KPC-SCALE PROPERTIES OF EMISSION LINE GALAXIES AT INTERMEDIATE REDSHIFTS

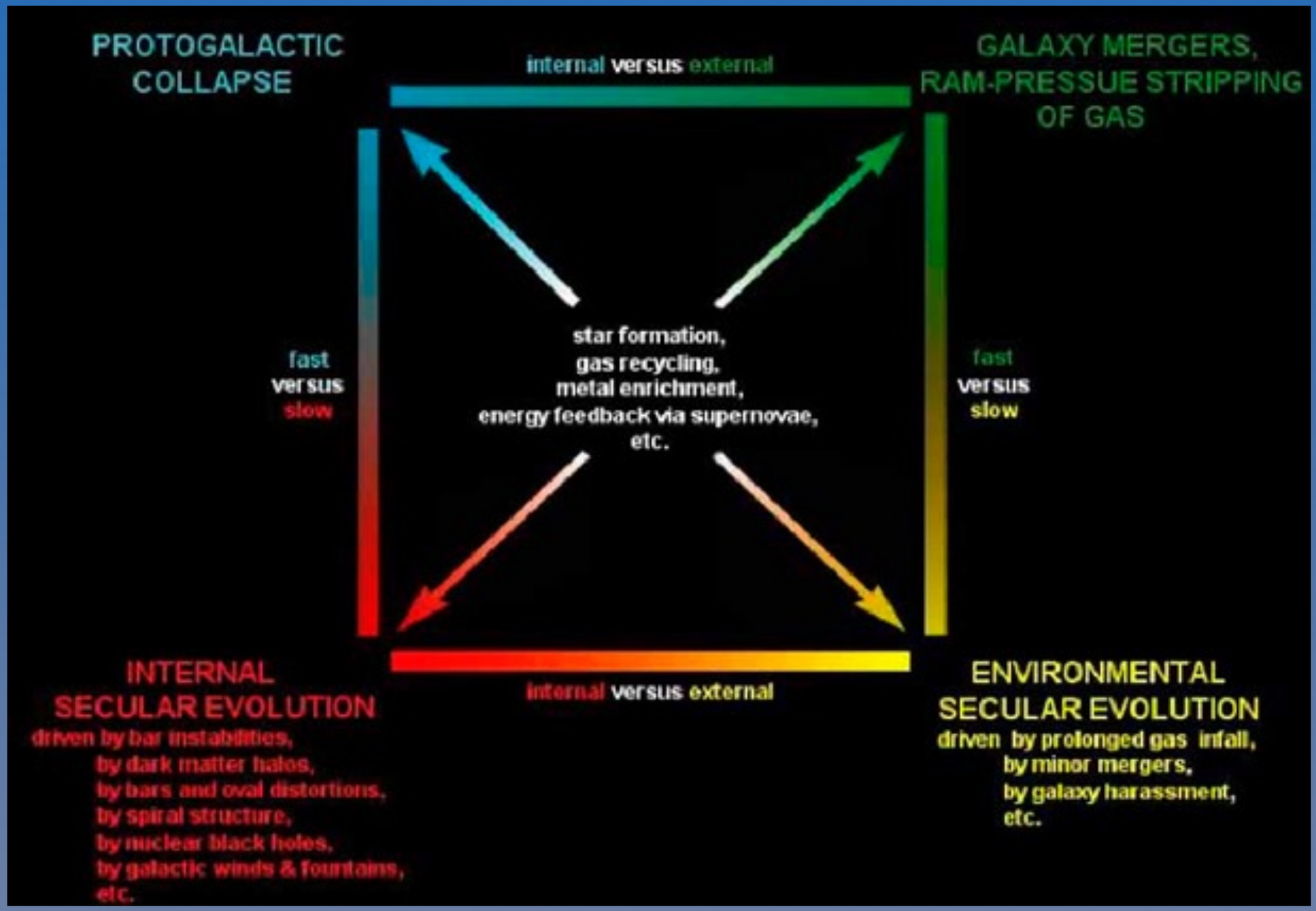
SHOOBY HEMMATI

Collaborators: Bahram Mobasher, Sarah Miller, Hooshang Nayyeri, Henry Ferguson & the CANDELS team

Deep15 Conference at Sintra - March 2015

ASTRONOMY UCR

GALAXY EVOLUTION, BIG PICTURE



credit: Kormendy 2004

DATA

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PHOTOMETRIC DATA:
(CANDELS HST IN OPTICAL + NIR)

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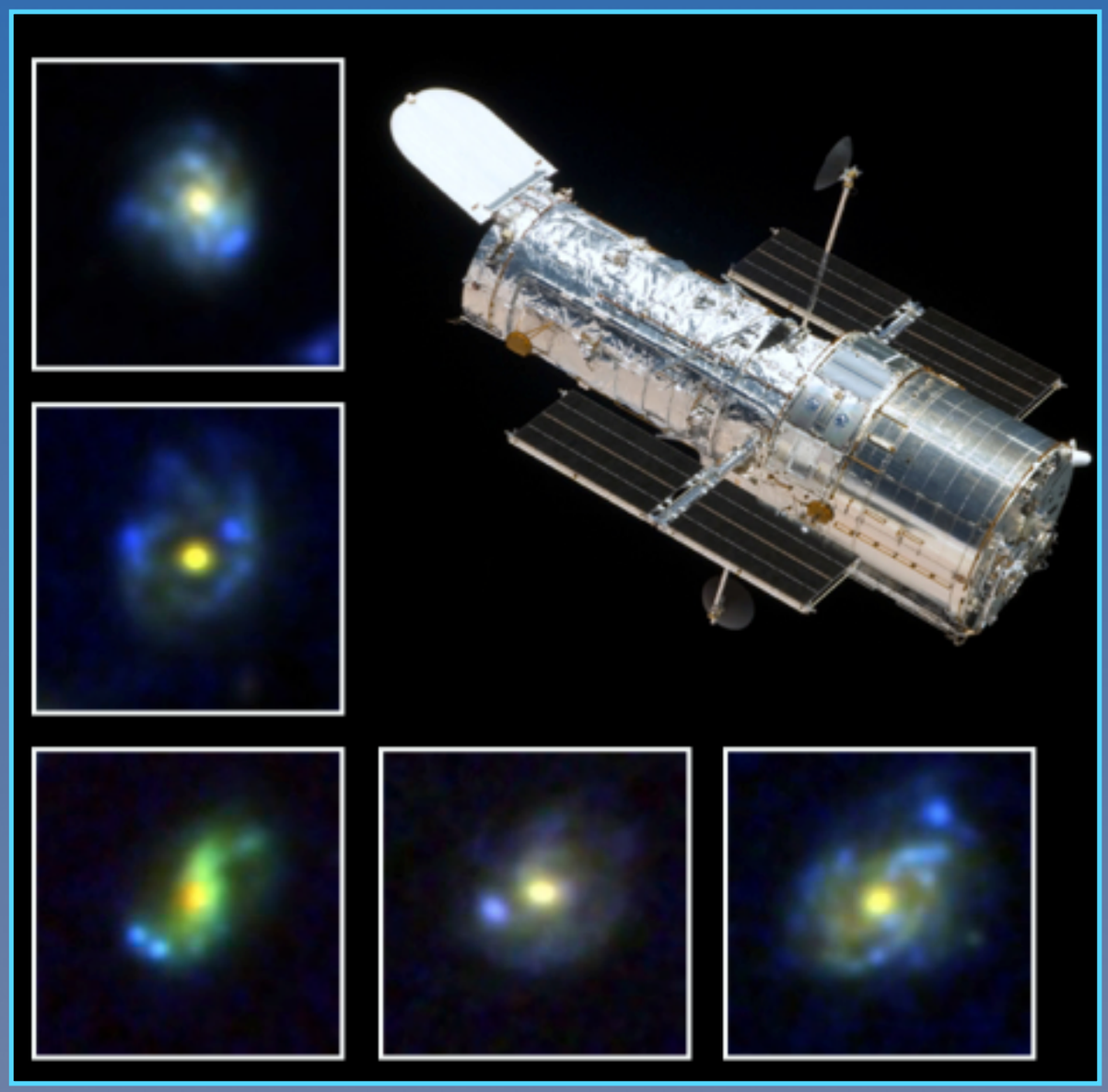

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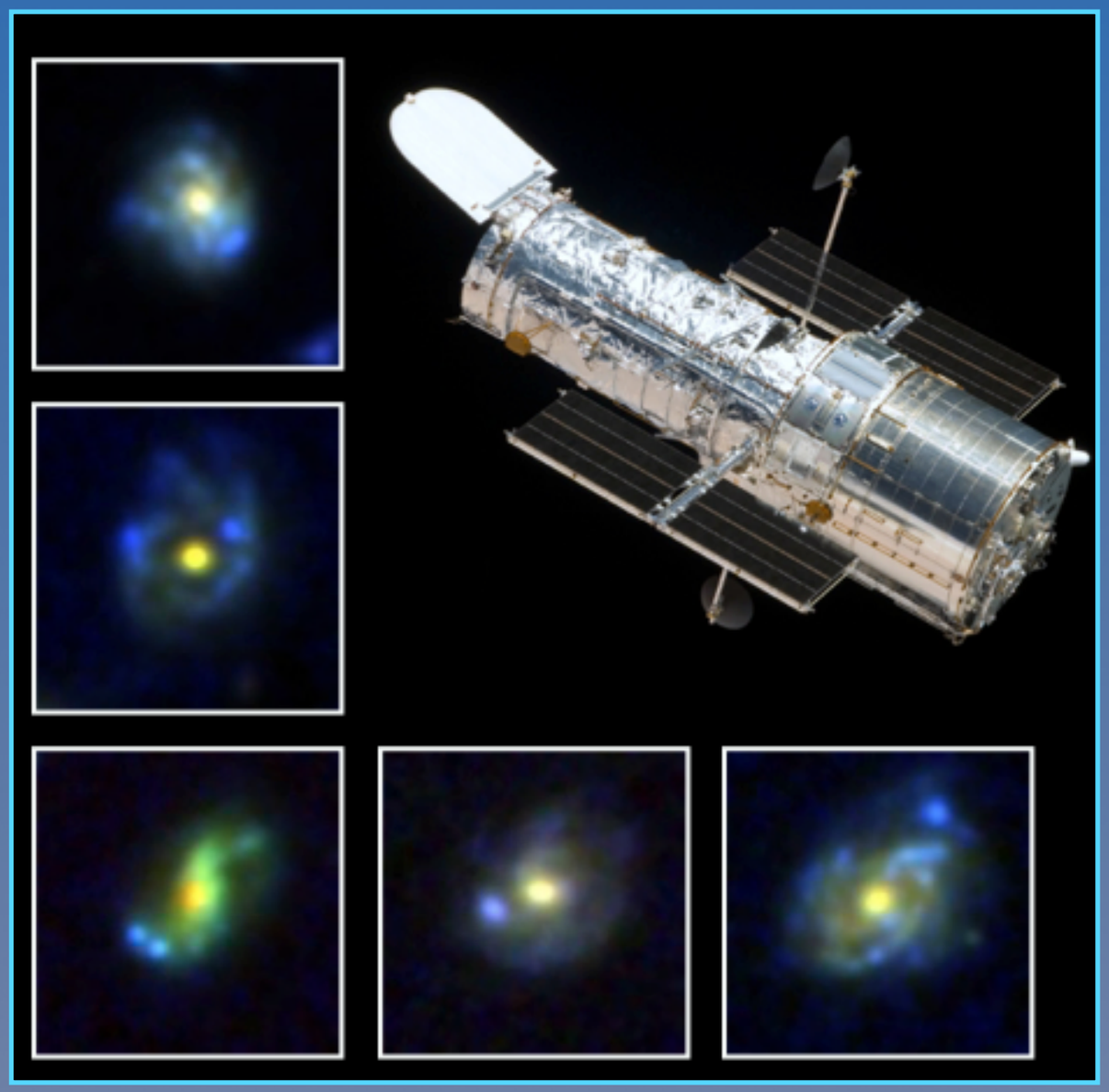

SPECTROSCOPIC DATA: (DEIMOS ON KECKII)

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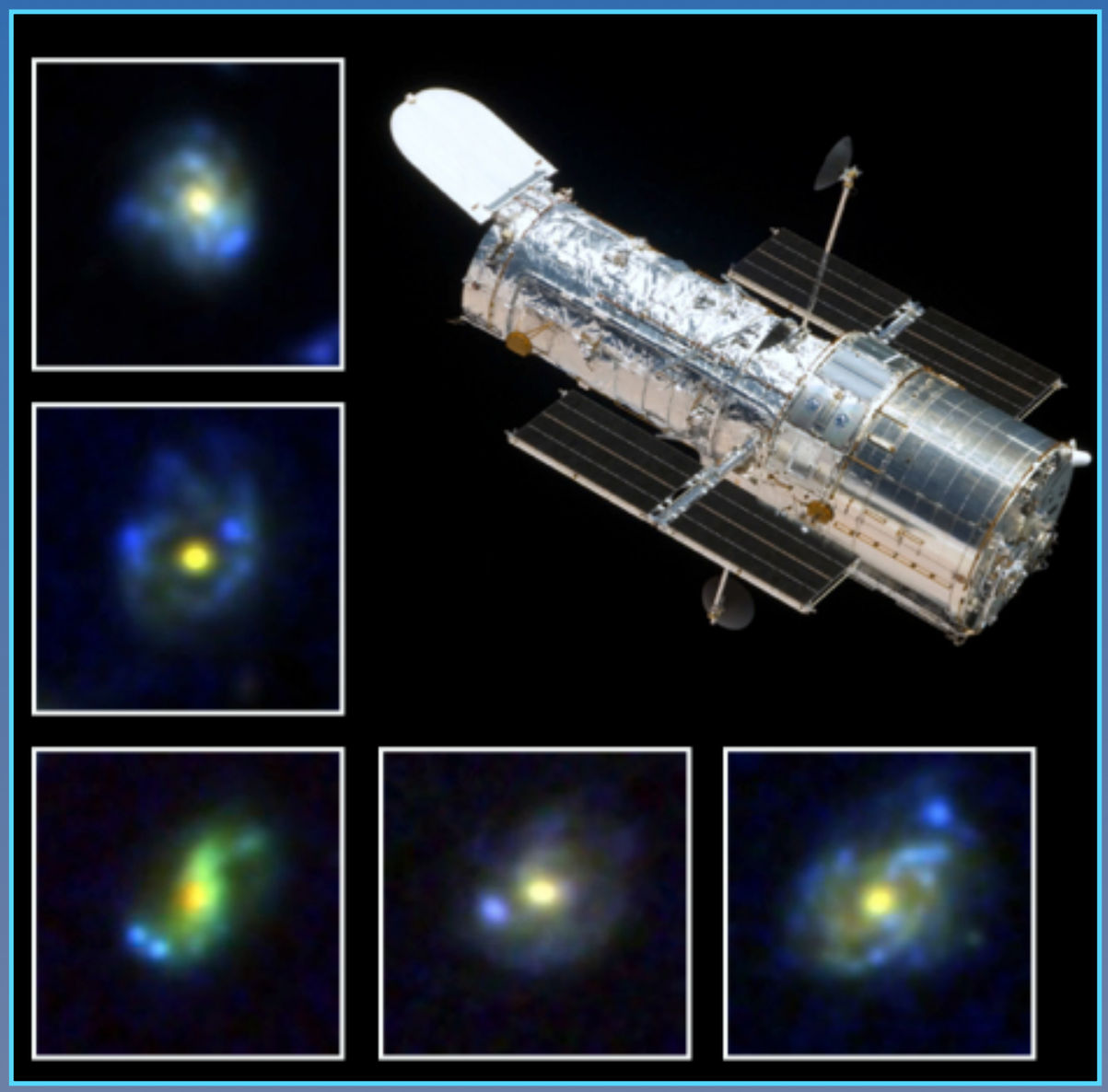

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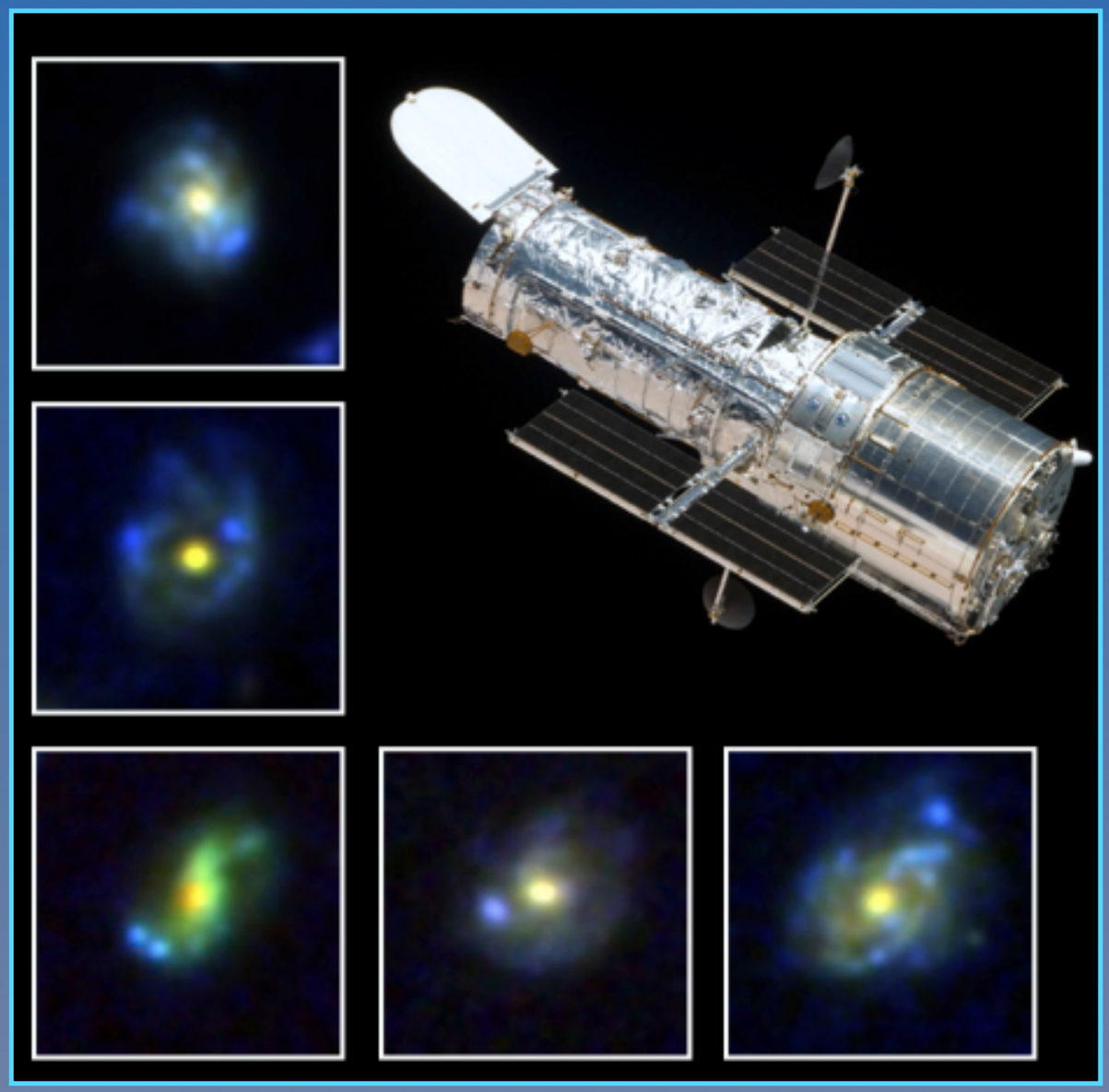

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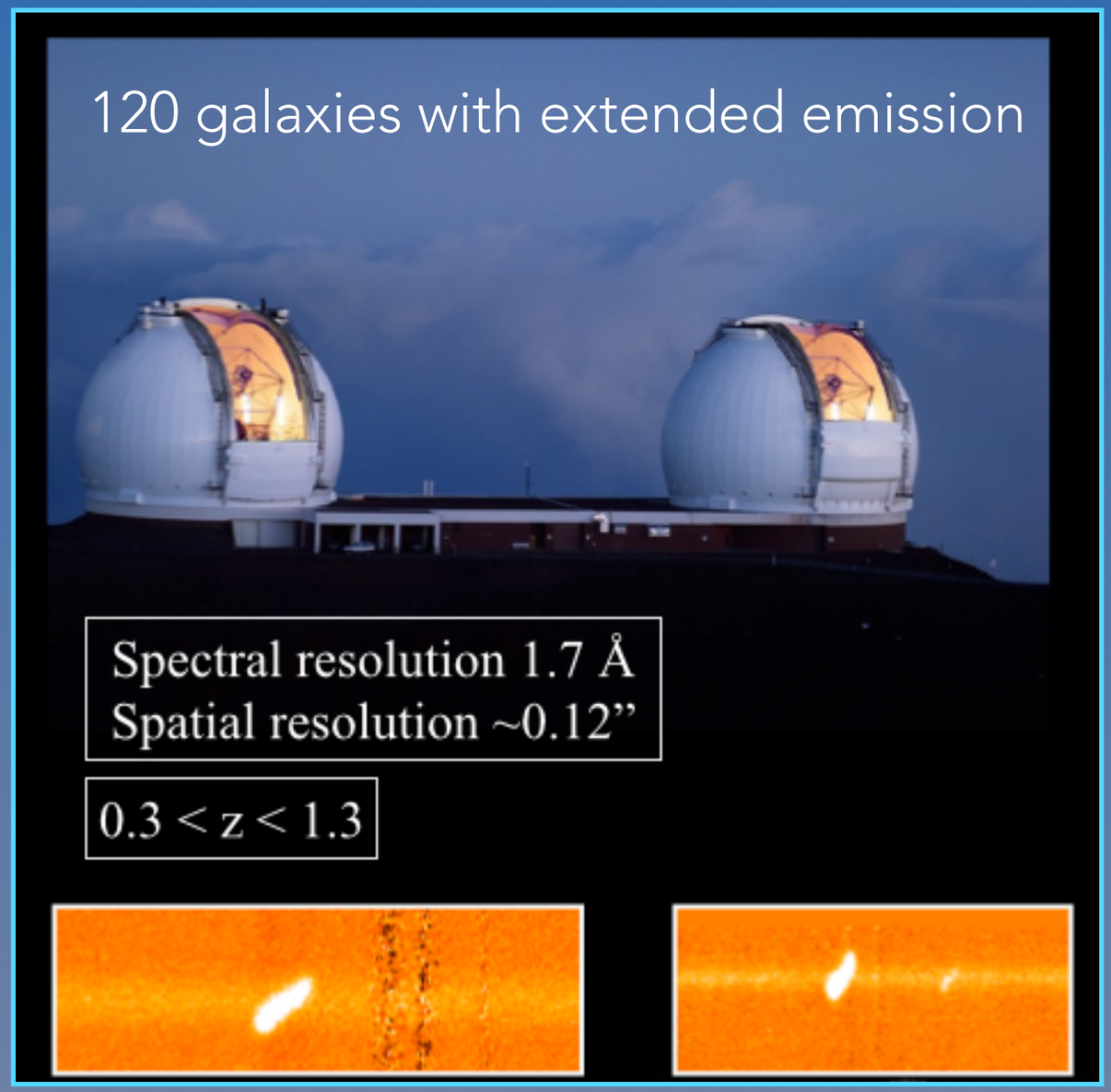

PIXEL-BY-PIXEL SED FITTING

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PSF match cutouts to lowest resolution (H band):

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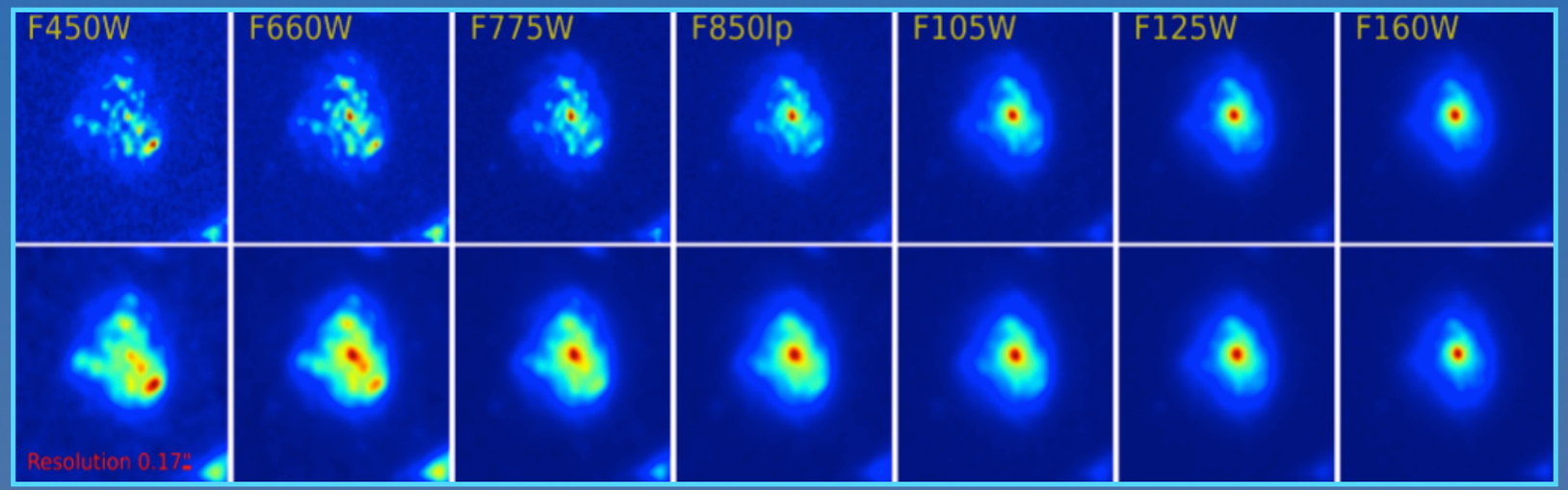
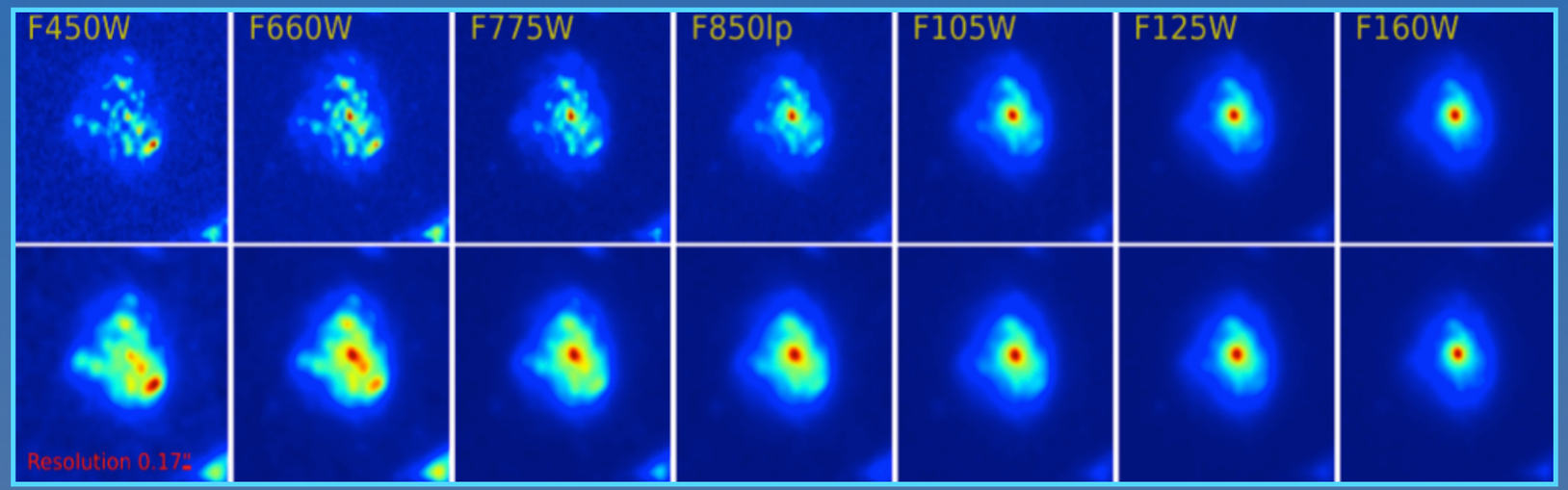


PIXEL-BY-PIXEL SED FITTING

PSF match cutouts to lowest resolution (H band):

- 80 x 80 pixel cutouts
- science and RMS
- SExtractor seg map



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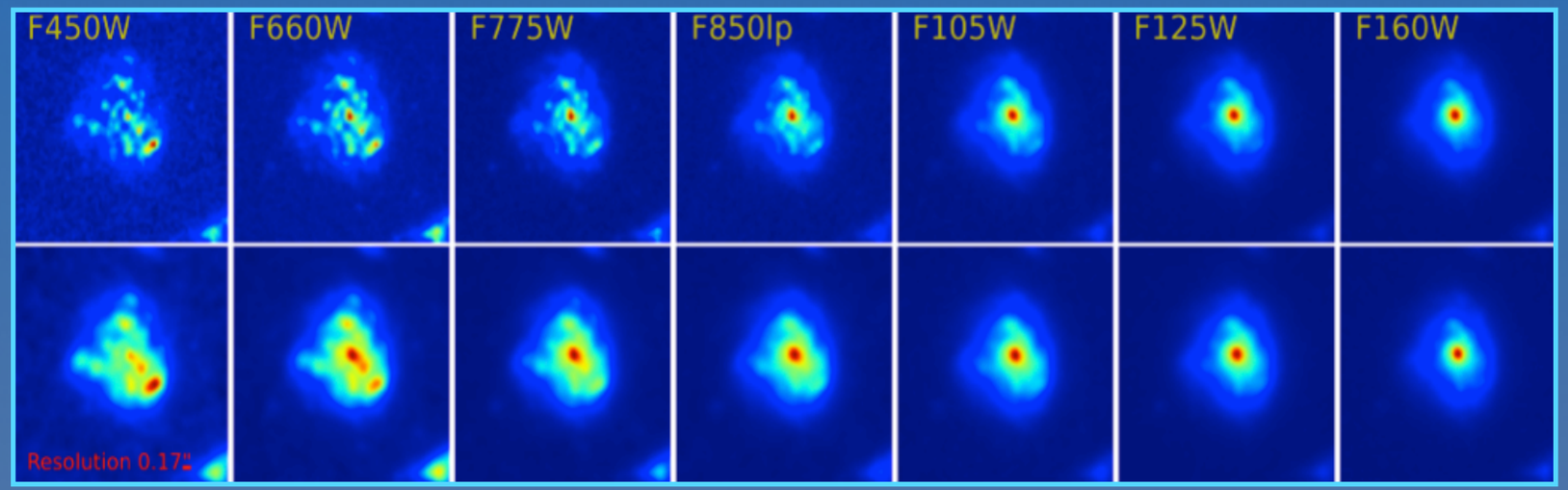

SED fitting per pixel:

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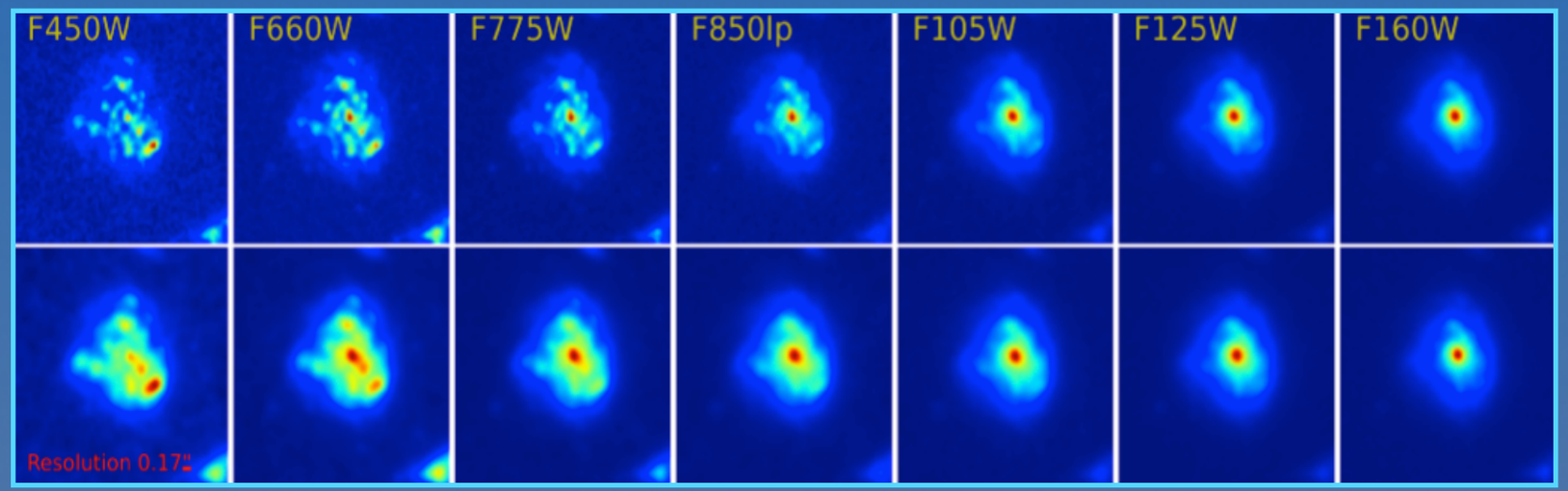

SED fitting per pixel:

LEPHARE CODE
- fix specZ
- minimize X Squared

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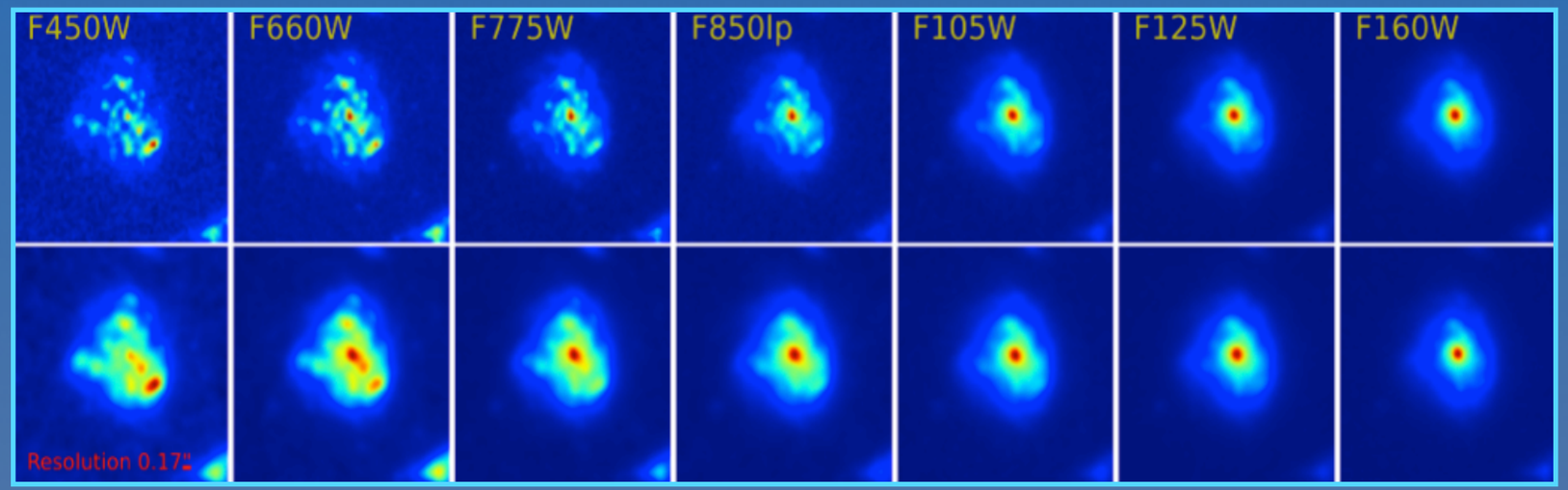

SED fitting per pixel:

Model Library
- BC03 models
- Chabrier IMF
- SFH (const. declining, burst)
- Calzetti SB attenuation
- 40% Solar Metallicity

LEPHARE CODE
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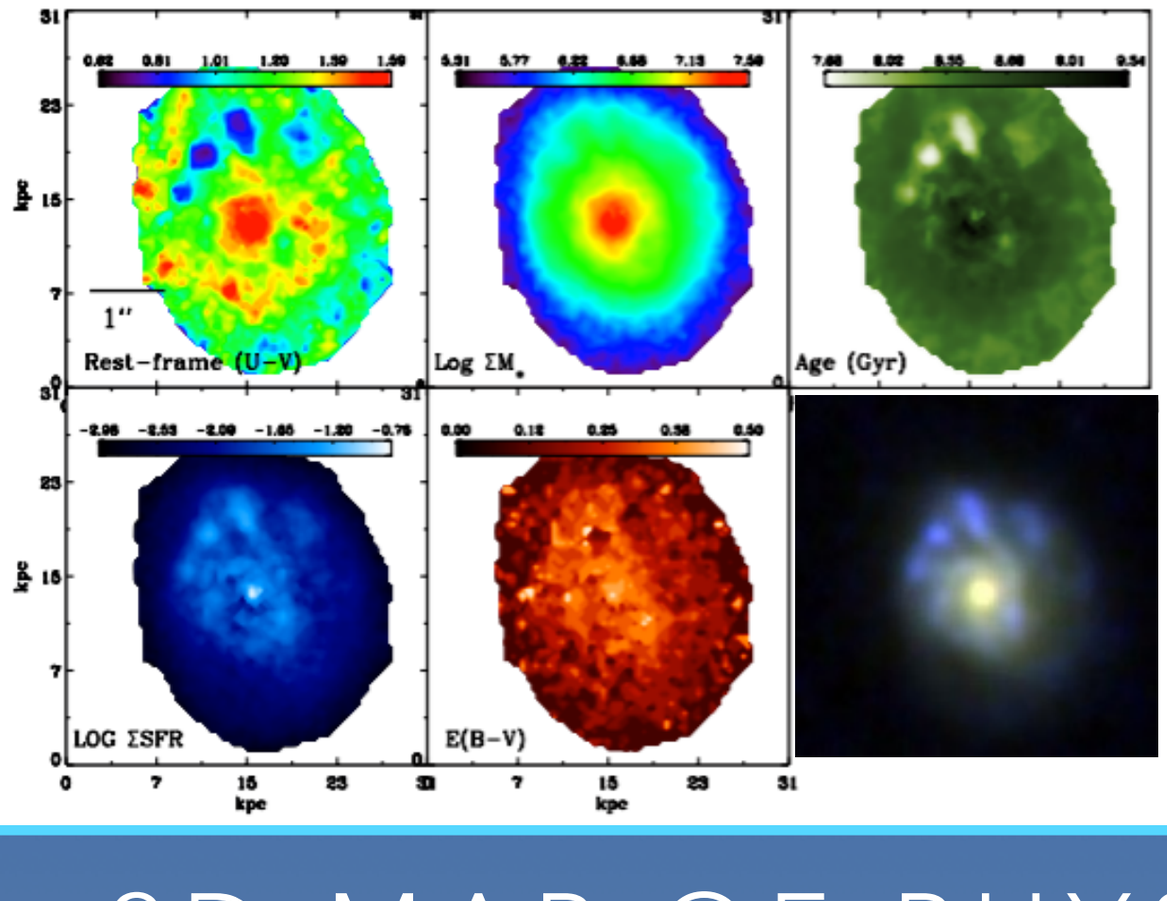
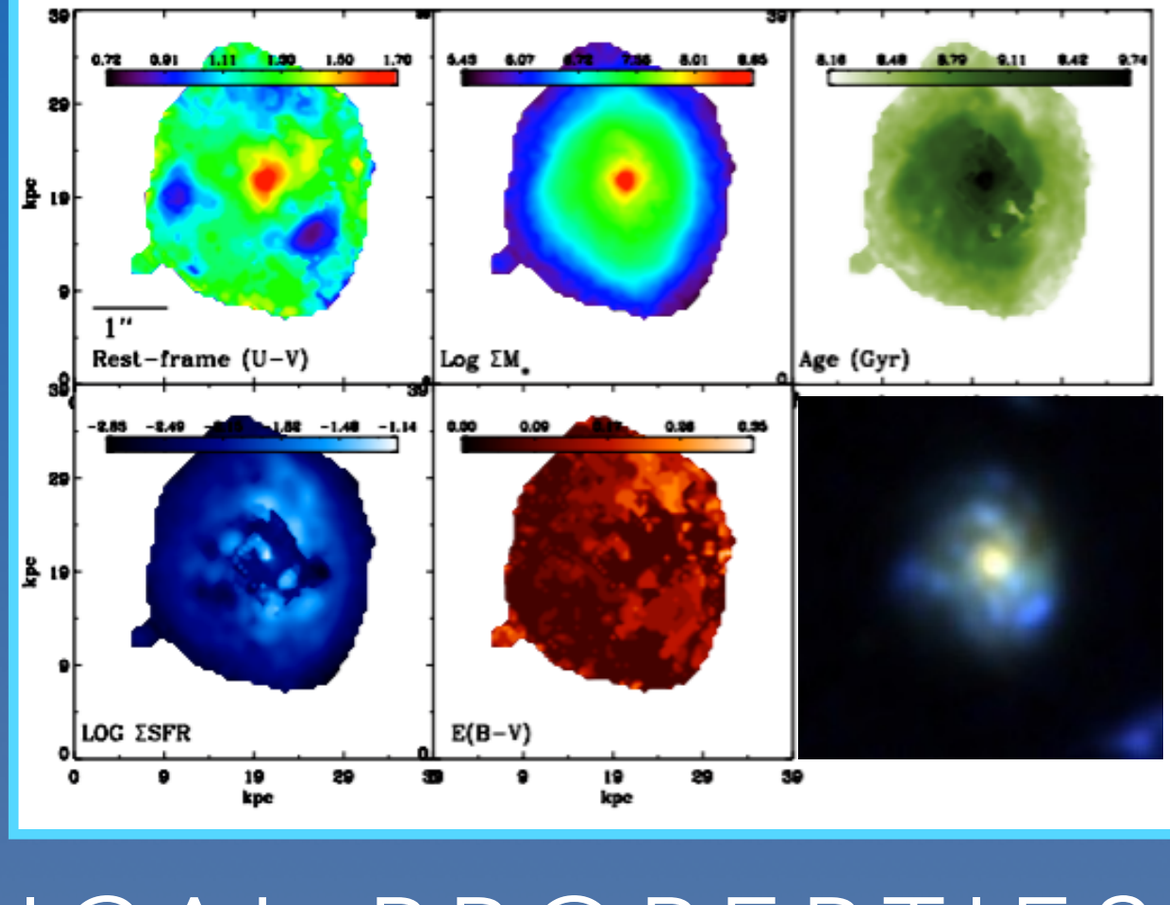
- minimize X Squared





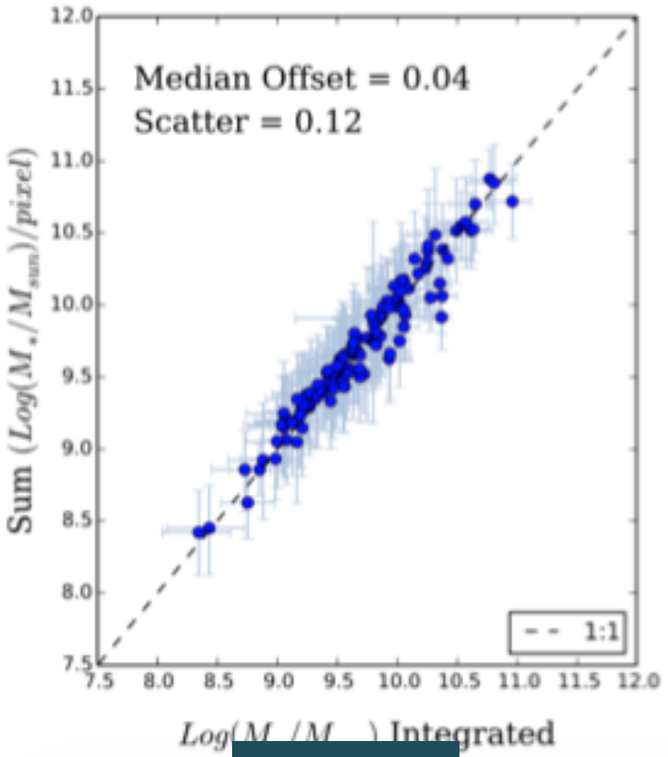
2D MAP OF PHYSICAL PROPERTIES

* U-V COLOR COVERING THE BALMER/4000A BREAK
* RED BULGE, GREEN DISKS WITH BLUE CLUMPS
* STELLAR MASS DISTRIBUTION IS SMOOTH

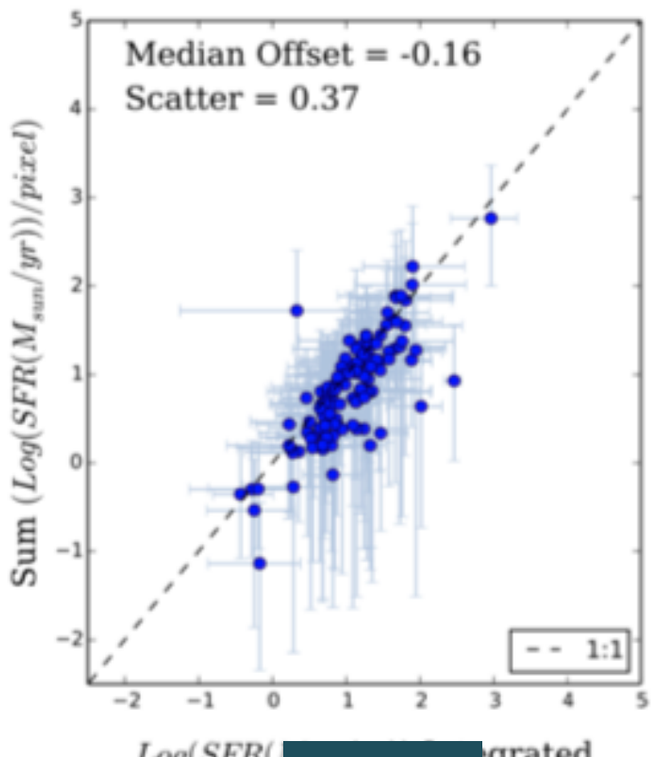
UNCERTAINTY OF PARAMETER AT EACH PIXEL, SIGMA OF MARGINALIZING OVER ALL THE OTHER PARAMETERS.

SEE ALL MAPS AT WWW.SHOUBY.COM/RESEARCH/DISK-GALAXIES

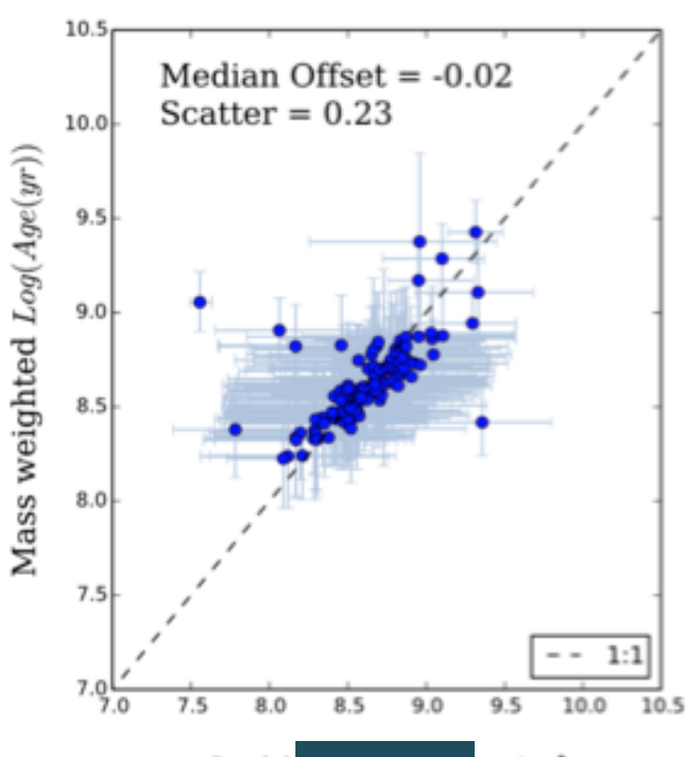
INTEGRATED VS. RESOLVED



MASS



SFR

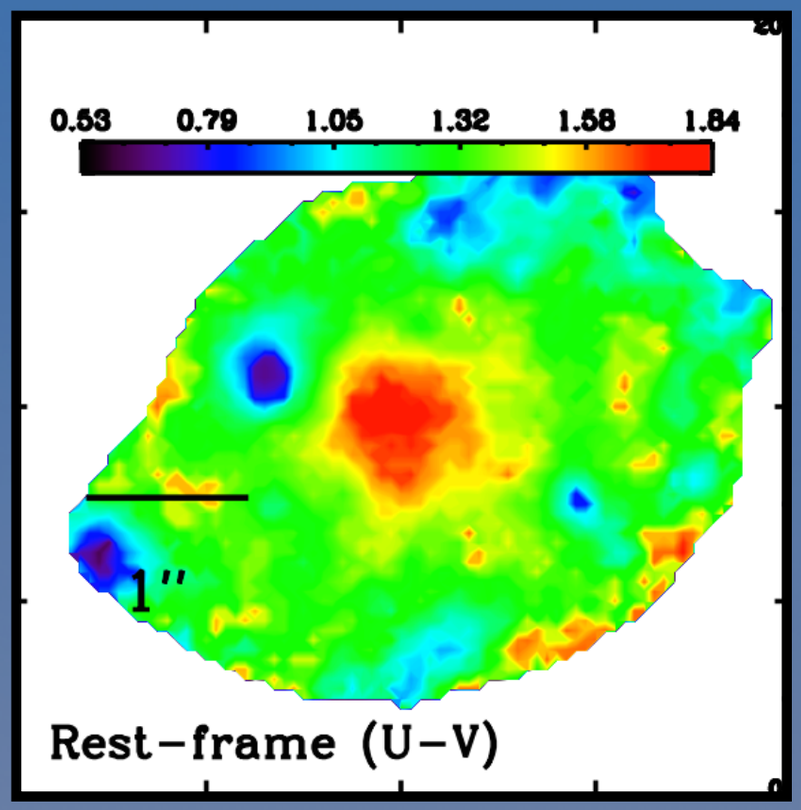


AGE

- Integral of Resolved and Global Stellar Mass of galaxies agree well.
- The slight offset between the SFR might be due to overcorrection of dust ‘’Globally’’.
- Mass-weighted Age agreement 10 times better than previous studies.

RED AND BLUE REGIONS

- High-pass and Low-pass filter based on Distribution of Rest-frame (U-V) color.
- SExtractor on Filtered images to find red and blue regions in low and high pass images respectively.



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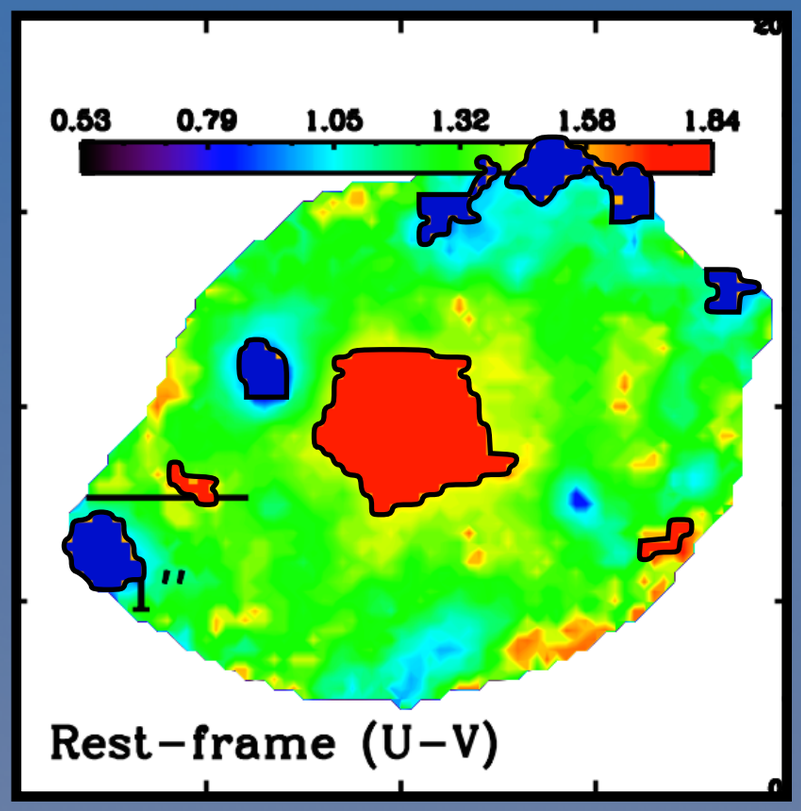

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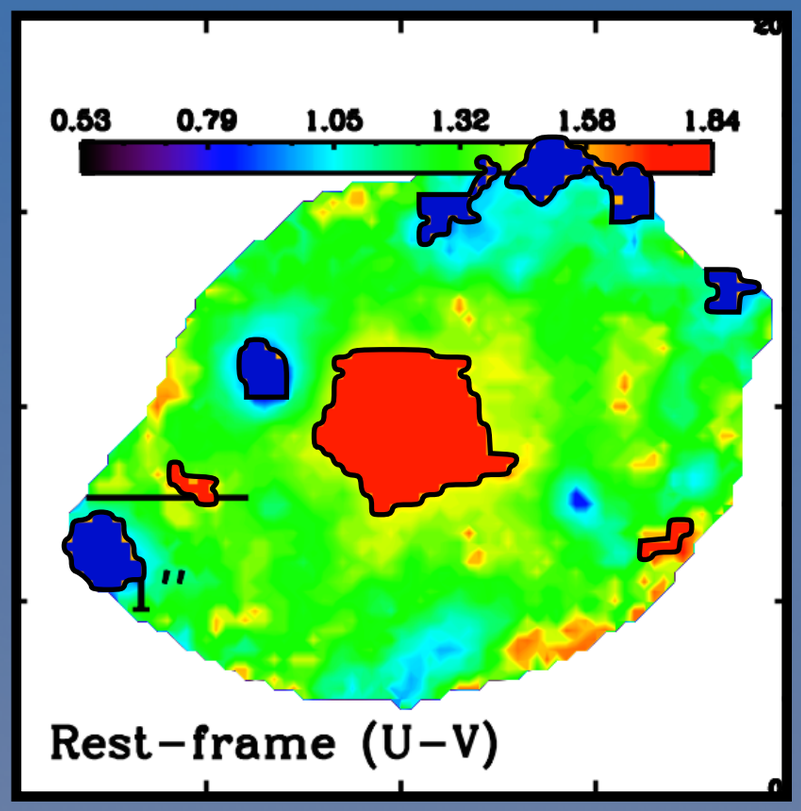

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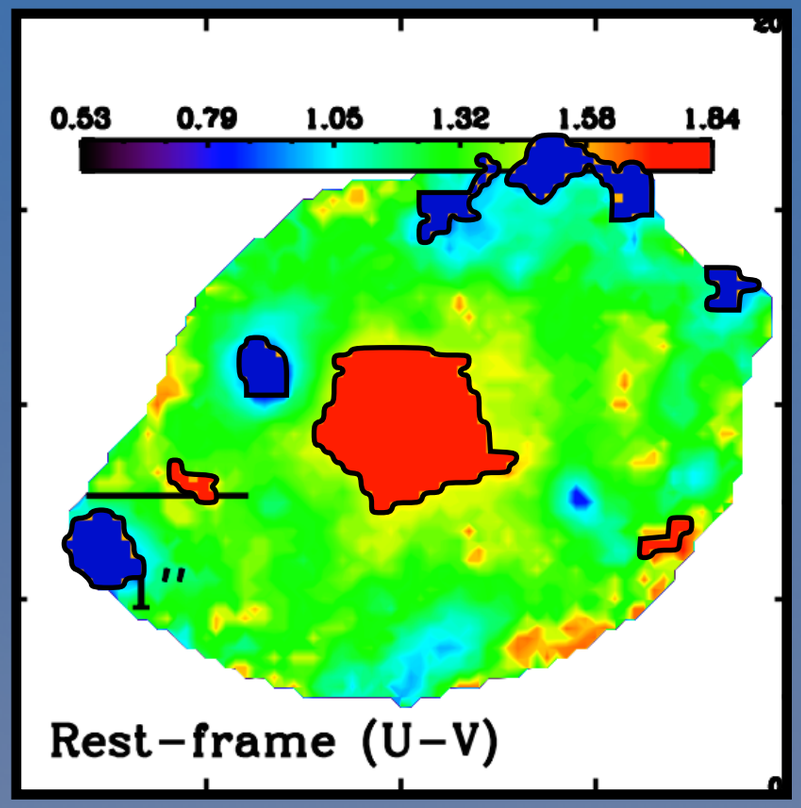
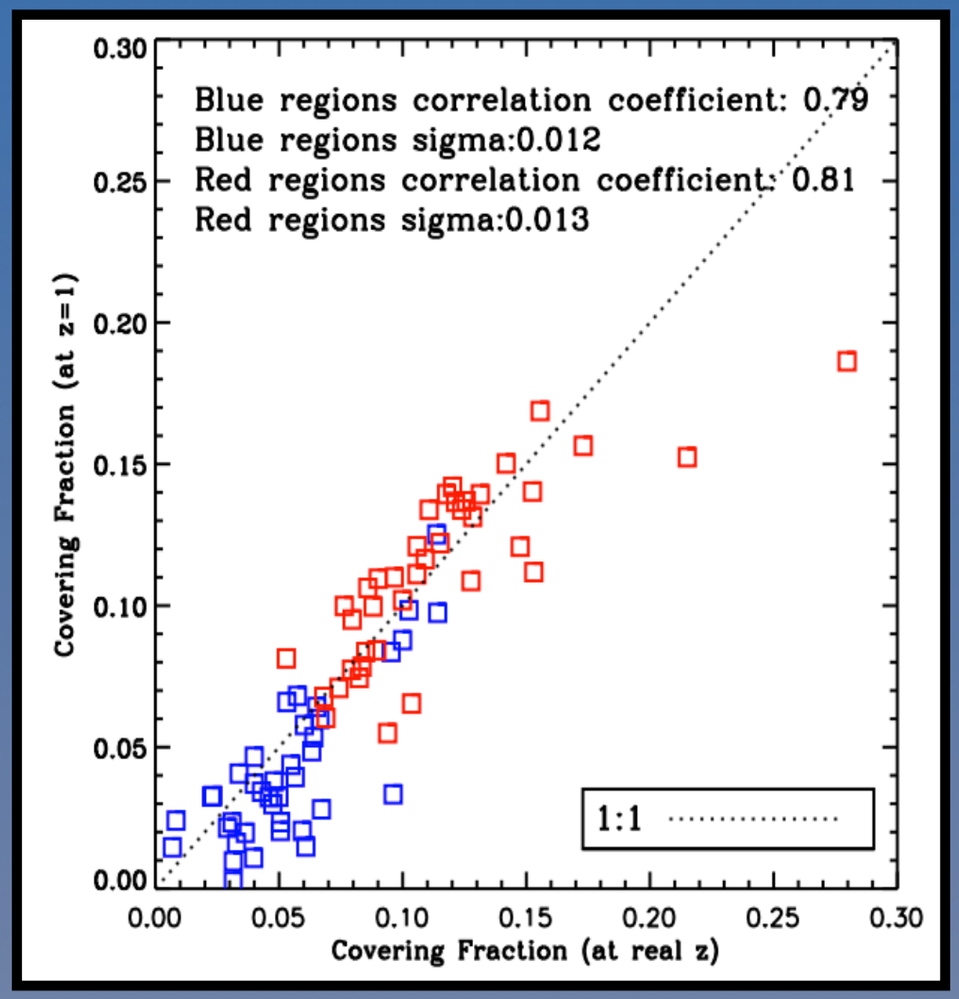
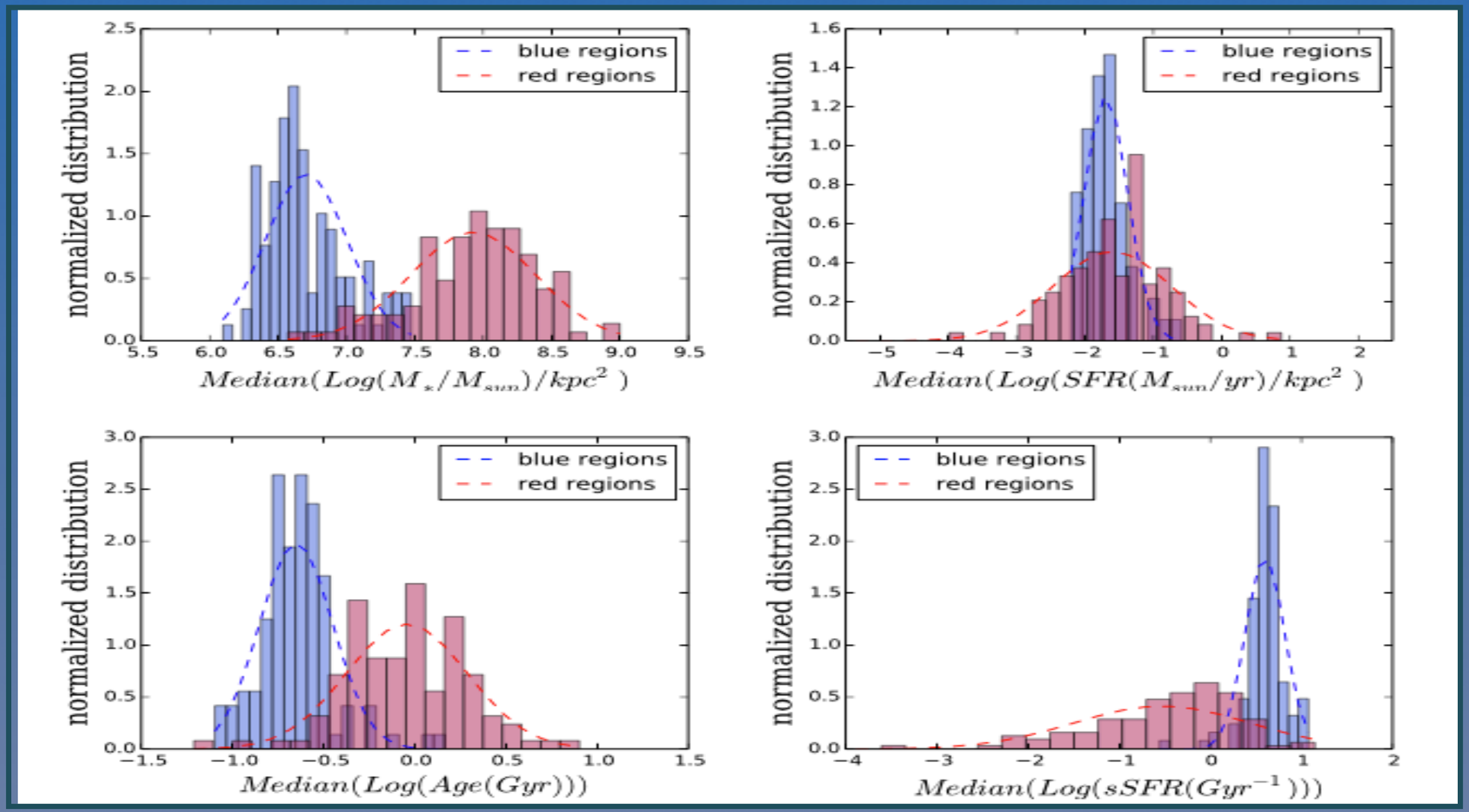




PROPERTIES OF RED AND BLUE REGIONS:

Hemmati et al. 2014



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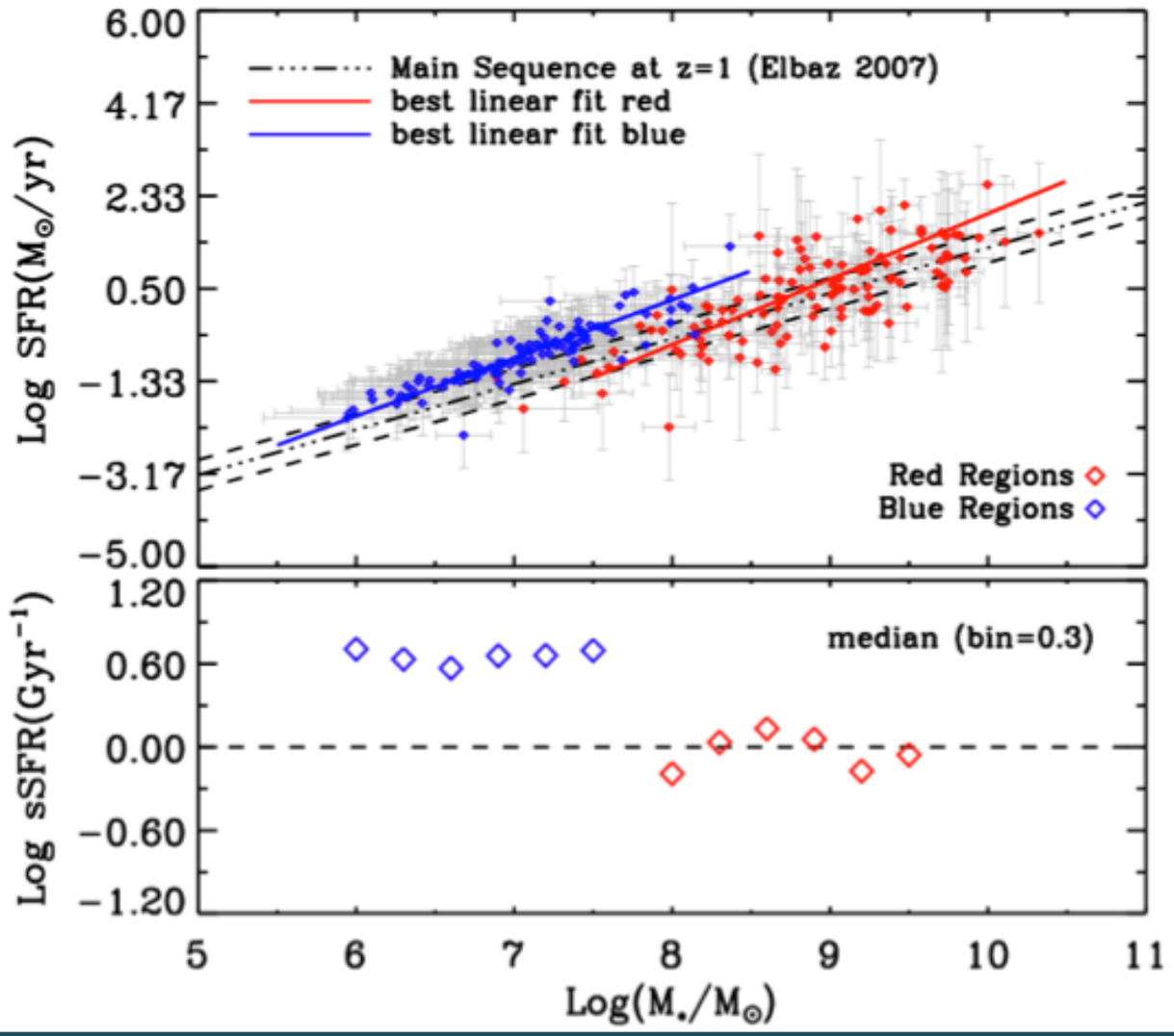

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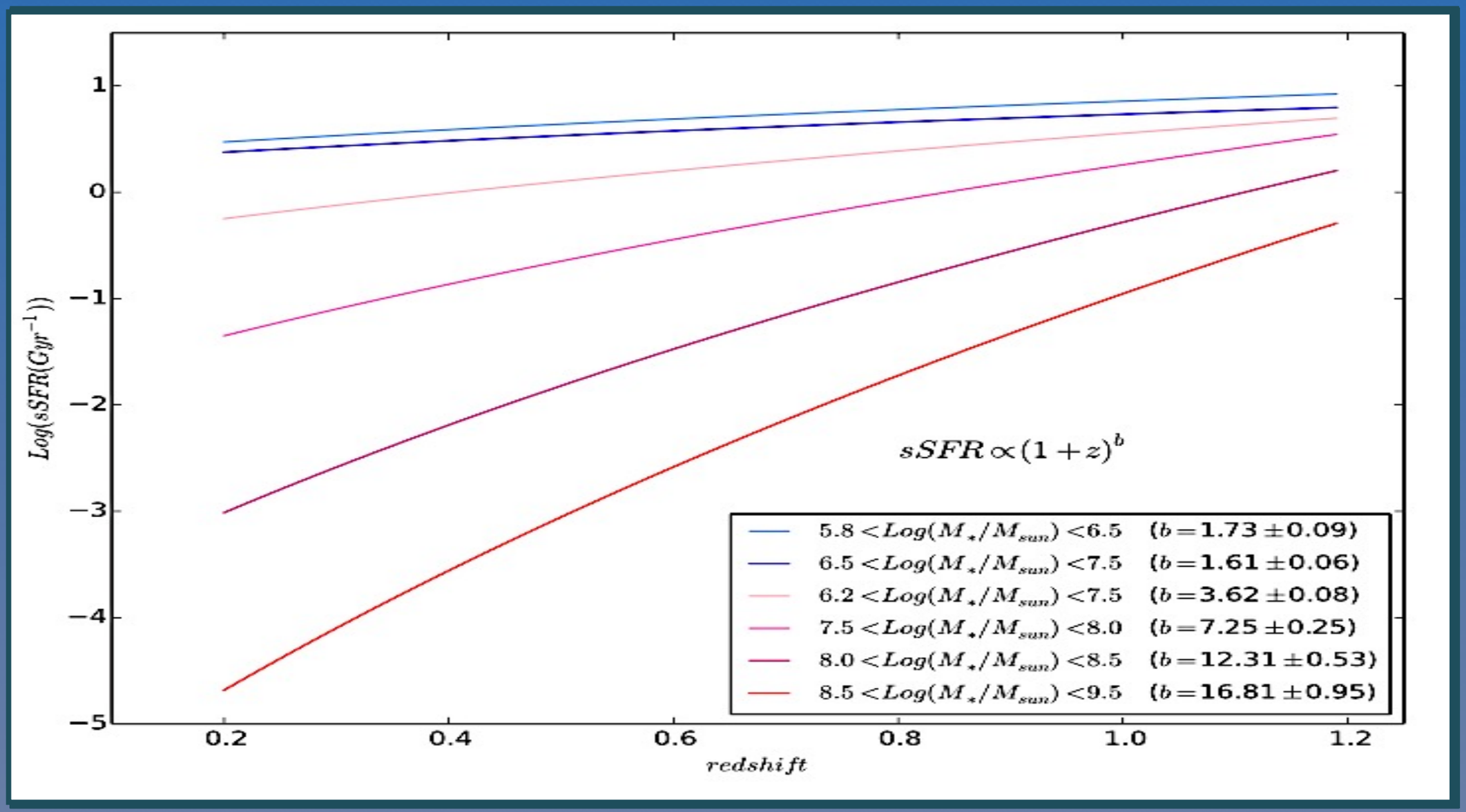

ADD SPECTROSCOPIC FLAVOR

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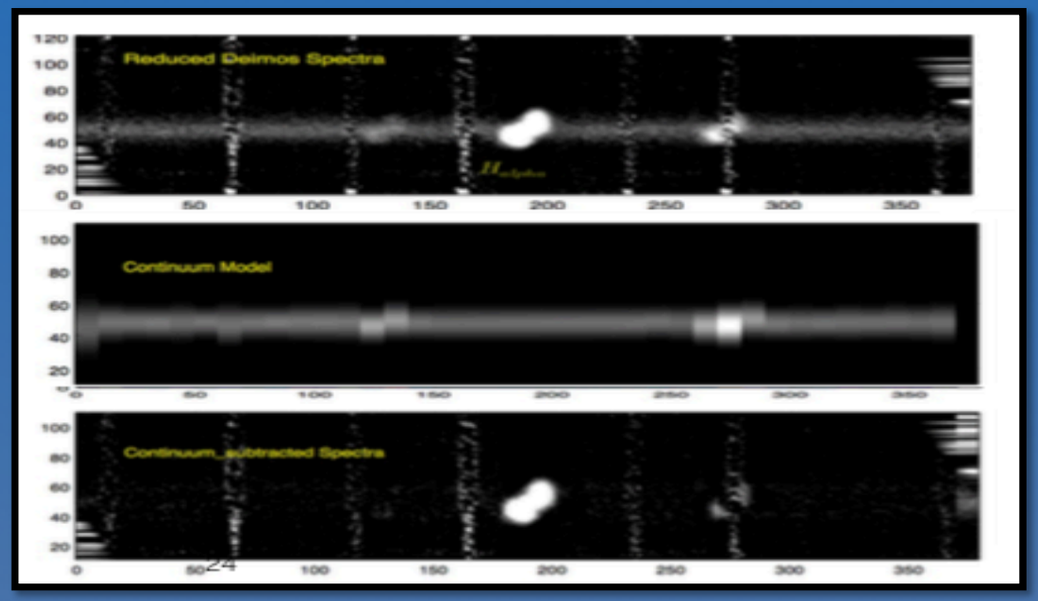

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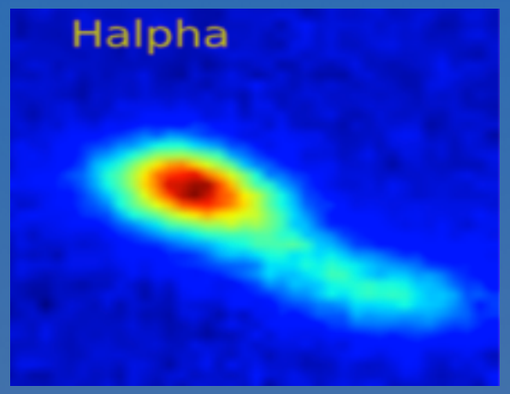

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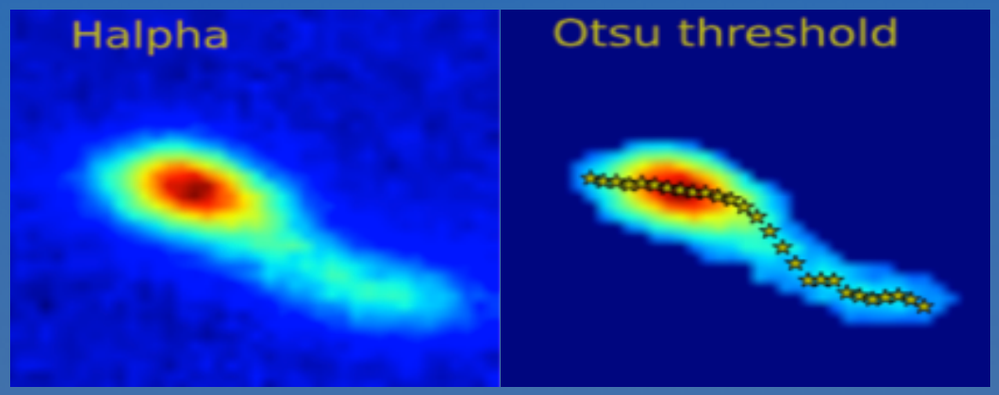

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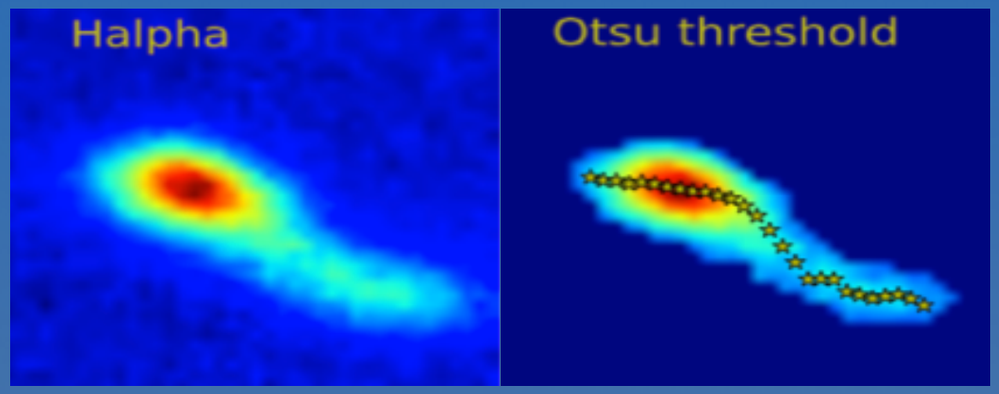

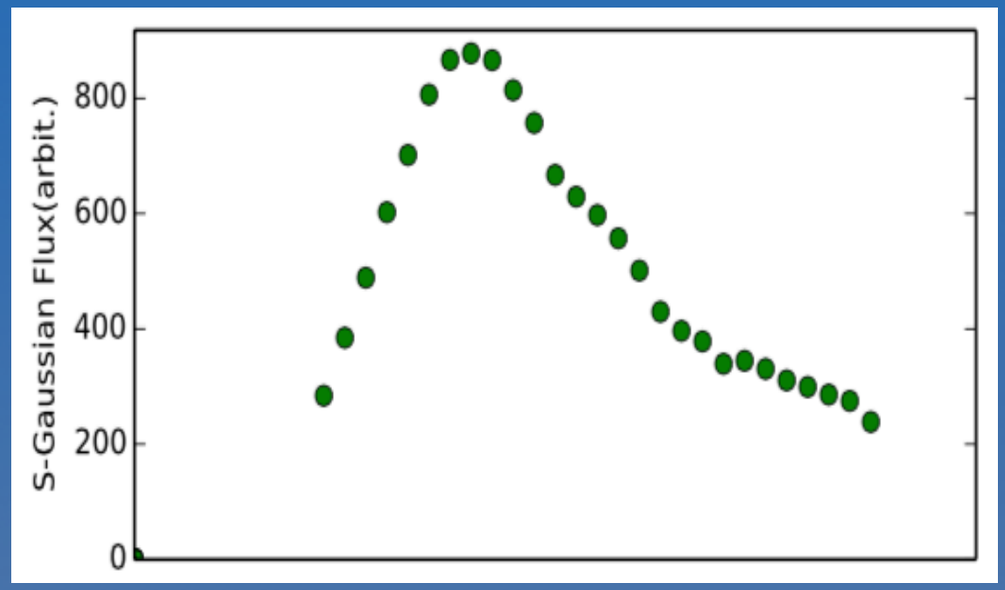

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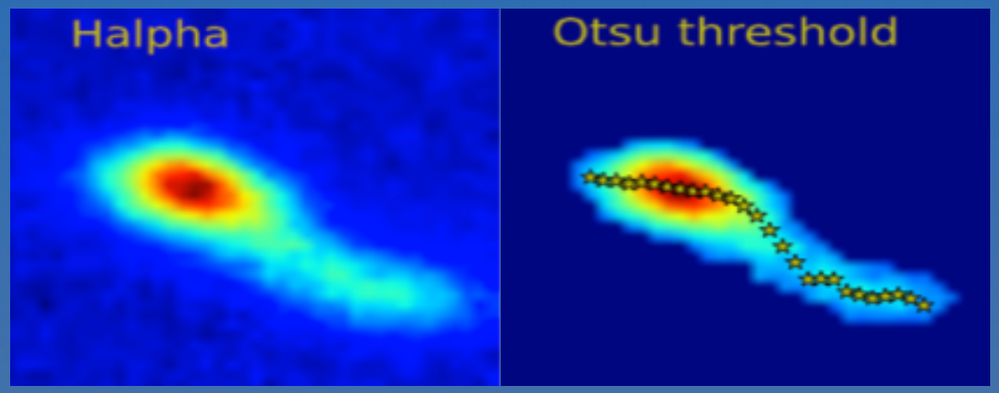

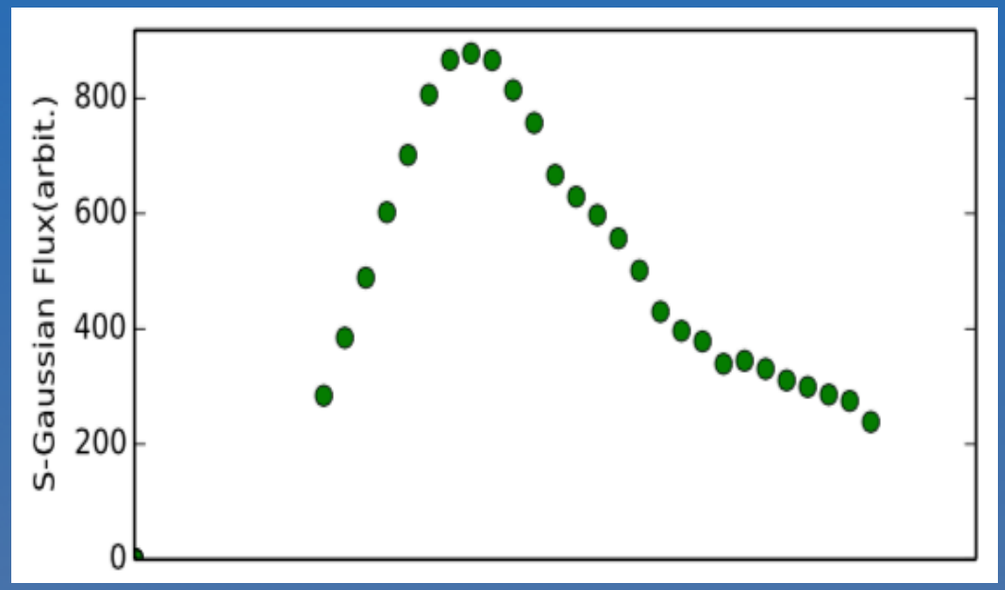

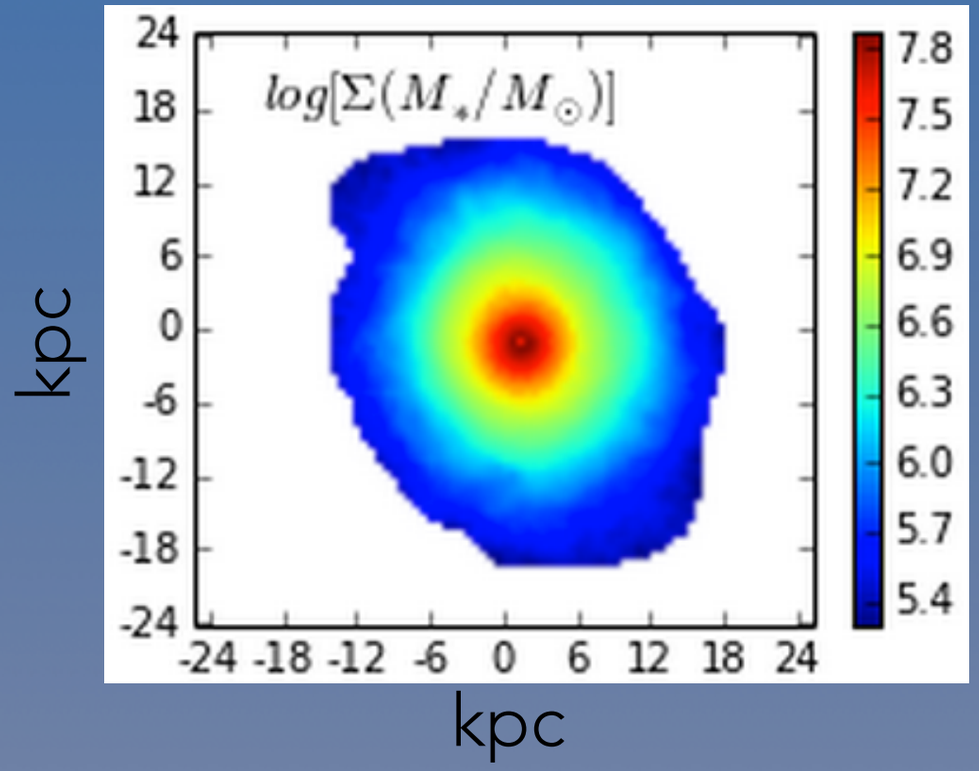

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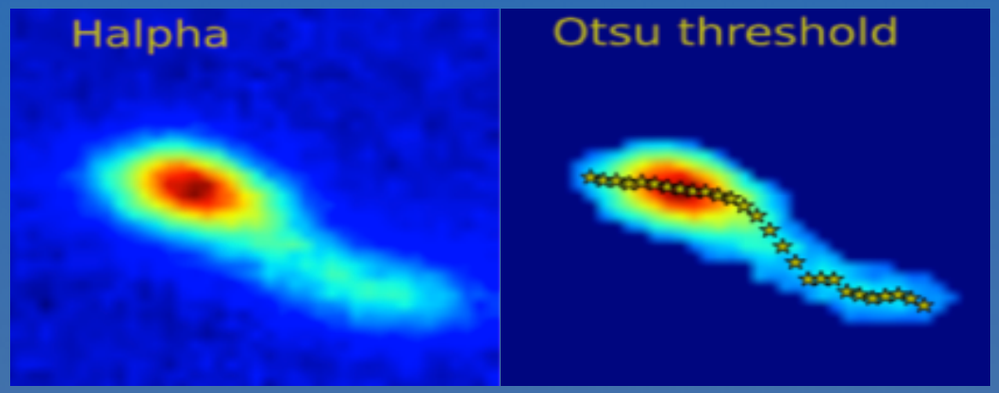

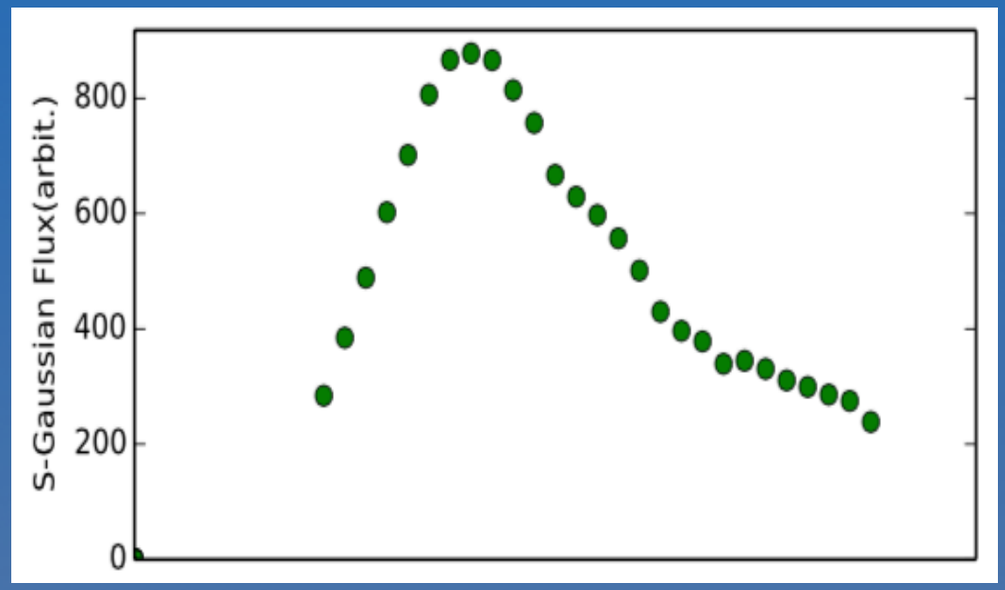

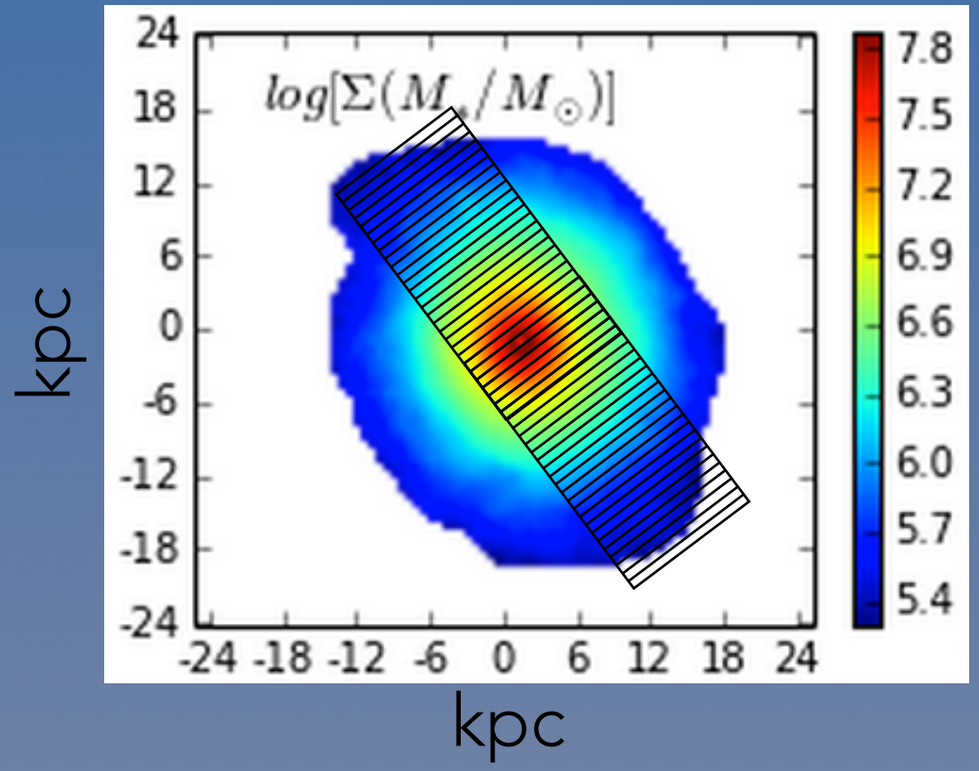

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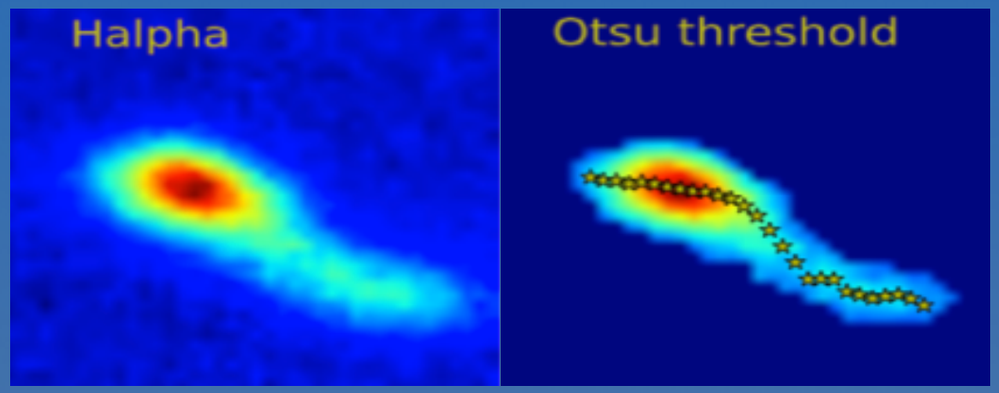
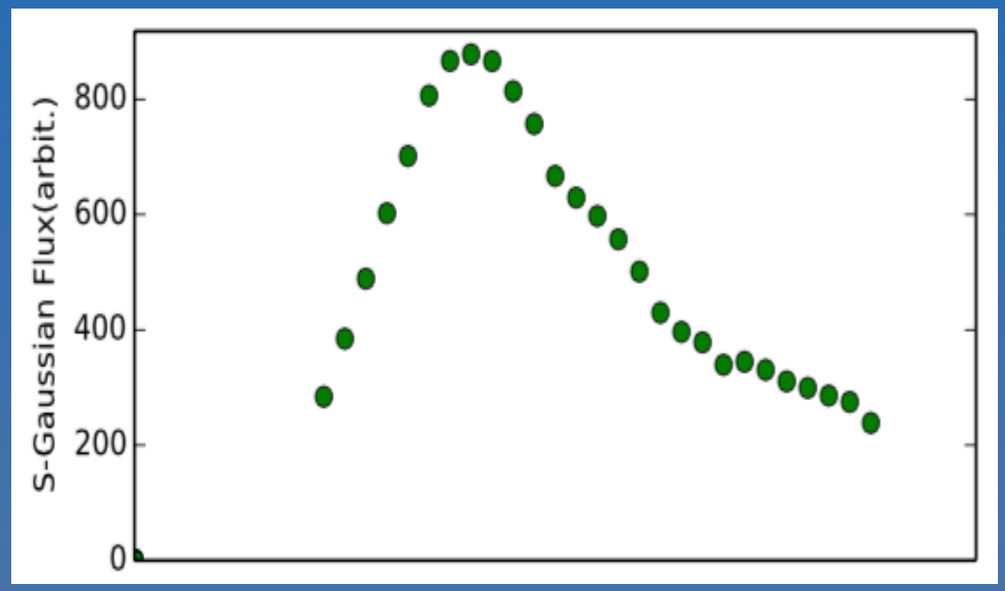
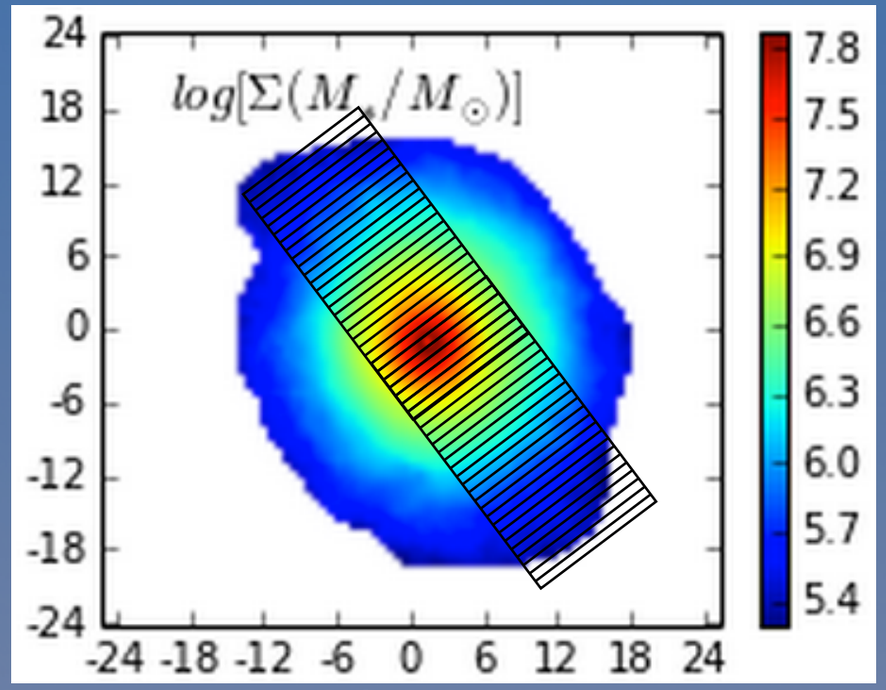
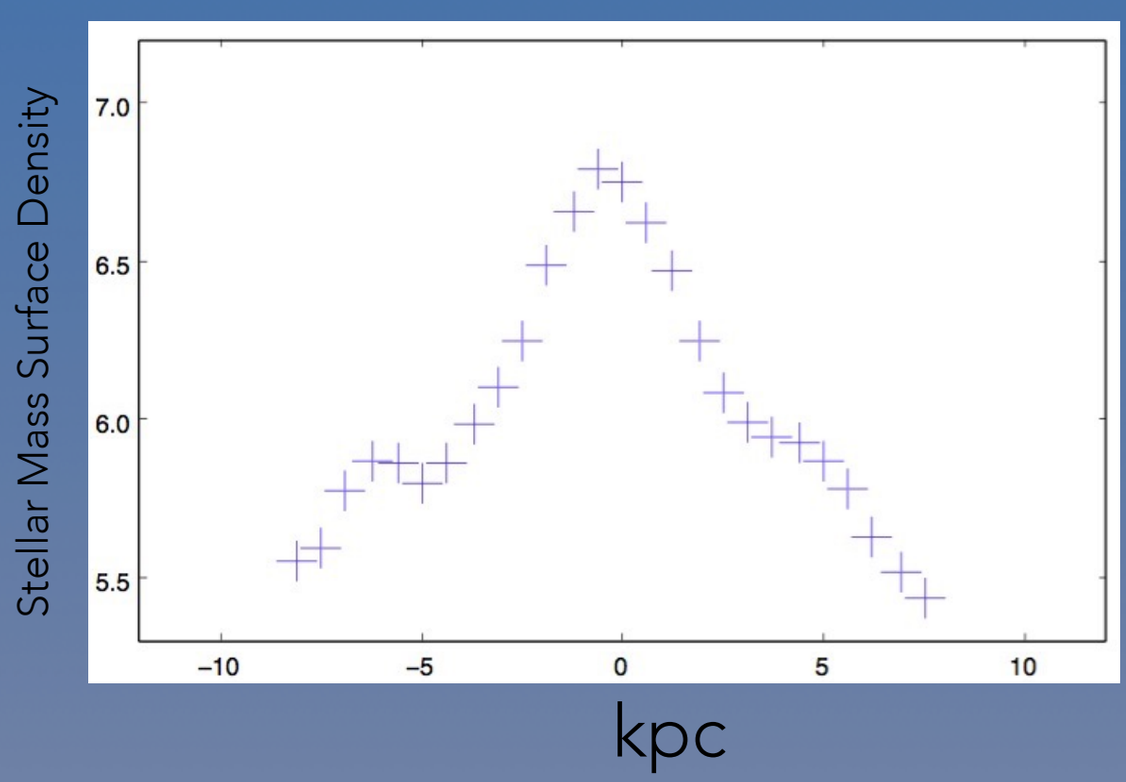






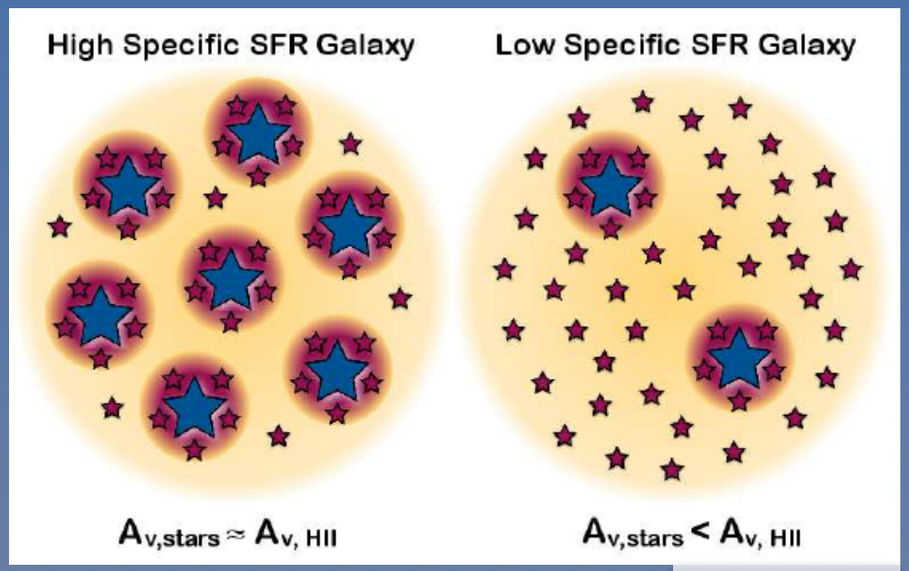


DUST

Assuming Calzetti attenuation curve,

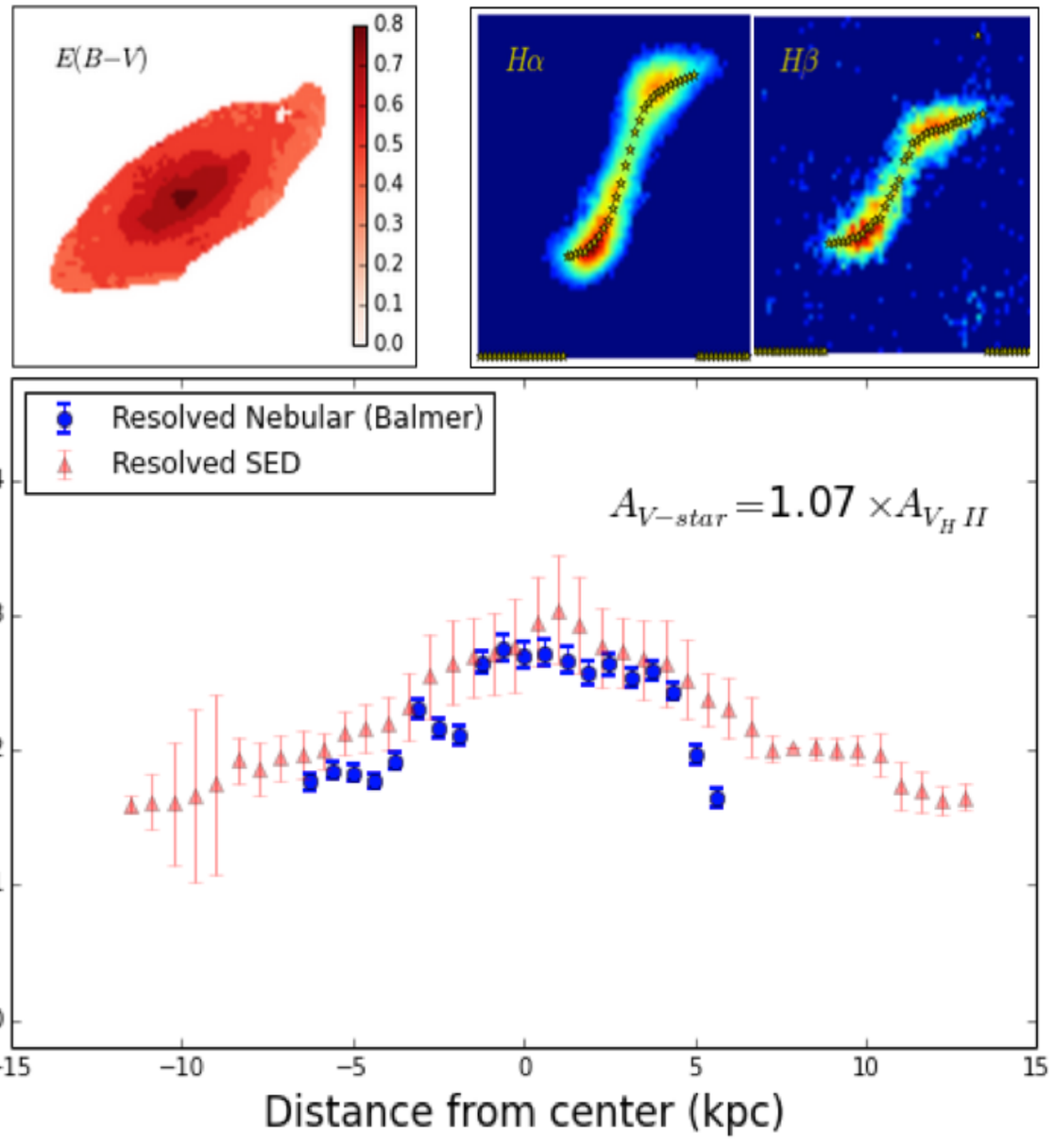
SED fitting —>Av Star

Balmer Decrement (H alpha / H beta) =>Av HII

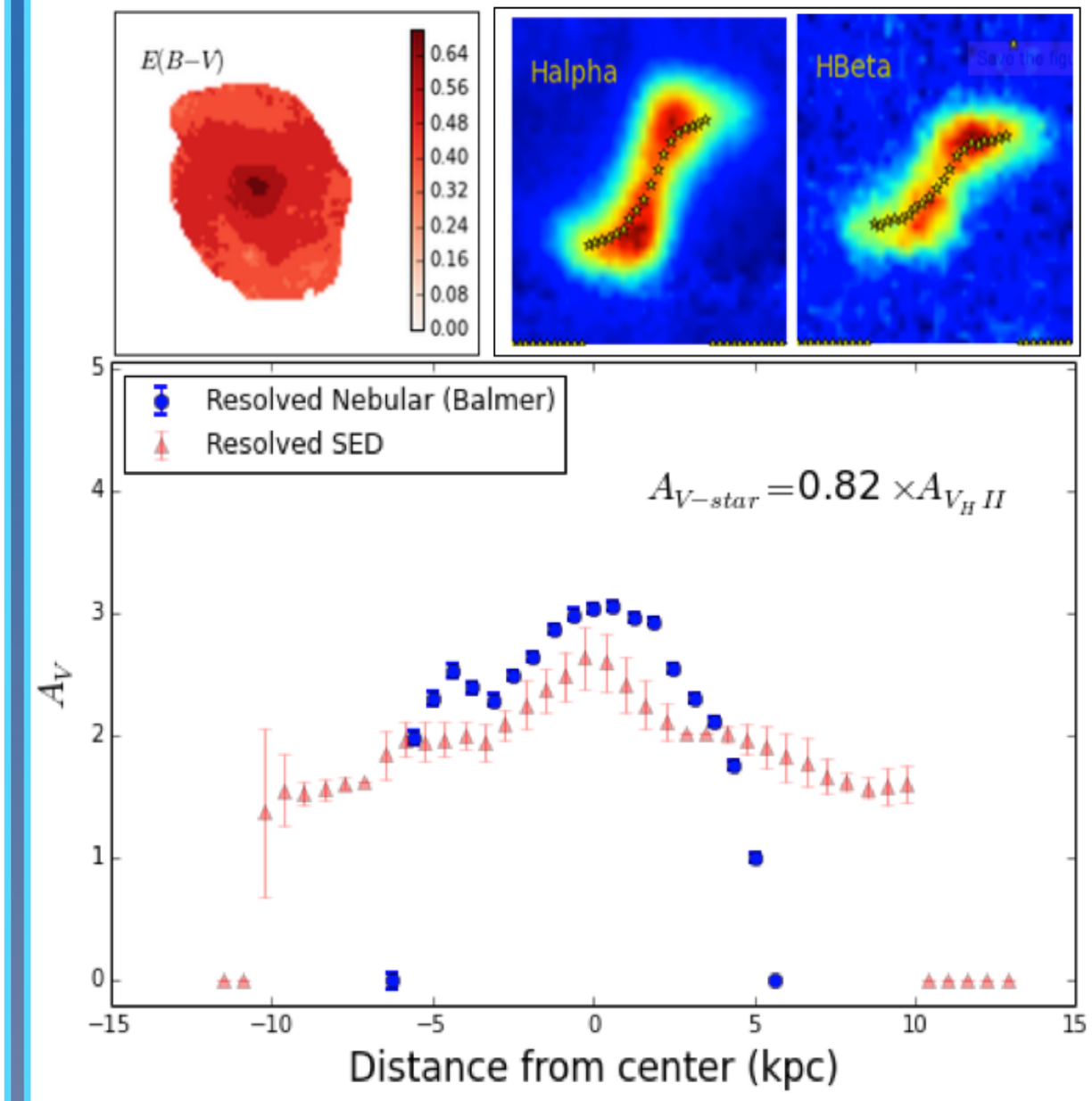


Price et al. 2014

NEBULAR VS. STELLAR ATTENUATION

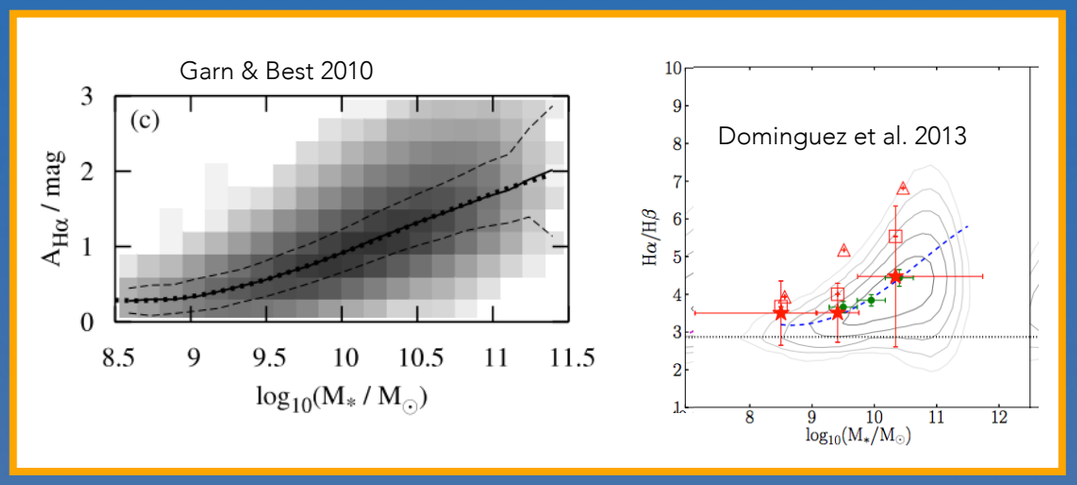


LOG M/MSUN =9.74



LOG M /MSUN=9.70

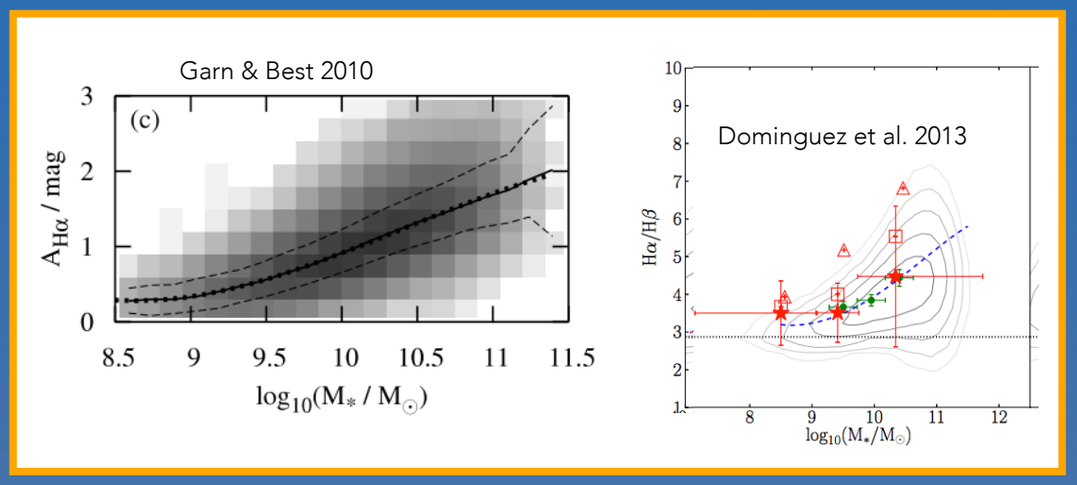
DUST ATTENUATION AND MASS

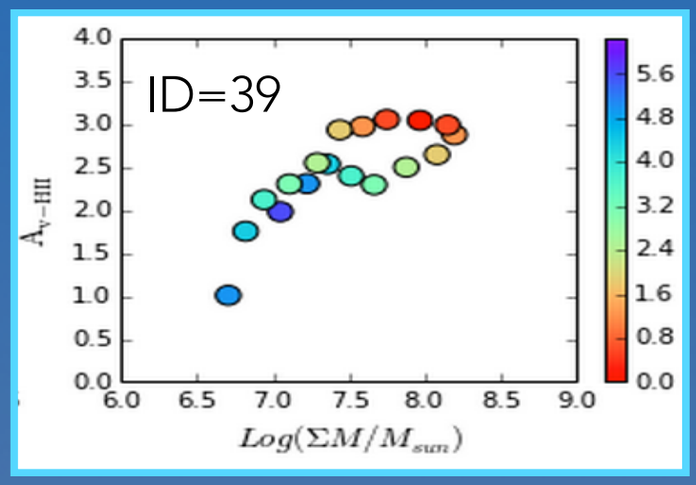


Nebular attenuation increases with stellar mass locally (Garn and Best) and at higher redshifts (Sobral et al. , Dominguez et al.)

As galaxies build up their mass they also build up their dust content.

DUST ATTENUATION AND MASS





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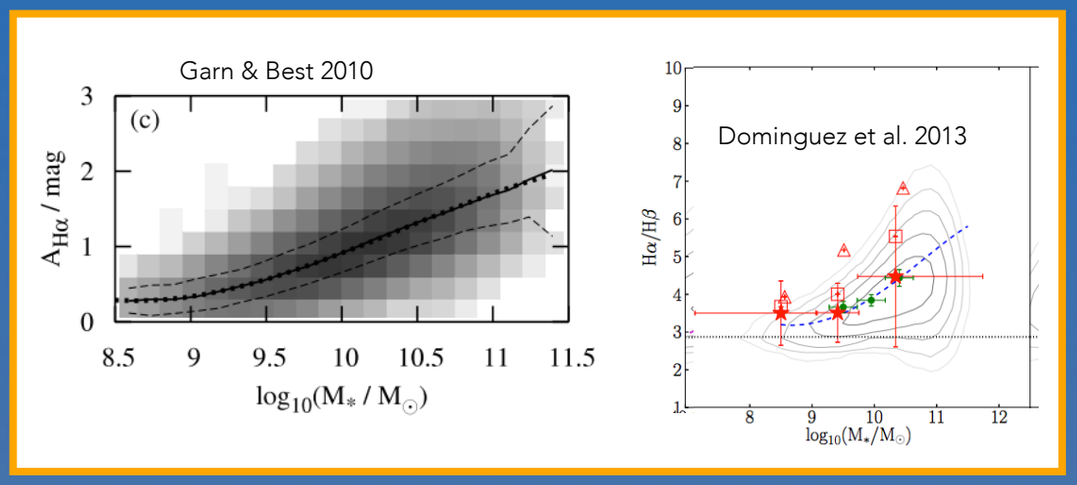

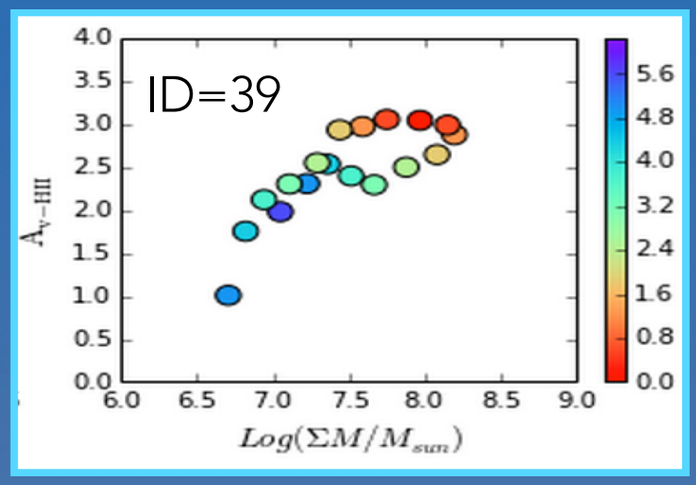

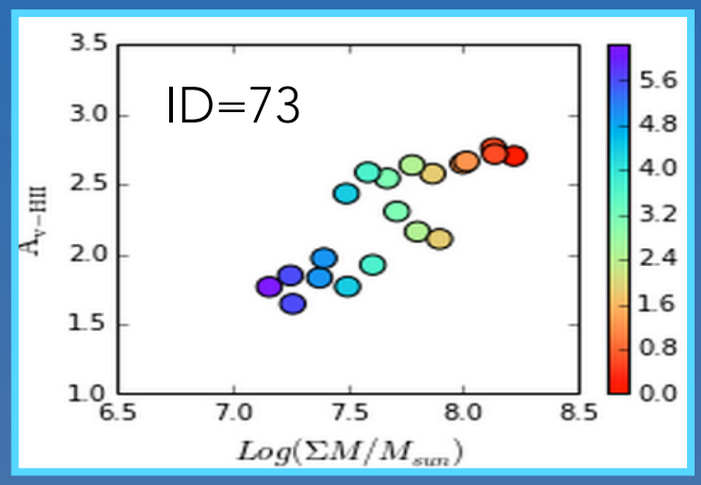

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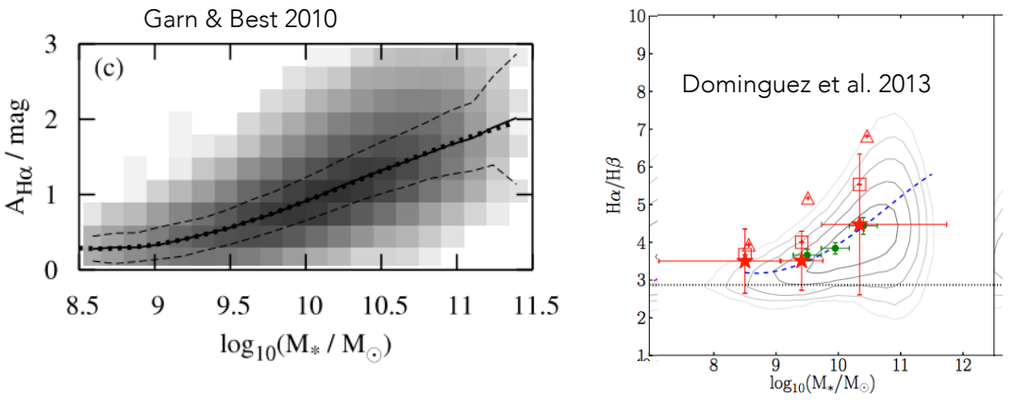
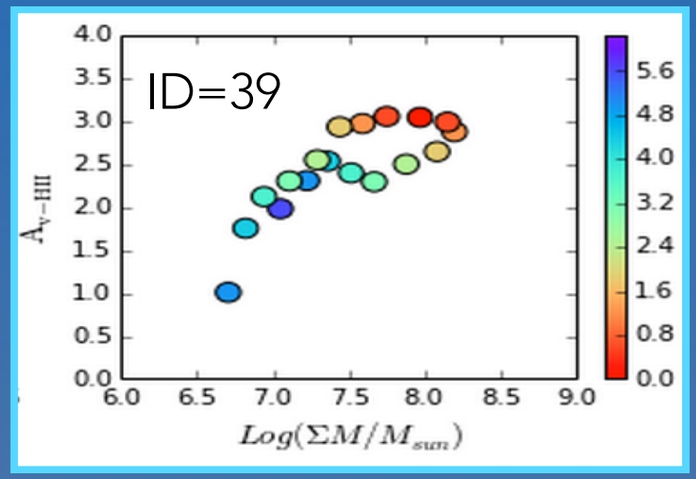
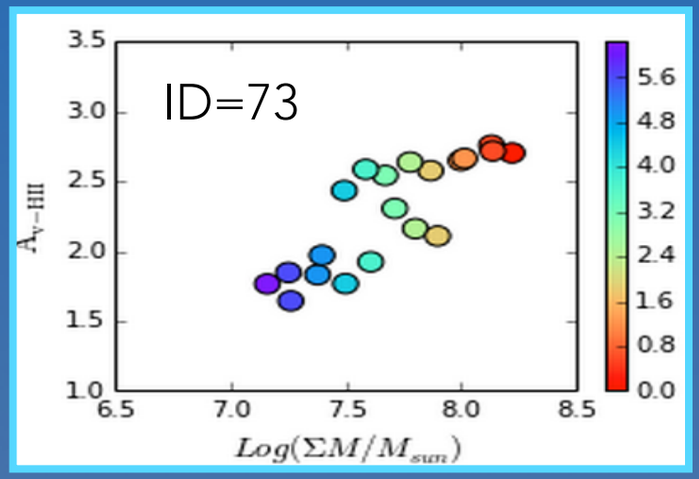
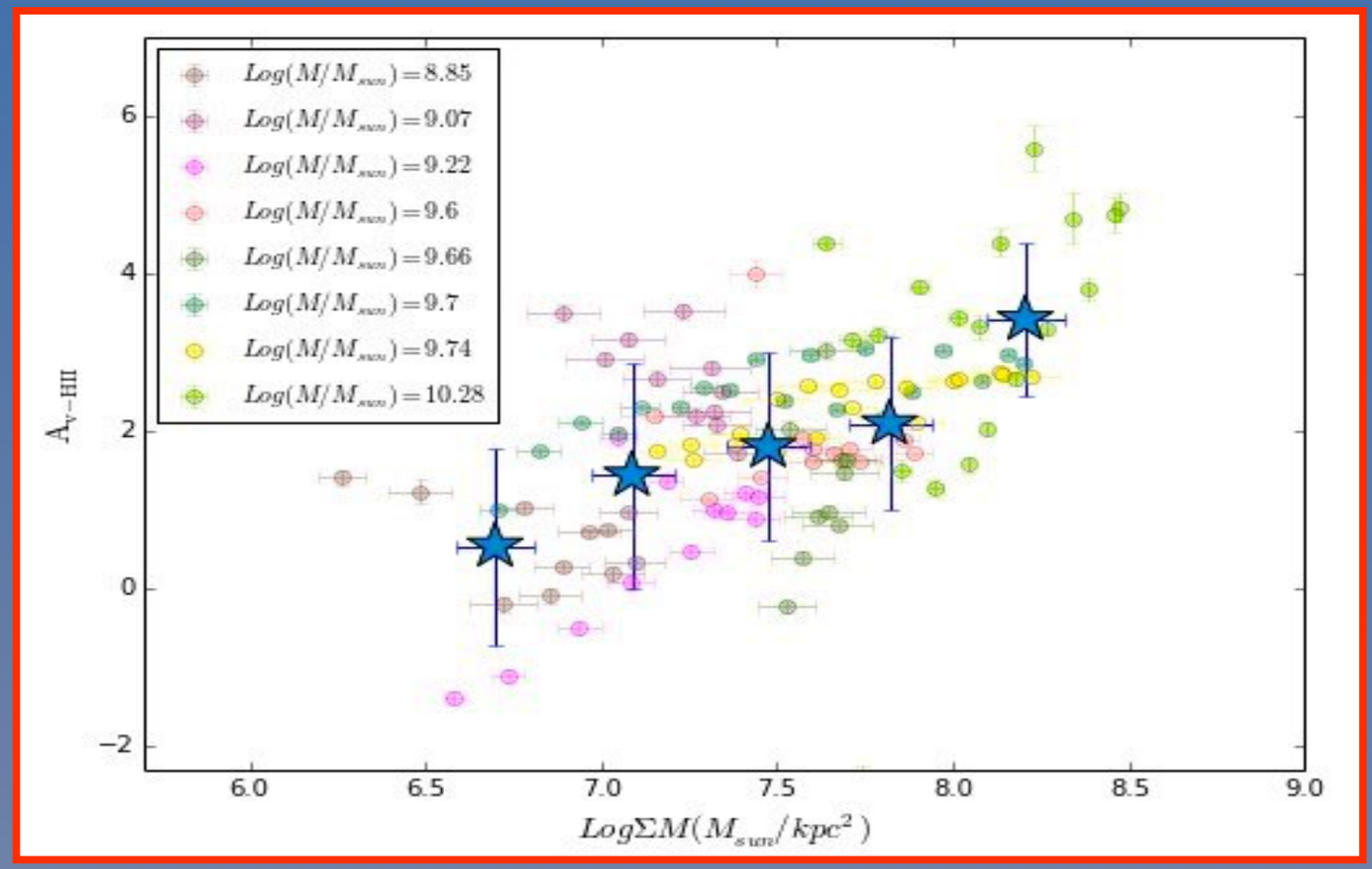




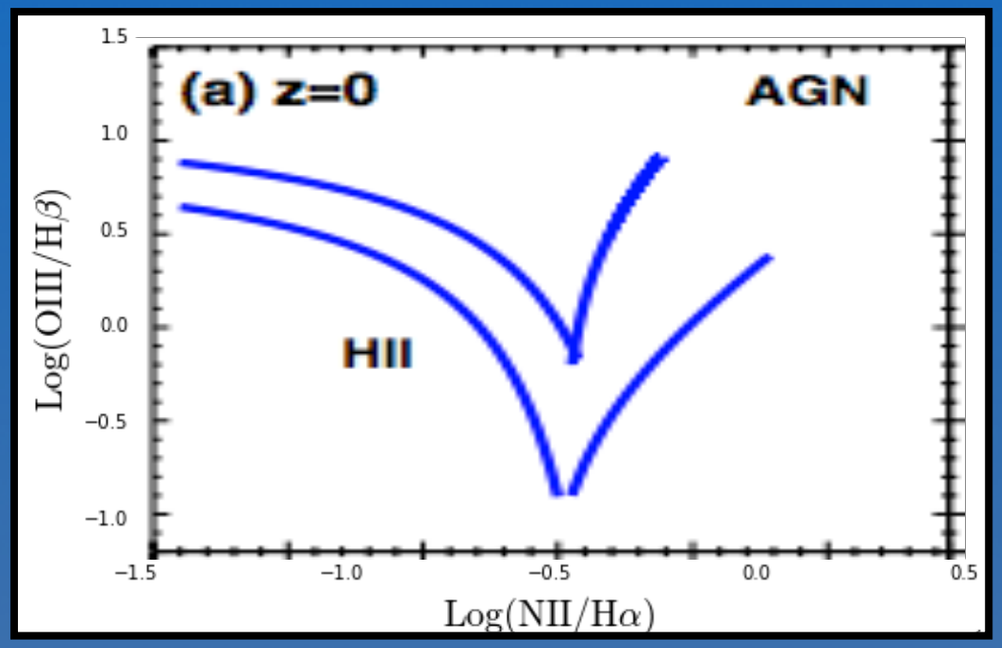


Nebular attenuation increases with stellar mass locally (Garn and Best) and at higher redshifts (Sobral et al. , Dominguez et al.)

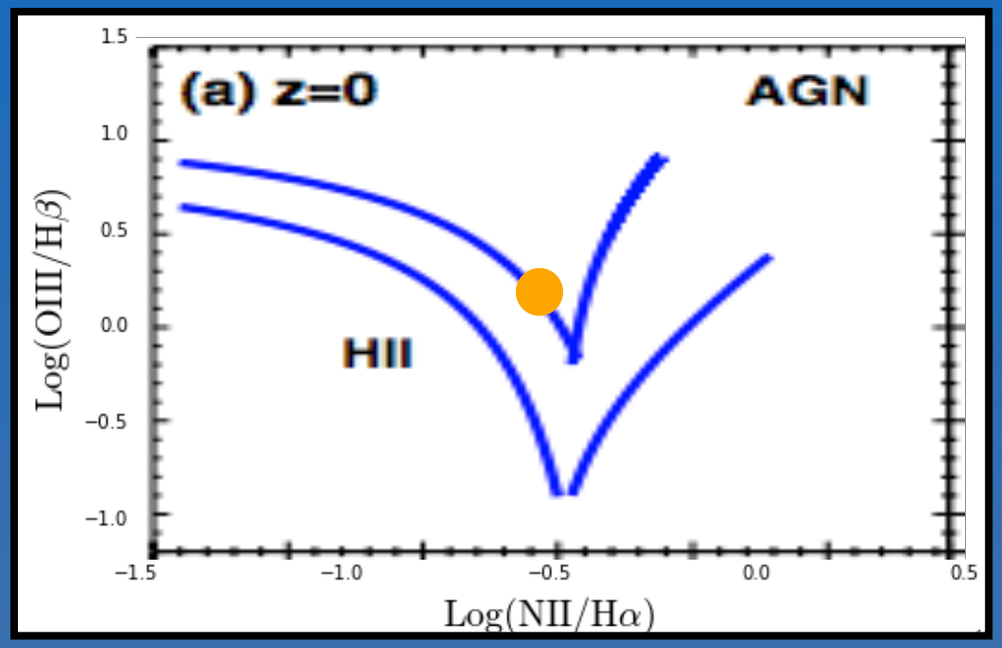
As galaxies build up their mass they also build up their dust content.



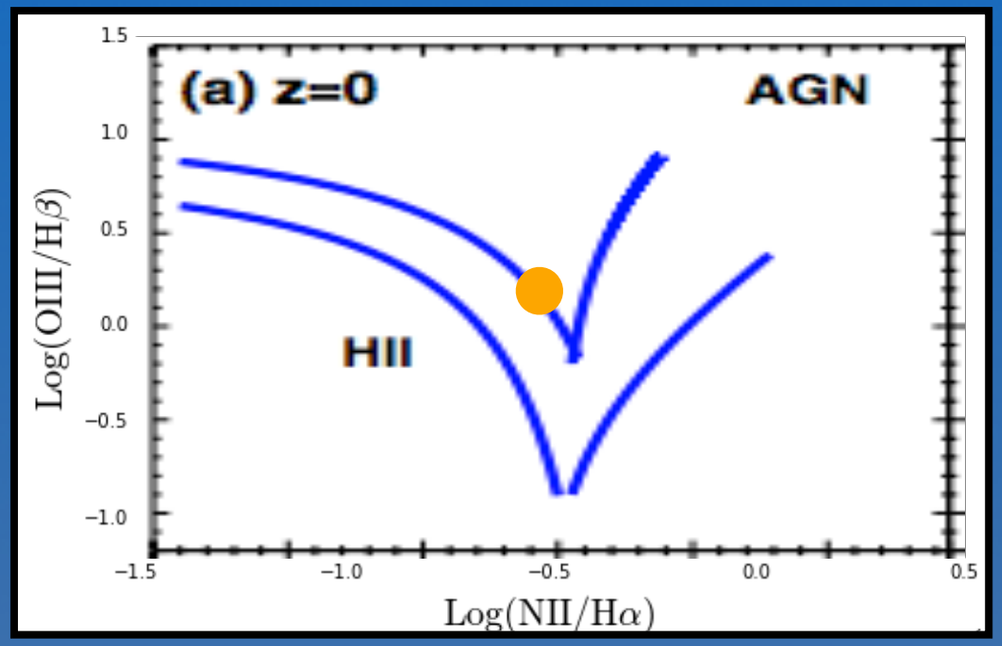
B P T

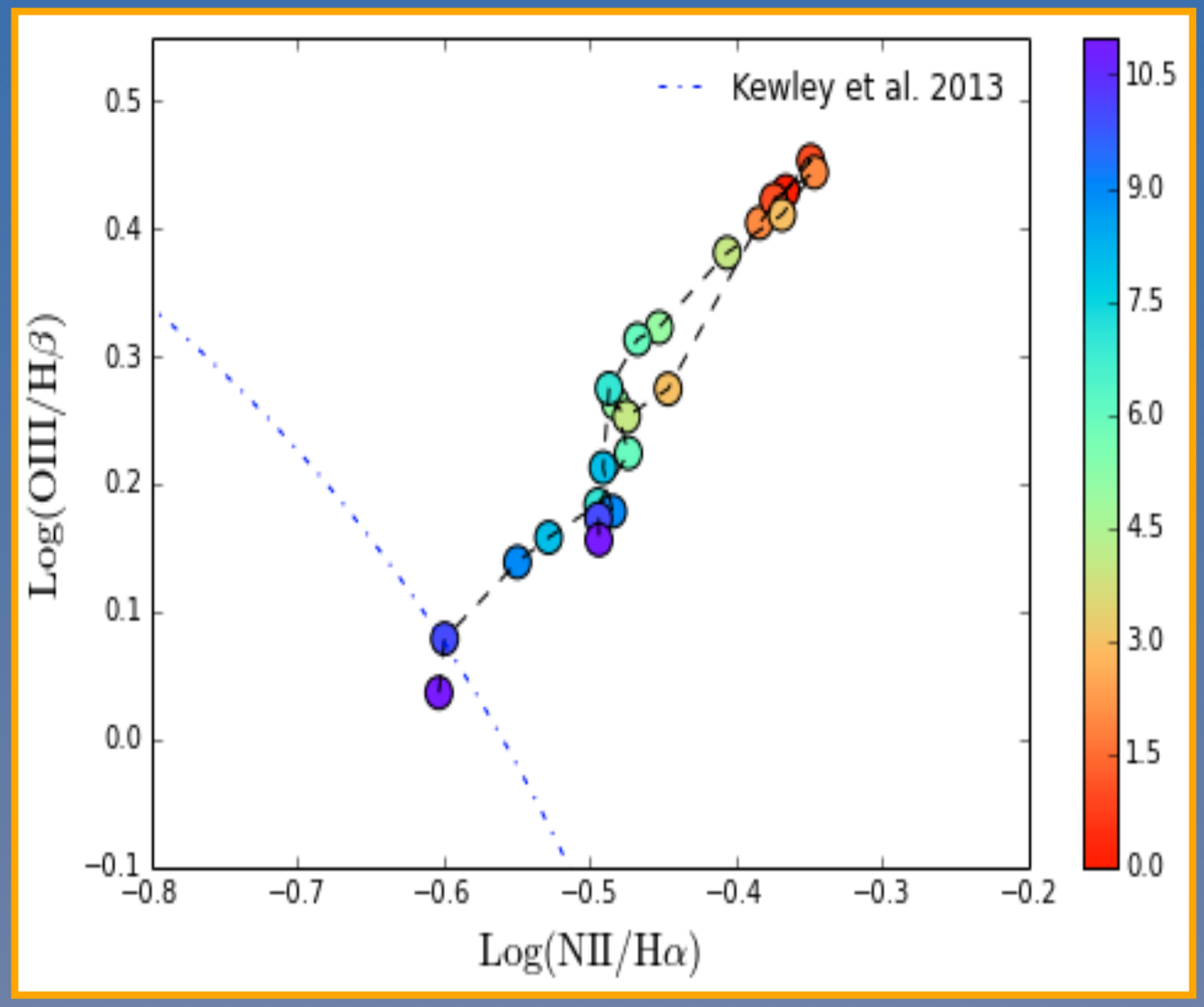


BPT

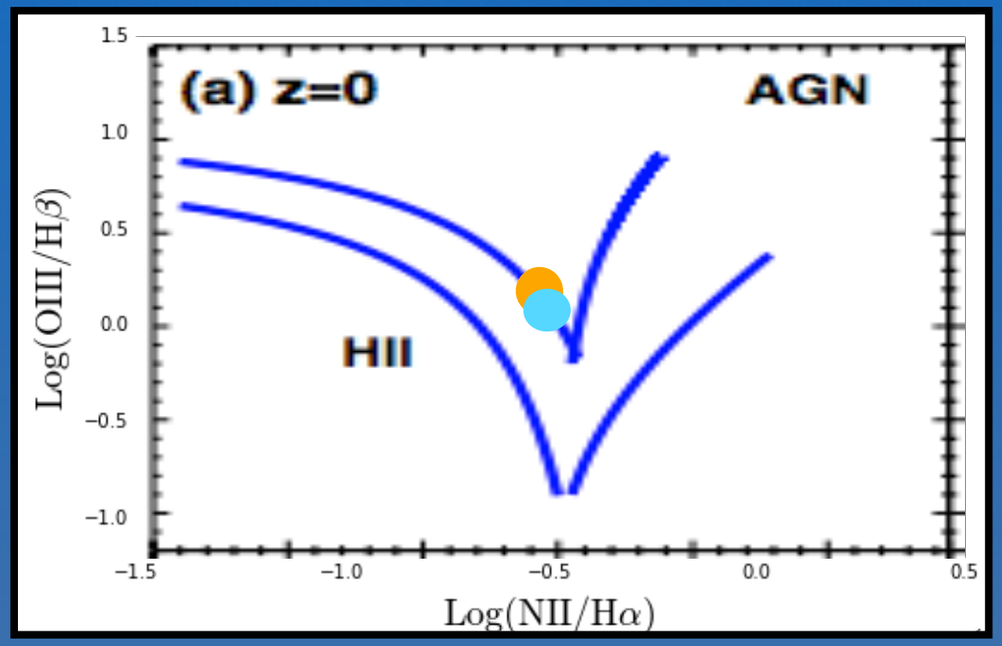


BPT


(a) z=0
AGN
HII
Log(OIII/Hβ)
Log(NII/Hα)
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−1.0
−0.5
0.0
0.5


Kewley et al. 2013
Log(OIII/Hβ)
Log(NII/Hα)
0.5
0.4
0.3
0.2
0.1
0.0
−0.1
−0.8
−0.7
−0.6
−0.5
−0.4
−0.3
−0.2
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0

BPT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Log(NII/Hα)
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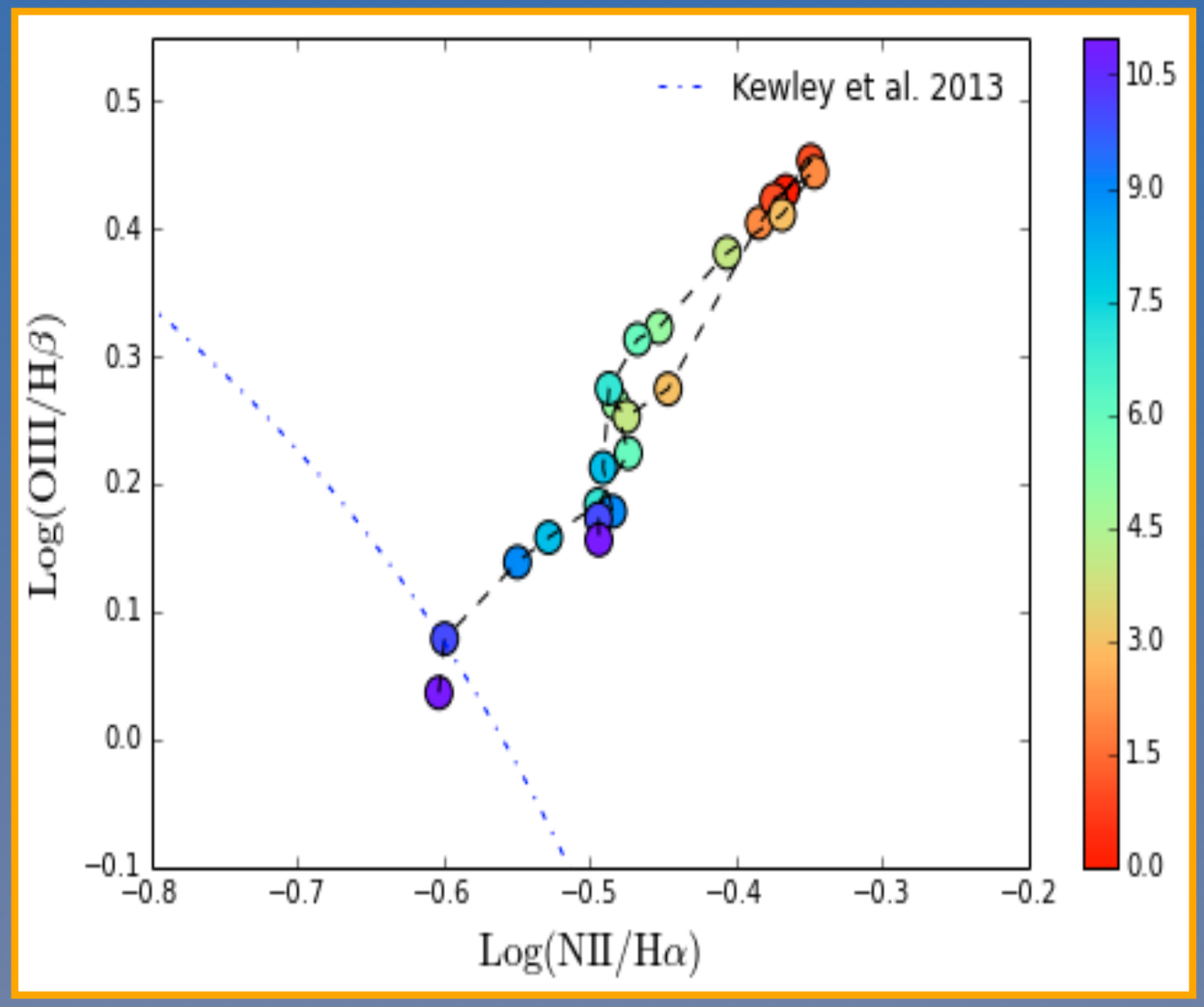
1.0
0.5
0.0
−0.5
−1.0
−1.5
−1.0
−0.5
0.0
0.5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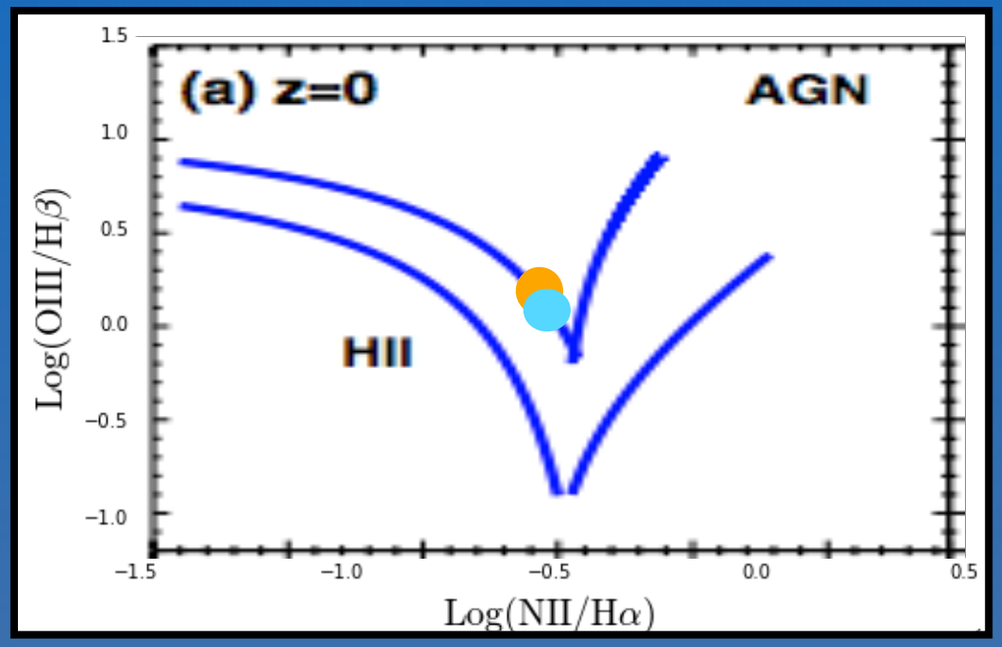
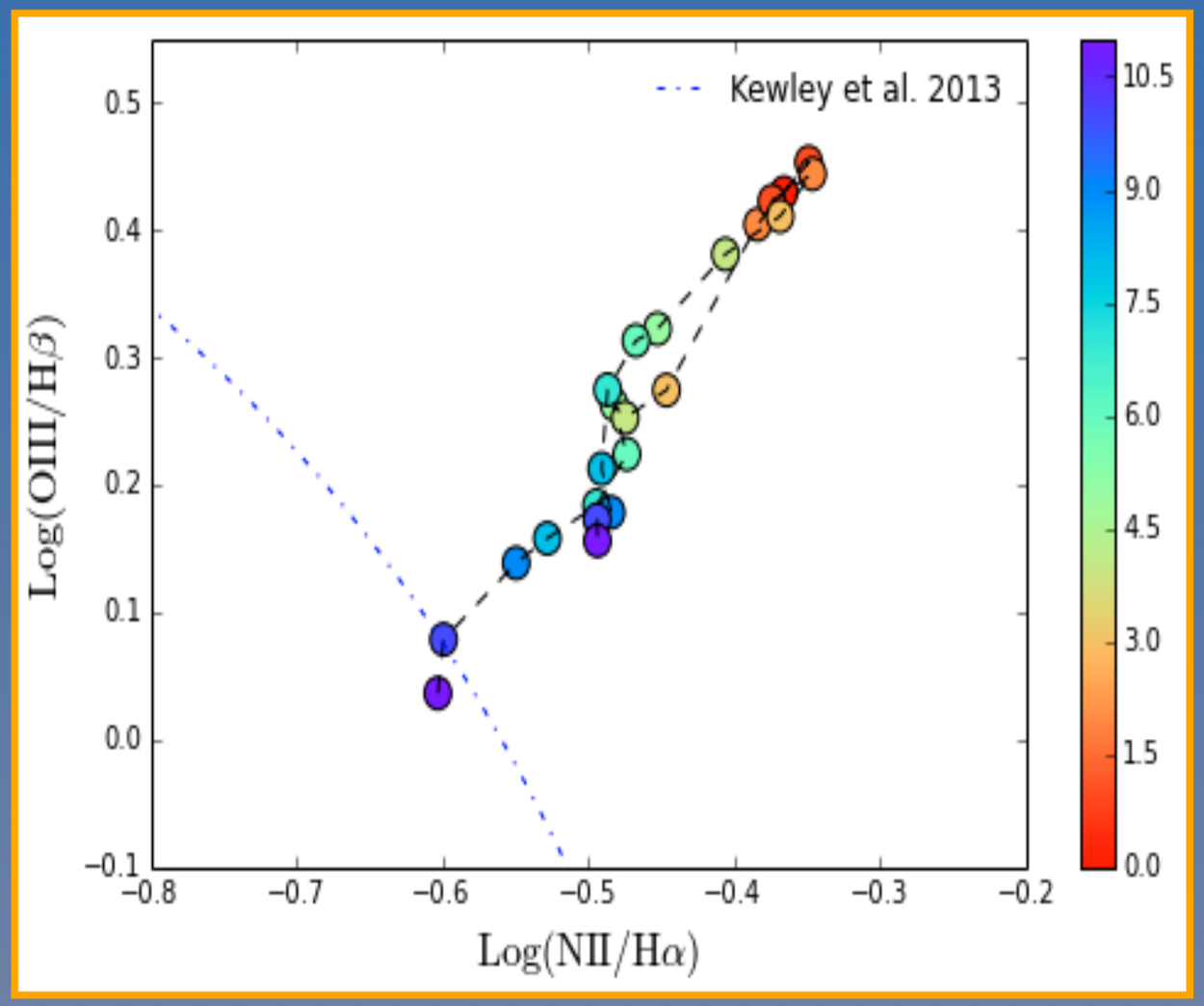
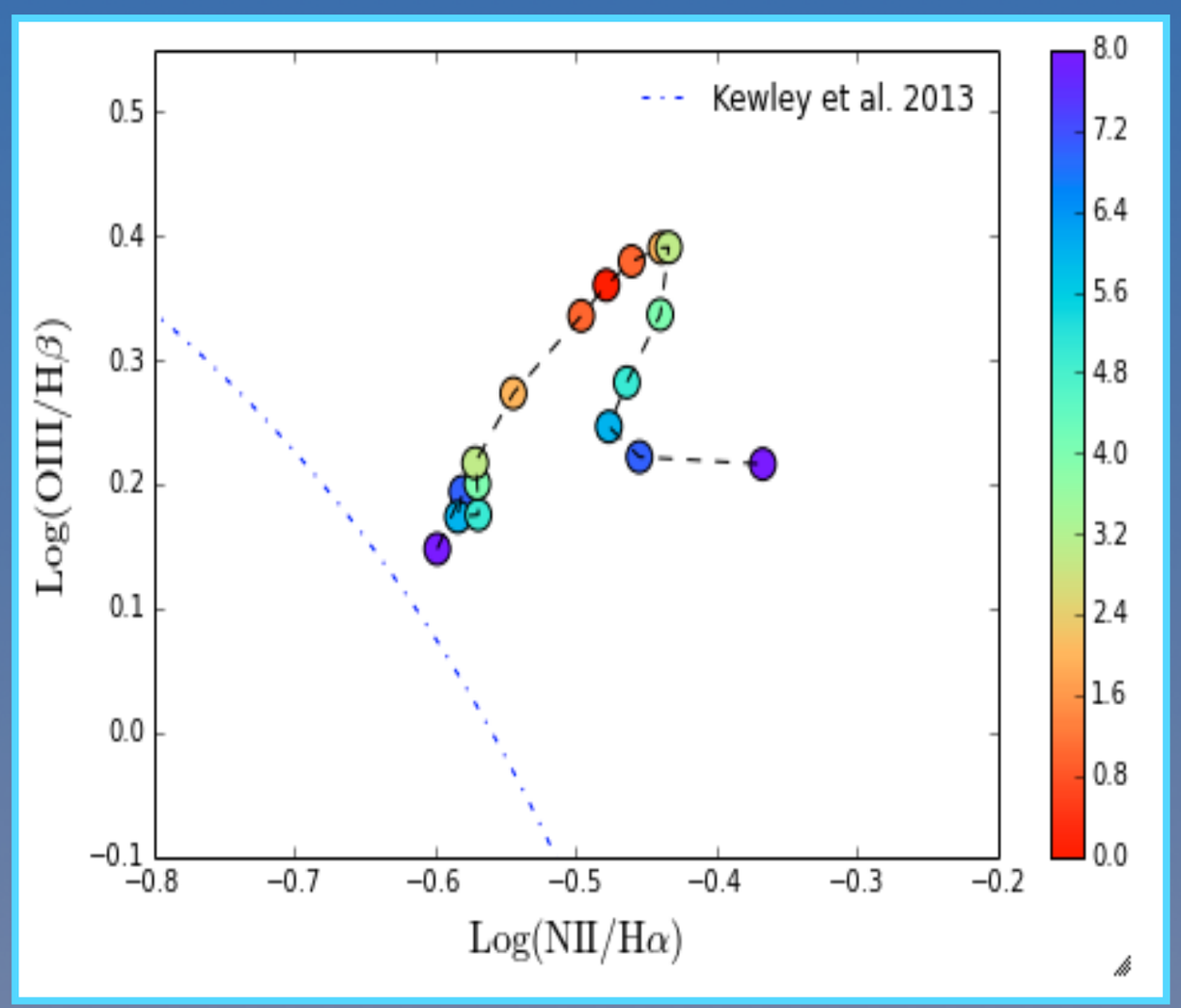
−0.7
−0.6
−0.5
−0.4
−0.3
−0.2
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0

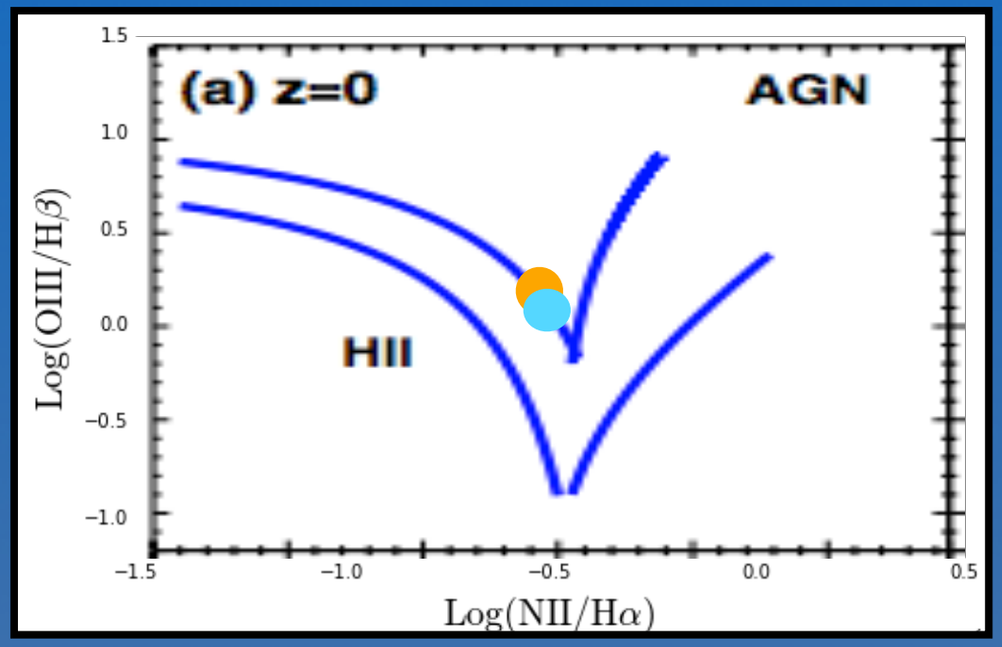
BPT


(a) z=0
AGN
HII
Log(OIII/Hβ)
Log(NII/Hα)


Kewley et al. 2013
Log(OIII/Hβ)
Log(NII/Hα)


Kewley et al. 2013
Log(OIII/Hβ)
Log(NII/Hα)

BPT


(a) z=0
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HII
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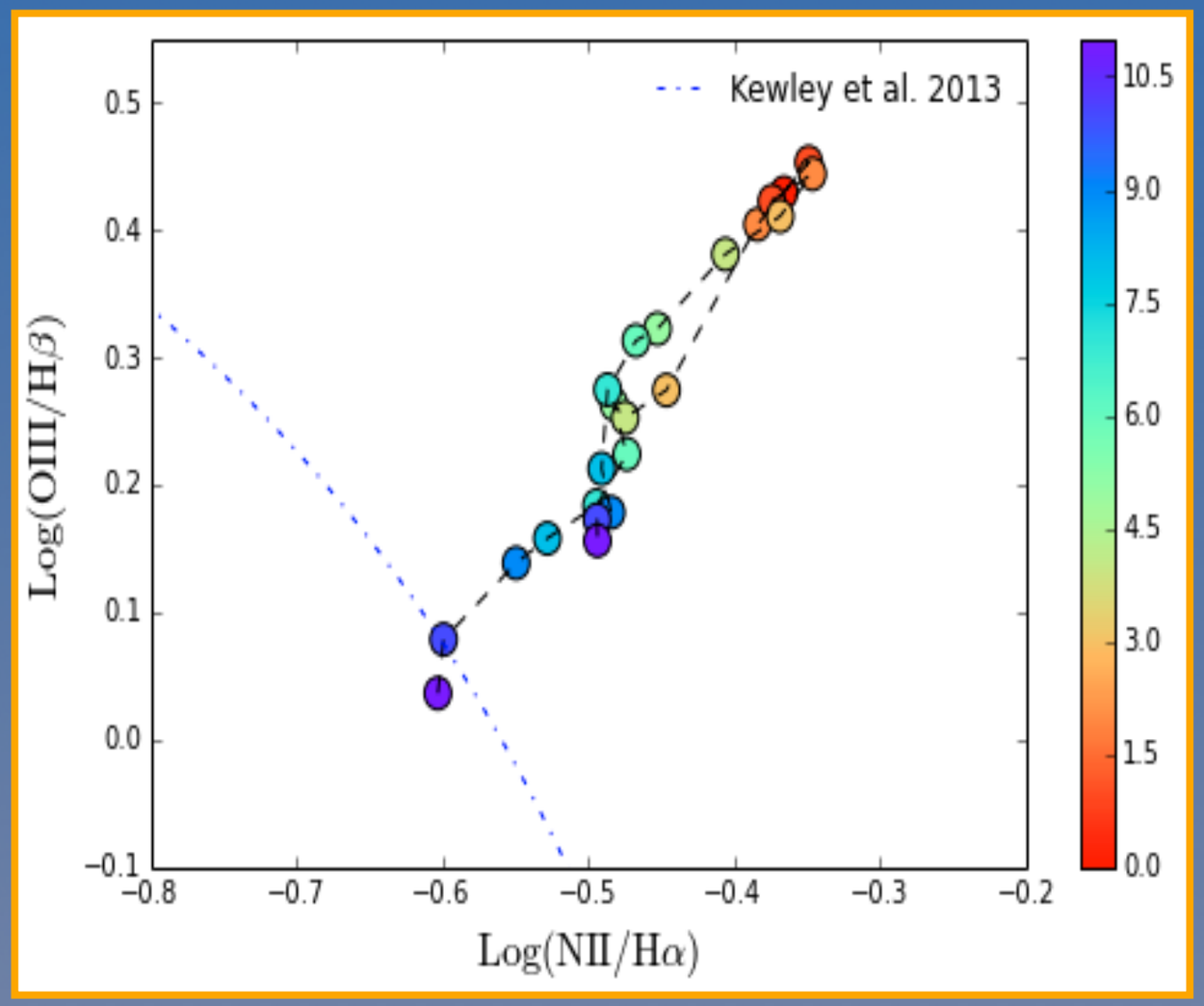
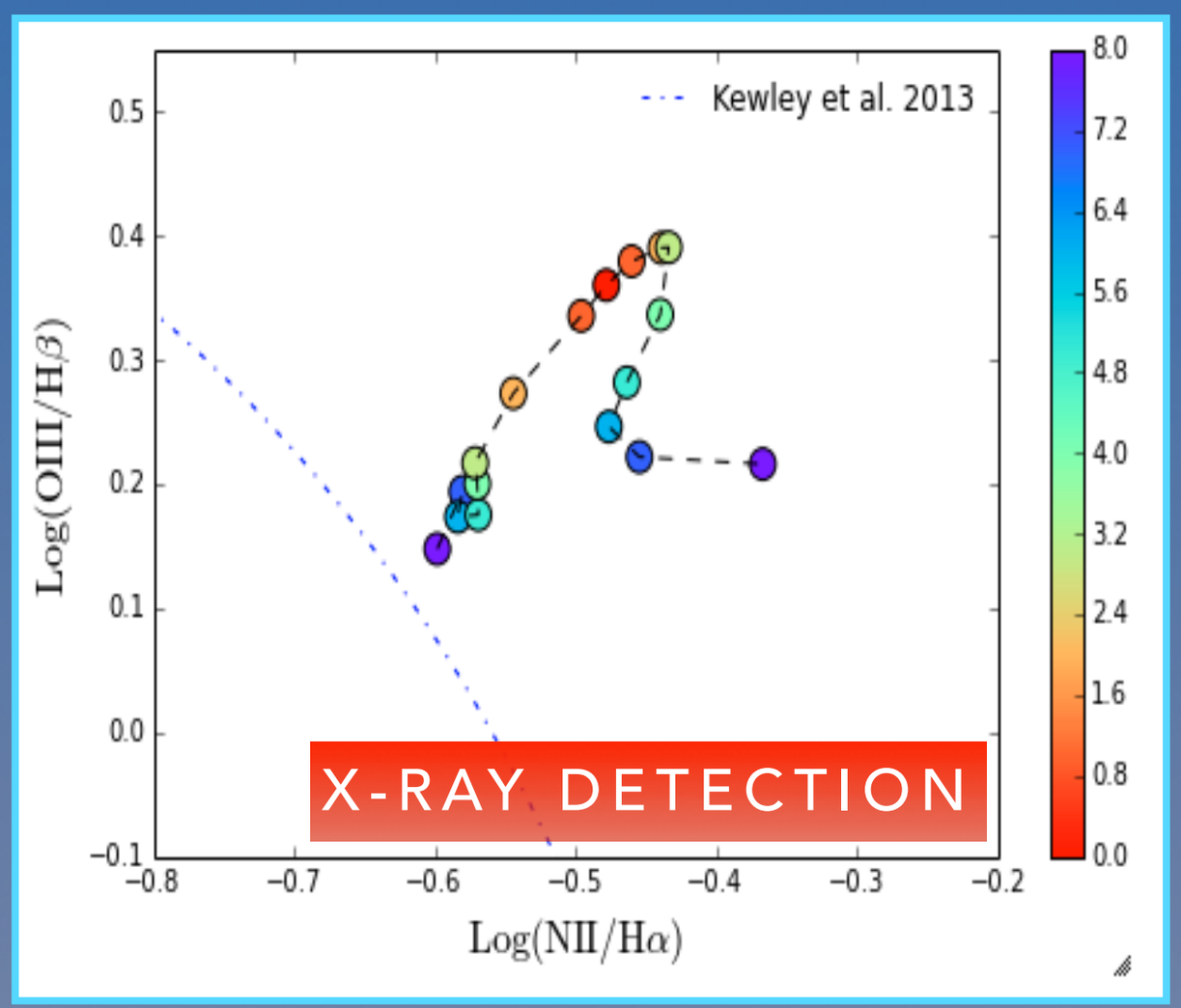
Log(NII/Hα)


Kewley et al. 2013
Log(OIII/Hβ)
Log(NII/Hα)


Kewley et al. 2013
X-RAY DETECTION
Log(OIII/Hβ)
Log(NII/Hα)

What is next …

ALMA (Atacama Large Millimeter/ submillimiter Array)

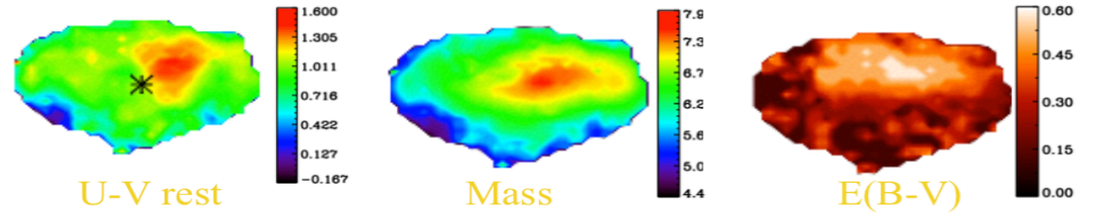
(cold molecular gas) CO(3-2) to get gas mass to decompose baryonic mass from Dynamical mass → Dark Matter profile?

Preliminary

Supernova Host Galaxies

Comparison of Maps of SN host galaxies using images pre and post SN
This can confirm the type Ia classification and gives insight on how SN would change kpc-scale appearance of galaxies.

GND13cam (Camille) Specz_host = 1.22



SN is at older and redder regions of the galaxy reinforce Type Ia

pre-SN images: by Steve Rodney

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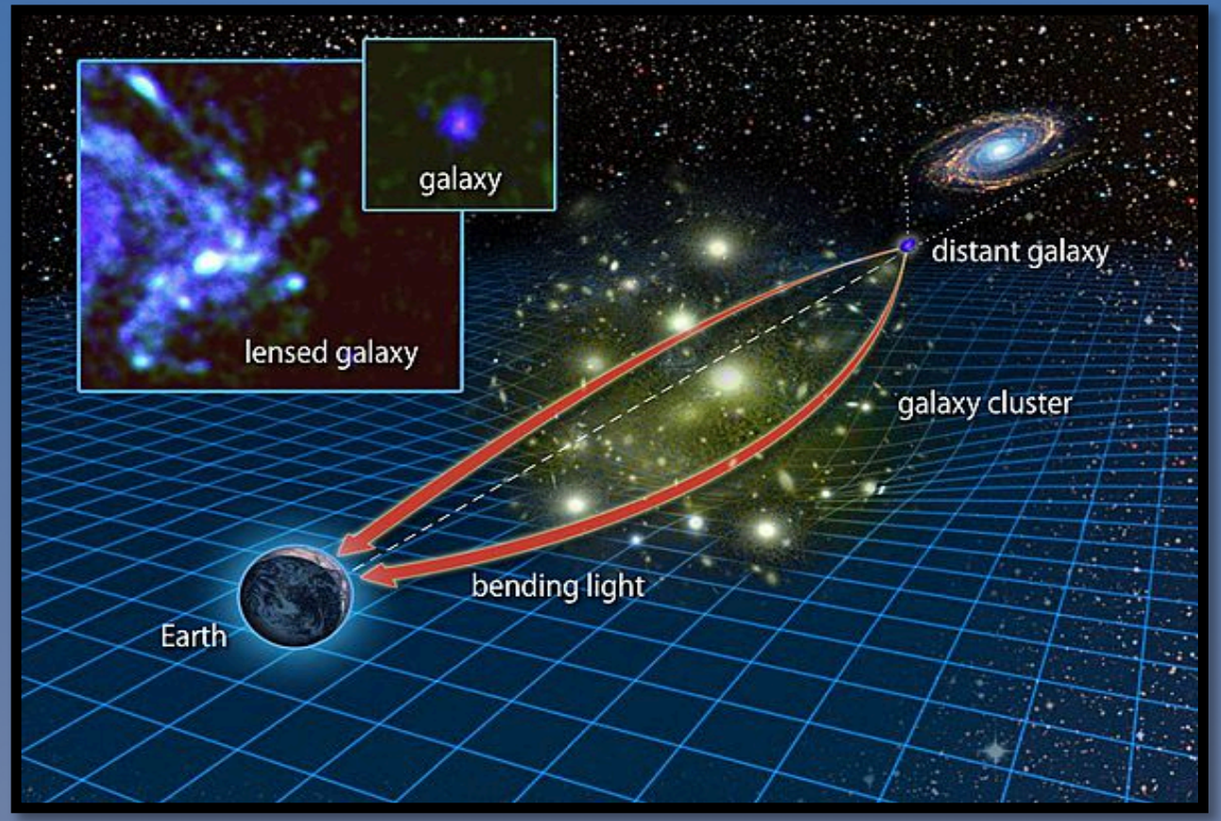

SUMMARY

- Resolved SED fitting of emission-line galaxies , 2D Maps of physical properties .
- Clumpy color and smooth mass surface density distribution.
- Identified red and blue regions from (U-V)rest color maps.
- Blue clumps are regions of higher sSFR in the disk.
- Main sequence of star formation in kpc-scale steeper compared to same redshift galaxies.
- Nebular and stellar dust attenuation along the disk of (z~0.4) galaxies.
- Dust attenuation increases with stellar mass surface density.
- Resolved BPT.

Thanks