

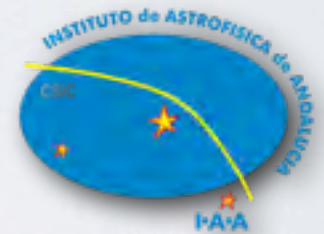
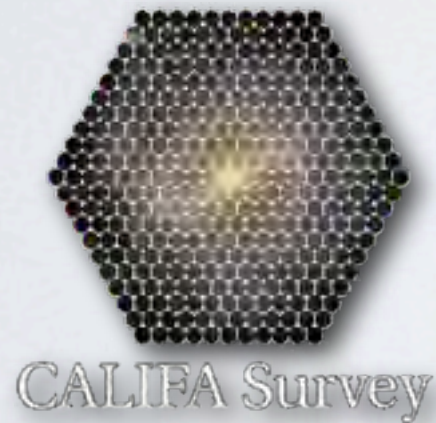
# CALIFA SURVEY:

## INTRODUCTION & DATA STRUCTURE

Rubén García-Benito  
(IAA-CSIC)

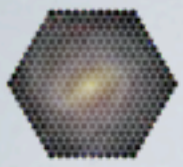
&

the CALIFA collaboration



“IVOA Interoperability Meeting” ◦ 18-23 May 2014





# CALIFA (CALAR ALTO Legacy Integral Field Area survey)

S.F. Sánchez et al. 2012, A&A, 538, 8

## Science drivers:

- \* Model the stellar population and constrain the star formation histories
- \* Trace the distribution of ionized gas and chemical abundances for the gas phase
- \* Measure the stellar and gaseous kinematics

<http://califa.caha.es>

~ 80 members / 13 countries

**P.I.: S. F. Sánchez** (Granada & México)

PS.: C. J. Walcher (Potsdam)

250 dark nights in 3 years:

**IFU PMAS/PPAK @ 3.5m CAHA (Almería)**





600  
galaxies

$0.005 < \text{redshift} < 0.03$

★ Large homogeneous sample

937 galaxies  
Mother sample

Apparent angular  
diameter selection  
from SDSS DR7

Volume-complete  
(correction)

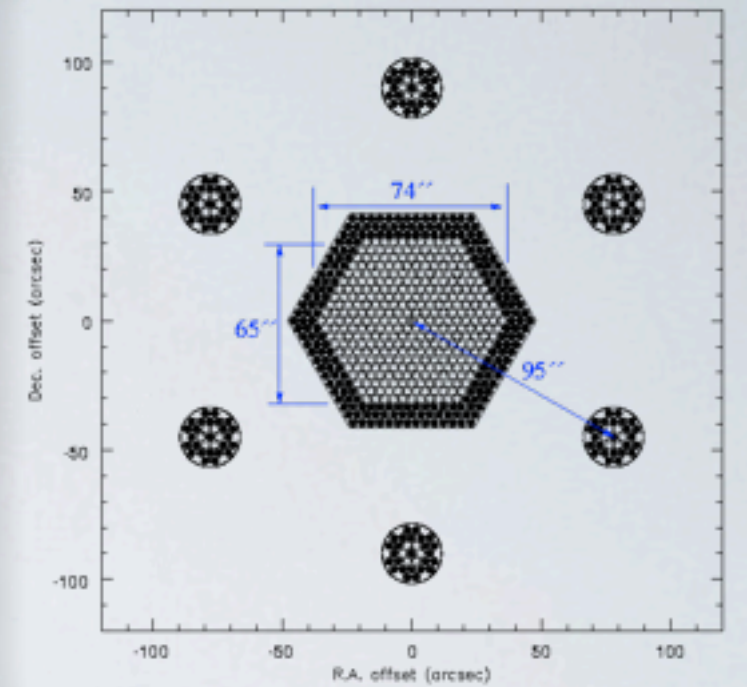


600  
galaxies

$0.005 < \text{redshift} < 0.03$

★ Large homogeneous sample

937 galaxies  
Mother sample



★ Large FoV (1'x1')

Fibers 2.7 arsec  
~ 0.5 - 1 kpc

3 dithering:  
final 1 arsec  
sampling



600  
galaxies

$0.005 < \text{redshift} < 0.03$

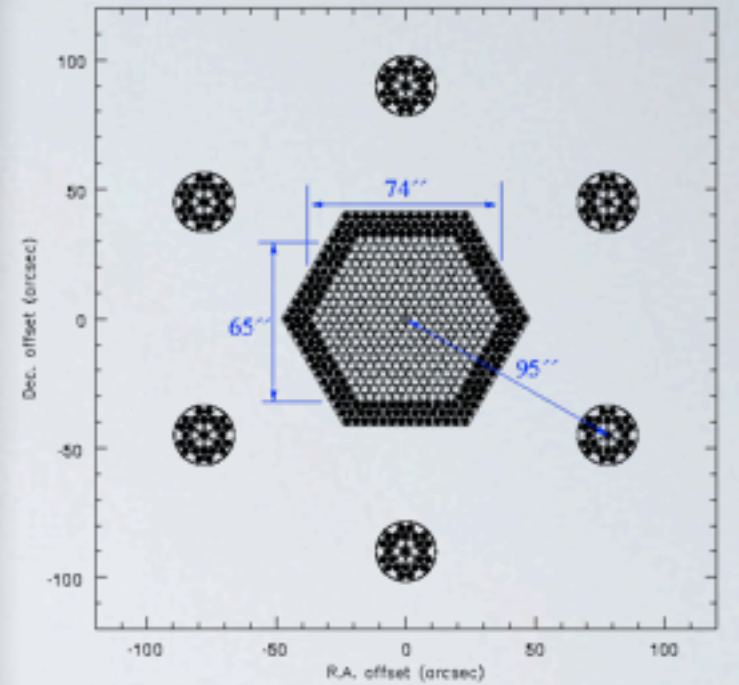
★ Large homogeneous sample

937 galaxies  
Mother sample

$\lambda$  range:  
3700-7000 Å

★ Cover optical  $\lambda$

V1200@R = 1650  
V500@R = 850

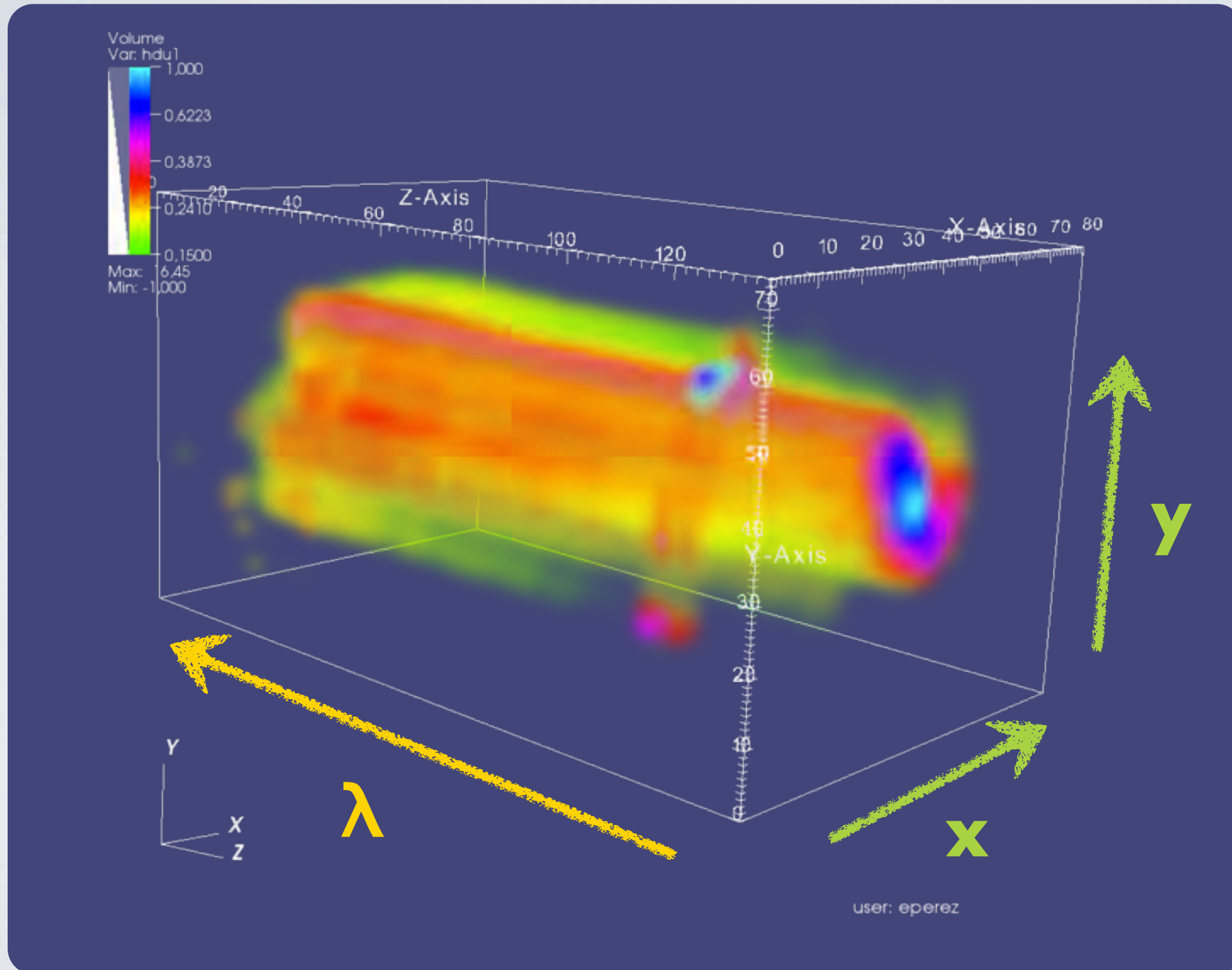
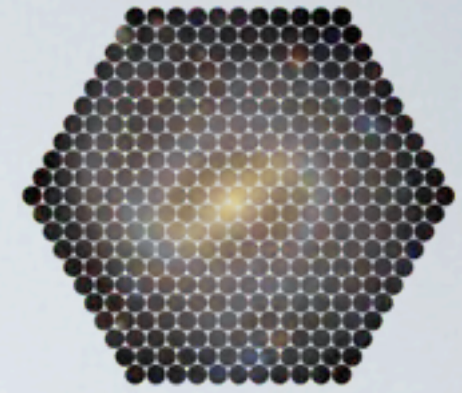


★ Large FoV (1'x1')

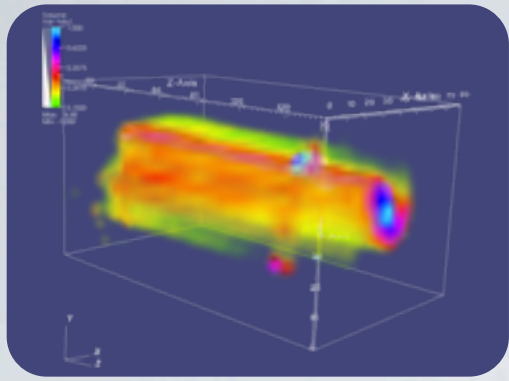
Fibers 2.7 arsec  
~ 0.5 - 1 kpc

3 dithering:  
final 1 arsec  
sampling

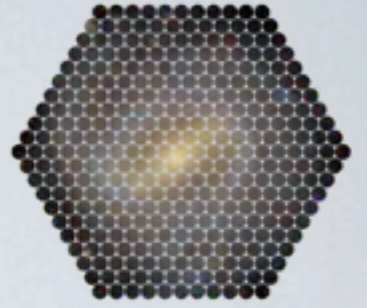
# DATA CUBE





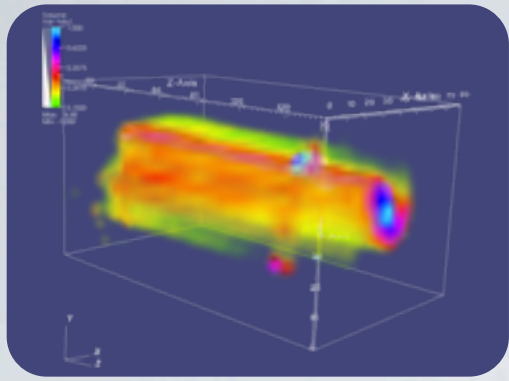


# CALIFA DATACUBES

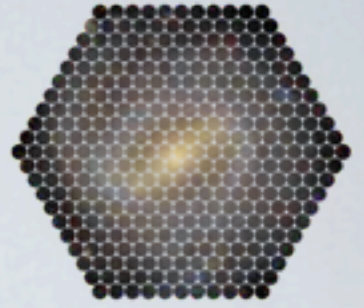


- \* FITS Files (reduced)
- \* 2 files per galaxy: V500 & V1200





# CALIFA DATACUBES



- \* FITS Files (reduced)
- \* 2 files per galaxy: V500 & V1200

```
In [2]: s = pyfits.open('NGC6497.V500.rscube.fits')
```

```
In [3]: s.info()
```

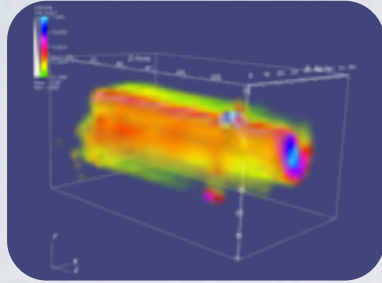
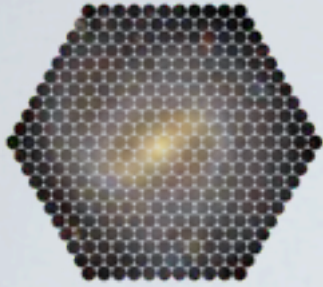
```
Filename: NGC6497.V500.rscube.fits
```

No.	Name	Type	Cards	Dimensions	Format
0	PRIMARY	PrimaryHDU	496	(77, 72, 1877)	float32
1	ERROR	ImageHDU	9	(77, 72, 1877)	float32
2	ERRWEIGHT	ImageHDU	9	(77, 72, 1877)	float32
3	BADPIX	ImageHDU	9	(77, 72, 1877)	uint8

**x** **y** **λ**



# CALIFA DATACUBES



```

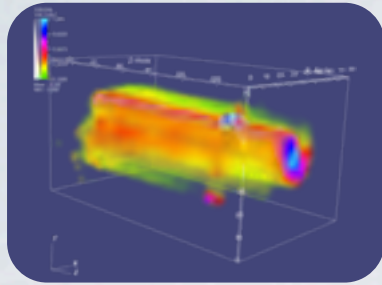
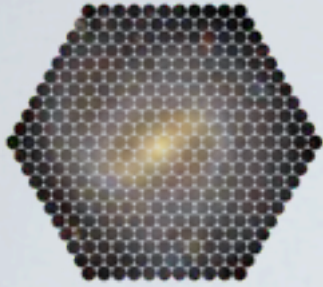
HIERARCH PPAK P3 PIPE NSKY FIB = 30 / Number of averaged sky fibers
HIERARCH PPAK P3 PIPE SKY MEAN = 21.41 / Mean sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY MIN = 21.48 / Minimum sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY MAX = 21.32 / Maximum sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY RMS = 0.03 / RMS sky brightness of sky fibers
HIERARCH PPAK P3 PIPE CONT = 'run180_00444.fits' / Name of the continuum frame
HIERARCH PPAK P3 PIPE CONT MST = 0 / master TRACE used
HIERARCH PPAK P3 PIPE ARC = 'run180_00443.fits' / Name of the arc frame
HIERARCH PPAK P3 PIPE ARC MST = 0 / master ARC lamp used
HIERARCH PPAK P3 PIPE WOFFSET = 0.006 / wavelength offset of OI 5577 sky line
HIERARCH PPAK P3 PIPE WRMS = 0.044 / offset RMS of OI 5577 sky line
HIERARCH PIPE P3 PIPE OFFX = 2.25 / IFU RA offset from ref coordinate
HIERARCH PIPE P3 PIPE OFFY = 1.25 / IFU DEC offset from ref coordinate
HIERARCH PIPE P3 PIPE CHISQ = 2.43 / CHISQ of image matching
HIERARCH PIPE P3 PIPE VALIDFIB = 252 / Valid fibers for image matching
HIERARCH PIPE P3 PIPE PHOTSCL = 0.896 / photometric scale factor
HIERARCH OBJDESC GALAXY = 'Object description'
AUTHOR = 'CALIFA Collaboration' / Creator of the dataset
INTRUME = 'PMAS/PPAK' / Instrument use for observations
HIERARCH PIPE VERS = 1.4 / Pipeline version
HIERARCH PIPE UNITS = '1e-16 erg/s/cm^2/A' / flux unit
OBJECT = 'NGC6497' / Target object
CALIFAID= 863 / CALIFAID of object
HIERARCH PIPE REDUATE = '24-11-2013T05:02:43' / Date/Time the file was produced
HIERARCH PIPE GALEXT COR = 1 / Applied Galactic Extinction (0 NO,1 Yes)
HIERARCH PIPE GALEXT AV = 0.184 / Galactic extinction in V-Band (-1 if not)
CRVAL3 = 3749.0
CDELTA3 = 2.0
CRPIX3 = 1.0
CRVAL2 = 59.470875 / DEC at CRPIX2 in deg
CDELTA2 = 1.0
CRPIX2 = 34 / Ref pixel for WCS
INTCUBE = 'INVERSEDISTANCE (sigma=0.75 | radius_limit=3.5)' / Interpolation meth
WCSAXES = 3 / Axes of the WCS
WCSNAME = 'TELESCOPE'
RAESYS = 'ICRS'
CTYPE1 = 'RA---TAN' / Variable measured by the WCS
CUNIT1 = 'deg' / Units
CTYPE2 = 'DEC--TAN' / Variable measured by the WCS
CUNIT2 = 'deg' / Units
CD1_1 = -0.0002777777777777777 / Pixels in degrees for X-axis
CD1_2 = 0.0
CD2_1 = 0.0
CD2_2 = 0.0002777777777777777 / Pixels in degrees for Y-axis
CTYPE3 = 'WAVELENGTH' / Spectral Axis Type
CUNIT3 = 'Angstrom' / Units
CD3_3 = 2.0 / Linear dispersion (Angstrom/pixel)
REGISTER= 'True' / Registering using SDSS images
SDSSMAG = 'True' / Calculate SDSS 30arcsec aperture mag
HIERARCH PIPE FILE VBAND = 'NGC6497.V.fits' / Synthetic V-band Fits image
HIERARCH DATE OBS = 20100714 / observation date
FILENAME= 'NGC6497.V500.rscube.fits.gz' / File Name
HIERARCH PIPE APER CURB R = '13.389' / 30arcsec r band photometry from cube
HIERARCH PIPE APER CURB G = '13.389' / 30arcsec g band photometry from cube
HIERARCH PIPE ABS SDSS P13D RATIO R = 1.04716800466376 / ratio of SDSS photomet
HIERARCH PIPE ABS SDSS P13D RATIO G = 1.0314546744239 / ratio of SDSS photometr
HIERARCH PIPE ABS SDSS P13D RATIO B = 1.0314546744239 / ratio of SDSS photometr

```

No.	Name	Type	Cards	Dimensions	Format
0	PRIMARY	PrimaryHDU	496	(77, 72, 1877)	FITS



# CALIFA DATACUBES



λ

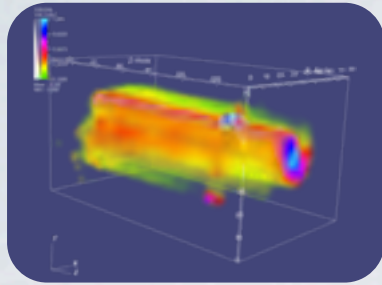
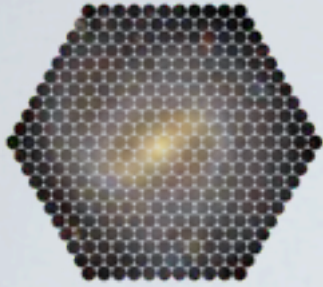
```

HIERARCH PPAK P3 PIPE NSKY FIB = 30 / Number of averaged sky fibers
HIERARCH PPAK P3 PIPE SKY MEAN = 21.41 / Mean sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY MIN = 21.48 / Minimum sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY MAX = 21.32 / Maximum sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY RMS = 0.03 / RMS sky brightness of sky fibers
HIERARCH PPAK P3 PIPE CONT = 'run180_00444.fits' / Name of the continuum frame
HIERARCH PPAK P3 PIPE CONT MST = 0 / master TRACE used
HIERARCH PPAK P3 PIPE ARC = 'run180_00443.fits' / Name of the arc frame
HIERARCH PPAK P3 PIPE ARC MST = 0 / master ARC lamp used
HIERARCH PPAK P3 PIPE WOFFSET = 0.006 / wavelength offset of OI 5577 sky line
HIERARCH PPAK P3 PIPE WRMS = 0.044 / offset RMS of OI 5577 sky line
HIERARCH PIPE P3 PIPE OFFX = 2.25 / IFU RA offset from ref coordinate
HIERARCH PIPE P3 PIPE OFFY = 1.25 / IFU DEC offset from ref coordinate
HIERARCH PIPE P3 PIPE CHISQ = 2.43 / CHISQ of image matching
HIERARCH PIPE P3 PIPE VALIDFIB = 252 / Valid fibers for image matching
HIERARCH PIPE P3 PIPE PHOTSCL = 0.896 / photometric scale factor
HIERARCH OBJDESC GALAXY = 'Object description'
AUTHOR = 'CALIFA Collaboration' / Creator of the dataset
INTRUME = 'PMAS/PPAK' / Instrument use for observations
HIERARCH PIPE VERS = 1.4 / Pipeline version
HIERARCH PIPE UNITS = '1e-16 erg/s/cm^2/A' / flux unit
OBJECT = 'NGC6497' / Target object
CALIFAID = 863 / CALIFAID of object
HIERARCH PIPE REDUATE = '24-11-2013T05:02:43' / Date/Time the file was produced
HIERARCH PIPE GALEXT COR = 1 / Applied Galactic Extinction (0 NO,1 Yes)
HIERARCH PIPE GALEXT AV = 0.18 / Galactic extinction in V-Band (-1 if not)
CRVAL3 = 3749.0
CDELTA3 = 2.0
CRPIX3 = 1.0
CRVAL2 = 59.478875 / DEC at CRPIX2 in deg
CDELTA2 = 1.0
CRPIX2 = 34 / Ref pixel for WCS
INTCUBE = 'INVERSEDISTANCE (sigma=0.75 | radius_limit=3.5)' / Interpolation meth
WCSAXES = 3 / Axes of the WCS
WCSNAME = 'TELESCOPE'
RADESYS = 'ICRS'
CTYPE1 = 'RA---TAN' / Variable measured by the WCS
CUNIT1 = 'deg' / Units
CTYPE2 = 'DEC--TAN' / Variable measured by the WCS
CUNIT2 = 'deg' / Units
CD1_1 = -0.00027777777777777777 / Pixels in degrees for X-axis
CD1_2 = 0.0
CD2_1 = 0.0
CD2_2 = 0.00027777777777777777 / Pixels in degrees for Y-axis
CTYPE3 = 'WAVELENGTH' / Spectral Axis Type
CUNIT3 = 'Angstrom' / Units
CD3_3 = 2.0 / Linear dispersion (Angstrom/pixel)
REGISTER = 'True' / Registering using SDSS images
SDSSMAG = 'True' / Calculate SDSS 30arcsec aperture mag
HIERARCH PIPE FILE VBAND = 'NGC6497.V.fits' / Synthetic V-band Fits image
HIERARCH DATE OBS = 20100714 / observation date
FILENAME = 'NGC6497.V500.rscube.fits.gz' / File Name
HIERARCH PIPE APER CURB R = '13.389' / 30arcsec r band photometry from cube
arcsec g band photometry from cube
16800466376 / ratio of SDSS photomet
39218543173 / ratio of SDSS photomet
8009504775 / ratio of SDSS photometry
etry (CALIFA-sample_ext_mag.csv)
etry (CALIFA-sample_ext_mag.csv)
780800796902 / ratio of SDSS photomet
128548050898 / ratio of SDSS photomet
HIERARCH PIPE APER SDSS PY3D RATIO = 1.0314546744239 / ratio of SDSS photometry /
    
```

No.	Name	Type	Cards	Dimensions	For
0	PRIMARY	PrimaryHDU	496	(77, 72, 1877)	



# CALIFA DATACUBES



Y

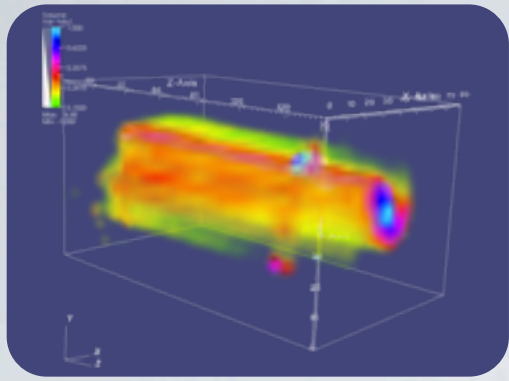
```

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HIERARCH PPAK P3 PIPE SKY MIN = 21.48 / Minimum sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY MAX = 21.32 / Maximum sky brightness of sky fibers
HIERARCH PPAK P3 PIPE SKY RMS = 0.03 / RMS sky brightness of sky fibers
HIERARCH PPAK P3 PIPE CONT = 'run180_00444.fits' / Name of the continuum frame
HIERARCH PPAK P3 PIPE CONT MST = 0 / master TRACE used
HIERARCH PPAK P3 PIPE ARC = 'run180_00443.fits' / Name of the arc frame
HIERARCH PPAK P3 PIPE ARC MST = 0 / master ARC lamp used
HIERARCH PPAK P3 PIPE WOFFSET = 0.006 / wavelength offset of OI 5577 sky line
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HIERARCH PIPE VERS = 1.4 / Pipeline version
HIERARCH PIPE UNITS = '1e-16 erg/s/cm^2/A' / flux unit
OBJECT = 'NGC6497' / Target object
CALIFAID = 863 / CALIFAID of object
HIERARCH PIPE REDUATE = '24-11-2013T05:02:43' / Date/Time the file was produced
HIERARCH PIPE GALEXT COR = 1 / Applied Galactic Extinction (0 NO,1 Yes)
HIERARCH PIPE GALEXT AV = 0.184 / Galactic extinction in V-Band (-1 if not)
CRVAL3 = 3749.0
CDELTA3 = 2.0
CRPIX3 = 1.0
CRVAL2 = 59.470875 / DEC at CRPIX2 in deg
CDELTA2 = 1.0
CRPIX2 = 34 / Ref pixel for WCS
INTCUBE = 'INVERSEDISTANCE (sigma=0.75 | radius_limit=3.5)' / Interpolation meth
WCSAXES = 3 / Axes of the WCS
WCSNAME = 'TELESCOPE'
RADESYS = 'ICRS'
CTYPE1 = 'RA---TAN' / Variable measured by the WCS
CUNIT1 = 'deg' / Units
CTYPE2 = 'DEC--TAN' / Variable measured by the WCS
CUNIT2 = 'deg' / Units
CD1_1 = -0.00027777777777777777 / Pixels in degrees for X-axis
CD1_2 = 0.0
CD2_1 = 0.0
CD2_2 = 0.00027777777777777777 / Pixels in degrees for Y-axis
CTYPE3 = 'WAVELENGTH' / Spectral Axis Type
CUNIT3 = 'Angstrom' / Units
CD3_3 = 2.0 / Linear dispersion (Angstrom/pixel)
REGISTER = 'True' / Registering using SDSS images
SDSSMAG = 'True' / Calculate SDSS 30arcsec aperture mag
HIERARCH PIPE FILE VBAND = 'NGC6497.V.fits' / Synthetic V-band Fits image
HIERARCH DATE OBS = 20100714 / observation date
FILENAME = 'NGC6497.V500.rscube.fits.gz' / File Name
HIERARCH PIPE APER CUBE R = '13.389' / 30arcsec r band photometry from cube
HIERARCH PIPE APER CUBE G = '13.389' / 30arcsec g band photometry from cube
HIERARCH PIPE ABS SDSS P13D RATIO R = 1.047128548050898 / ratio of SDSS photomet
HIERARCH PIPE ABS SDSS P13D RATIO G = 1.0314546744239 / ratio of SDSS photometry /

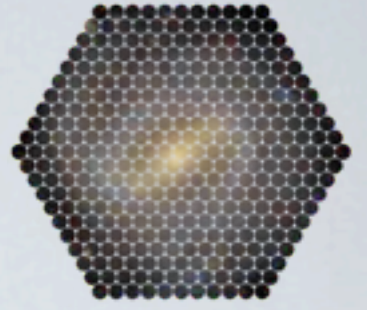
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No.	Name	Type	Cards	Dimensions	Format
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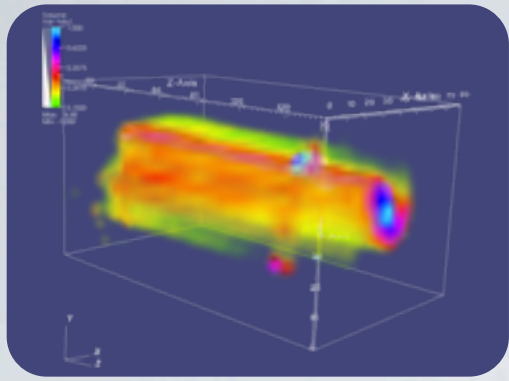


# CALIFA DATACUBES

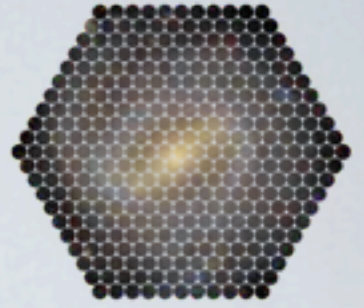


Errors, error weights & flags





# CALIFA DATACUBES



Errors, error weights & flags

```
In [2]: s = pyfits.open('NGC6497.V500.rscube.fits')
```

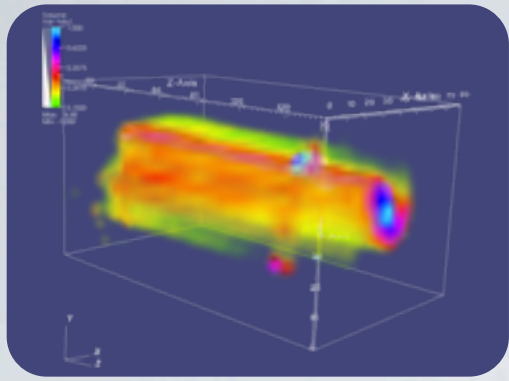
```
In [3]: s.info()
```

```
Filename: NGC6497.V500.rscube.fits
```

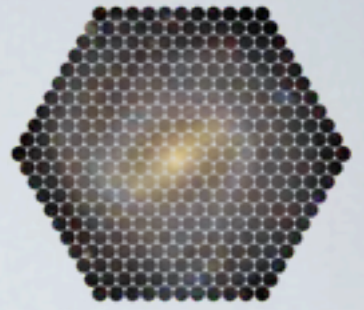
**x y  $\lambda$**

No.	Name	Type	Cards	Dimensions	Format
0	PRIMARY	PrimaryHDU	496	(77, 72, 1877)	float32
1	ERROR	ImageHDU	9	(77, 72, 1877)	float32
2	ERRWEIGHT	ImageHDU	9	(77, 72, 1877)	float32
3	BADPIX	ImageHDU	9	(77, 72, 1877)	uint8





# CALIFA DATACUBES

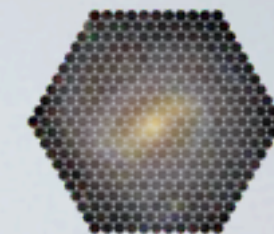


Errors, error weights & flags

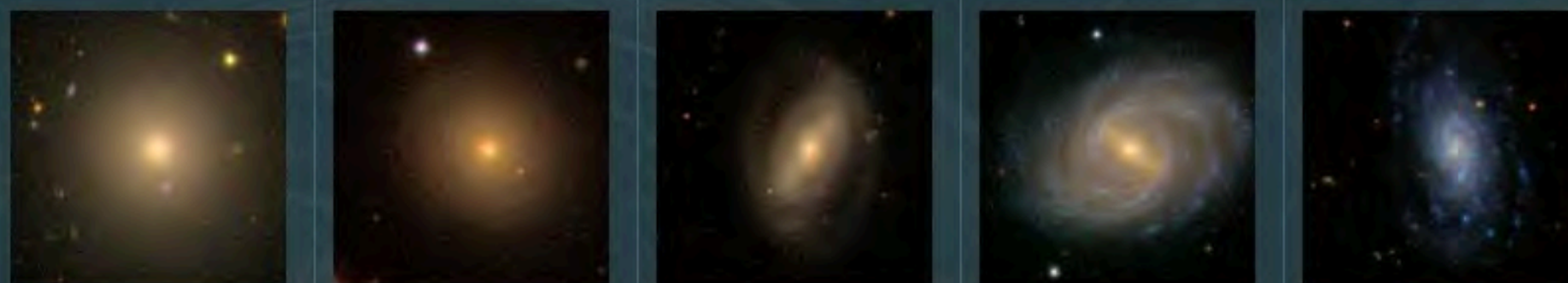
HDU	Extension name	Format	Content
0	Primary	32-bit float	flux density in units of $10^{-16} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ \AA}^{-1}$
1	ERROR	32-bit float	$1\sigma$ error on the flux density
2	ERRWEIGHT	32-bit float	error weighting factor
3	BADPIX	8-bit integer	bad pixel flags (1 = bad, 0 = good)



# CALIFA DRI SEARCH TOOL



## CALIFA 1st DATA RELEASE



NGC6125

H $\alpha$

Gas vel

SP Age

V-band Flux

NGC 1349

H $\alpha$

Gas vel

SP Age

V-band Flux

NGC4003

H $\alpha$

Gas vel

SP Age

V-band Flux

NGC5406

H $\alpha$

Gas vel

SP Age

V-band Flux

UGC07012

H $\alpha$

Gas vel

SP Age

V-band Flux

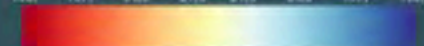
Flux  $10^{-16}$  erg/s/cm/arcsec<sup>2</sup>/Å

0.000 0.171 0.344 0.516 0.689 0.862 1.034 1.207



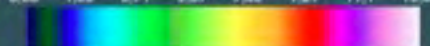
velocity km/s

-190 -107 -44.3 -21.4 21.4 44.3 107 190



log(Age/Gyr)

0.00 1.86 3.71 5.57 7.43 9.29 11.1 13.0



Flux  $10^{-16}$  erg/s/cm/arcsec<sup>2</sup>

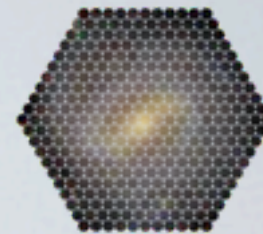
0.00 0.183 0.366 0.549 0.732 0.915 1.098 1.281



Top-Panel: SDSS postage-stamp images of the CALIFA target galaxies, with a FoV of 90"x90". Bottom-Panel: Summary of the vast information contained in the CALIFA data



# CALIFA DR1 SEARCH TOOL



Publications Members' Page Editors Page Next Events

## CALIFA DR1 Searching Tool

This search tool is designed to select CALIFA data corresponding to particular targets, based on some of their properties. It includes all the CALIFA galaxies contained within the mother sample. Therefore, many of the listed objects do not have released data. If you are not sure which objects are included in the DR please select **"Galaxies with both setups"** in the Object entry.

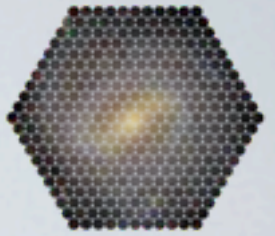
Disclaimer: If you are a Mac user and you encounter problems with this search tool, please, use this other [search tool](#)

Object	<input type="text"/>	
RA (HH:MM:SS)	<input type="text"/>	± DELTA_RA (MM) <input type="text"/>
DEC (±DD:MM:SS)	<input type="text"/>	± DELTA_DEC (MM) <input type="text"/>
REDSHIFT	<input type="text"/>	- <input type="text"/>
g-band magnitude	<input type="text"/>	- <input type="text"/>
Obs. date (YYYY-MM-DD)	<input type="text"/>	
Hubble type	<input type="text"/>	
Barredness	<input type="text"/>	
Merging or Isolated	<input type="text"/>	
inclination (degrees)	<input type="text"/>	- <input type="text"/>
V-band Atmospheric extinction	<input type="text"/>	- <input type="text"/>
Airmass	<input type="text"/>	- <input type="text"/>
SDSS/CALIFA PHOTOMETRIC RATIO	<input type="text"/>	- <input type="text"/>

**FTP**



# CALIFA TABLE FORMAT: ASCII



```
# AUTHOR: Carlos C. Califa
# SOURCE: CALIFA Collaboration
# DATE: 2011-08-24
# VERSION: 1.0
# COLAPRV: J. Walcher
# PUBAPRV: None
# COLUMN1: CALIFAID, int, , the ID of the CALIFA galaxy
# COLUMN2: CALIFAName, string, , the CALIFA name of the galaxy
# COLUMN3: Name, string, , the NED name of the galaxy
# COLUMN4: RA, float, degrees, right ascension J2000.0
# COLUMN5: DEC, float, degrees, declination J2000.0
```

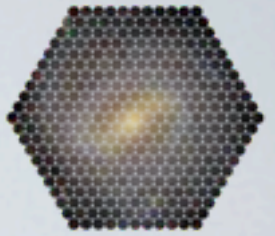
## Header

```
1, CALIFA001, IC5376, 0.33241081, 34.52566909
2, CALIFA002, UGC00005, 0.77351248, -1.91383457
3, CALIFA003, NGC7819, 1.10210525, 31.47200775
4, CALIFA004, UGC00029, 1.14060366, 28.30172348
5, CALIFA005, IC1528, 1.27240324, -7.09338998
...
```

## Data



# CALIFA TABLE FORMAT: FITS



```
AUTHOR = 'C.J. Walcher'
SOURCE = 'CALIFA Collaboration'
DATE = '2011-09-30'
VERSION = '1.0 '
COLAPRV = 'J. Walcher'
PUBAPRV = 'None '
TTYPE1 = 'califaid'
TFORM1 = 'J '
TCOMM1 = 'the id of the califa galaxy'
TNULL1 = 2147483647
TTYPE2 = 'ra '
TFORM2 = 'E '
TUNIT2 = 'degrees '
TCOMM2 = 'right ascension J2000.0'
TTYPE3 = 'de '
TFORM3 = 'E '
TUNIT3 = 'degrees '
TCOMM3 = 'declination J2000.0'
TTYPE4 = 'hubtyp '
TFORM4 = '128A '
TCOMM4 = 'hubble type s or e'
TTYPE5 = 'hubsubtyp'
```

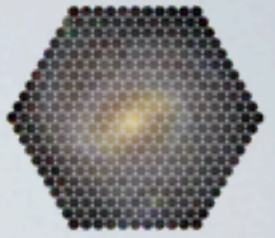
ASCII	FITS	Explanation
short	I	16-bit signed integer
int	J	32-bit signed integer
long	K	64-bit signed integer
float	E	32-bit single precision floating point
double	D	64-bit double precision floating point
string	?A	String in ASCII format/Number of characters for FITS

## Header

```
[8]: s[1].data['CALIFAID']
Out[8]:
array([ 1,  3,  7, 10, 14, 39, 42, 43, 53, 73, 88, 100, 127,
        146, 151, 155, 156, 273, 274, 277, 306, 307, 309, 319, 326, 341,
        364, 475, 479, 486, 515, 518, 528, 548, 577, 607, 608, 609, 610,
        657, 663, 664, 665, 676, 680, 684, 758, 764, 769, 783, 797, 798,
        806, 820, 822, 823, 824, 826, 828, 829, 832, 833, 835, 837, 840,
        843, 845, 846, 847, 848, 850, 851, 852, 854, 856, 857, 858, 859,
        860, 863, 864, 865, 866, 867, 872, 874, 877, 878, 881, 883, 887,
        888, 890, 893, 896, 901, 902, 904, 935, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999])
```



# CALIFA TABLE FORMAT: FITS



TOPCAT File Subsets Help

TOPCAT

Table List  
1: DR1\_V500\_QC\_param.fits

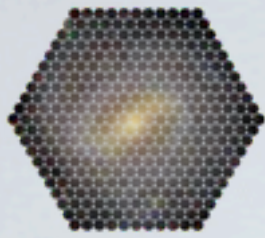
Current Table Properties  
Label: DR1\_V500\_QC\_param.fits  
Location: /Users/rgb/Downloads/DR1\_V500\_QC\_param.fits

TOPCAT(1): Table Browser

Table Browser for 1: DR1\_V500\_QC\_param.fits

	CALIFAID	NAME	RADEG	DECDEG	OBS_AIR_MEAN	OBS_AIR_RMS	RED_VE...	OBS_SKY_MAG	OBS_SKY_RMS
1	1	IC5376	0,33241	34,52567	1,01679	0,010996	1.3c	21,3533	0,016667
2	3	NGC7819	1,10211	31,47201	1,01496	0,008121	1.3c	20,77	0,033333
3	7	UGC00036	1,30784	6,77203	1,33612	0,054512	1.3c	20,5433	0,026667
4	10	NGC0036	2,84291	6,38935	1,31405	0,049407	1.3c	21,0167	0,02
5	14	UGC00312	7,84967	8,46673	1,25556	0,040651	1.3c	21,03	0,02
6	39	NGC0444	18,95651	31,08062	1,02608	0,012042	1.3c	20,8267	0,02
7	42	NGC0477	20,33535	40,48815	1,10479	0,029094	1.3c	20,9633	0,02
8	43	IC1683	20,6622	34,43713	1,00771	0,005508	1.3c	21,2933	0,01
9	53	UGC01057	22,22189	13,7938	1,19365	0,039825	1.3c	20,7067	0,026667
10	73	NGC0776	29,97719	23,64428	1,03955	0,009561	1.3c	21,1333	0,01
11	88	UGC01938	37,09224	23,21463	1,12618	0,032338	1.3c	20,8133	0,02
12	100	NGC1056	40,7013	28,57416	1,36765	0,262953	1.3c	20,7367	0,016667
13	127	NGC1349	52,86463	4,3809	1,22064	0,01934	1.3c	20,5767	0,013333
14	146	UGC03352	79,92452	84,05262	1,47406	0,004297	1.3c	20,7167	0,023333





# CALIFA DR1 & VO

News Publications Members' Page Editors Page Next Events

## Electronic DR1 tables and Virtual Observatory information

### Electronic Tables

In order to judge the quality of the datacubes, we defined a complete set of parameters that cover the basic scientific data properties as described in DR article. The corresponding QC tables and the main sample table are linked below for download in a special CSV and standard FITS table format together with a associated text files with further details on the content of the table.

A description of the [CALIFA table format](#) is available and we recommend to use the FITS tables in conjunction with the [TOPCAT](#) table viewer.

Content	FITS table	CSV table	Table description
DR1 sample	<a href="#">DR1_sample.fits</a>	<a href="#">DR1_sample.csv</a>	<a href="#">DR1_sample.txt</a>
V500 QC parameters	<a href="#">DR1_V500_QC_param.fits</a>	<a href="#">DR1_V500_QC_param.csv</a>	<a href="#">DR1_V500_QC_param.txt</a>
V1200 QC parameters	<a href="#">DR1_V1200_QC_param.fits</a>	<a href="#">DR1_V1200_QC_param.csv</a>	<a href="#">DR1_V1200_QC_param.txt</a>

### VO Table access and queries

The table above are also accessible through the VO based on the Table Access Protocol (TAP) and can be directly queried and retrieved with TOPCAT at the url <http://dc.g-vo.org/tap>, where the two QC control tables are combined into the califadr1.cubes table and the DR1 sample table is available as califadr1.objects. All the available tables and their schemata can checked in TOPCAT or at the this link [CALIFA VO tables](#). More sophisticated queries can be issued than in the fixed web from of the DR1 retrieval tool. Below are a few example queries using ADQL linked through a VO web interface, but can also used in TOPCAT directly:

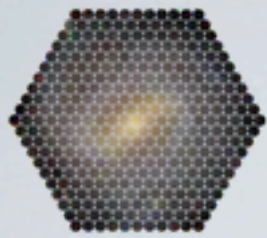
- » [Select V500 datasets of all Elliptical galaxies with excellent data reduction and S/N>30 at the half-light radius](#)
- » [Select V1200 datasets of spiral galaxies with low axis ratios \(b/A<0.4\) and with a sky surface brightness B>22.2mag/arcsec2](#)
- » [Create a list/table of all datasets that can be used with wget to download the files](#)

Many more complex queries can be generated from the available tables and can be even more expanded when the CALIFA sample characterization paper is available and its associated tables. Note that selecting the 'accref' column as the only column of the queried table allows to use it for mass download of datasets with 'wget' as shown in the last example above.

### Direct VO access to CALIFA spectra using SSAP

Individual spectra from the cubes are exposed via SSAP; the service's IVORN is `ivo://org.gavo.dc/califa/q/s`. User





# CALIFA DRI & VO

GERMAN ASTROPHYSICAL  
**GAVO**  
VIRTUAL OBSERVATORY

[Help](#)

[Service info](#)

**Metadata**

[Description >>](#)

[Keywords >>](#)

[Creator >>](#)

[Created >>](#)

[Data updated >>](#)


[Source >>](#)

---

[Try ADQL](#) to query our data.

---

Please report errors and problems to the [site operators](#). Thanks.  
[Privacy](#) | [Disclaimer](#)  
[Log in](#)



**Information on resource 'Calar Alto Legacy Integral Field spectroscopy Area survey'**

---

CALIFA is obtaining spatially resolved spectroscopic information of a diameter selected sample of 600 galaxies in the Local Universe ( $0.005 < z < 0.03$ ). It has been designed to allow the building of two-dimensional maps of the following quantities:

- stellar populations: ages and metallicities;
- ionized gas: distribution, excitation mechanism and chemical abundances
- kinematic properties: both from stellar and ionized gas components.

CALIFA uses the PPAK integral field unit (IFU), with a hexagonal field-of-view of 1.3 square arcmin, with a 100% covering factor by adopting a three-pointing dithering scheme. The optical wavelength range is covered from 3700 to 7000 Å, using two overlapping setups (V500 and V1200), with different resolutions of about 850 and 1650, respectively. CALIFA is a legacy survey, intended for the community and its current Data Release 1 provides access to the first 100 galaxies.

---

**Services defined within this resource descriptor**

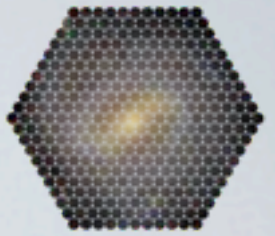
- [CALIFA Cube Datalink Service](#)
- [CALIFA Spectral Datalink Service](#)
- [CALIFA spectra](#)

**Tables defined within this resource descriptor**

- [califadr1.cubes](#) – queryable through [TAP](#) and [ADQL](#)  
Metadata for the CALIFA data cubes as delivered by the project.
- [califadr1.fluxposv1200](#) – queryable through [TAP](#) and [ADQL](#)



# CALIFA DRI & VO



Select V500 datasets of all Elliptical galaxies with excellent data reduction and  $S/N > 30$  at the half-light radius

## ADQL Query

On this page, you can use [ADQL](#) to query [some of our tables](#). This is mainly for dabbling; use [TAP](#) for larger jobs (e.g., [using PHandle](#) within your browser).

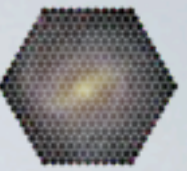
To learn what ADQL is or for further information on this implementation, see the [service info](#).

ADQL query

```
SELECT Target_name,califaid, setup, accref, flag_red_r, cal_sn_mean_win, hubtype from califadri.cubes
NATURAL JOIN califadri.objects where flag_red_r=0 and cal_sn_mean_win>30 and setup='V500' and
hubtype='E'
```



# VISUALISE & ANALYSE (V&A): TOOLS



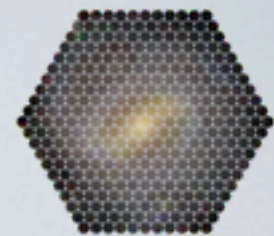
Thursday 22 May



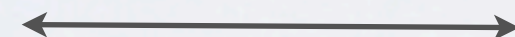
Pierre Fernique

HiPS<sup>3</sup>: HEALPix progressive surveys for cubes





.....



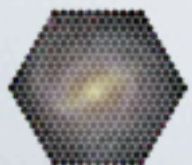
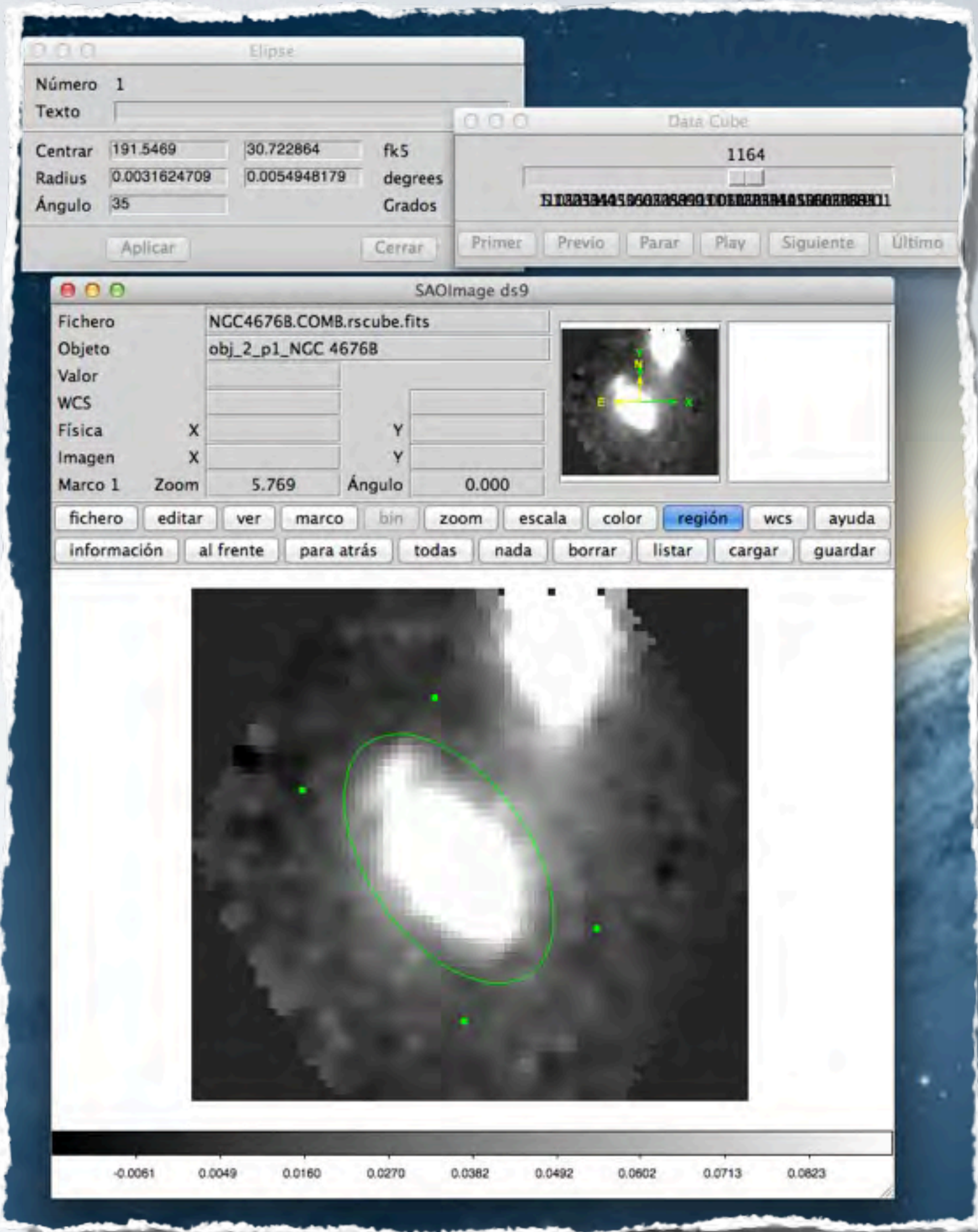
.....





# V & A CALIFA DATA: TOOLS

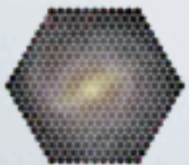
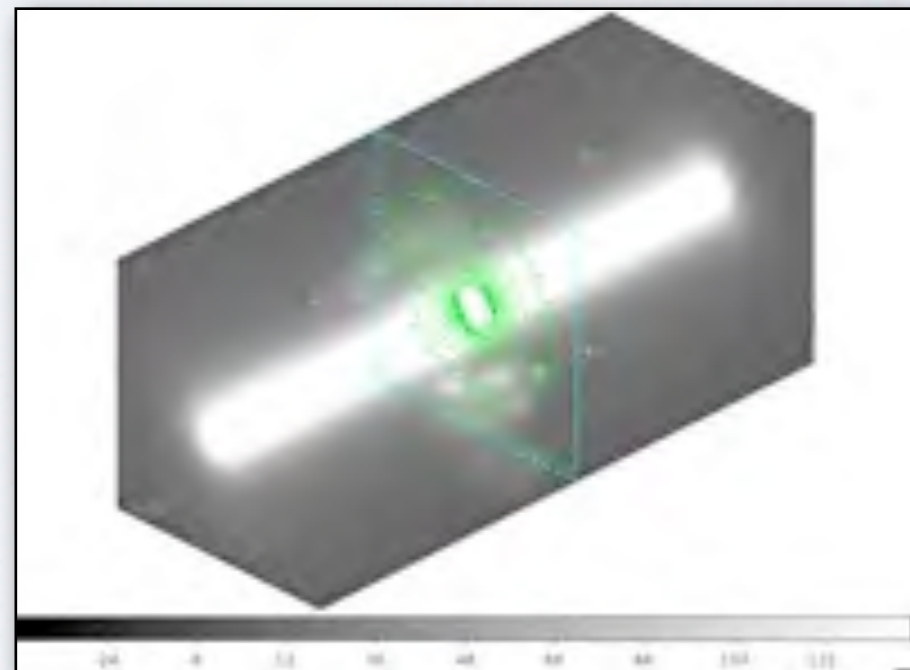
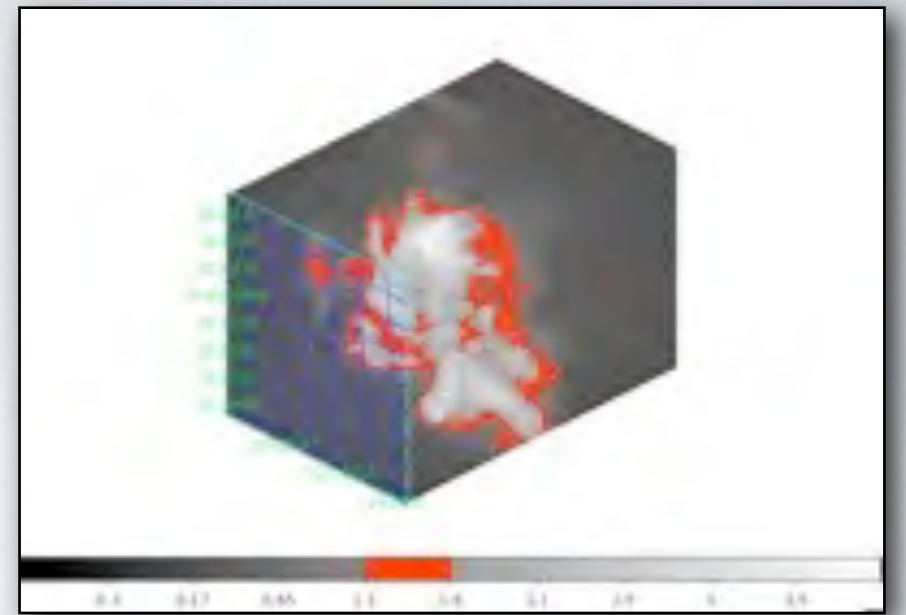
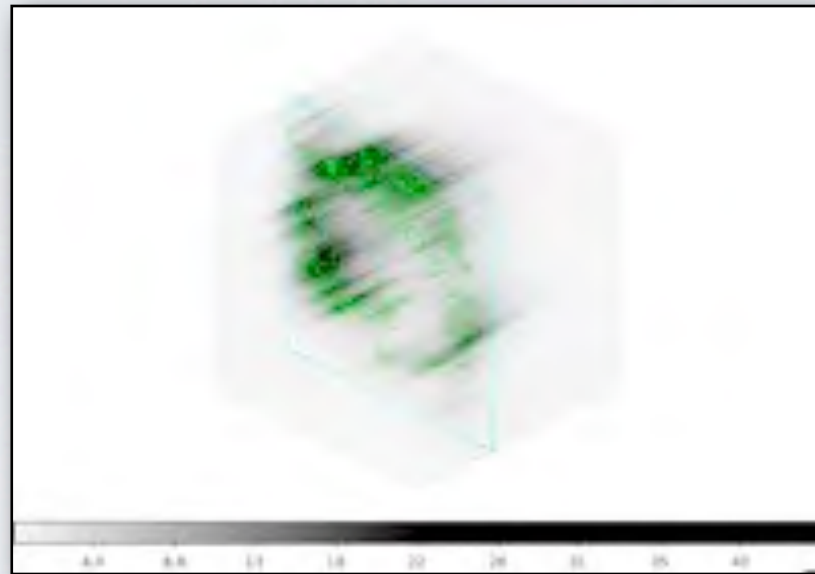
**DS9**





# V & A CALIFA DATA: TOOLS

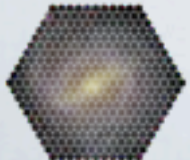
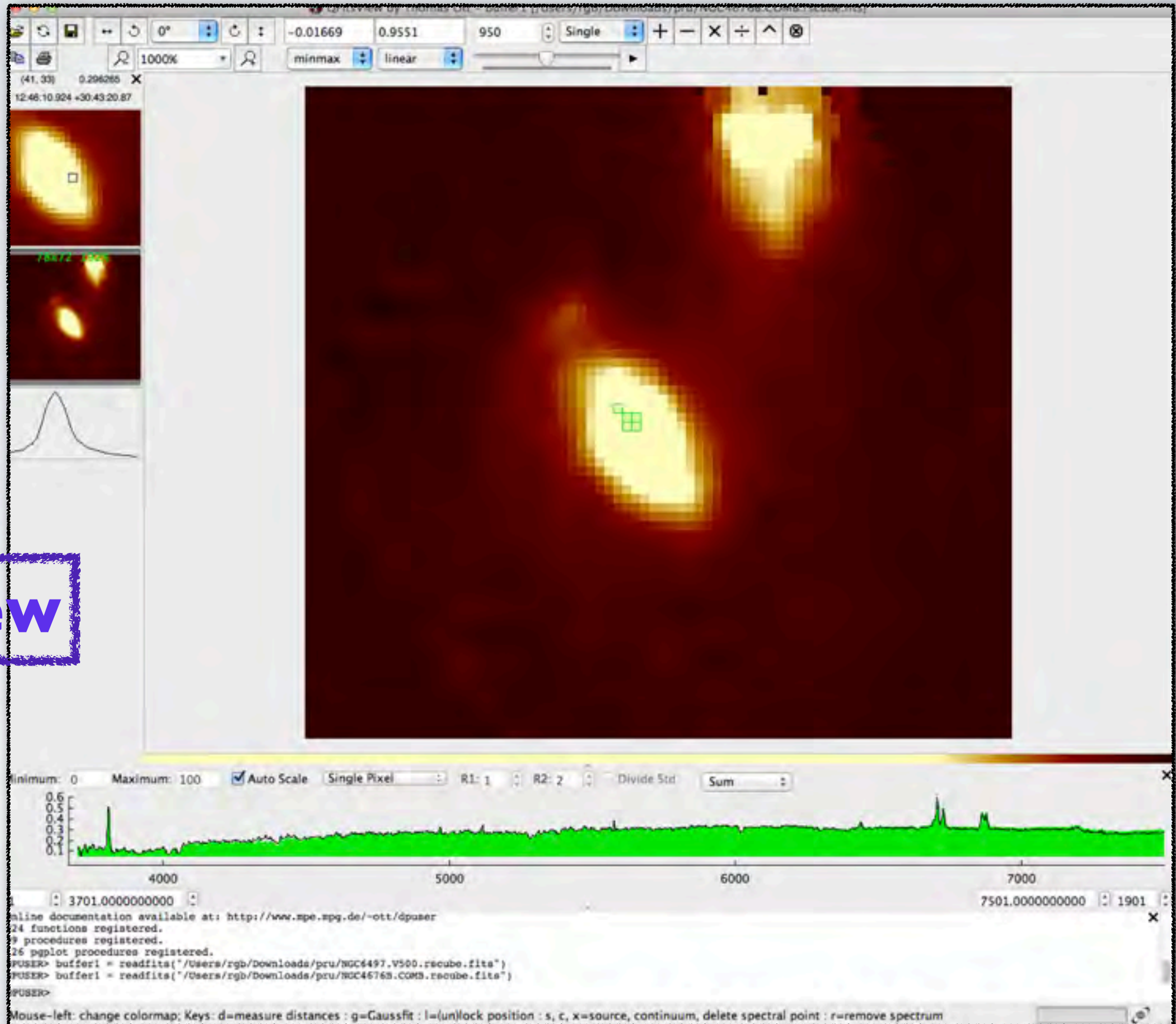
**DS9**





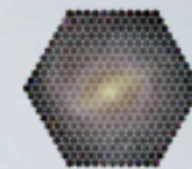
# V & A CALIFA DATA: TOOLS

**QFitsView**

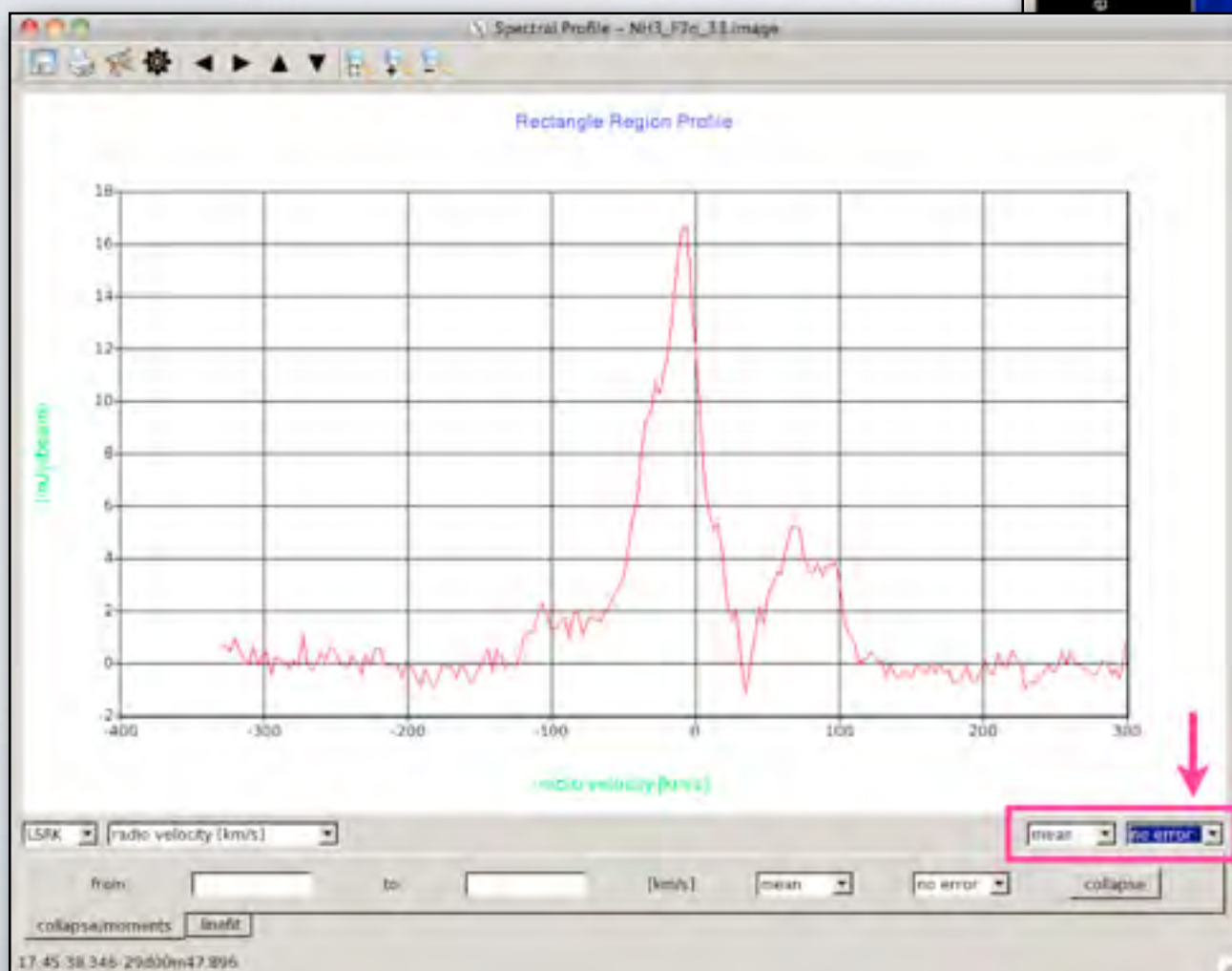
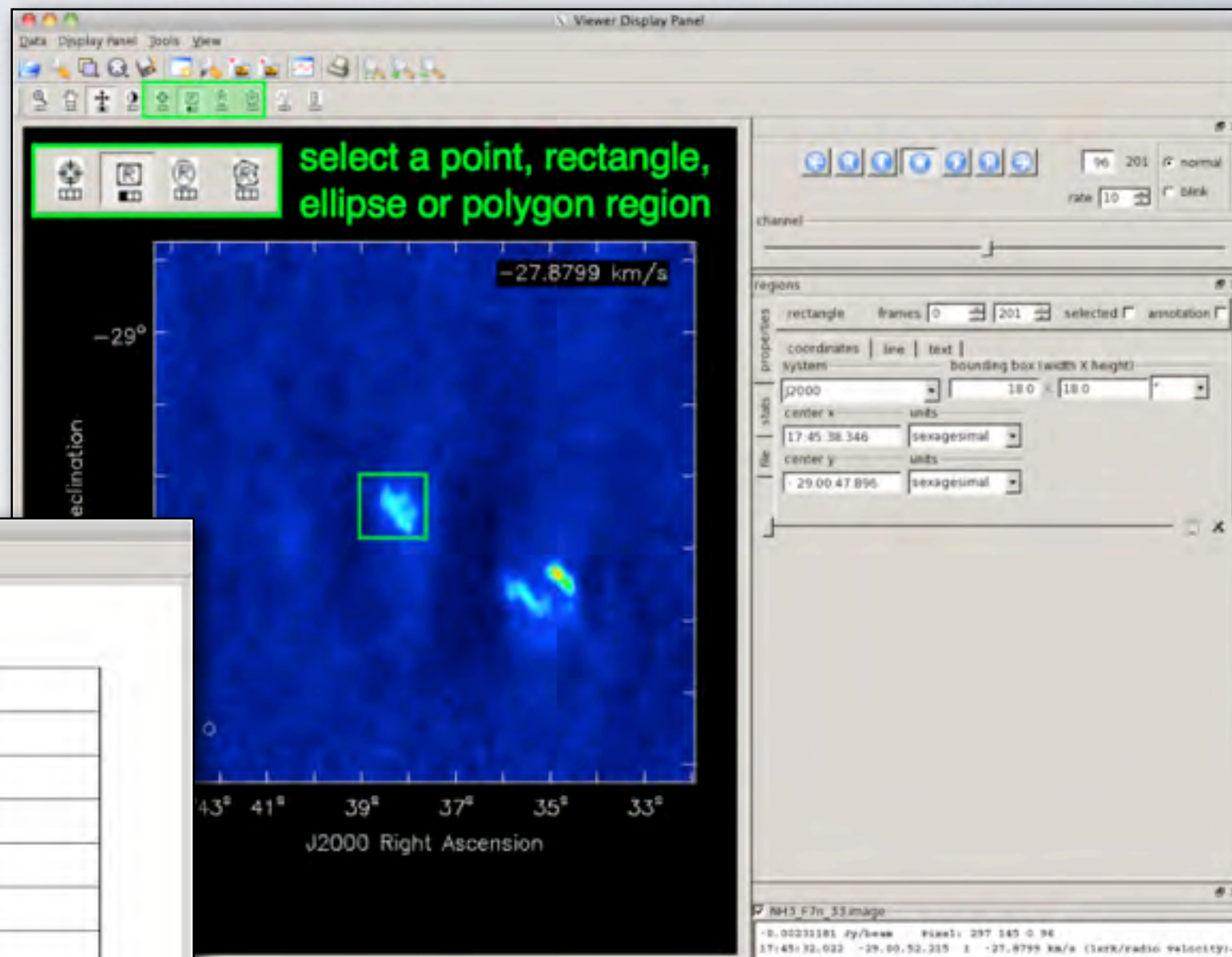




# V & A CALIFA DATA: TOOLS

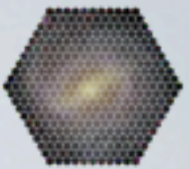


**CASA (NRAO)**






# V & A CALIFA DATA: TOOLS



## PINGSOFT (IDL)

PINGSoft: IFS viewer



Browse:  FITS File

Browse:  Position Table

Flux range: Min:  Set Max:  Reset

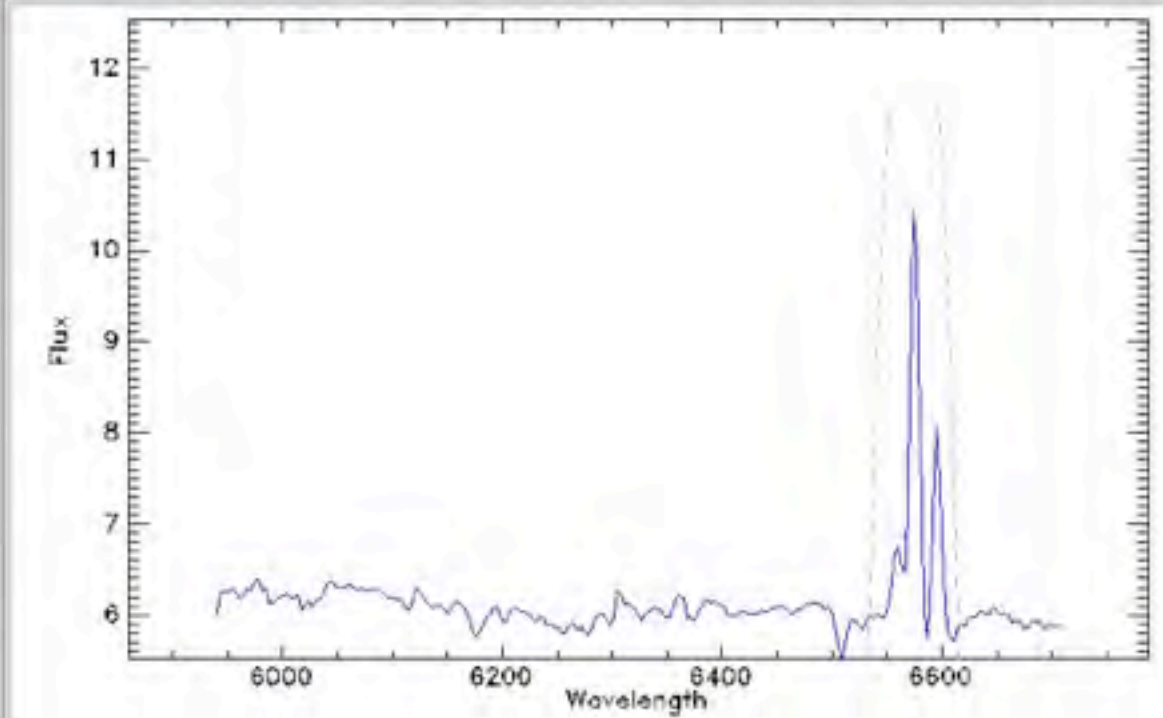
Wavelength range: Min:  Set Max:  Reset

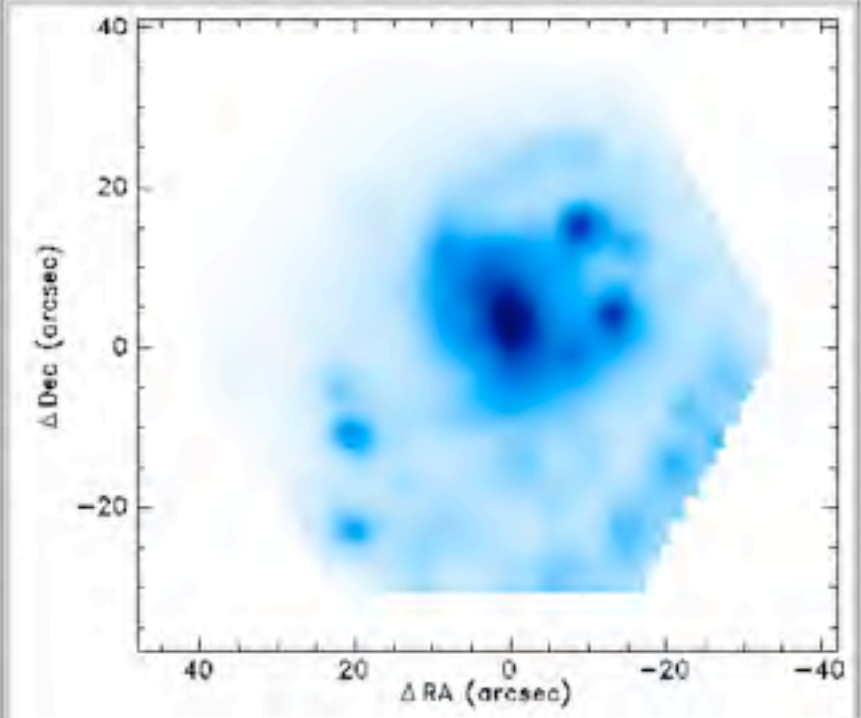
Scaling:  Linear  2D clipping  Rcrh  Power-Law  Square Root  Hist Equal  Gaussian

Display: Color Map:  Filter:  Mark wavelength:  Set  Draw spaxels borders  Invert Color Map

Spaxel	ID	[RA,Dec] offset	RA	Dec	RA deg	Dec deg
[ 41, 35]	2624	0.9 2.7	12h 41m 53.2s	41d 16m 25.5s	190.47165	41.273751

Object: NGC4625  
Explorer OFF, widget options active

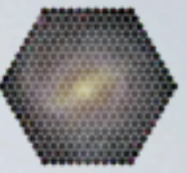




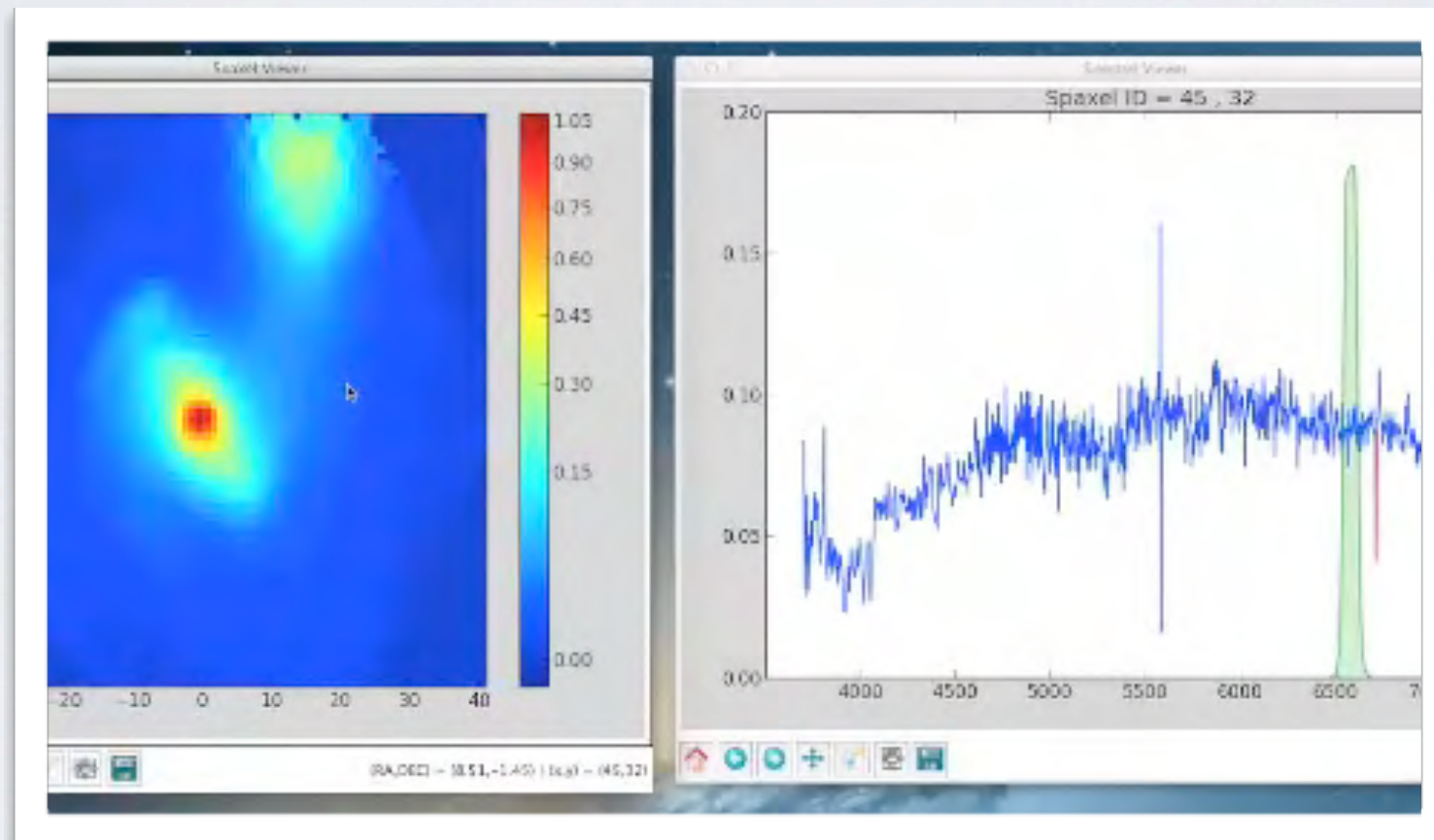
Shift Filter:



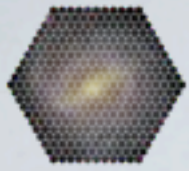
# V & A CALIFA DATA: TOOLS



## ViewCube (Python)







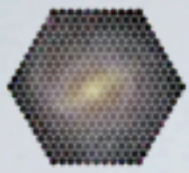
# ANALYSIS TOOLS

## Decomposing galaxy spectra



*The method*





# ANALYSIS TOOLS

## Decomposing galaxy spectra



*The method*

$$\mathbf{L}_{\text{gal}}(\lambda) = \sum_{\mathbf{t}, \mathbf{Z}} \mathbf{M}_{\text{SSP}}(\mathbf{t}, \mathbf{Z}) \times \mathbf{SSP}(\lambda; \mathbf{t}, \mathbf{Z}) \times \mathbf{e}^{-\tau(\lambda)}$$



Observables:  
*Full spectrum*



SFH:  
*Mass or  
light fractions*



Spectral Base



Dust



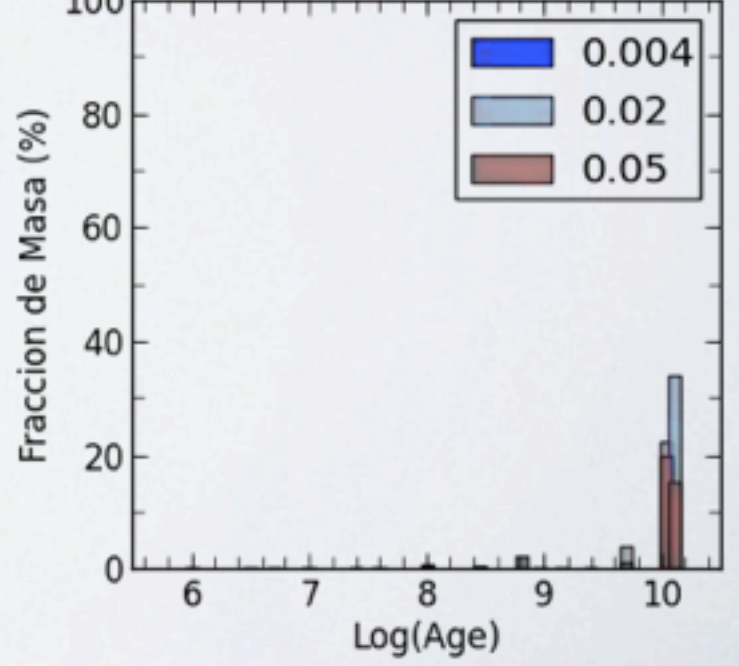
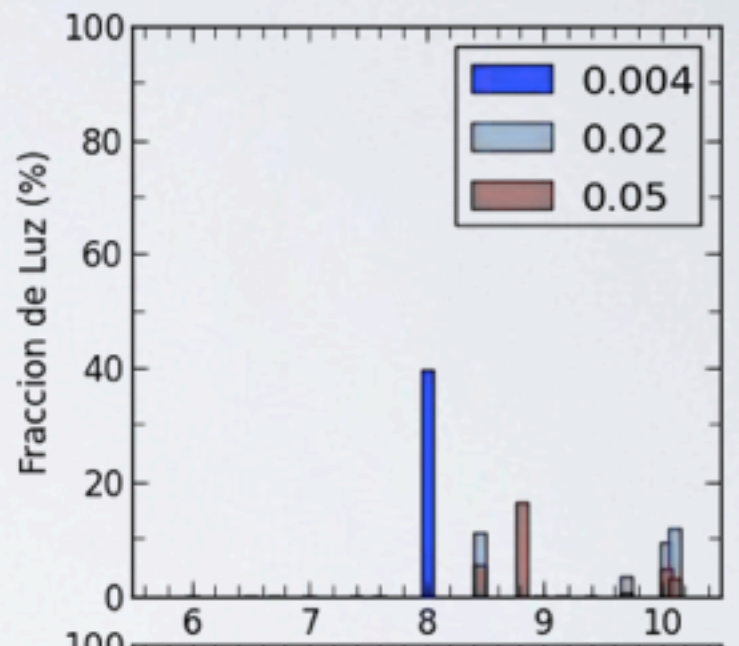
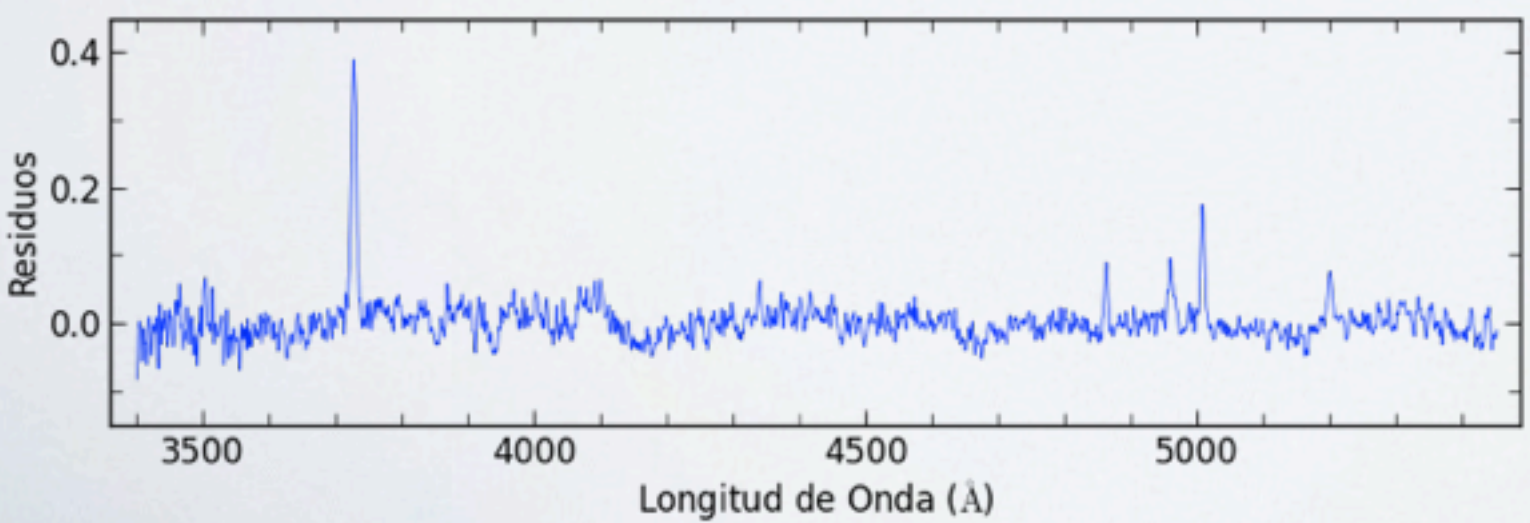
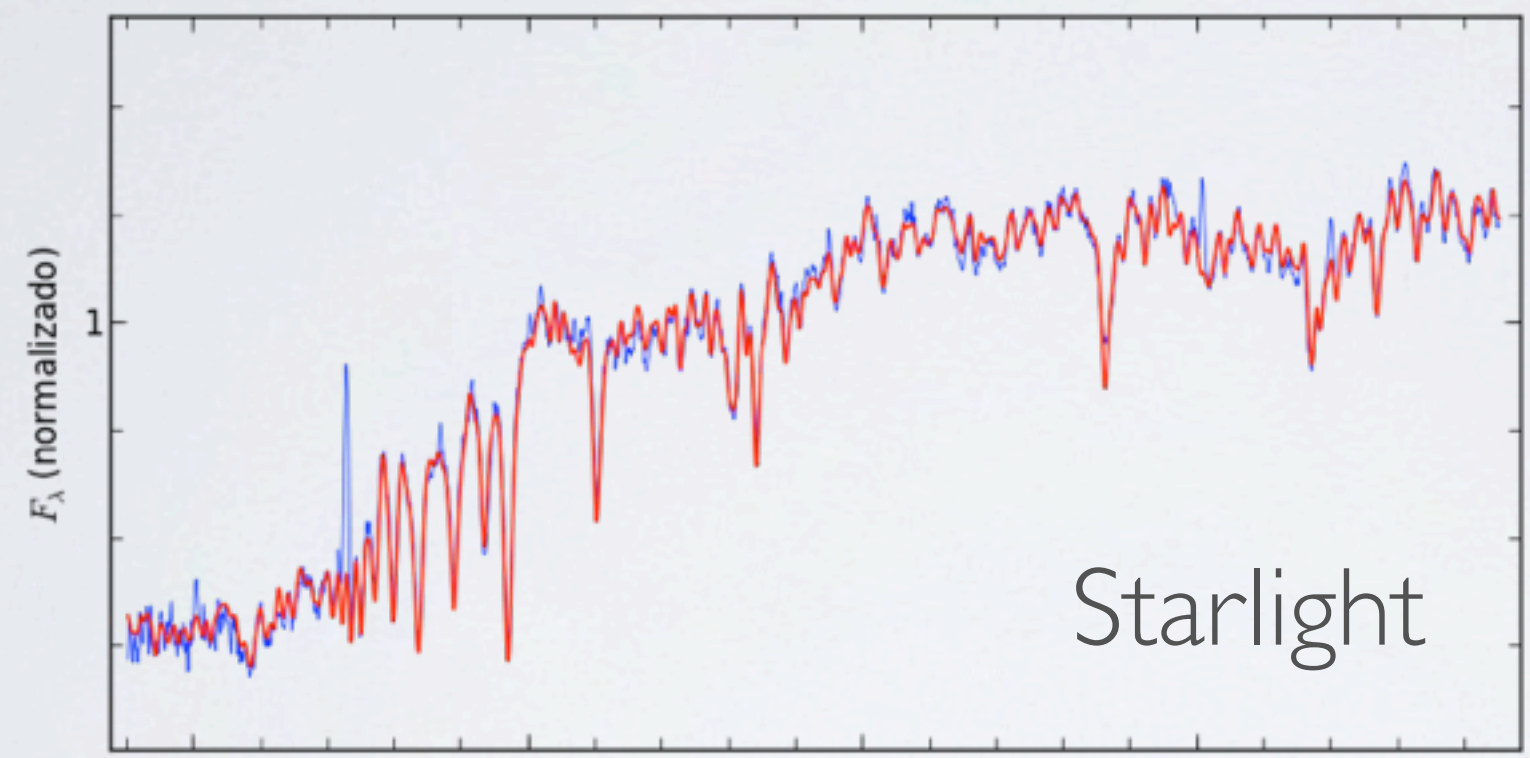
# The method

Decomposing galaxy spectra

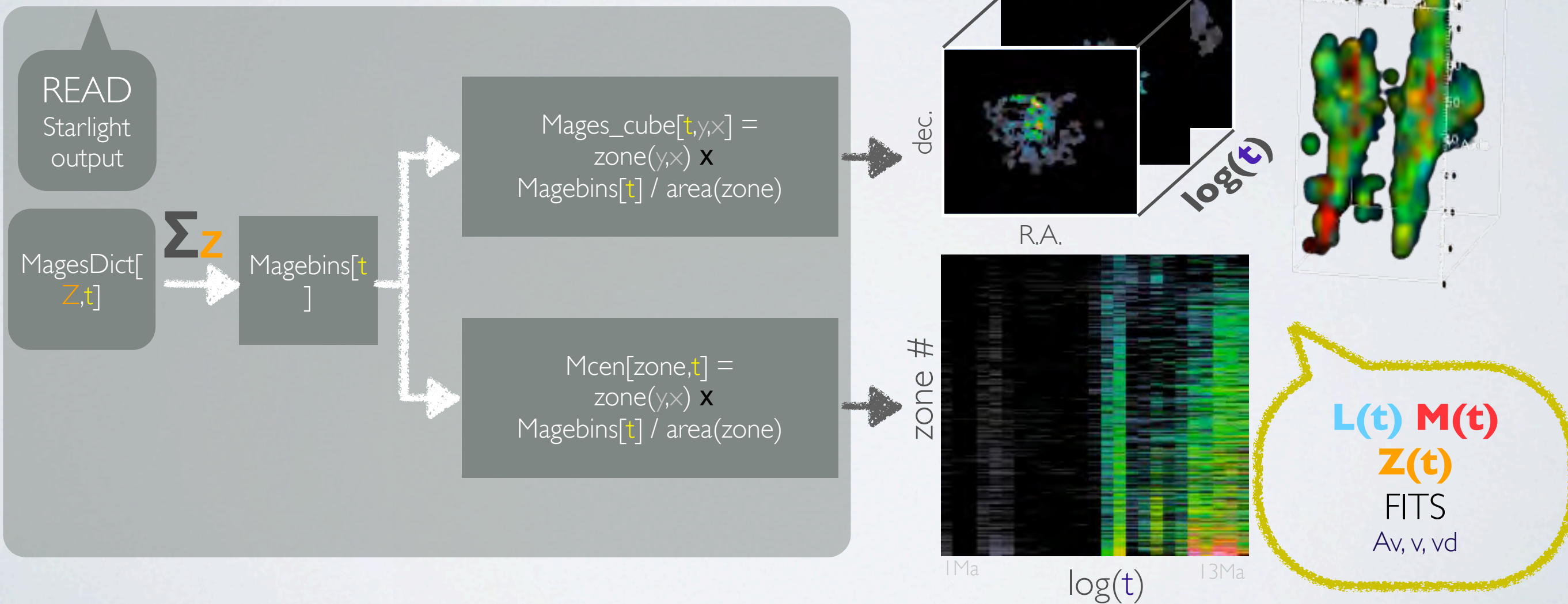
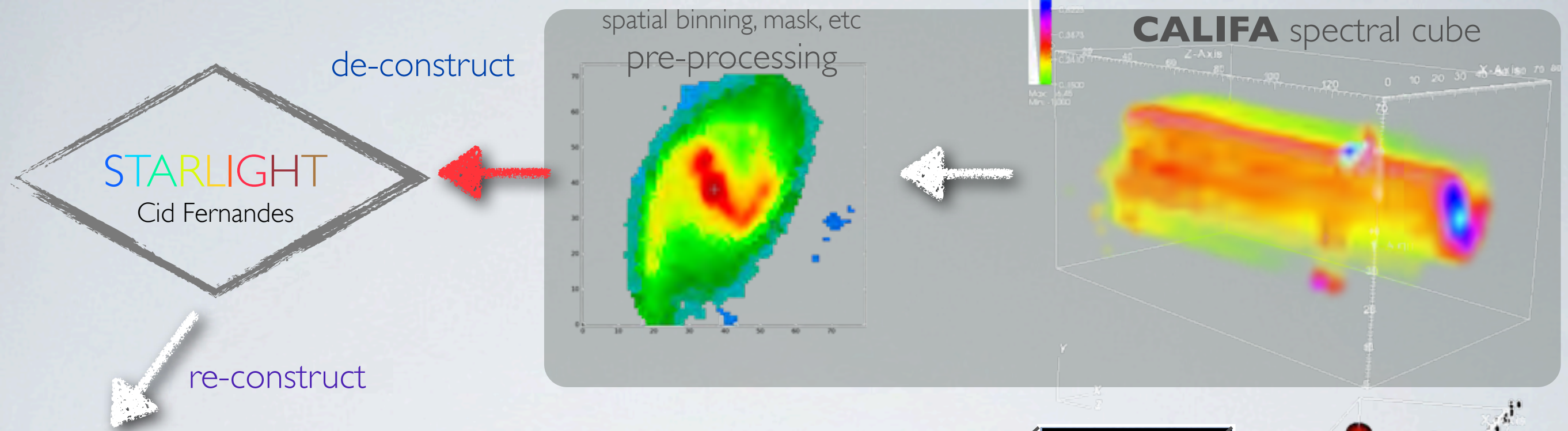


$M_{ion} = 0.00\% \mid 0.00\%$  (10Ma|20Ma) 5377x.nuc.txt.DR.sc4.C11.gm.CAL  
 $EW(H\beta) = 0.000 \mid 0.000$   $\frac{Cont_{ion}}{Cont_{tot}}$   $\chi^2 = 0.499$   
 $M_* = 1.169e+06 \times D^2 M_{\odot}$   $Z = 0.004 \oplus 0.02 \oplus 0.05$

$V_0 = -46.27 \text{ km/s}$   
 $V_d = 191.58 \text{ km/s}$   
 $AV = 0.5656 \text{ mag}$

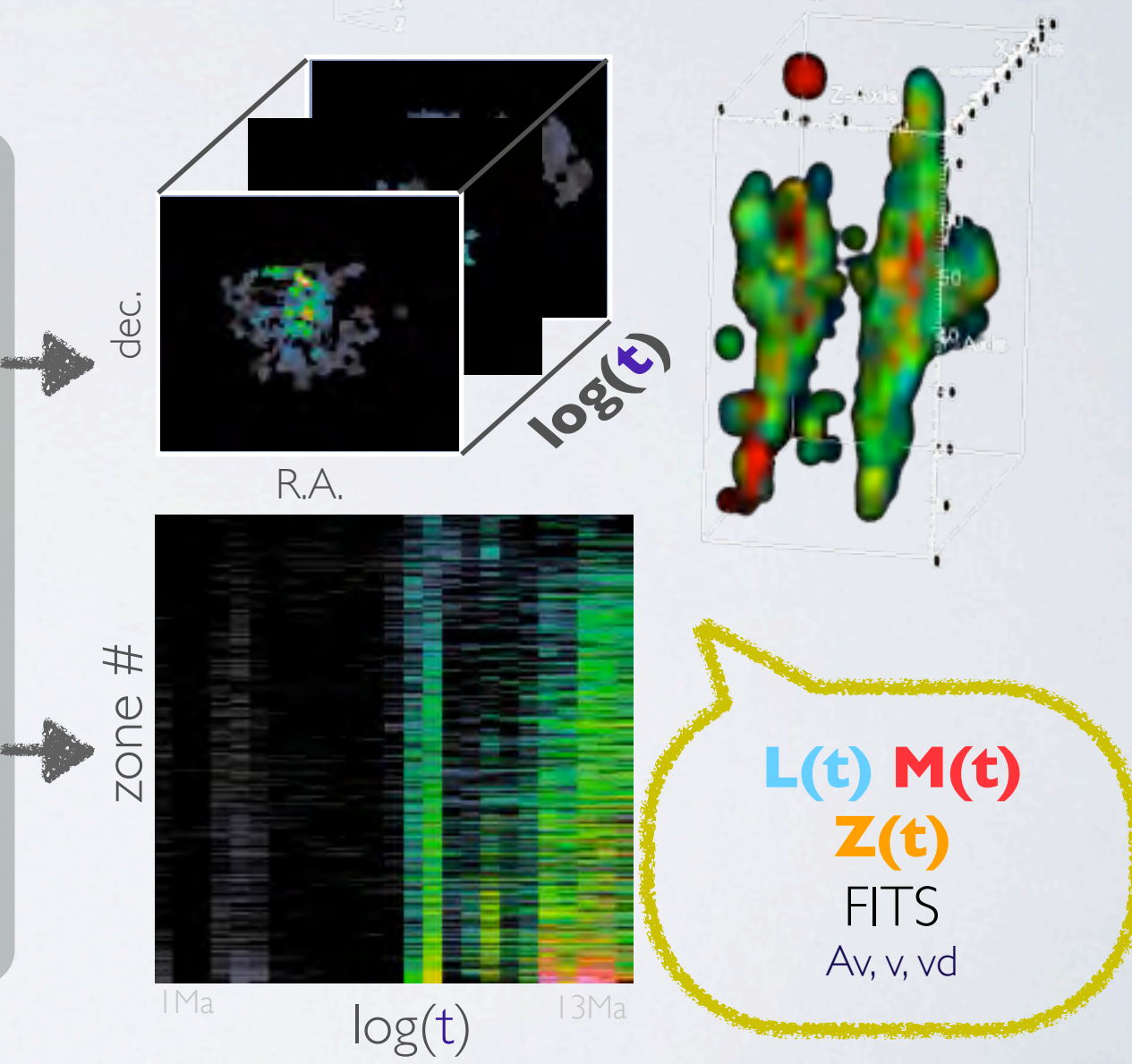
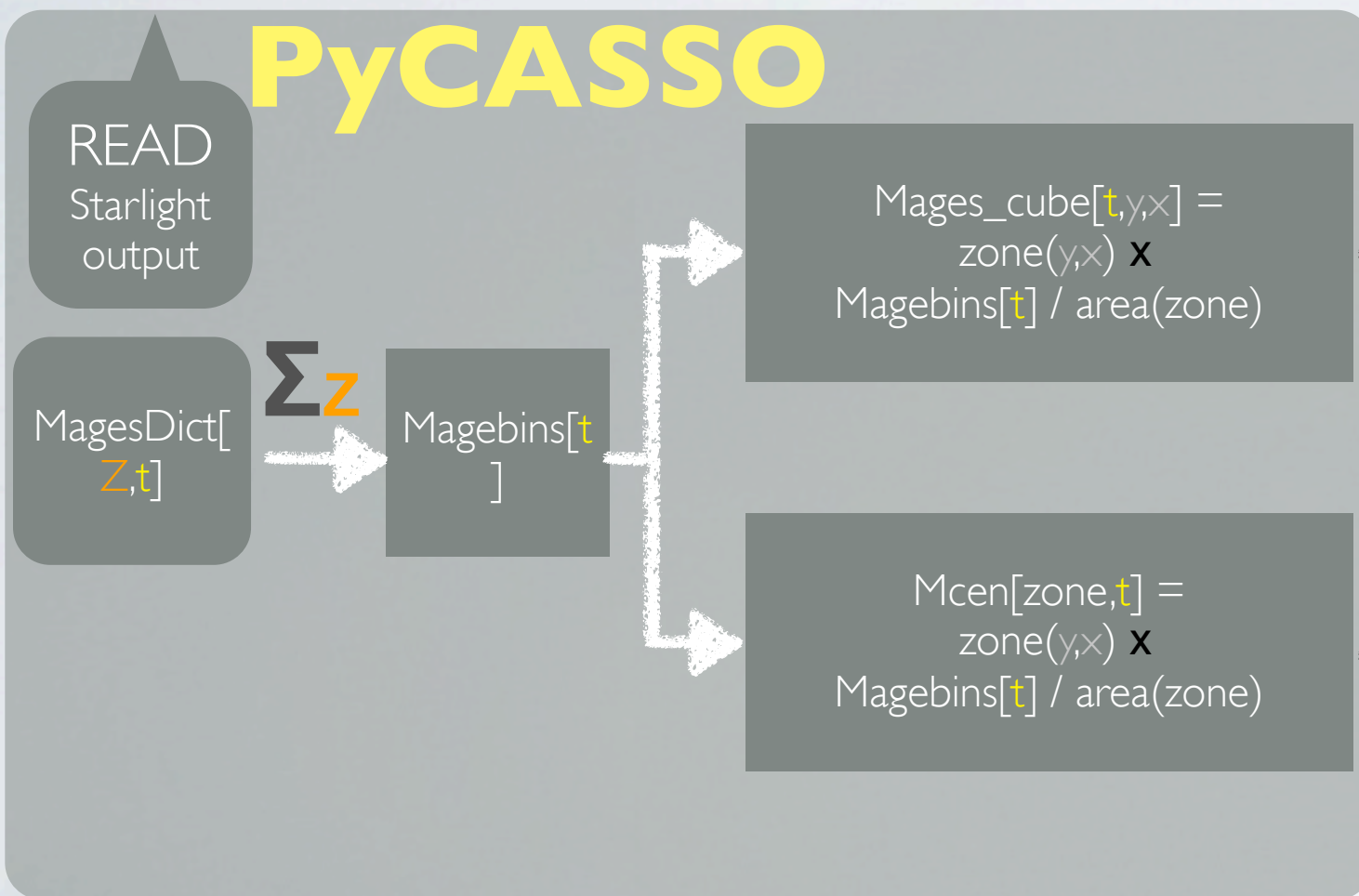
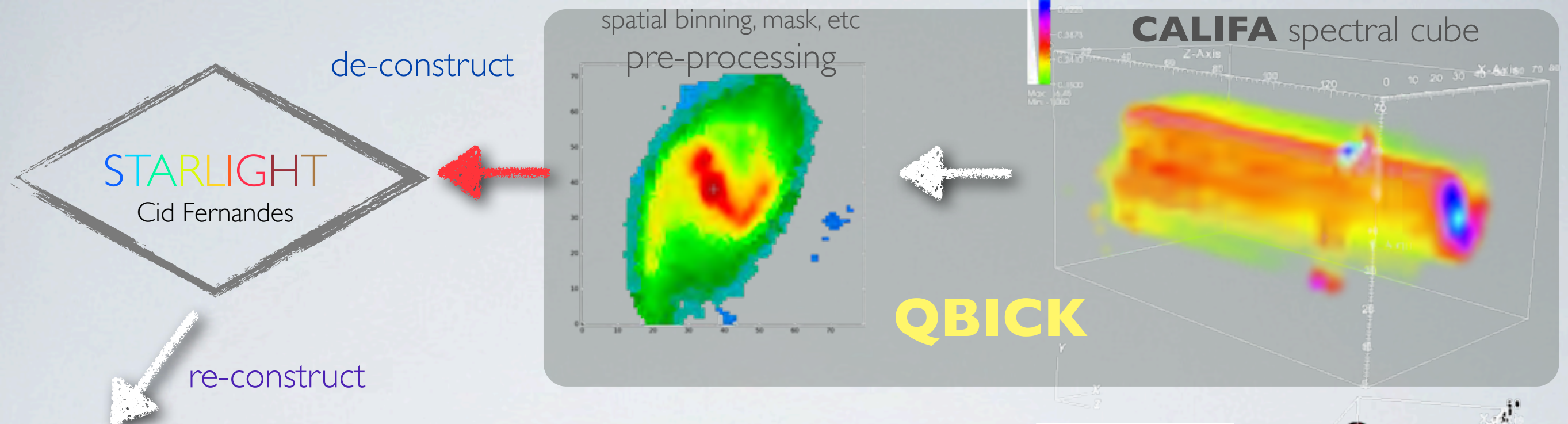






Processing & Analysis pipelines



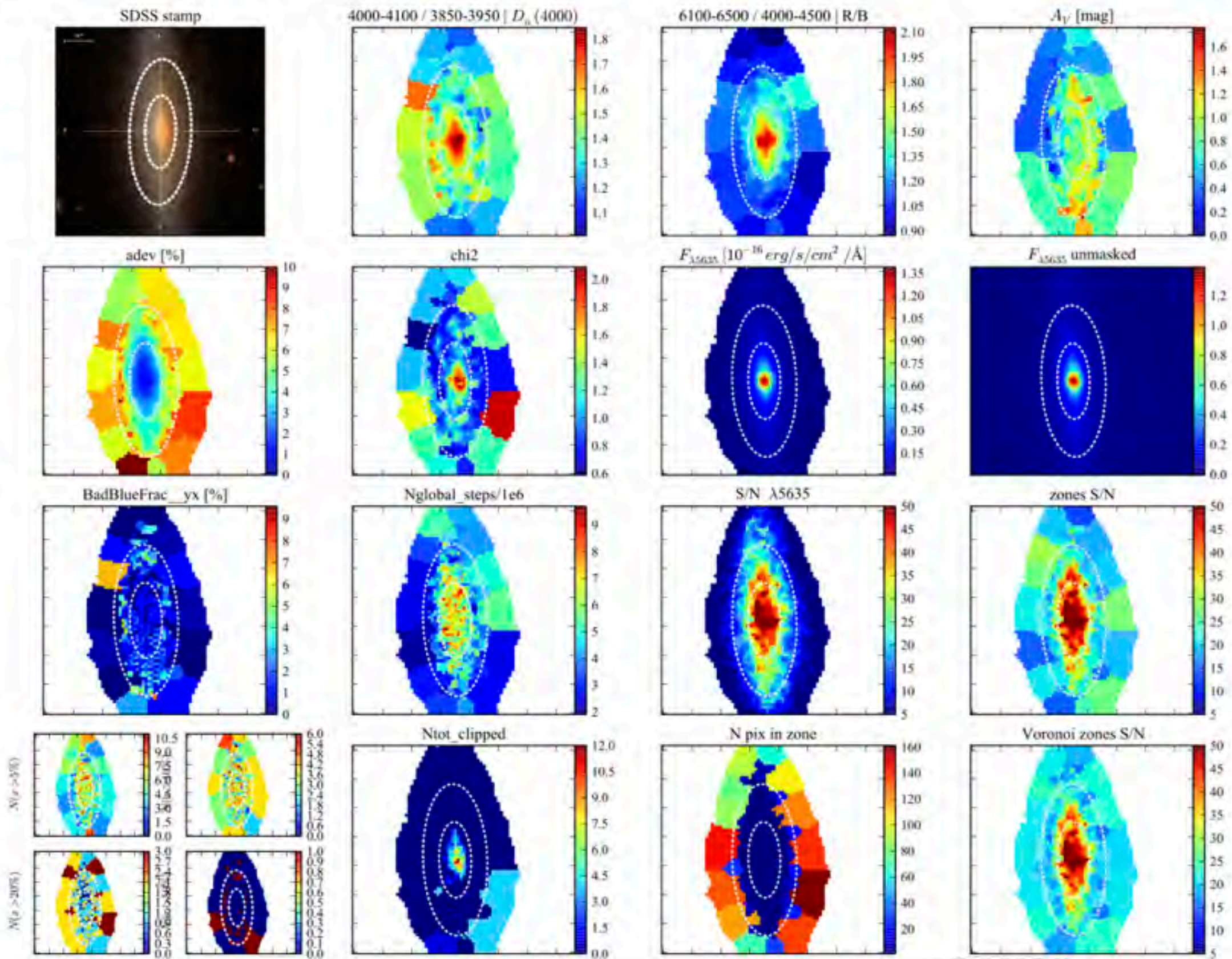


Processing & Analysis pipelines



# PyCASSO Products

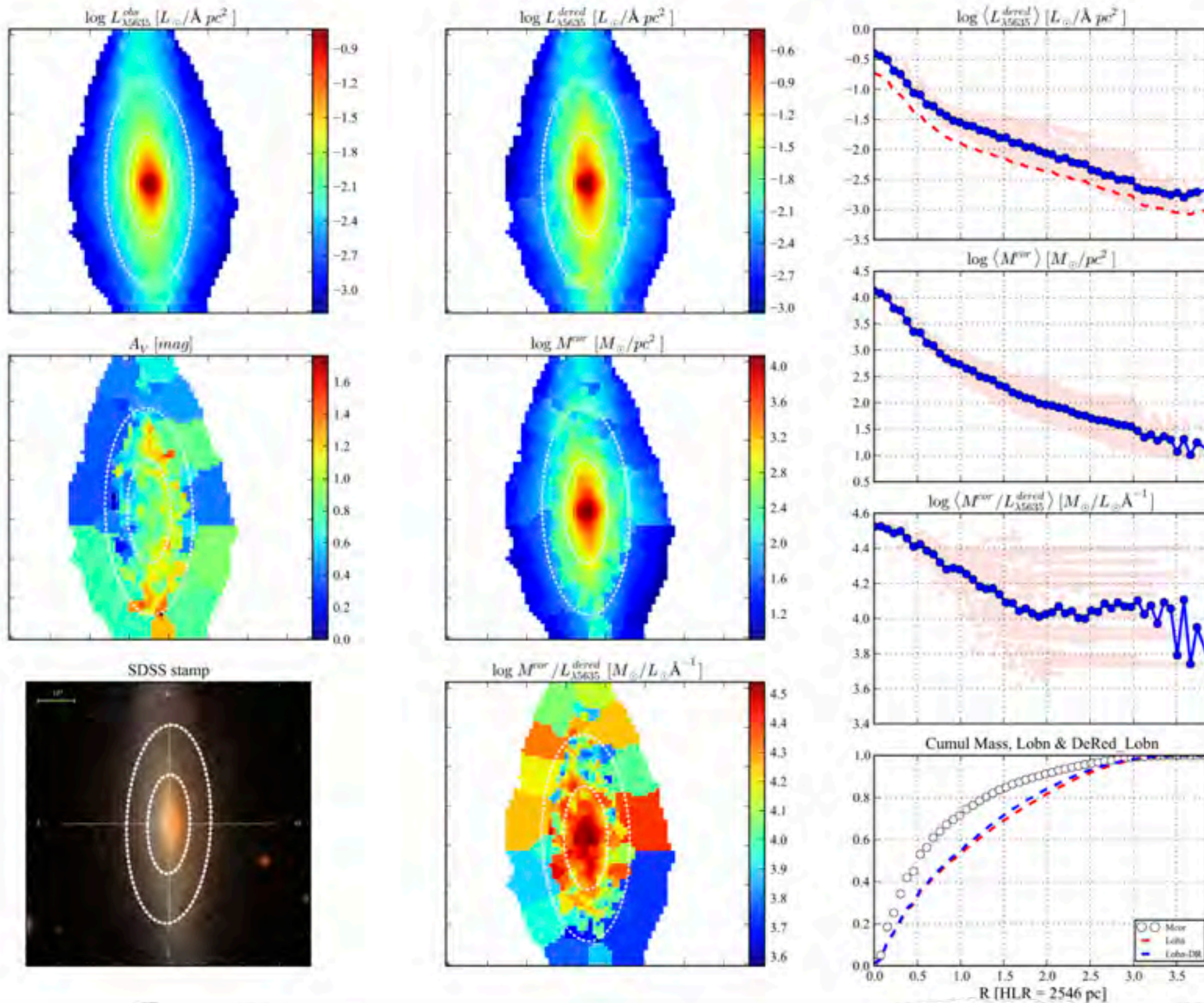
[Fig00] Data-&-Fit Quality || K0001 0.3.6 d13c512 w/base Bgsd01 || FWHM=0.5dex ;  $\Delta R=1.0$  pix || IC5376





# PyCASSO Products

Figure 1: Results for IC5376. Parameters:  $\text{FWHM}=0.5\text{dex}$ ;  $\Delta R=1.0\text{ pix}$  || IC5376





Calar Alto Legacy  
Integral Field  
Area survey

6900 Å 5250 Å 4100 Å

CALIFA

H $\alpha$  velocities



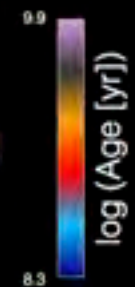
log ( $\mu_*$  [ $M_{\odot} \text{pc}^{-2}$ ])



H $\alpha$  flux



log (Age [yr])



Credits: R. García-Berito, F. Rosales-Ortega,  
E. Pérez, C.J. Walcher, S.F. Sánchez  
& the CALIFA team

H $\alpha$  [NII] 6584 Å [OIII] 5007 Å

Centro Astronómico  
Hispano Alemán



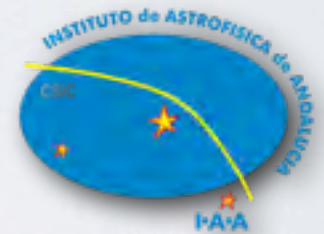
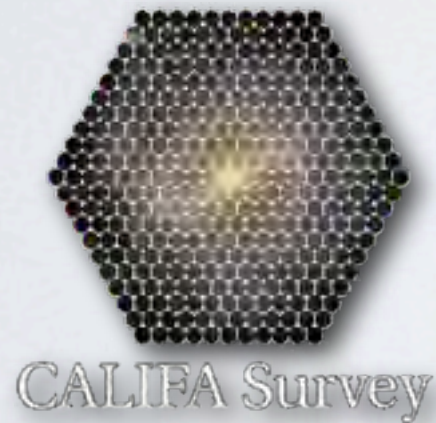
# CALIFA SURVEY:

## INTRODUCTION & DATA STRUCTURE

Rubén García-Benito  
(IAA-CSIC)

&

the CALIFA collaboration



“IVOA Interoperability Meeting” ◉ 18-23 May 2014