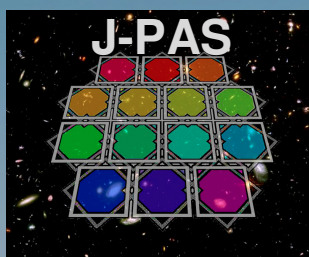


THE JAVALAMBRE-PAU ASTROPHYSICAL SURVEY

Jordi Cepa on behalf the J-PAS Collaboration)





OUTLINE

Presenting survey aims and design, but also

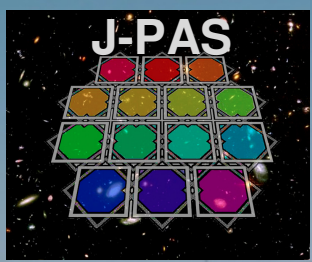
Instrument and survey status

A different way for 2D MOS

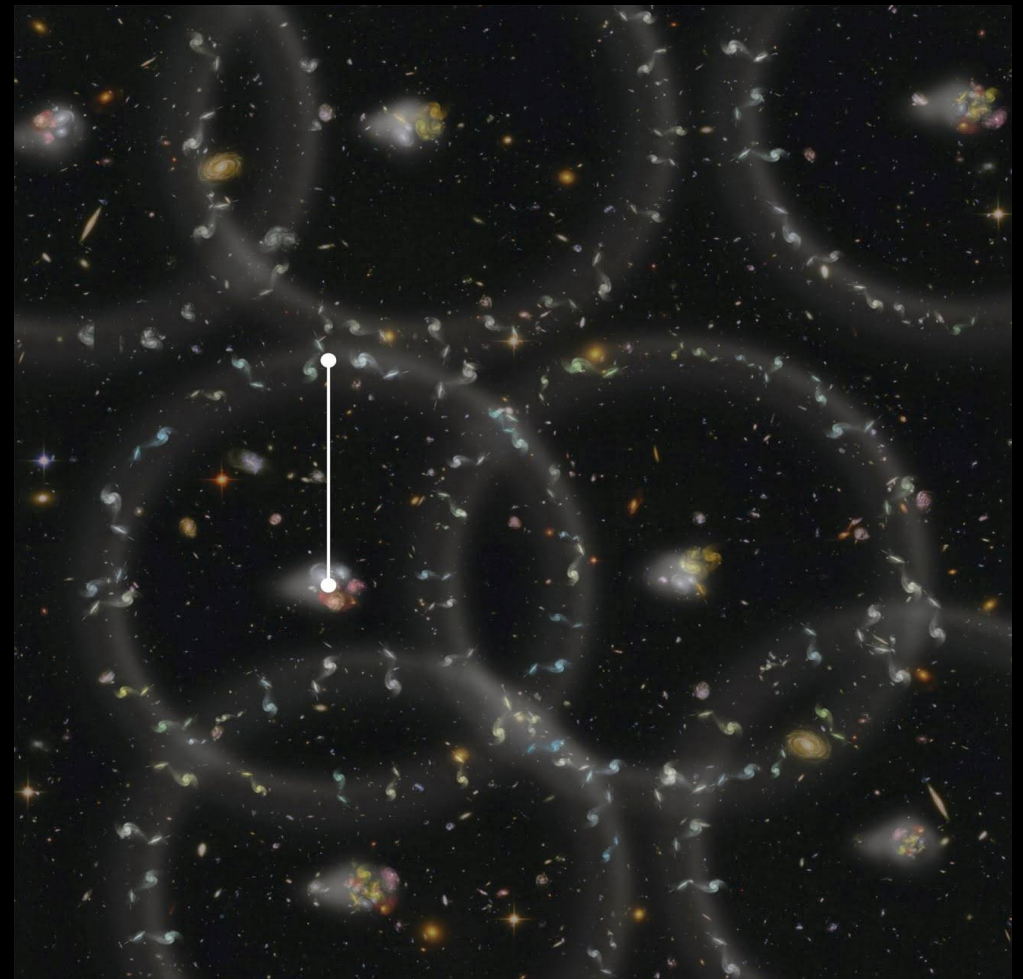
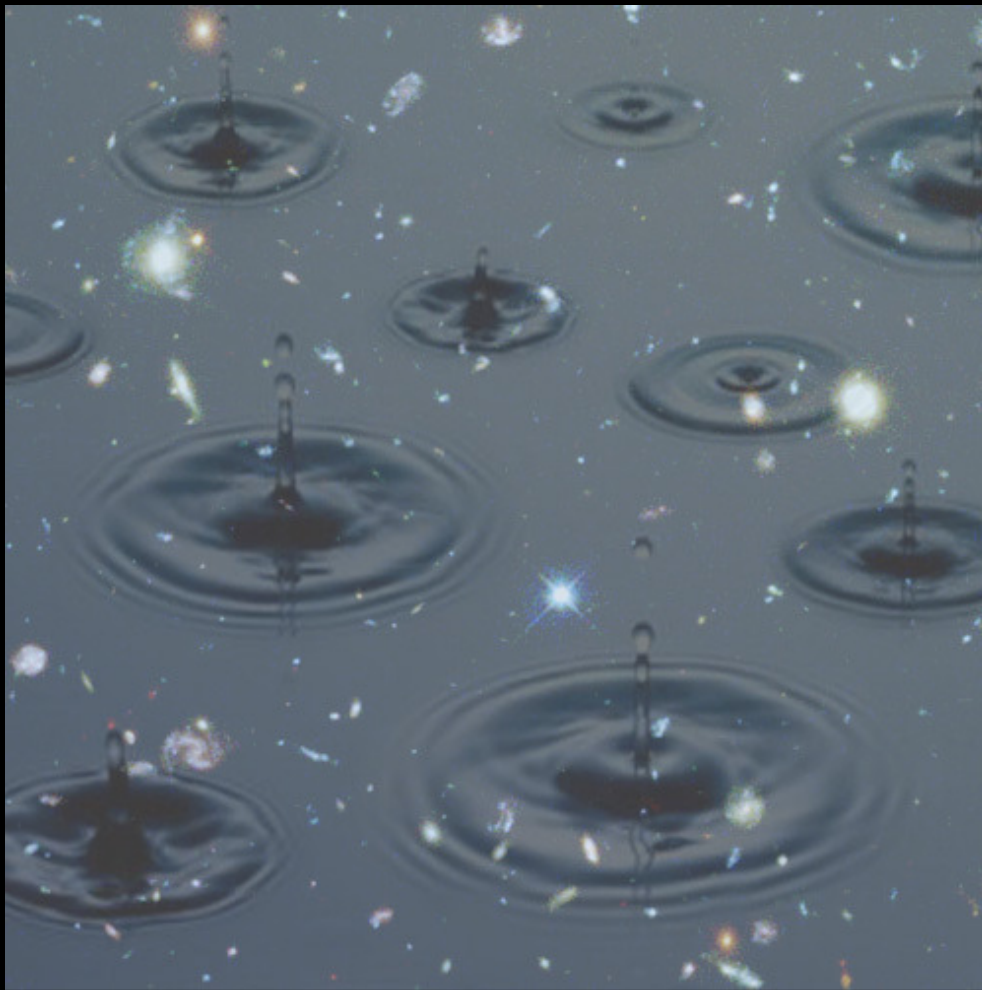
More info:

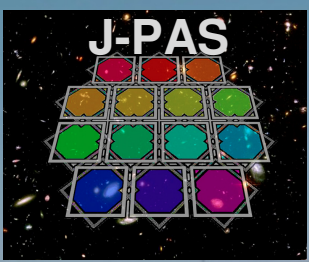
j-pas.org

Benítez et al. 2014, [arXiv:1403.5237](https://arxiv.org/abs/1403.5237)



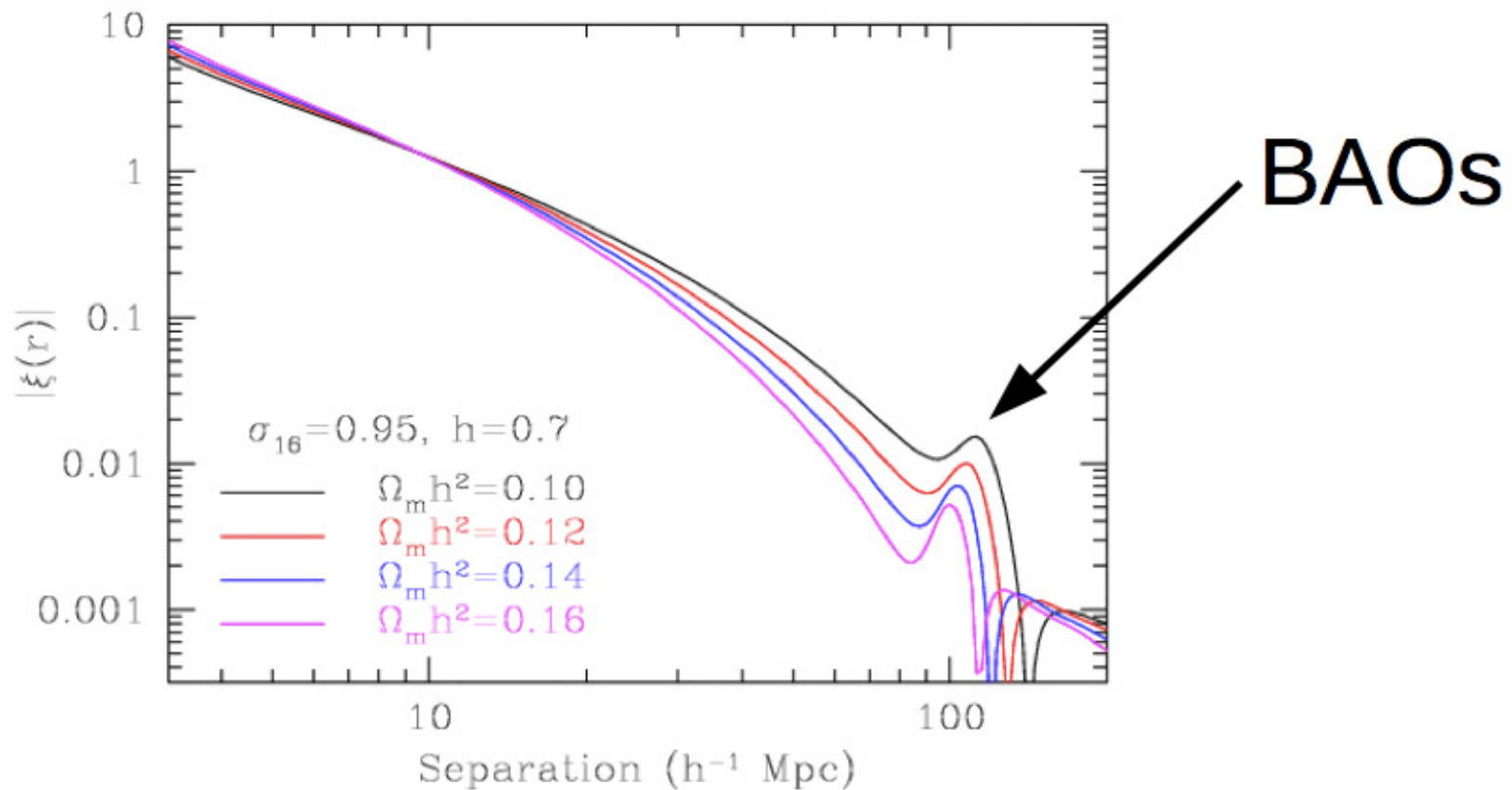
J-PAS MAIN SCIENTIFIC (but not only) MOTIVATION
UNDERSTANDING DARK ENERGY via BAOs
Steps towards the dark energy equation of state

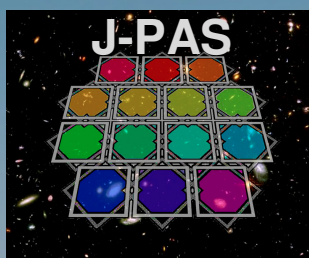




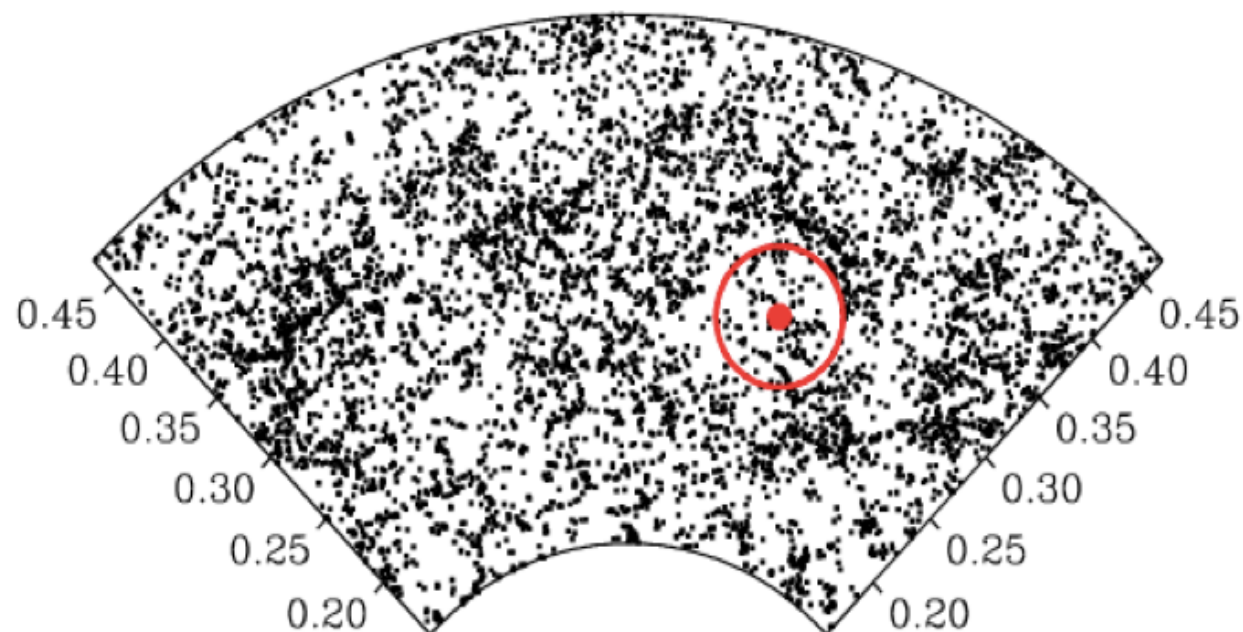
BARIONIC ACOUSTIC OSCILLATIONS

Statistical distribution of galaxies

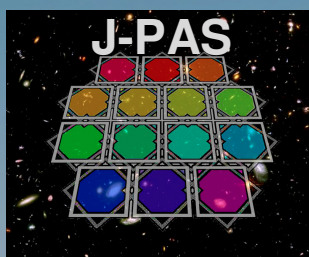




BARIONIC ACOUSTIC OSCILLATIONS

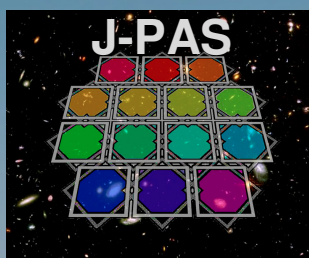


- Probe a volume much larger than typical peak size → Volume $> 1 \text{ (Gpc/h)}^3$
- Signal very weak → We need
 - Large statistics → 3D position of millions of galaxies
 - Accurate positions → accurate redshift determination ($\sigma_z/(1+z) < 0.003$)



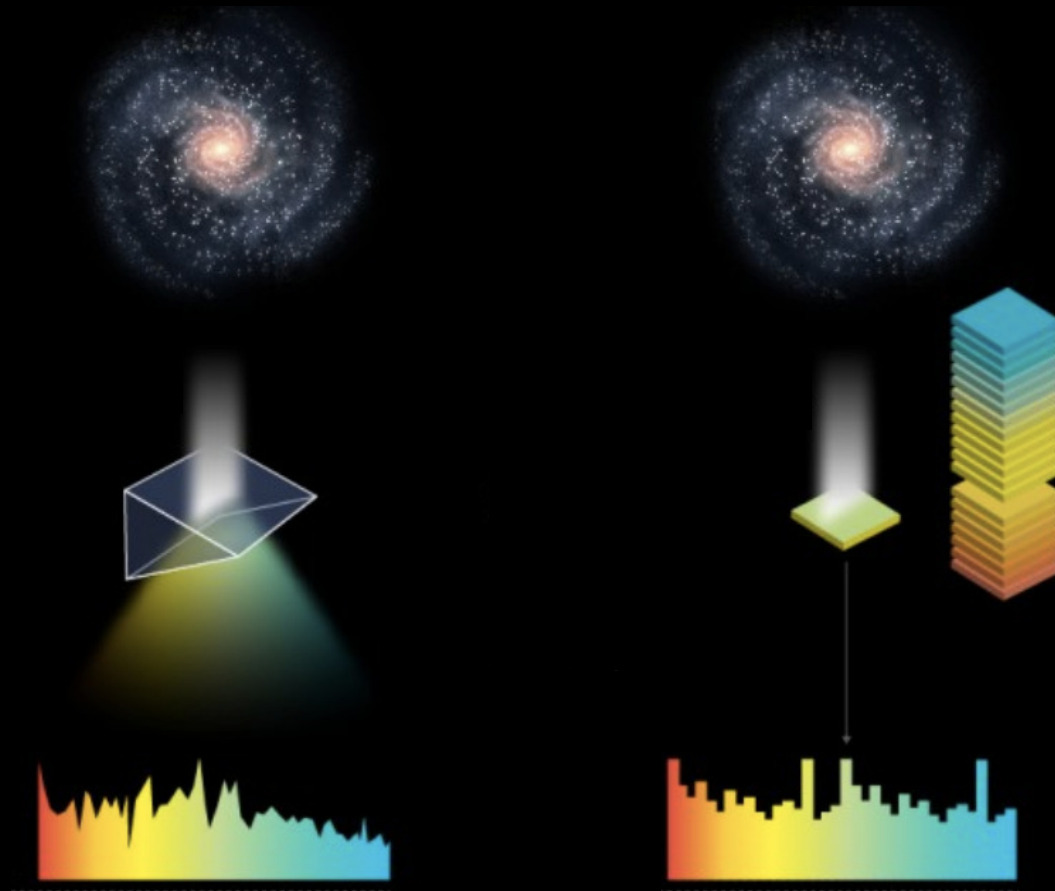
IMAGING VERSUS SPECTROSCOPY TO MEASURE BAOs (PHOTO-z vs SPECTROSCOPIC-z)

	BROAD BAND IMAGING	SPECTROSCOPY
REDSHIFT ACCURACY $\delta z/(1+z)$	LOW 0.04	HIGH 0.0005 – 0.0010
SPEED	FAST	SLOW
THROUGHPUT	HIGH	LOW
EFFICIENCY (NUMBER DENSITY)	HIGH	LOW Large Multiplexing required
TARGET SELECTION	NONE	BIASED
COST	CHEAPER	MORE EXPENSIVE



A PHOTOMETRIC ALTERNATIVE TO SPECTROSCOPY MEDIUM-NARROW BAND FILTERS

Low R 2D Spectroscopy



Proven feasibility:

COMBO-17

(Wolf et al 2001)

ALHAMBRA

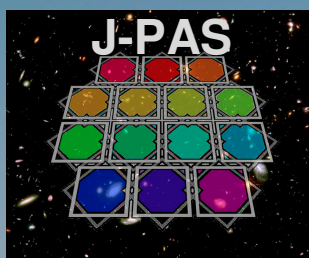
(Moles et al. 2008)

SHARDS

(Pérez-González et al. 2012)

Every filter is observed
independently:

**SUPERB LOW-FREQUENCY
FLUX CALIBRATION!!**



ALHAMBRA SURVEY J-PAS PRECURSOR

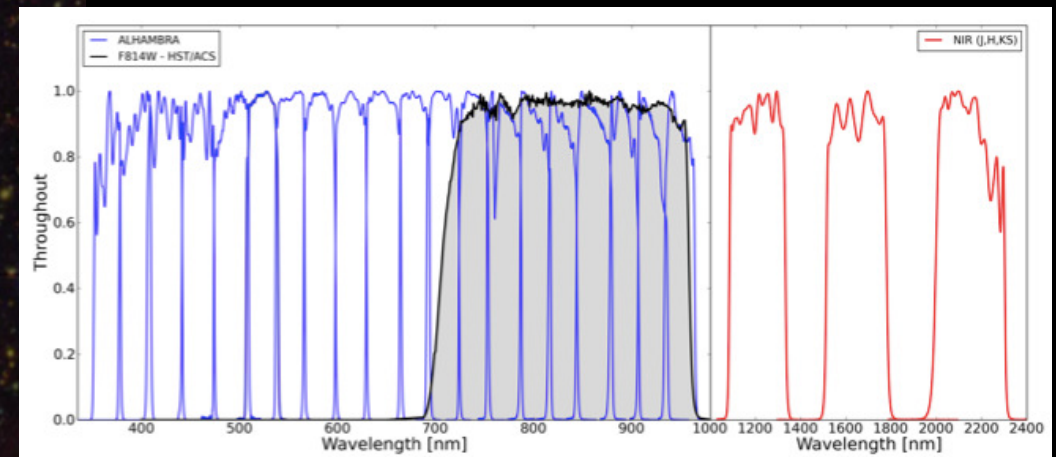
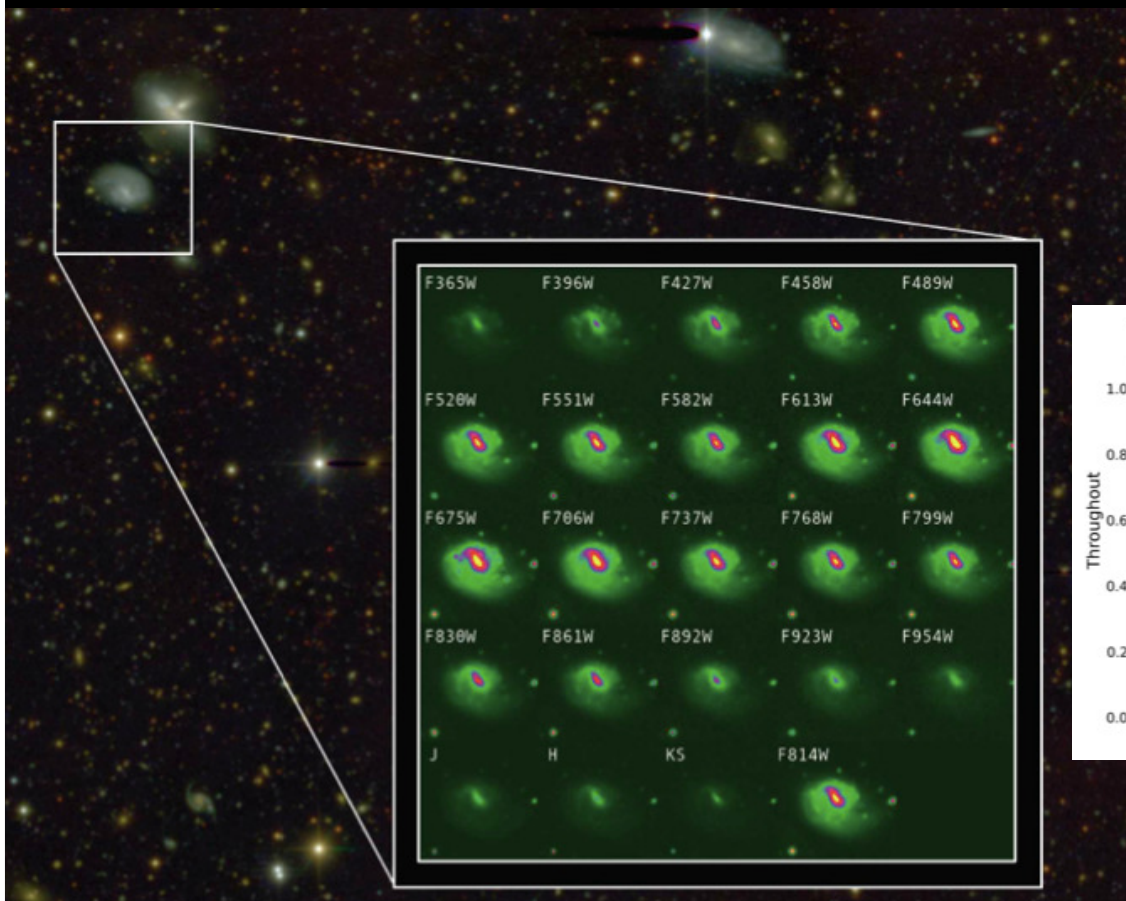
ALHAMBRA

www.alhambrasurvey.com

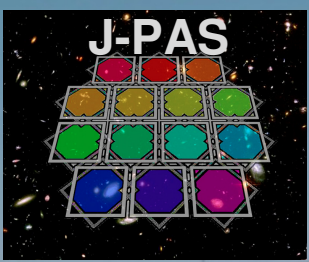
Moles et al. (2008)

CALAR ALTO

LAICA+OMEGA2000@ 3.5m CAHA

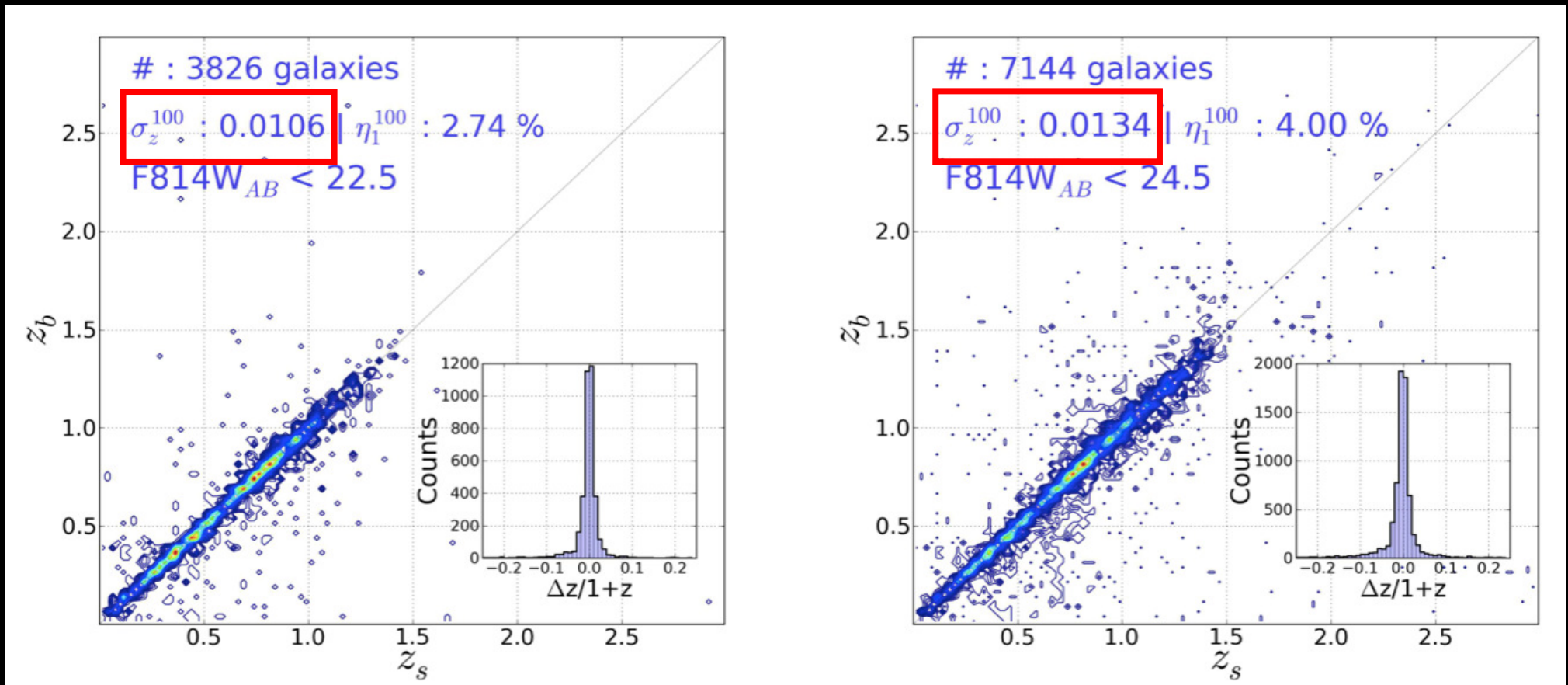


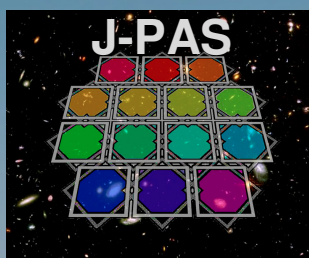
20 NB filters ($\Delta\lambda \sim 30\text{nm}$) + J, H, Ks
Sky coverage = $\sim 3 \text{ deg}^2$



ALHAMBRA SURVEY BAYESIAN PHOTOMETRIC REDSHIFTS

Accuracy $\delta z/(1+z)$ expected from mock catalogues ~ 0.015



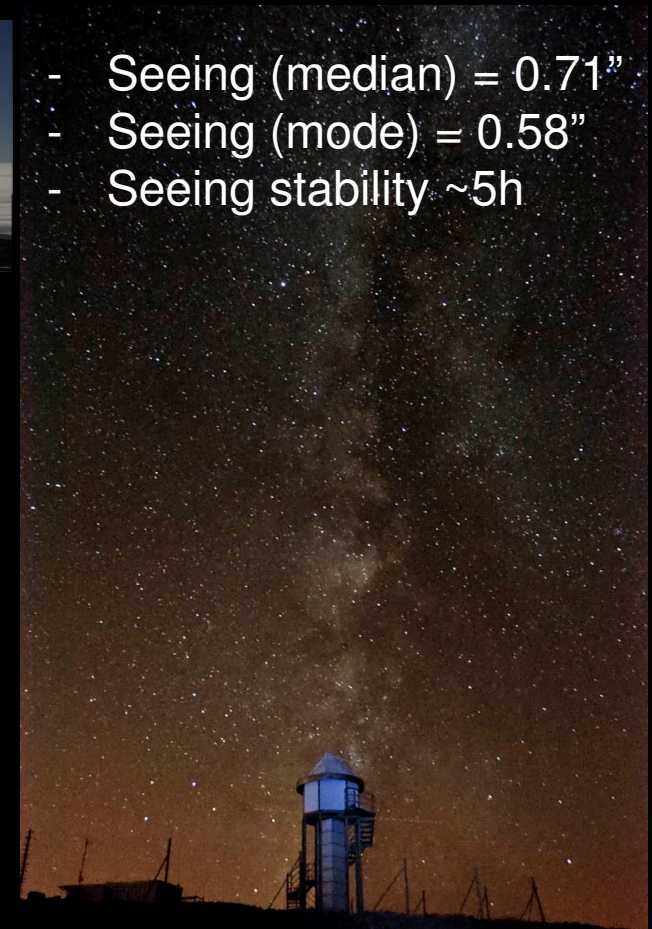
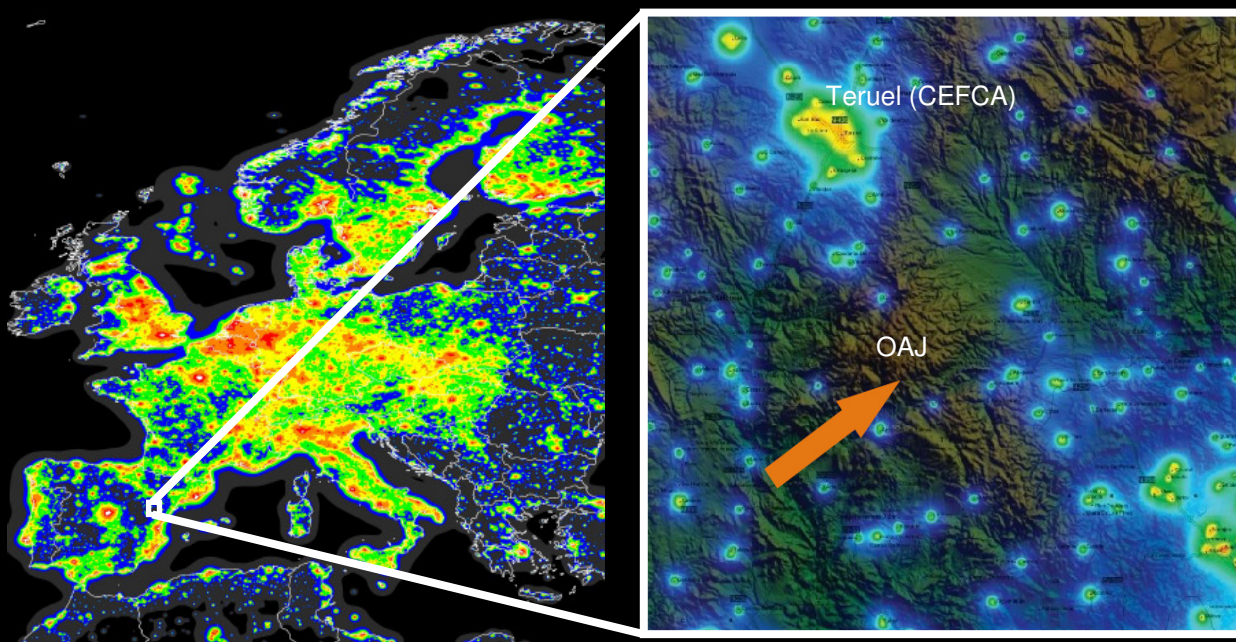


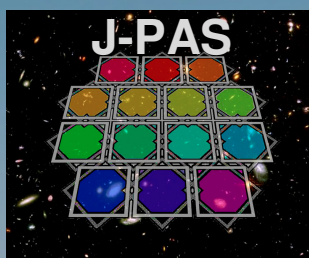
OAJ: A NEW SITE FOR PROFESSIONAL ASTRONOMY

Site testing during 2007-2009 @ Moles et al. (2010), PASP, Vol. 122, 889, 363
A “**DARK SITE**” according to the **IAU** requisites for the night sky characteristics



- Seeing (median) = 0.71''
- Seeing (mode) = 0.58''
- Seeing stability ~5h





THE **OBSERVATORIO ASTROFÍSICO DE JAVALAMBRE (OAJ)**

A NEW ASTRONOMICAL FACILITY DEDICATED TO CARRY OUT LARGE SKY SURVEYS

JST

Javalambre Survey Telescope

(2.55m; FoV 3 deg)

J-PAS ~ 6 years

First light 25/9/14

JAST

Javalambre Auxiliary Survey Telescope

(0.83m; FoV 2 deg)

J-PLUS ~ 3 years

(Javalambre Photometric
Local Universe Survey)

Telescope operative

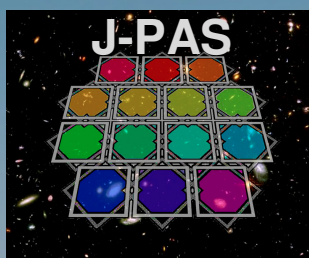
Camera installed 27/1/15



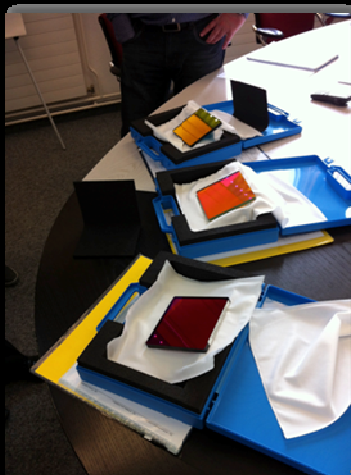
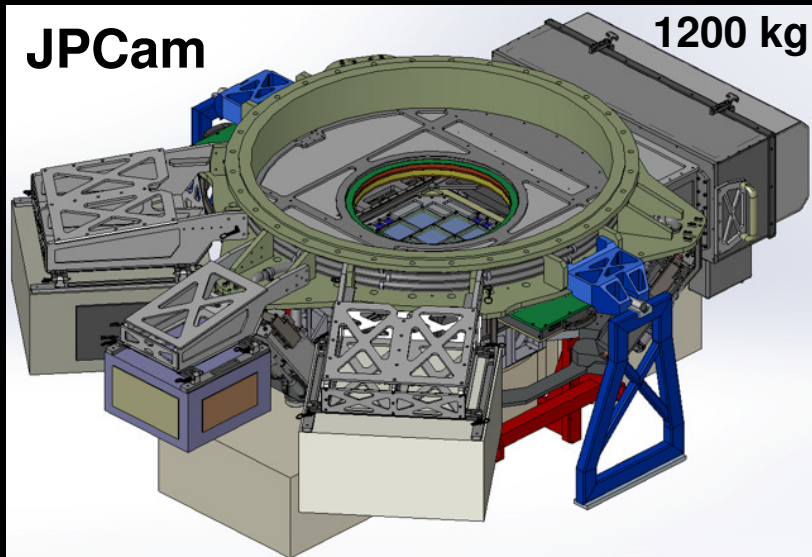
Observatorio
Astrofísico de
Javalambre



T250 first light
(25th
September
2014)

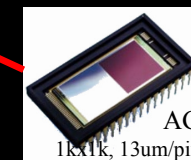
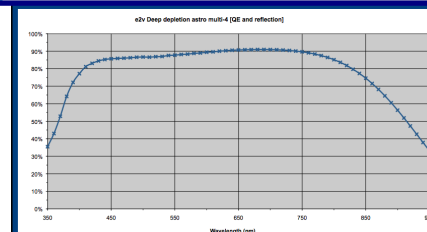
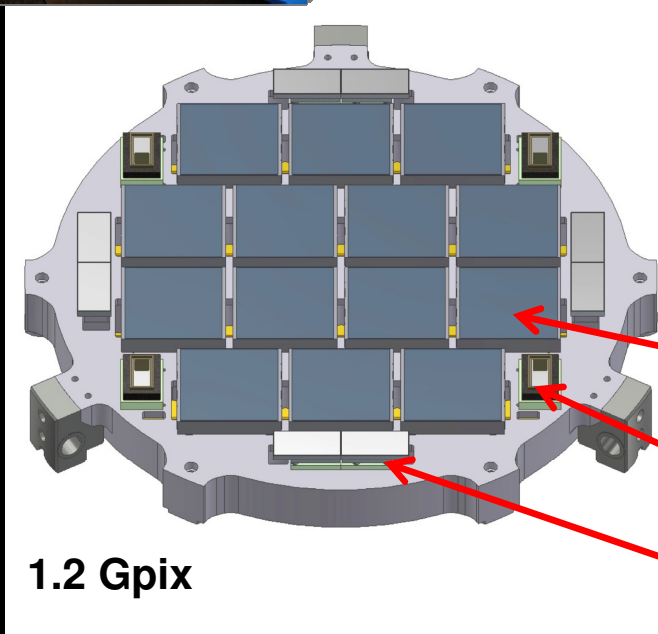
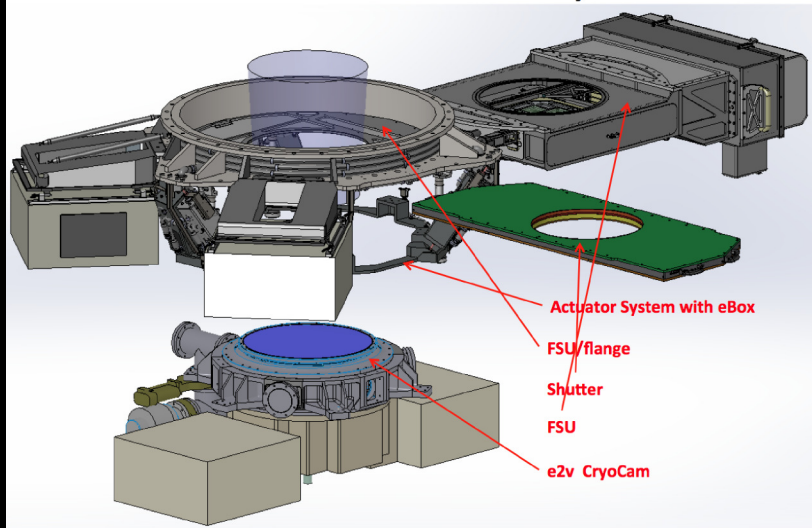


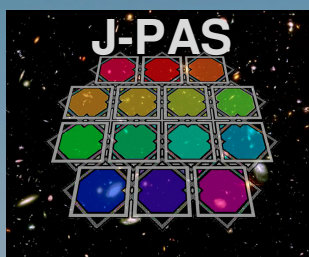
Javalambre Panoramic Camera @ JST for J-PAS



FoV	$\varnothing=3.0^\circ$ (full performance) $\varnothing = 3.1^\circ$ (reduced performance)
CCD format	9216 x 9240 pix, 10 $\mu\text{m}/\text{pix}$
Pixel scale	0.22"/pix
Read out time	12s
Read out noise	6 e ⁻ /pixel

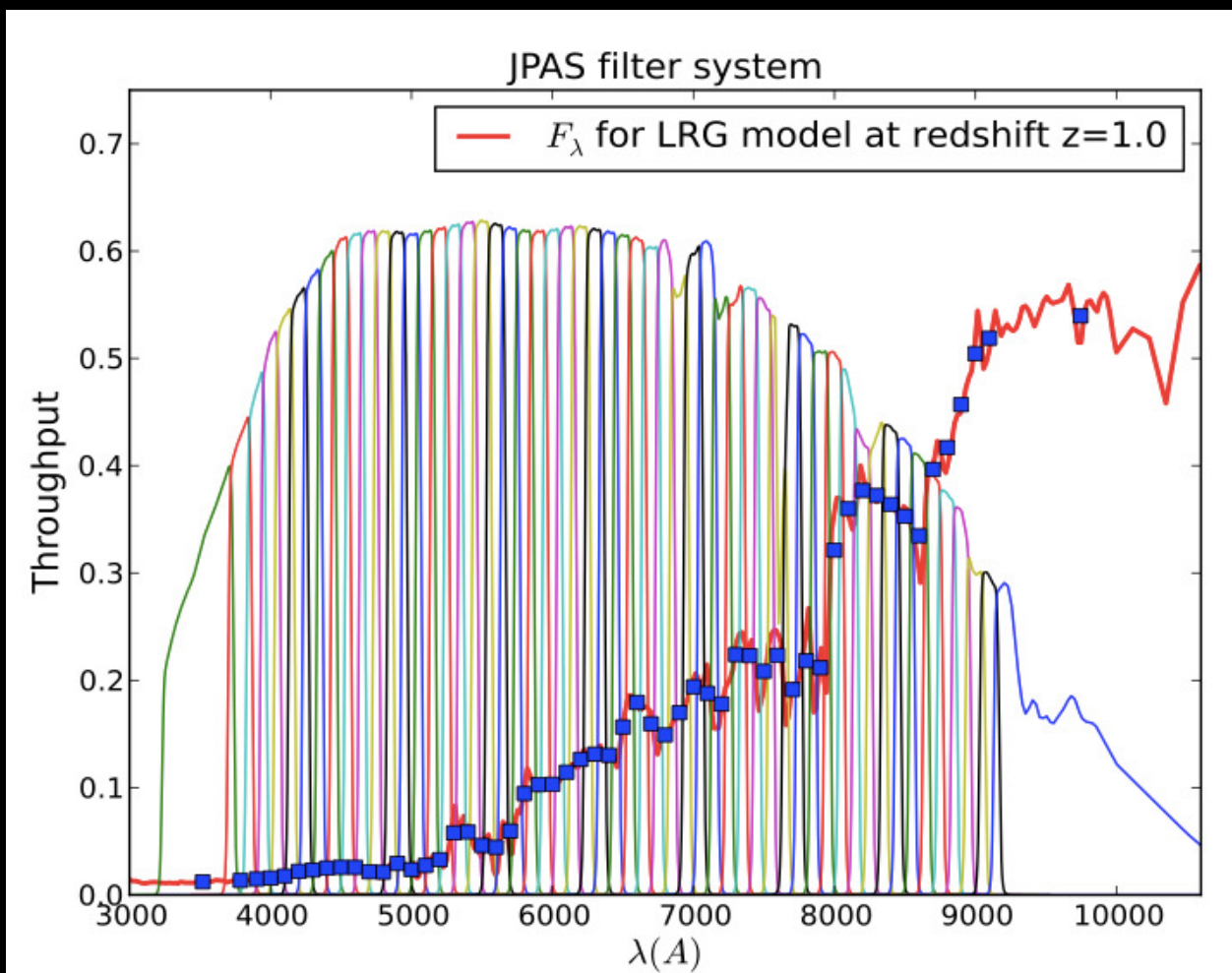
General Assembly





J-PAS DEFINITION & IMPLEMENTATION

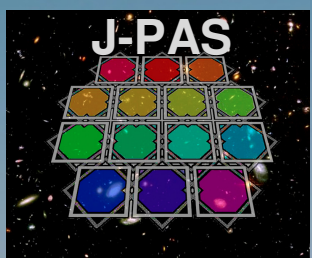
8500 deg²



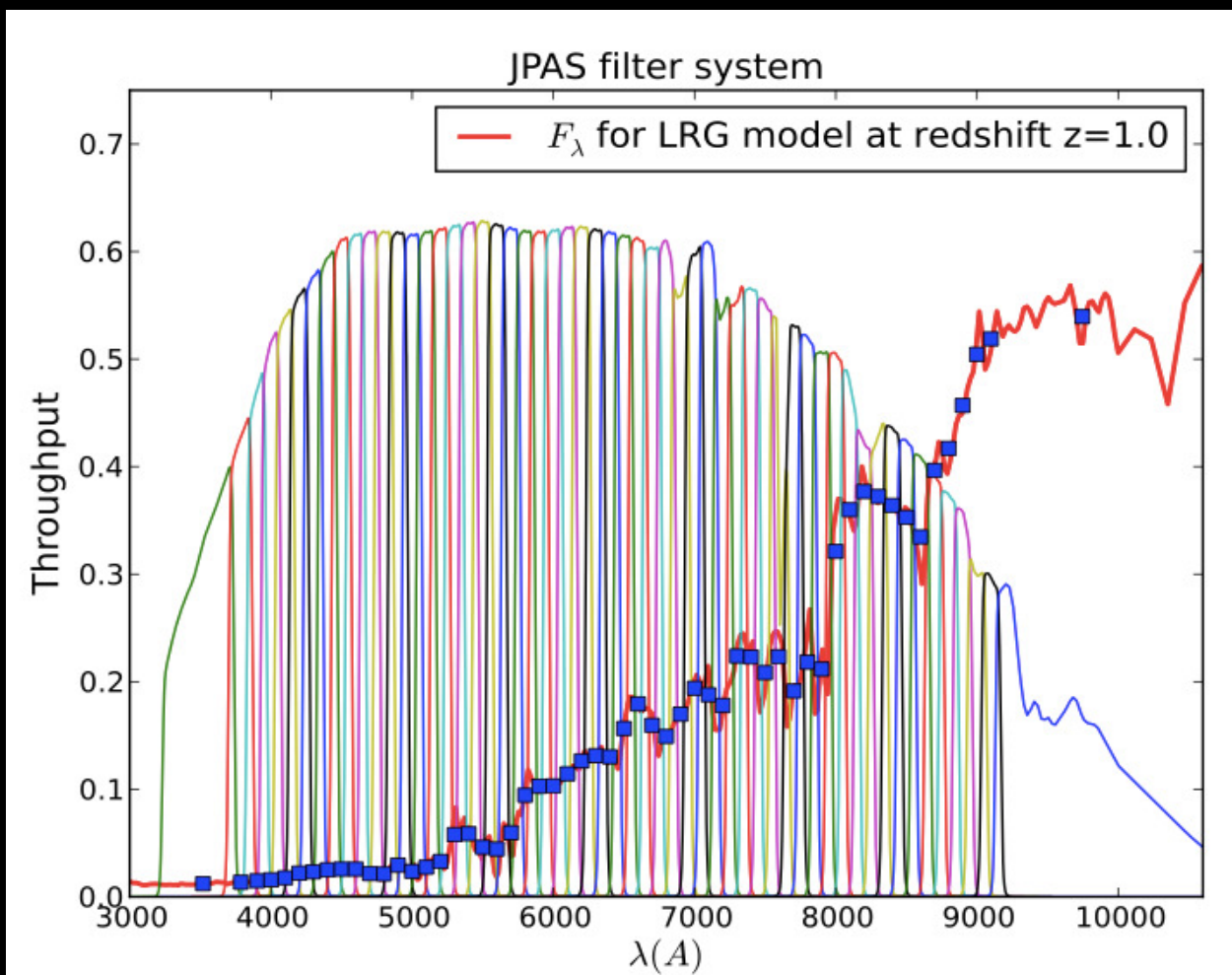
- 54 NB Filters
(FWHM~14.5nm; $\Delta\lambda\sim 10\text{nm}$)
- 1 Blue MB filter
(FWHM~260Å; $\lambda_c\sim 3600\text{Å}$)
- 1 Red BB filter
(FWHM~620Å; $\lambda_c\sim 9500\text{Å}$)
- Sloan u, g, r

In ~ 6.5 years
starting: 2016

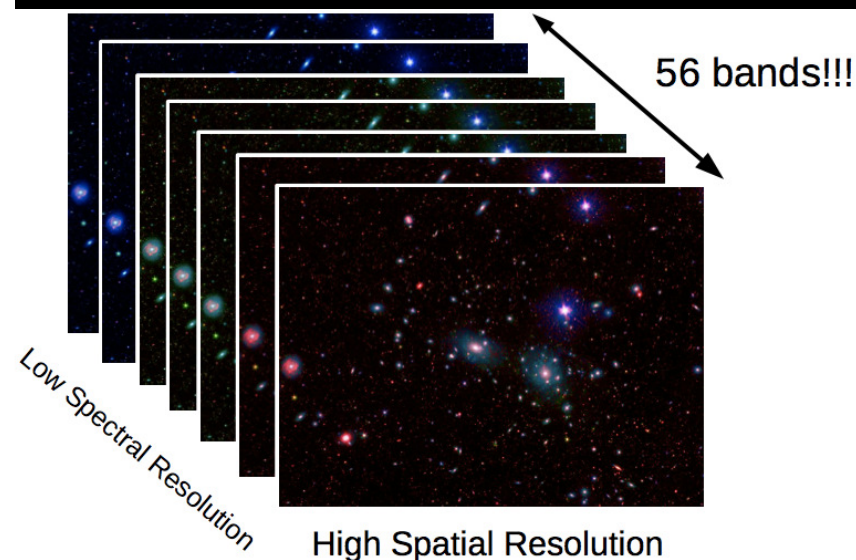
- BAOs: $\delta z / (1+z) < 0.003$
- Weak Lensing, SNe, Clusters



J-PAS DEFINITION & IMPLEMENTATION

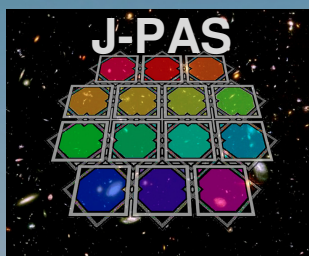


8500 deg²



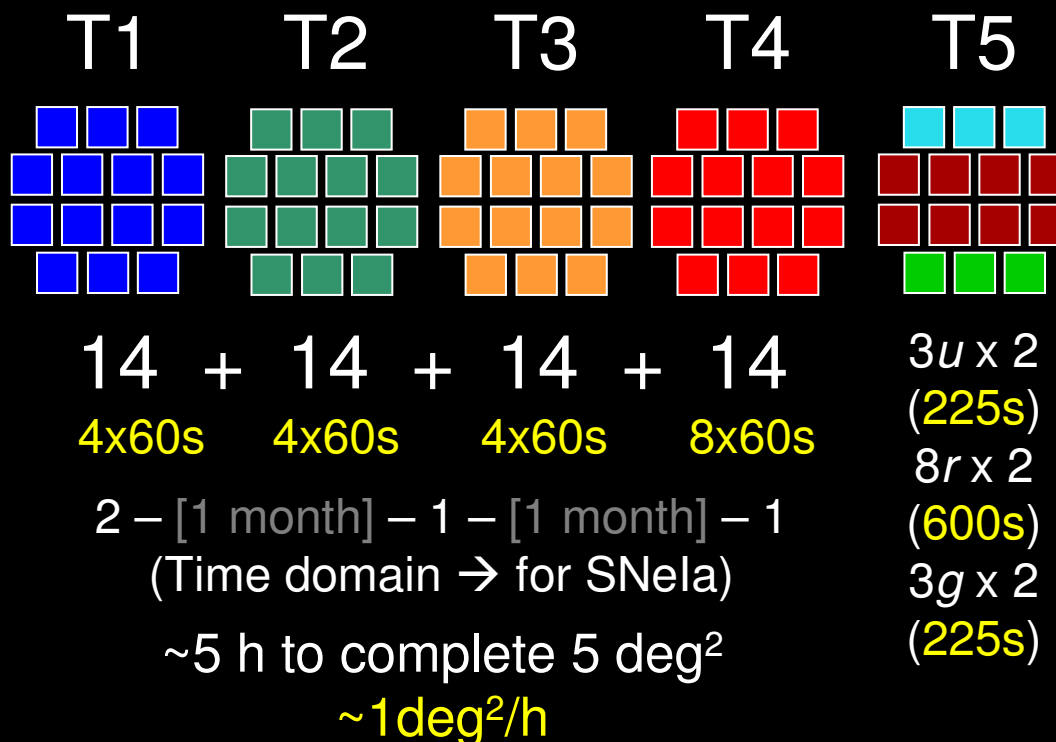
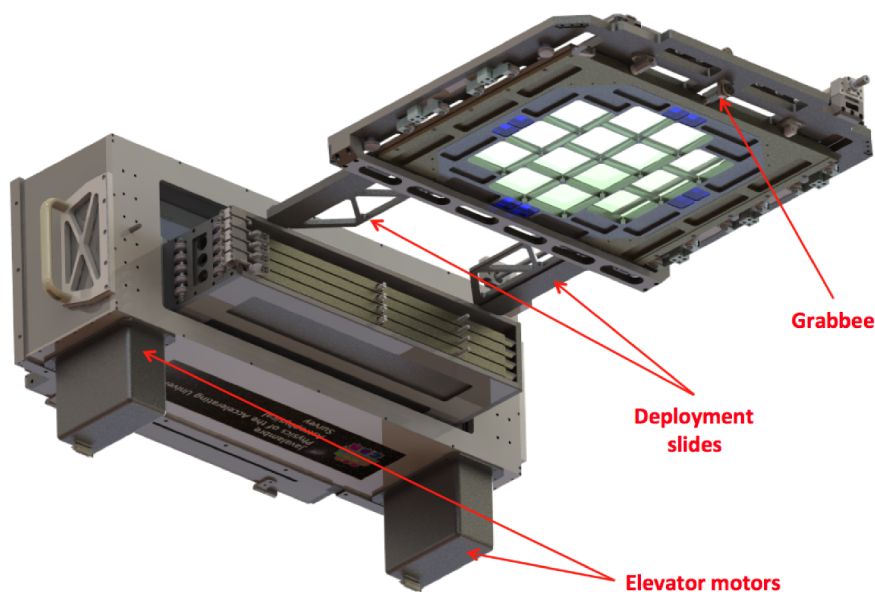
IFU of 1/5th of the Sky!!

NOT ONLY COSMOLOGY
A J-Spectrum (56 points)
FOR EVERY PIXEL OF THE SKY!!



J-PAS SURVEY STRATEGY

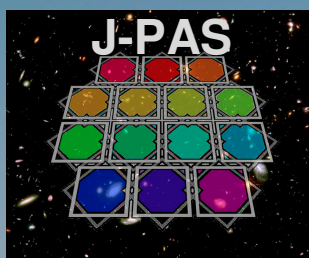
Filter Tray Injection Mechanism



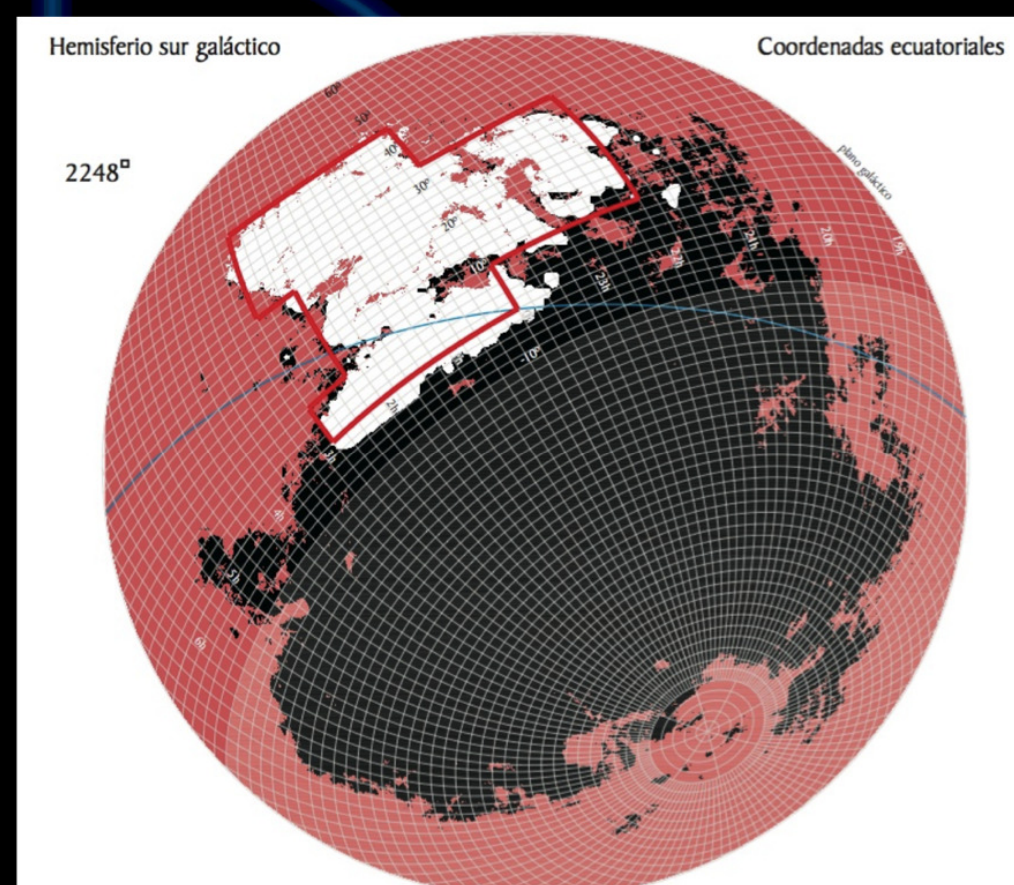
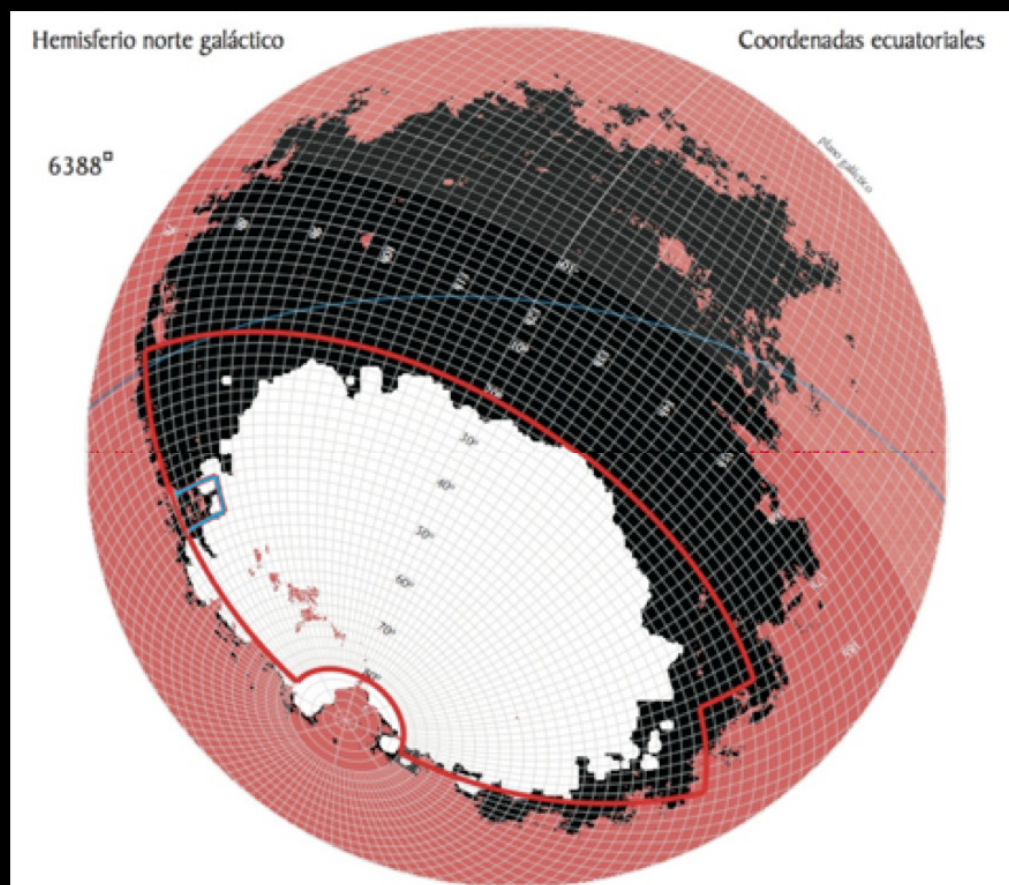
14 different filters in each tray

8500 h on target – 11600 h observing time
(overlaps, overheads, idle time, weather, visibility...)

~6.5 years completion



J-PAS AREA FIELDS

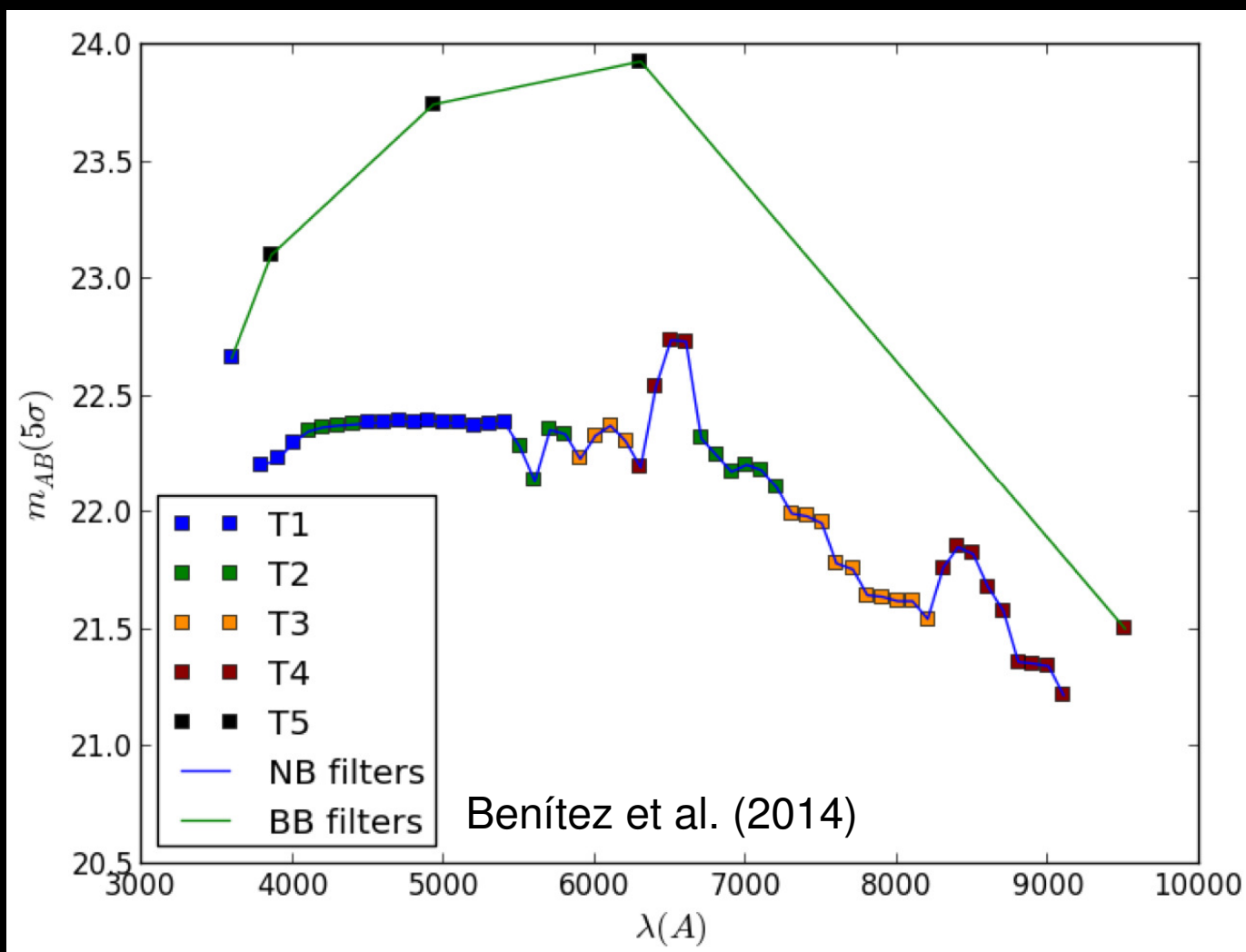


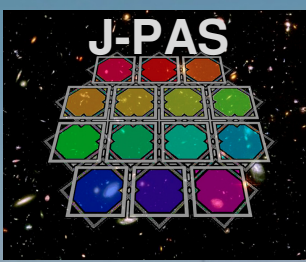
8500 deg² in ~ 34000 POINTINGS



J-PAS

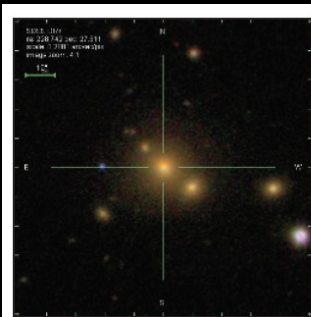
LIMITING MAGNITUDES ($5\sigma - \varnothing 3''$)



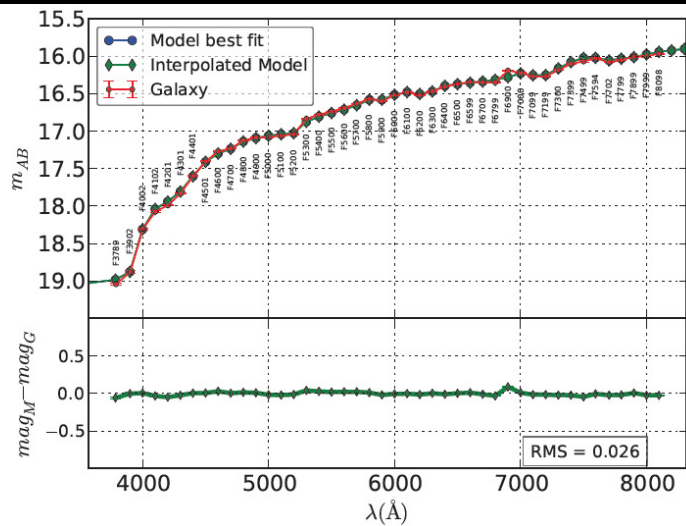


GALAXY EVOLUTION WITH J-PAS

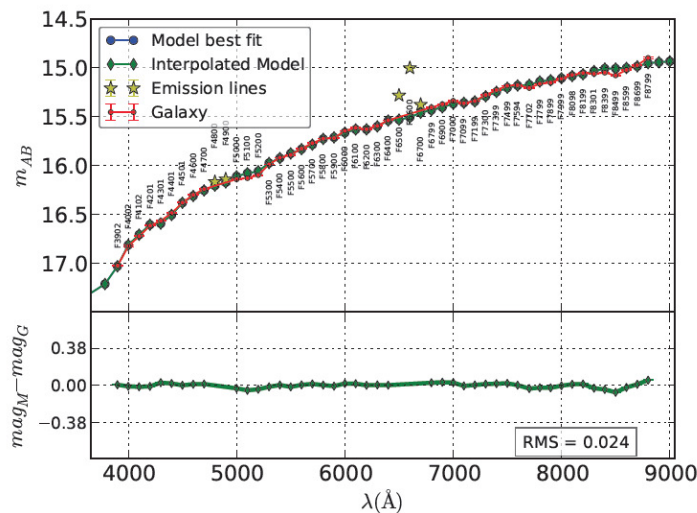
EXTENSIVE STUDIES UP TO REDSHIFT ~ 1.3



Info
 =====
 $S/N = 168.15$ [64.70-226.39]
 $\chi^2 = 15.209 \rightarrow 15.209$
 $N_{Ok} = 44$
 $N_{SSP} = 2$
 E.L. = 0 - 0



Info
 =====
 $S/N = 272.26$ [173.25-339.57]
 $\chi^2 = 32.950 \rightarrow 32.950$
 $N_{Ok} = 45$
 $N_{SSP} = 2$
 E.L. = 5 - 101111



Expected numbers:

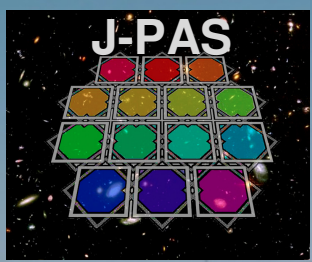
- 17.6M ETGs (3.7M at $z > 0.7$)
- 73.1M ELGs (19.7M at $z > 0.7$)

Stellar Population Studies

(Age, Metallicity, IMF, Extinction, Mass)

Spectral fitting at LR dominated by continuum shape & broad spectral features (indices)

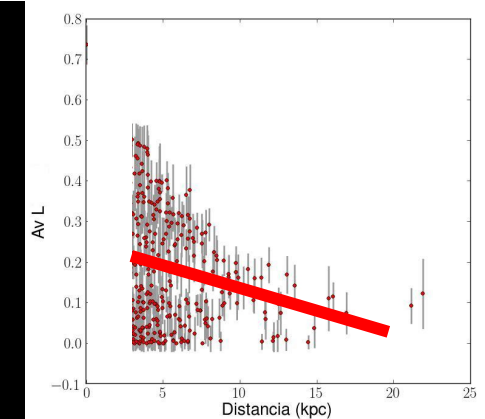
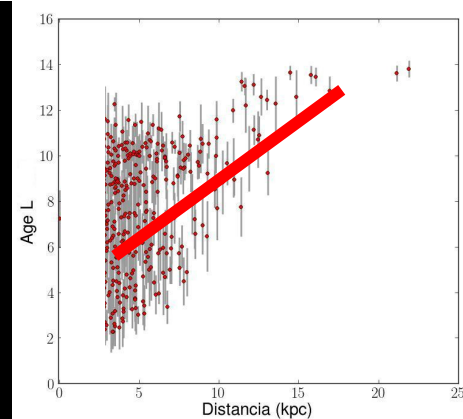
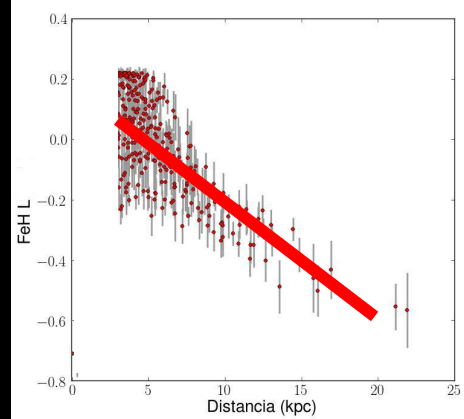
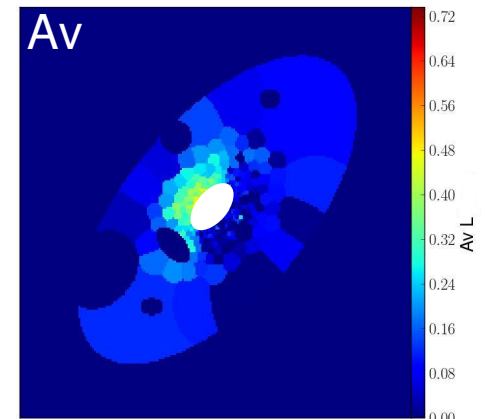
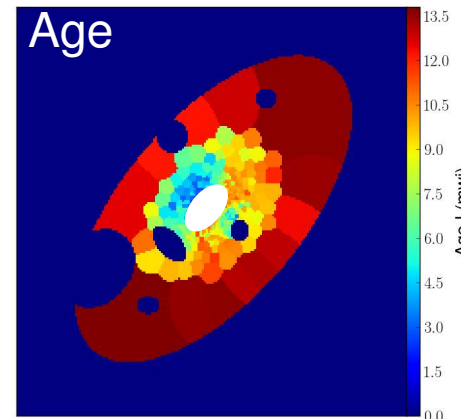
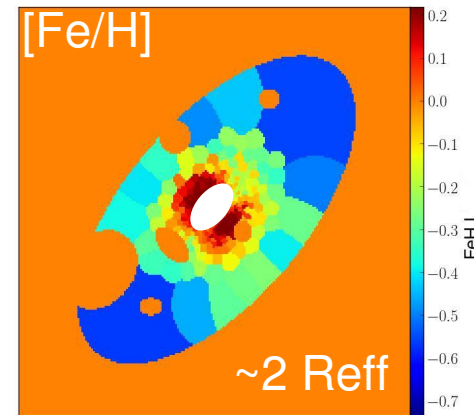
J-PAS to provide **very accurate** SEDs for millions of LRGs and ELGs



J-PAS IFU SCIENCE CASES

MASSIVE 2D STELLAR POPULATION ANALYSIS

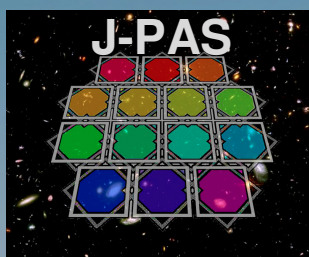
ALHAMBRA TEST CASE



J-PAS:

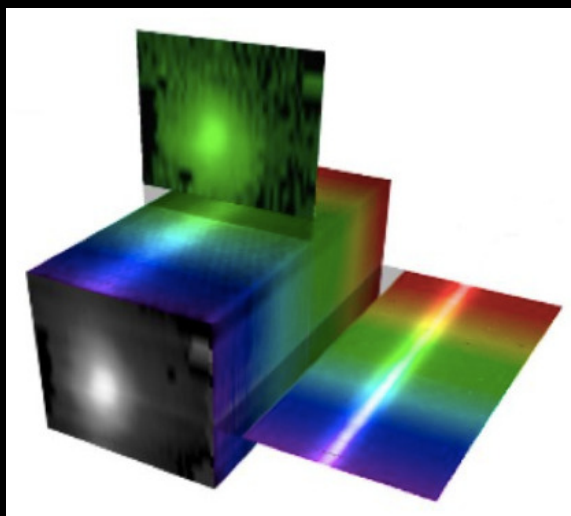
- Tenths of thousands nearby ($z < 0.1$) galaxies
- Stacking of millions ETGs at larger z 's

Size grow – Stel. Pops of halos vs Mass and z – Environment – Neighbours – Close pairs – SFRs – Dens. Numbers – L Functions...



SUMMARY

J-PAS OUTCOME



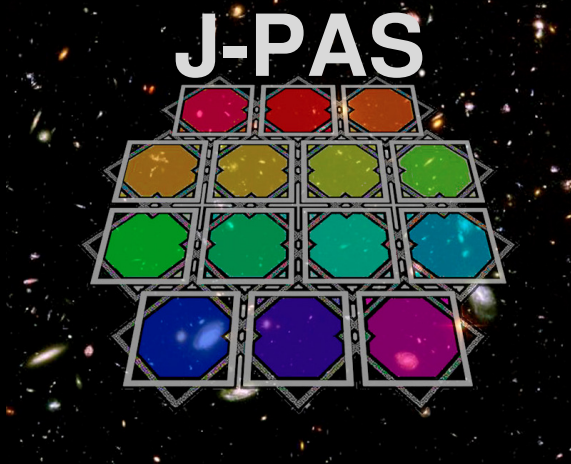
- > 34000 datacubes (56 + 3 bands)
- > 10 millions of raw images
- > 1 PB data
- J-Spectra for ~500M objects
- Photo-z's with
 - $\delta z/(1+z) \sim 0.003$ for 100M galaxies
 - $\delta z/(1+z) \sim 0.010$ for 300M galaxies
- J-PAS Database of ~30 TB

1 LR J-Spectrum for every pixel!

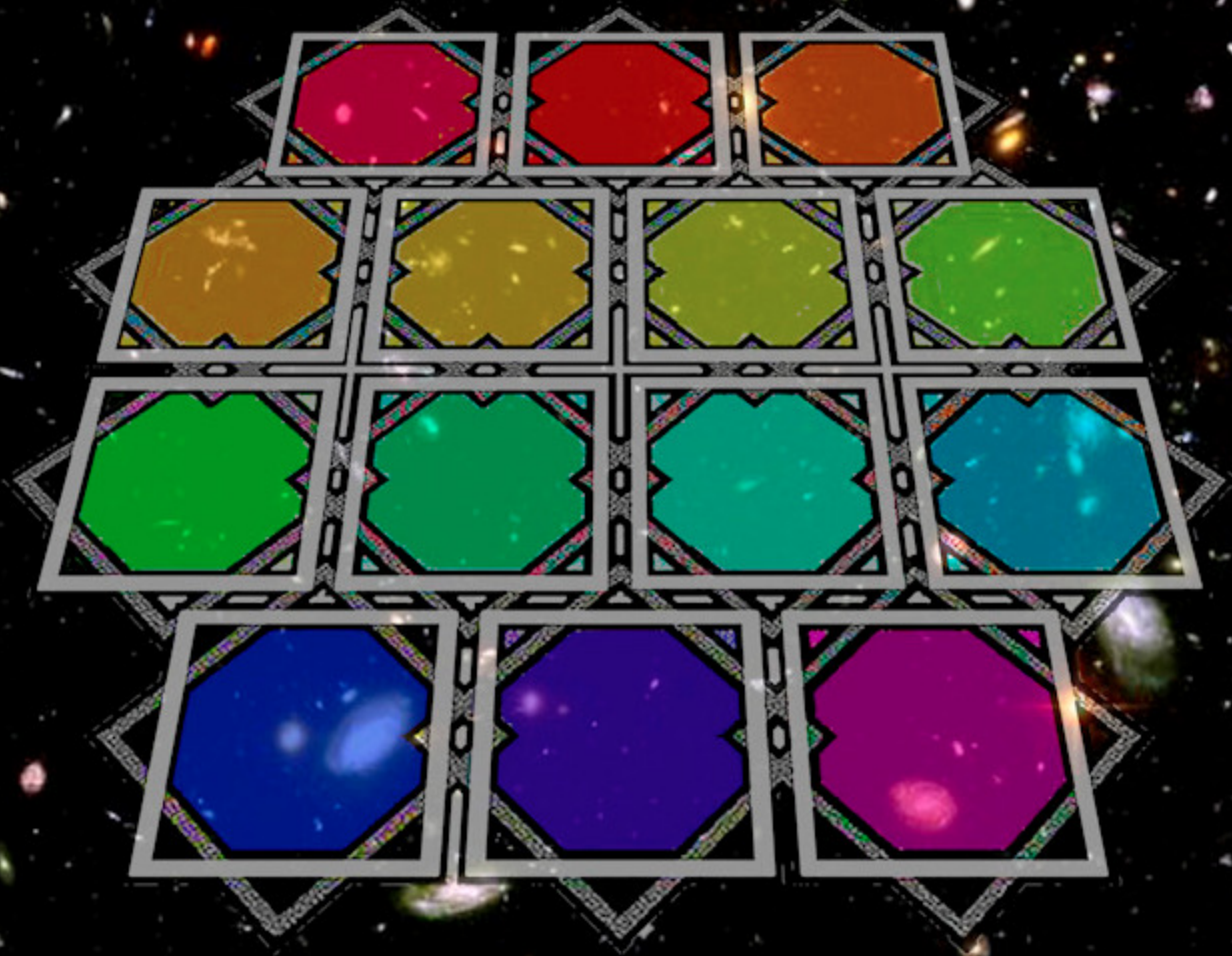
Unprecedented data for Galaxy Evolution studies and 2D Stellar Populations

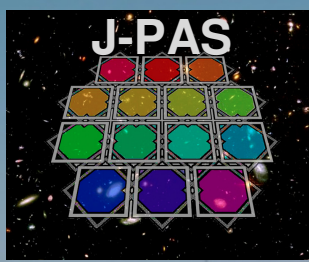
PUBLICLY AVAILABLE!

(LEGACY SURVEY)



THANKS





J-PLUS IN NUMBERS

- JAST/T80: **83 cm** M1 diameter
- Effective FoV @ T80Cam: **2.1 deg²**
- Plate scale: **0.5"/pix**

- Sky area: ~**8500 deg²** covered by J-PAS
- **12 filters** (SDSS g', r', i', z' + 8 intermediate/narrow widths). 3 in common with J-PAS ($u_j, OII, H\alpha$)
- Limiting magnitudes (S/N > 3):
 - **AB 21.5 – 21.7** in intermediate/narrow filters
 - ~1mag deeper than SDSS in u_j, g', r', i' and z'
 - **H α AB 22.7** (S/N=10 for AB=21)

- STANDARD OBSERVING UNIT per pointing (2.1 deg²) including overheads (grey time, 0.9" seeing, 1.2 airmass) ~ **1 HOUR**
- TOTAL EXECUTION TIME including "time domain" exposures < **3 YEARS**
- Starting in ~ **Mid 2013** (at least 1-1.5 years ahead of J-PAS)