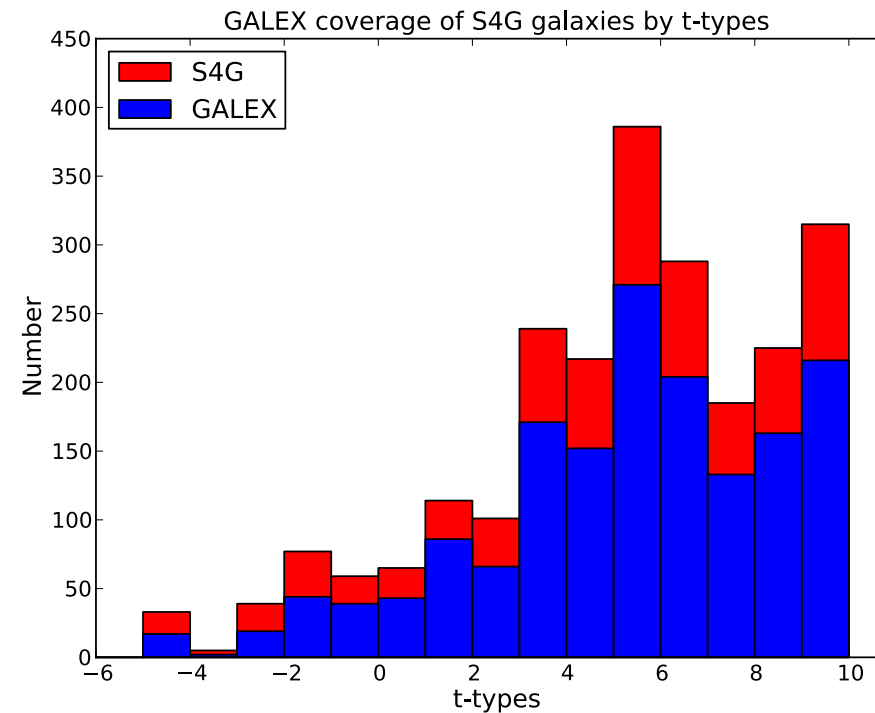
FOV
15' x 15'



SAMPLE

- S⁴G:
2,352 galaxies
IRAC 3.6 μ m, 4.5 μ m
d < 40 Mpc, |b| > 30°,
m_Bcorr < 15.5, D₂₅ > 1'

- GALEX counterparts:
> 1,500 galaxies,
FUV (1516Å), NUV
(2267Å)



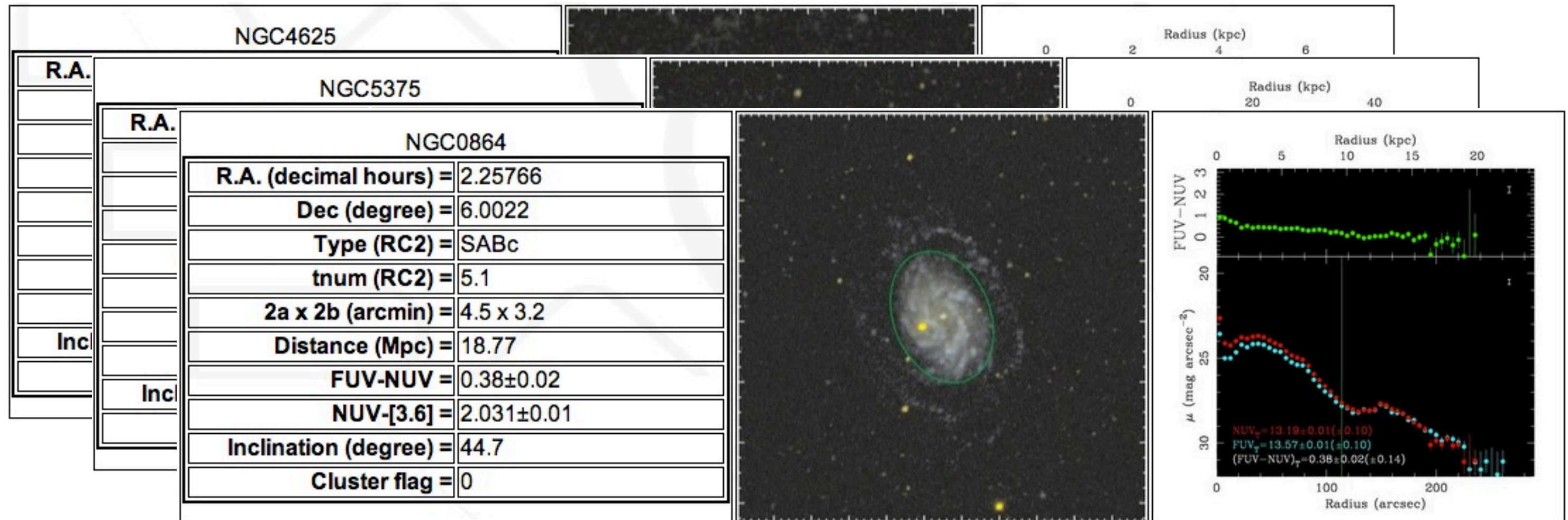
~70% of S4G covered

Data Products

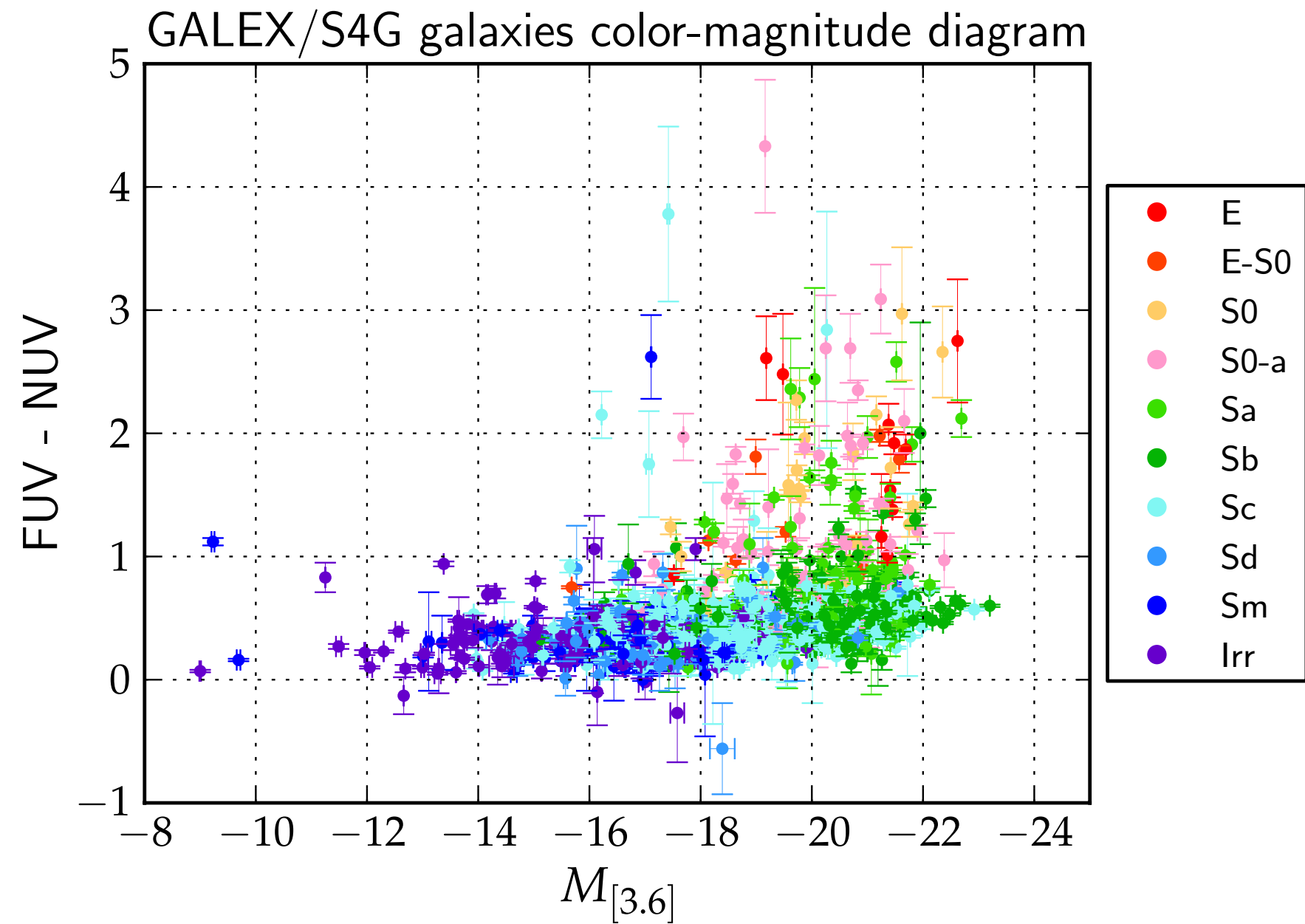
- We obtained asymptotic magnitudes, surface brightness profiles, color profiles, FUV+NUV RGB images from GALEX images.

Data Products

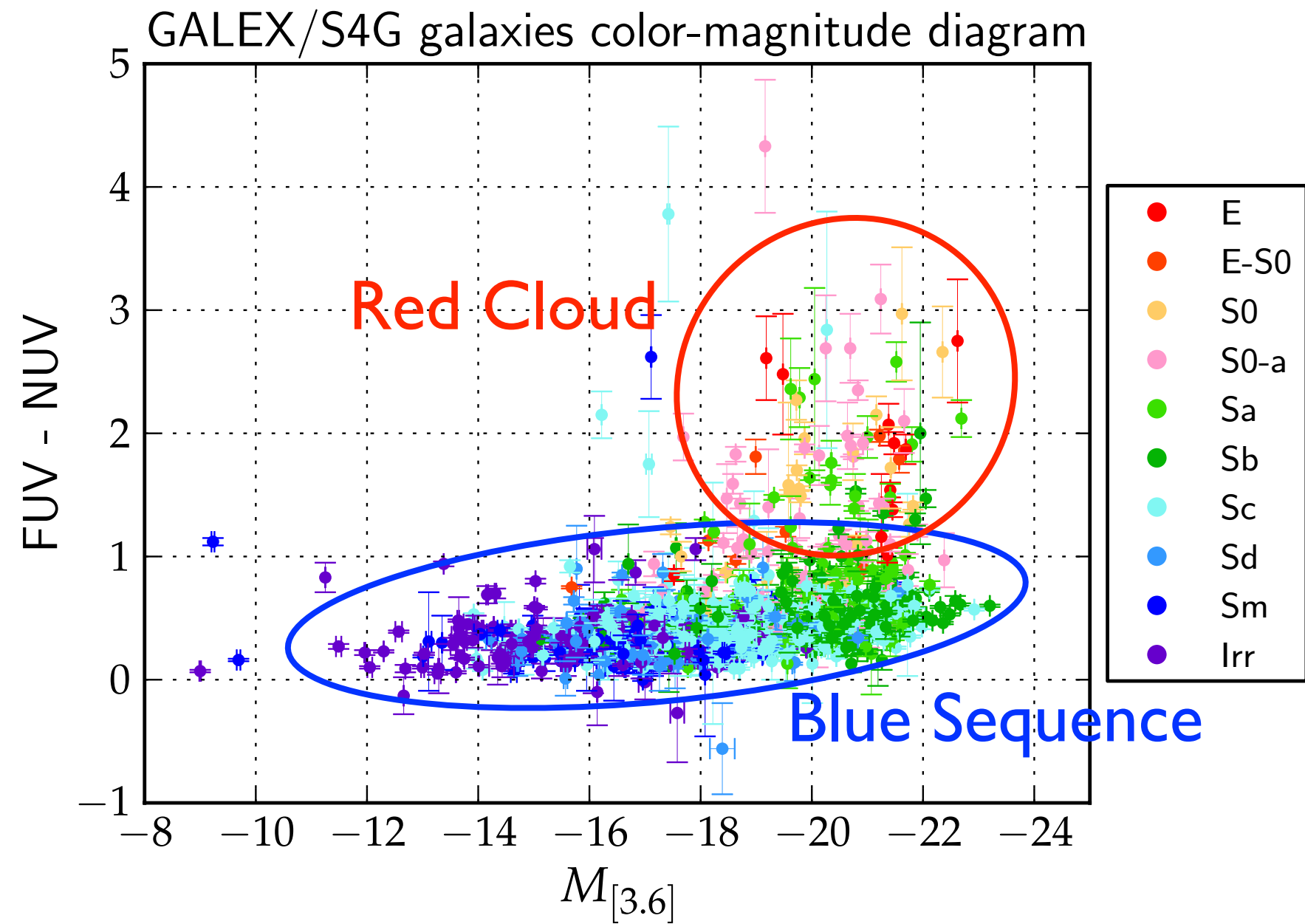
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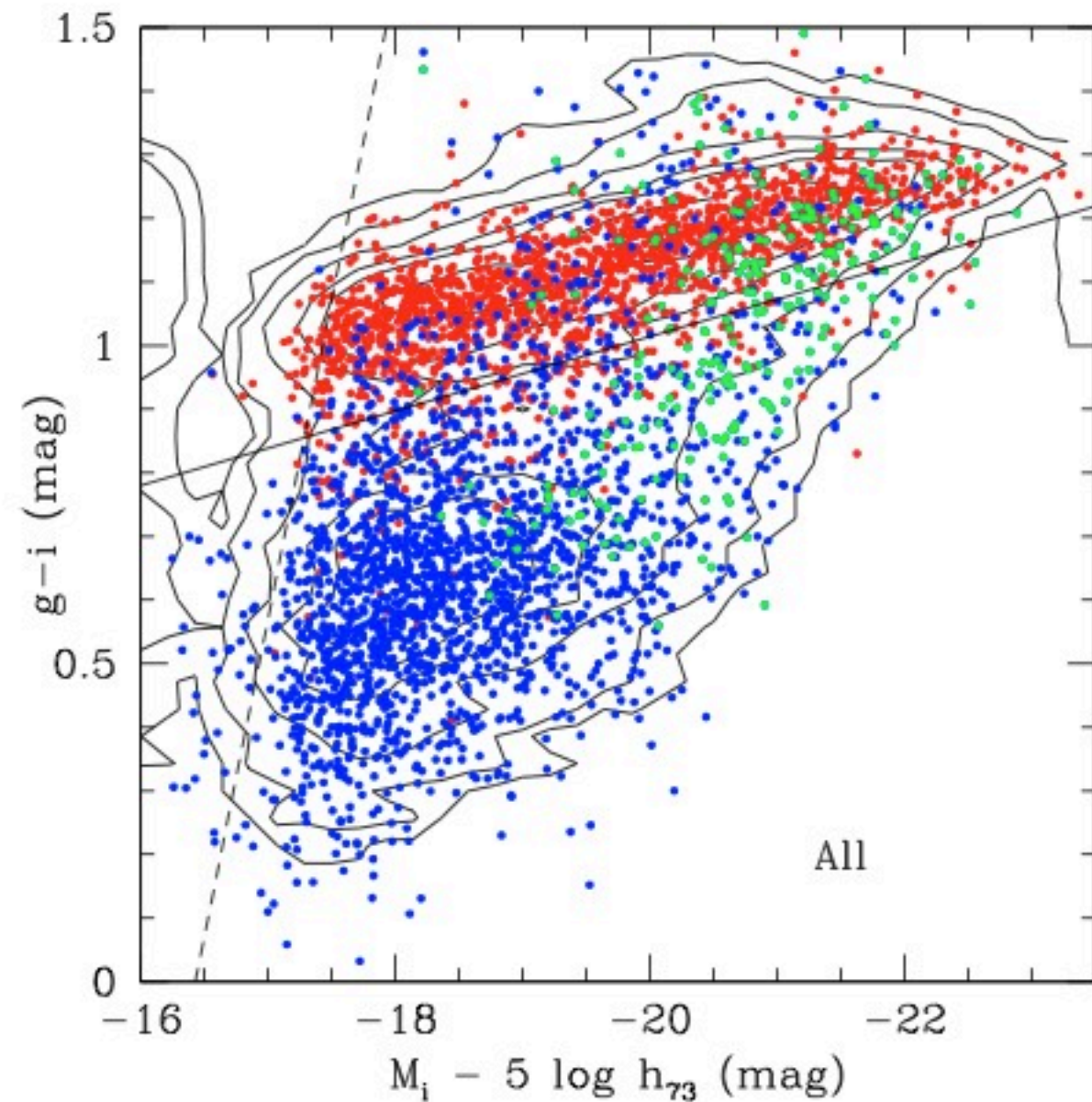
Color-Magnitude Diagram



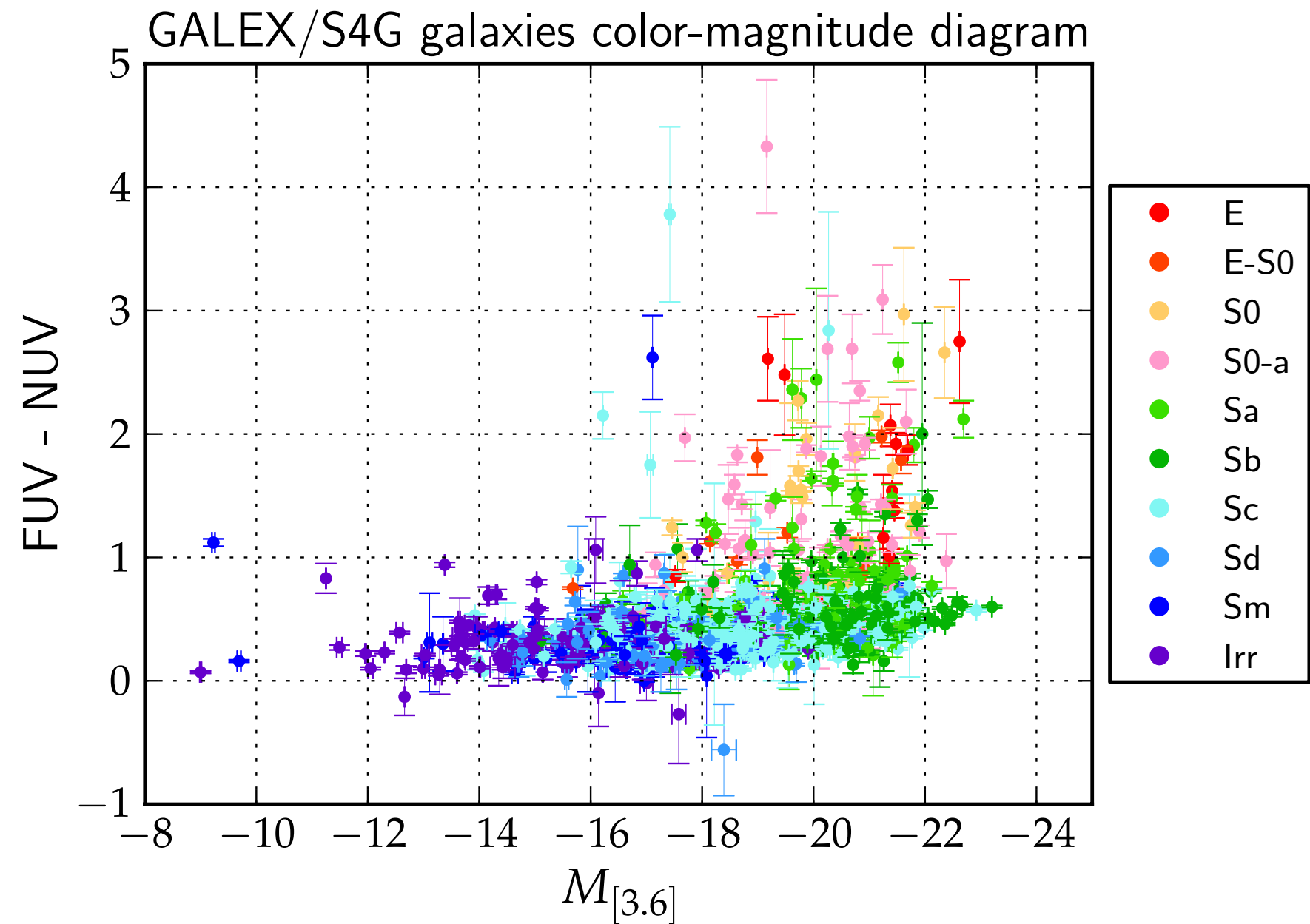
Color-Magnitude Diagram



Color-Magnitude Diagram

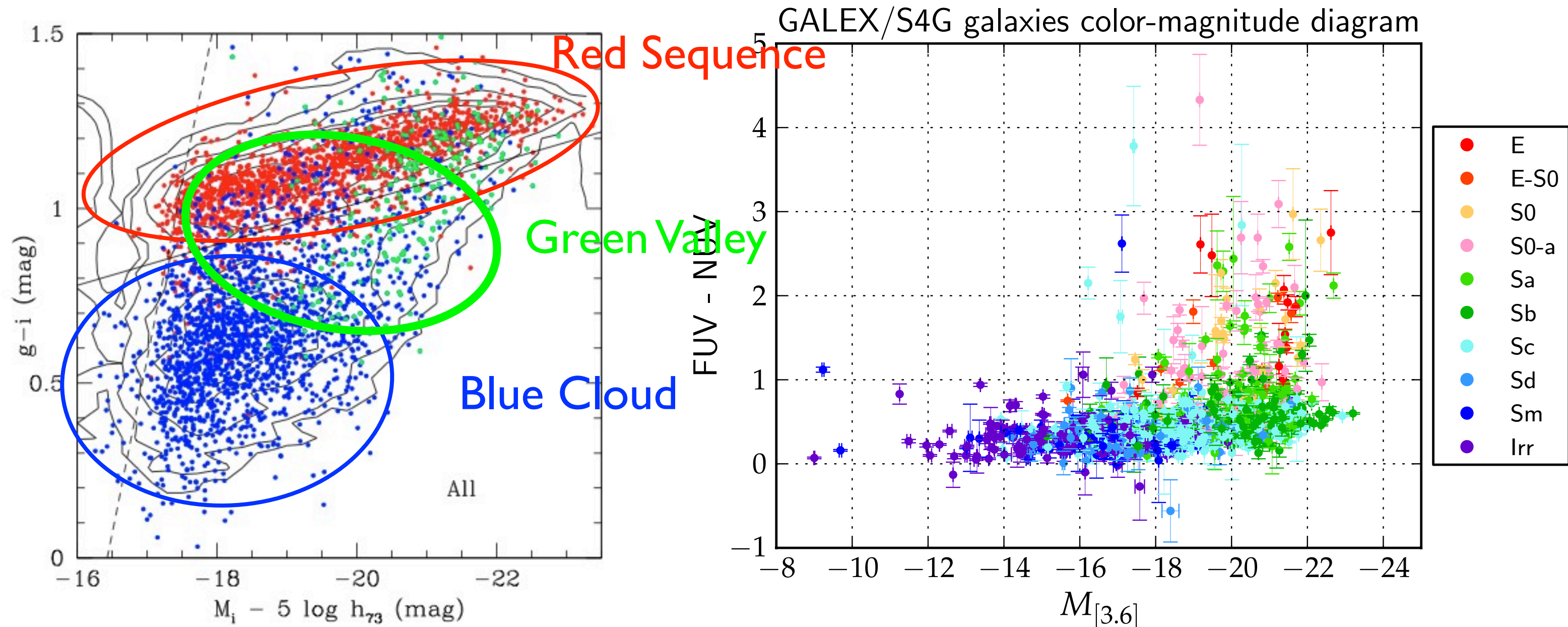


Gavazzi et al., 2010, A&A, 517, 73



OPPOSITE OF "CLASSICAL" OPTICAL/IR CMD

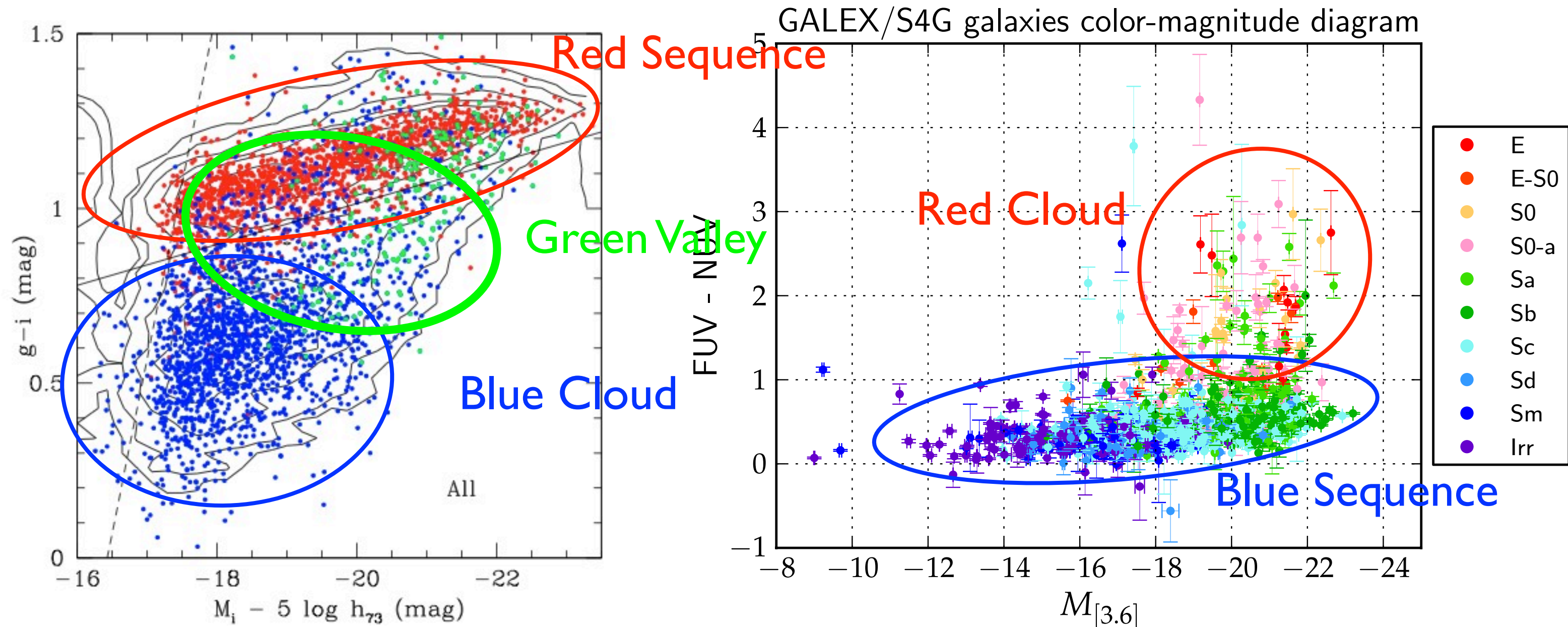
Color-Magnitude Diagram



Gavazzi et al., 2010, A&A, 517, 73

OPPOSITE OF "CLASSICAL" OPTICAL/IR CMD

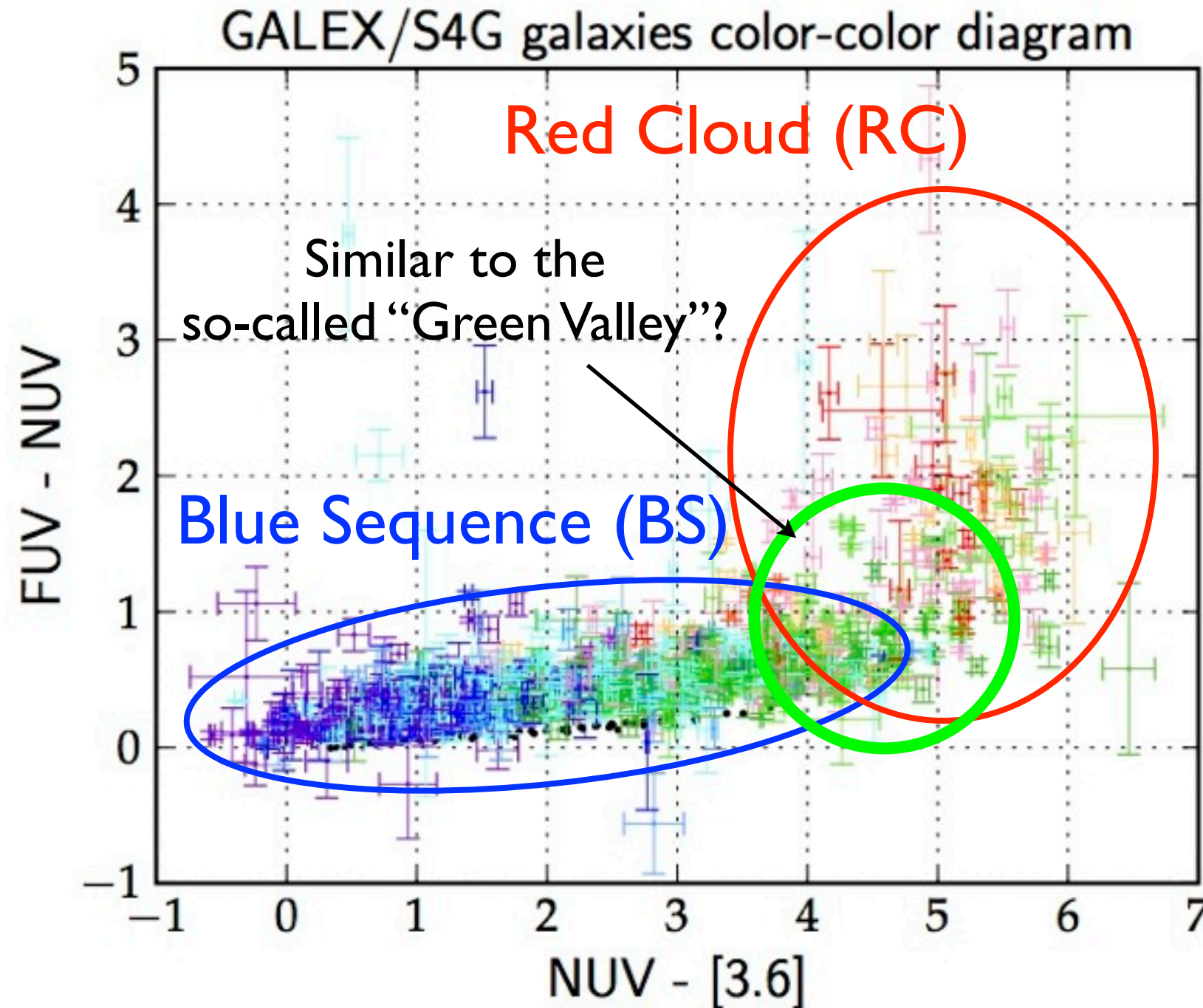
Color-Magnitude Diagram



Gavazzi et al., 2010, A&A, 517, 73

OPPOSITE OF "CLASSICAL" OPTICAL/IR CMD

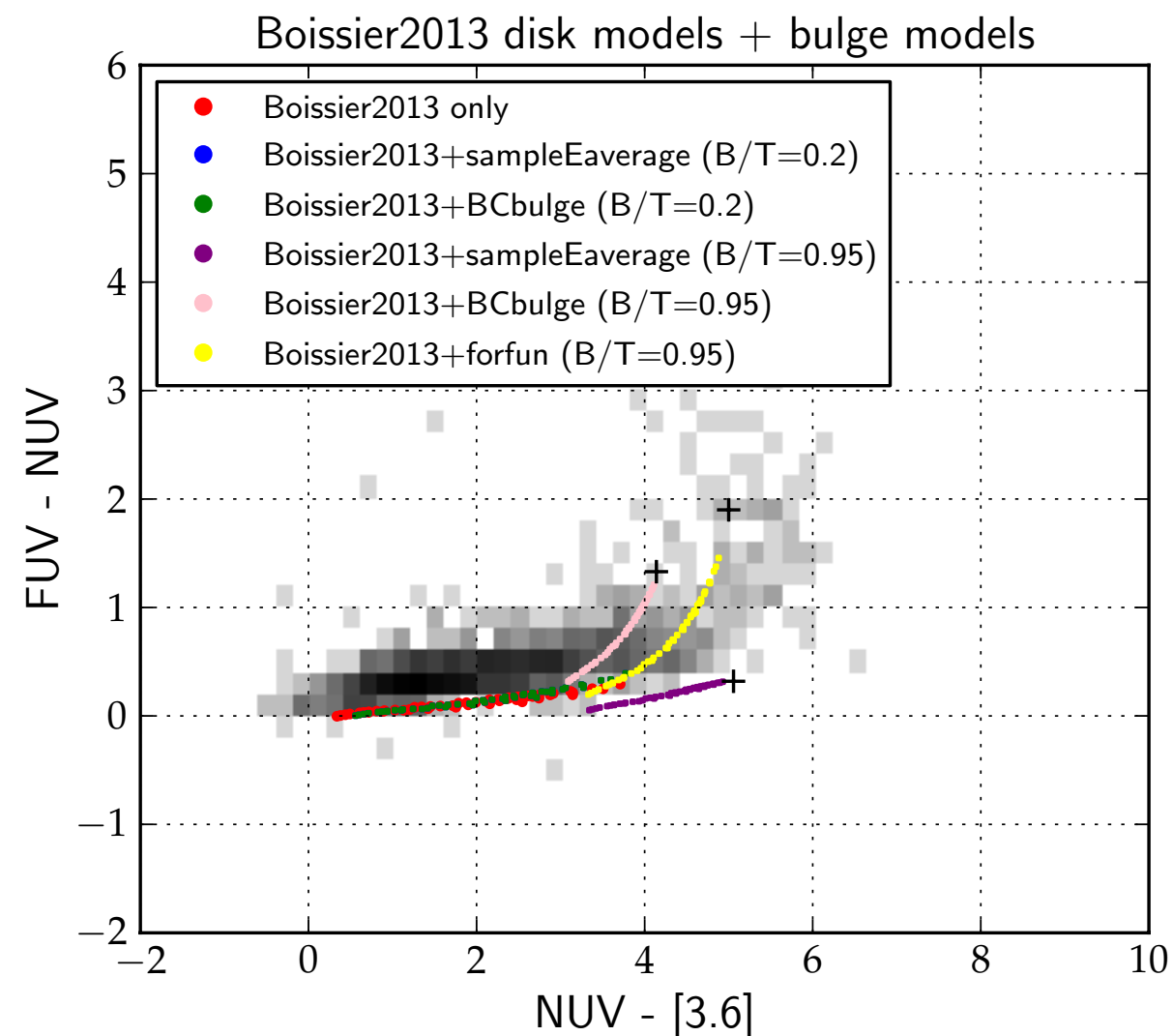
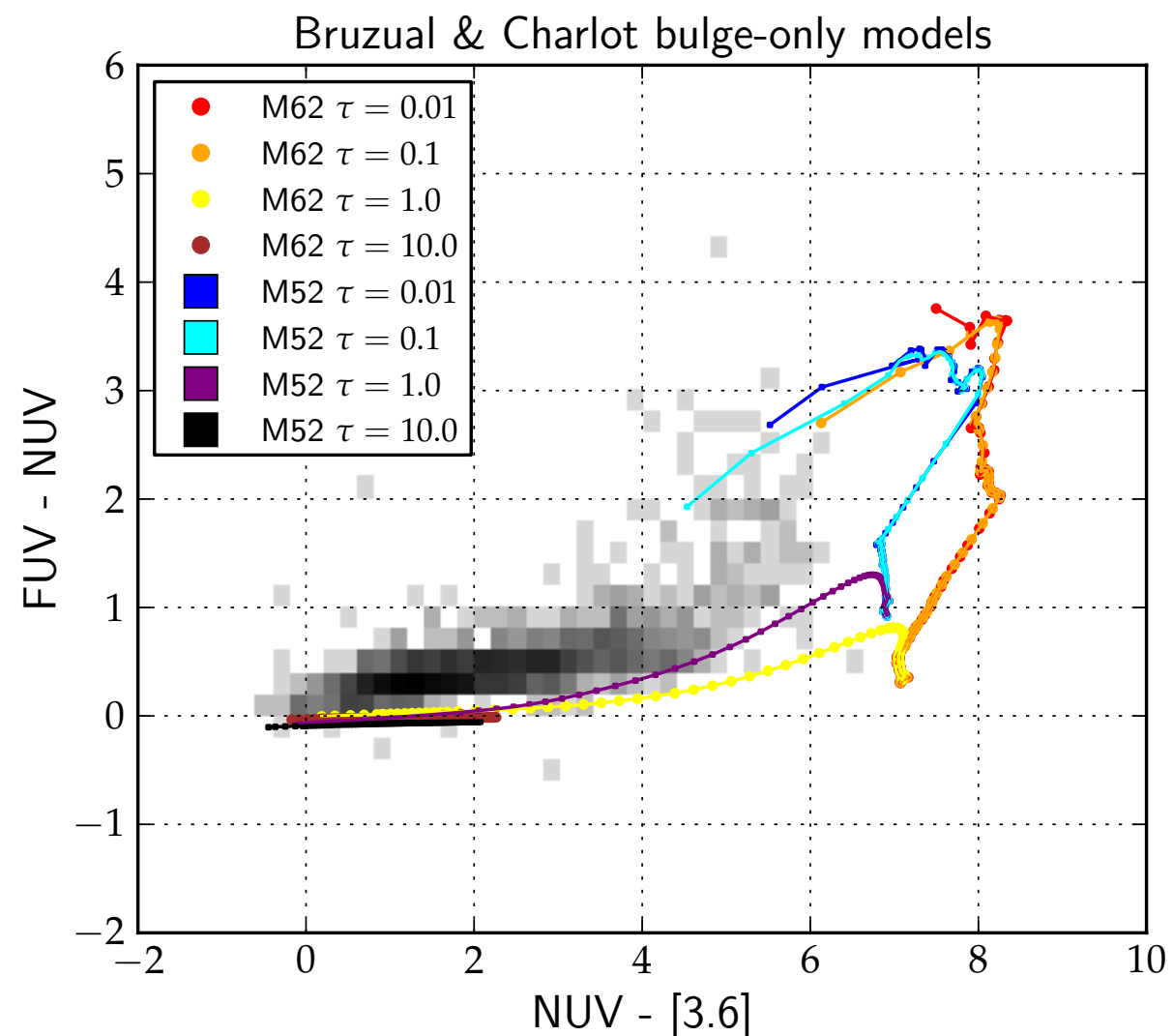
A tight color-color diagram of star-forming galaxies: a.k.a. the Blue Sequence



- (FUV-NUV) vs (NUV-[3.6]) plotted by morphological type.
- Obvious trend by type, with late-type galaxies aligned in a blue sequence, and early-type galaxies populating the red part of the diagram.

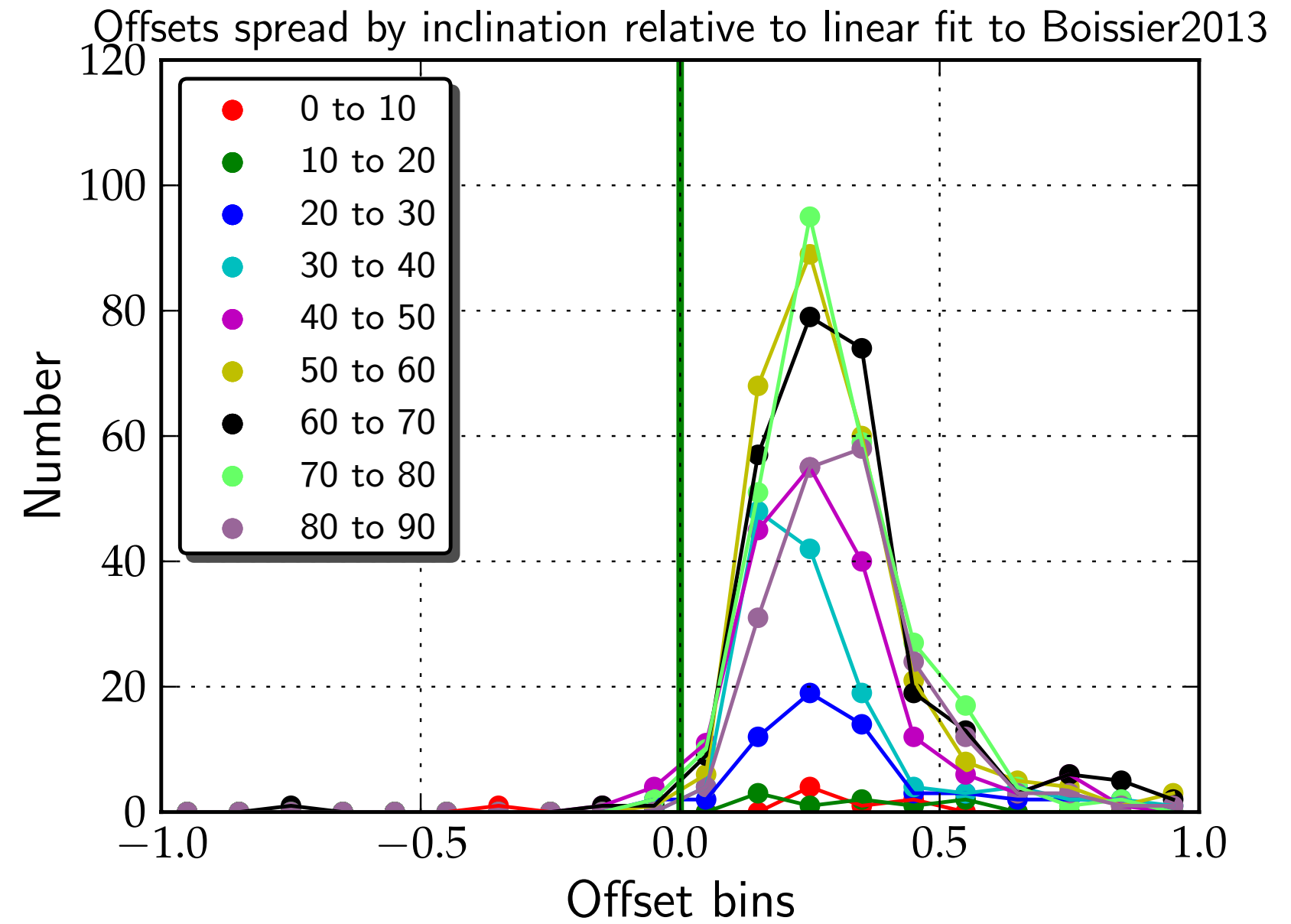
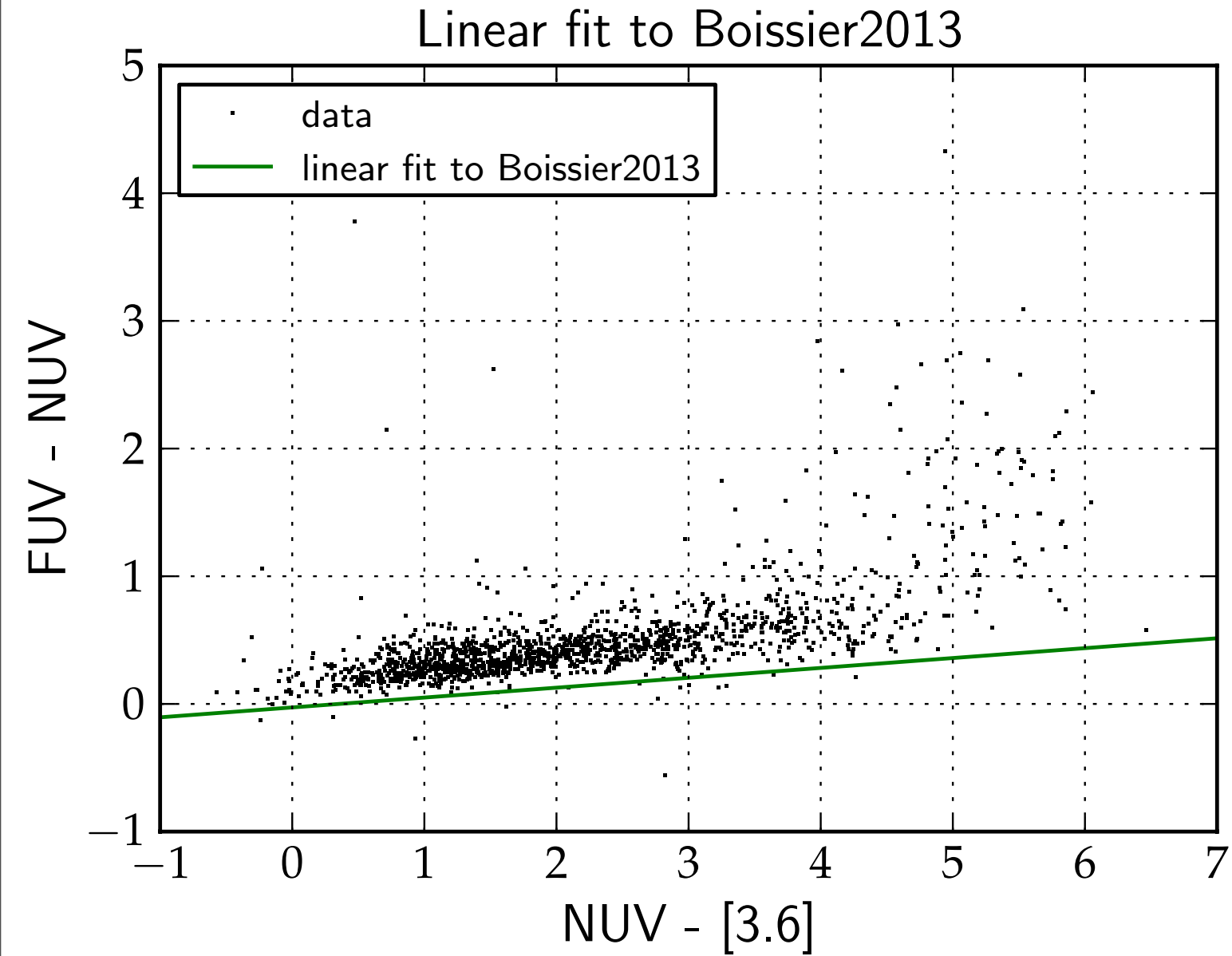
Applications of models

- We use Samuel Boissier's galaxies model to predict the disk UV and FIR colors and BC03 models for the bulge colors. (Boissier, L. & Prantzos, N., 2000, ASPC, 215, 53. 2000, MNRAS, 312, 398)

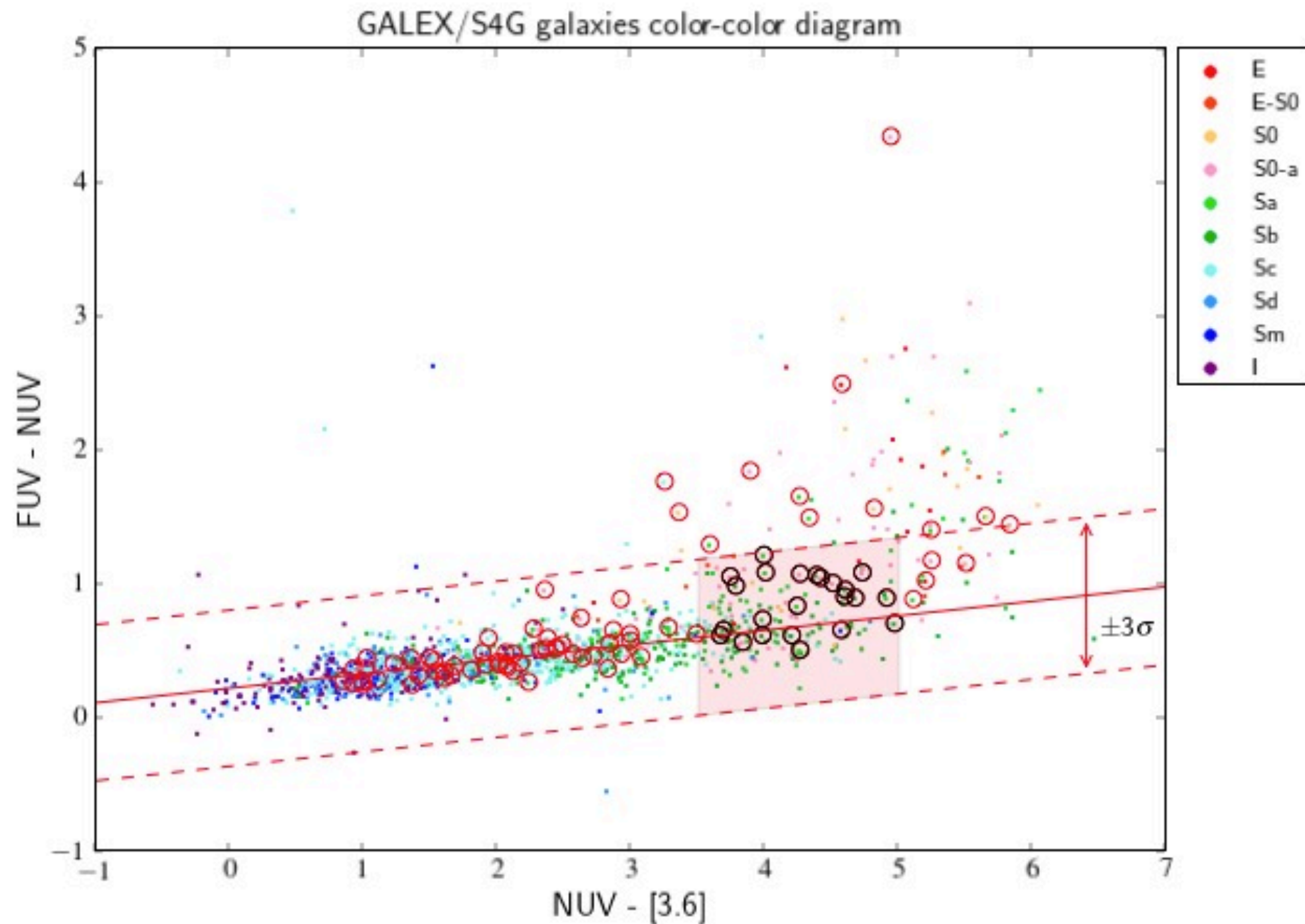


unrealistic
 $B/T=0.95$
needed
to reproduce
the color
distribution
we see

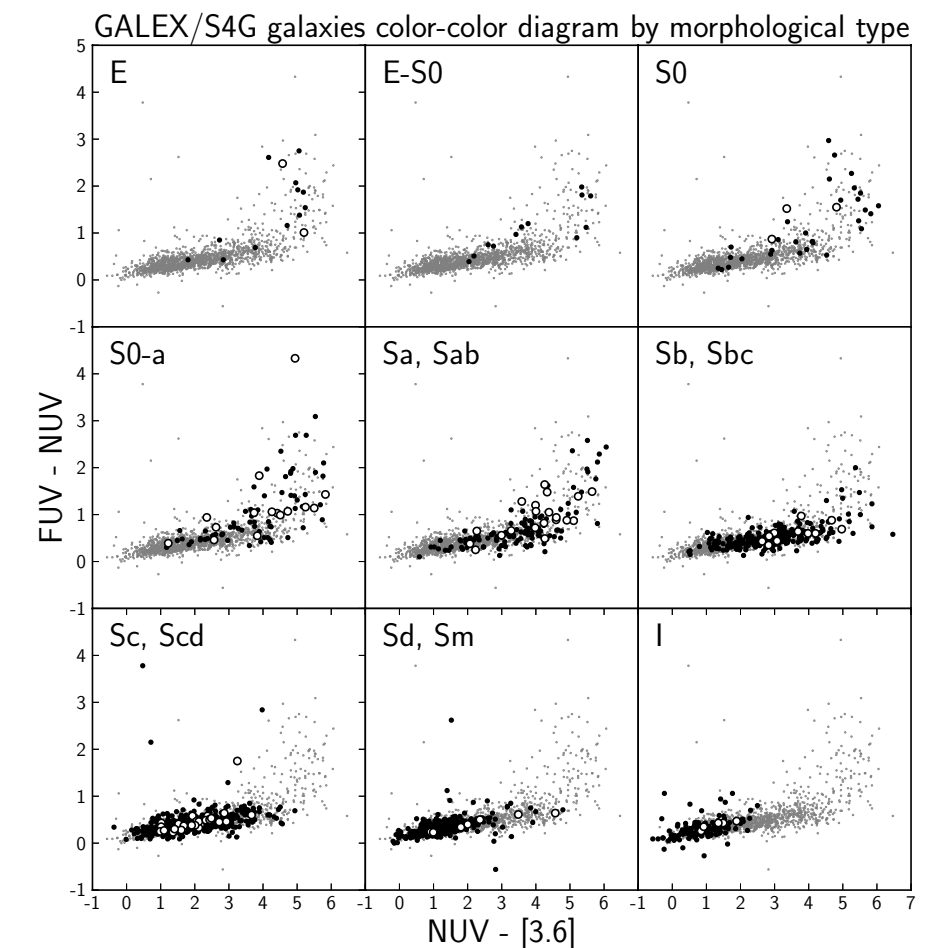
Inclination effects



Environmental Effects?



Current work:
Looking at groups and clusters
membership.



Future work

1. Analysis of the galaxies in this “transition zone” (outer-disks, inner-disks, gas consumption, central region, ram-pressure?, etc...)
2. XUV Catalogue (coming soon)
3. Observation of selected XUV galaxies with GTC (10.4 m) OSIRIS Tunable Filter scan (20hours obtained, queue scheduled between Oct. 2013 ~ Mar. 2014) to get H α and NII lines over an 8' radius FOV.
4. Get optical spectra of those regions that drive the BS --> RC

Summary

- (FUV - NUV) vs (NUV - [3.6]) color-color diagram: the smooth SFH and dust attenuation places the bulk of our galaxies in a tight sequence (the blue sequence) and a scattered red cloud. This is the opposite of the “classical” Red Sequence and Blue Cloud in optical-IR data.
- early-type spirals that are offset from that blue sequence (i.e. the red cloud) may be galaxies where the SF has been recently quenched, which suggest some kind of strangulation effect.
- We do not exclude the possibility of disk re-growth, which would move galaxies from the RC to the BS in our UV-IR color-color diagram.
- The analysis of the regions and structural components that are responsible for the evolution of these early-type spirals is underway along with the connection between these transitional systems and the overall population of XUV disks.

Thank you!



By using
Partiview
and
the Digital
Universe
package
Credit:
AMNH