Javalambre
Physics of the Accelerating Universe
Astrophysical
Survey

The *Javalambre*-PAU Astrophysical Survey (J-PAS) as of June 2014

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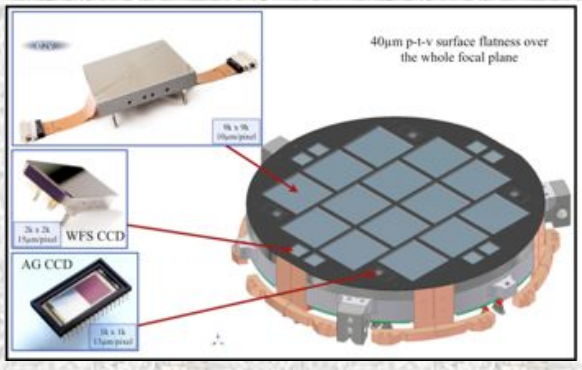
CEFCA



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FUNDACIÓN AGENCIA ARAGONESA
PARA LA INVESTIGACIÓN Y EL DESARROLLO

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Outline

- Brief sketch
- The *Observatorio Astrofísico de Javalambre* (OAJ): the site, the telescopes and the cameras
- The unit for data processing and storage (UPAD)
- The Science

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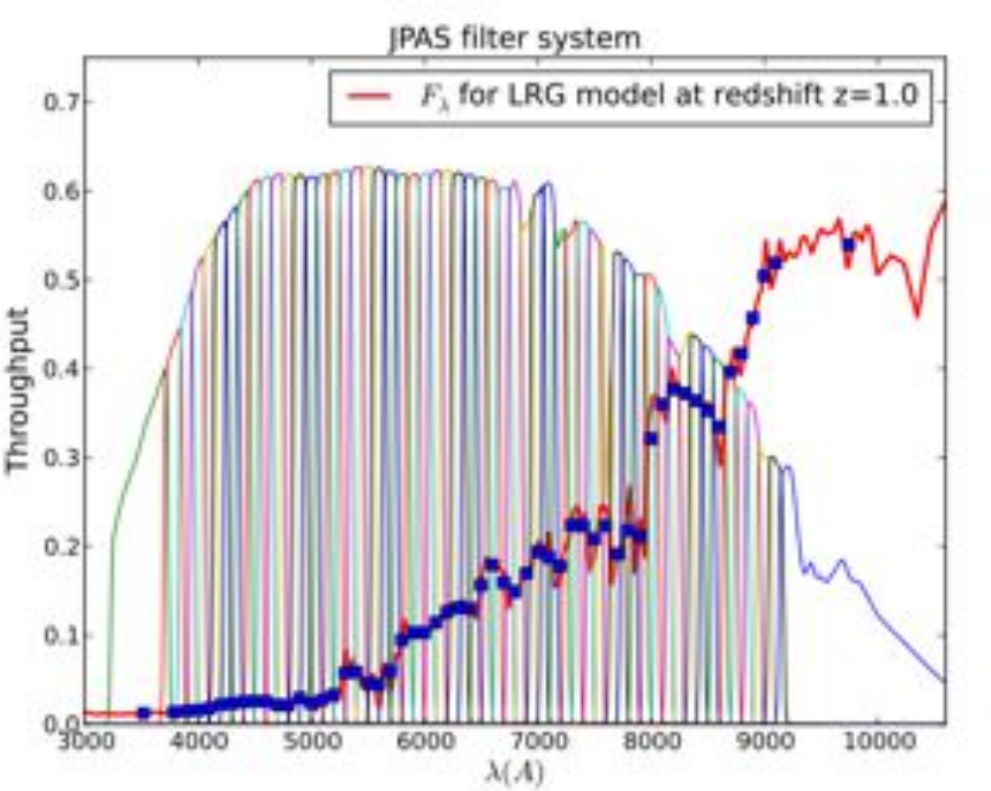
J-PAS is an *acronym of an acronym*, and stands for ***J****avalambre* *(**P**hysics of the Accelerating Universe)* ***A****strophysical* ***S****urvey.*

J-PAS, founded on the grounds of a MoU signed by three institutions (**CEFCA**, **UPS** [University of Saõ-Paulo, Brazil] and **ON** [Observatorio Nacional, Brazil]), gathers now the efforts of more than 100 scientists from Spain, Brazil, Japan, Italy and the US, in order to **cover 8,500 square degrees in the northern sky with 54 filters narrow band filters (~125 A) + 2 broad band filters, down to a depth of m_{AB} ~23.5 from the *Observatorio Astrofísico de Javalambre* (OAJ), in Teruel, Spain**. This survey should start at the end of **2015** and **finish** by **2021**

J-PAS should yield a pseudo-spectrum (R~50) in ***every*** pixel of the sky down to m_{AB} ~ 22.5 – 23.5



Javalambre sierra from my home in Teruel

Javalambre sierra from my home in Teruel

Observatorio Astrofísico de Javalambre


OAJ
OAJ CIVIL WORK
DEC 2012
JAST/T80
Monitor
Building
JST/T250
Coating
Plant
General Services
Plant
Residence
Control Room &
Laboratories

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OAJ

Javalambre
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OAJ

OAJ CIVIL WORK
MAR 2014

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OAJ

OAJ CIVIL WORK
MAR 2014


OAJ – May 2014
Median seeing ~0.7”
at *Pico del Buitre*
Elevation ~2,000 m

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OAJ

T80 -JAST

- M1 (∅) = 0.83 m
- FoV (∅) = 2 deg = 130 mm at FP
- Effective collecting area = 0.44 m^2
- Etendue = 1.5 m^2deg^2
- Plate scale = 55.56 arcsec/mm
  = 0.55 arcsec/pix
- Focal length = 3712mm → F#4.5
- IQ EE50 (∅) < 7μm = 0.39 arcsec
- IQ EE80 (∅) < 14.5μm = 0.81 arcsec

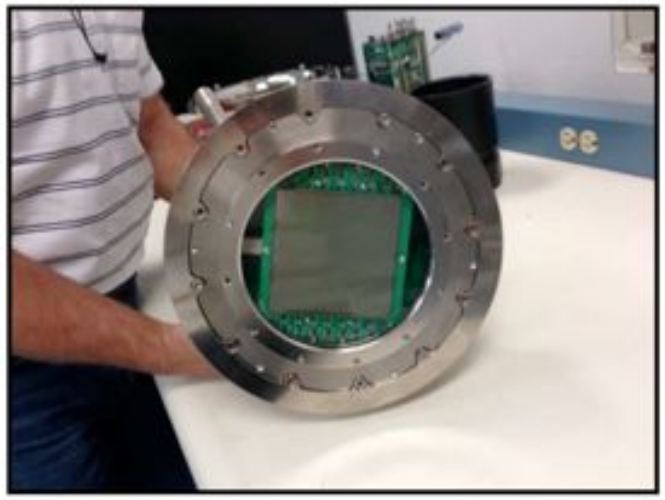
- Mount = German equatorial
- Config. = Ritchey Chrétien
- Focus = Cassegrain
- Field corrector of 3 lenses
- Mass 2.500 kg
- 1st Eigenfrequencies > 10 Hz

- Manufacturer: ASTELCO (Germany) + AMOS (Belgium)

T80 -JAST

- Problems with absolute & differential pointing and tracking **solved**
- Last ongoing scientific tests with **First Light Instrument (FLI)**
- **T80Cam** to be **re-**delivered by Spectral Instruments within a month
- **J-PLUS** expected to start by the end of the Autumn 2014 (conservative)

T80 -JAST



T80Cam 9Kpx x 9 Kpx chip

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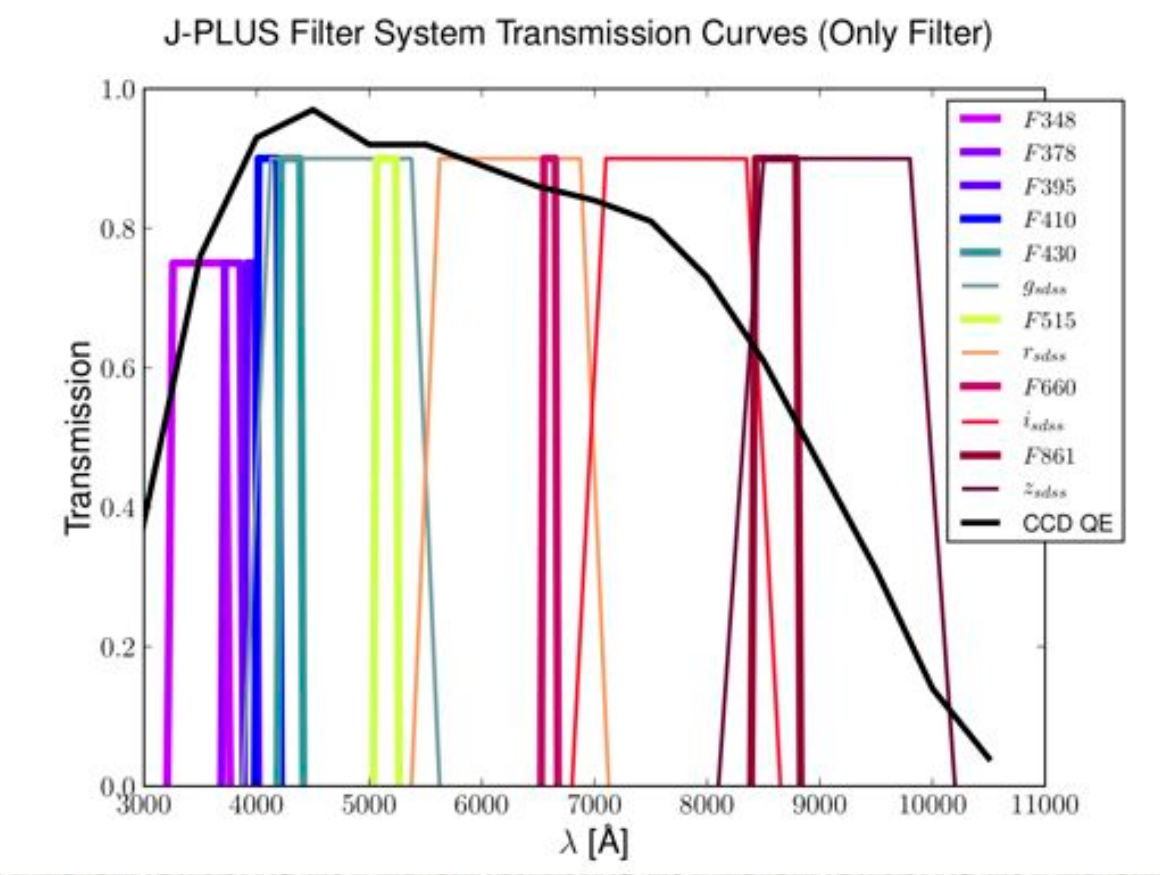
T80Cam FSU

This is the ***Javalambre*** **– Physics of the Local Universe Survey:**

- It will be conducted by the **JAST / T80**
- It will cover **same area** as J-PAS with **12 filters** (Sloan's *r, i, g* and *z* plus 8 more filters centred upon Halpha, OII, CaHK lines, Hdelta, G-band, etc, in order to ***optimize stellar spectral clasification****)*
- Some bands (Halpha and OII) are identical to J-PAS, and will have its own **scientific return in terms of studying the star formation in the local Universe**


J-PLUS Filter System Transmission Curves (Only Filter)
Transmission
λ [Å]
1.0
0.8
0.6
0.4
0.2
0.0
3000
4000
5000
6000
7000
8000
9000
10000
11000
F348
F378
F395
F410
F430
gsdss
F515
rsdss
F660
isdss
F861
zsdss
CCD QE

T250/JST

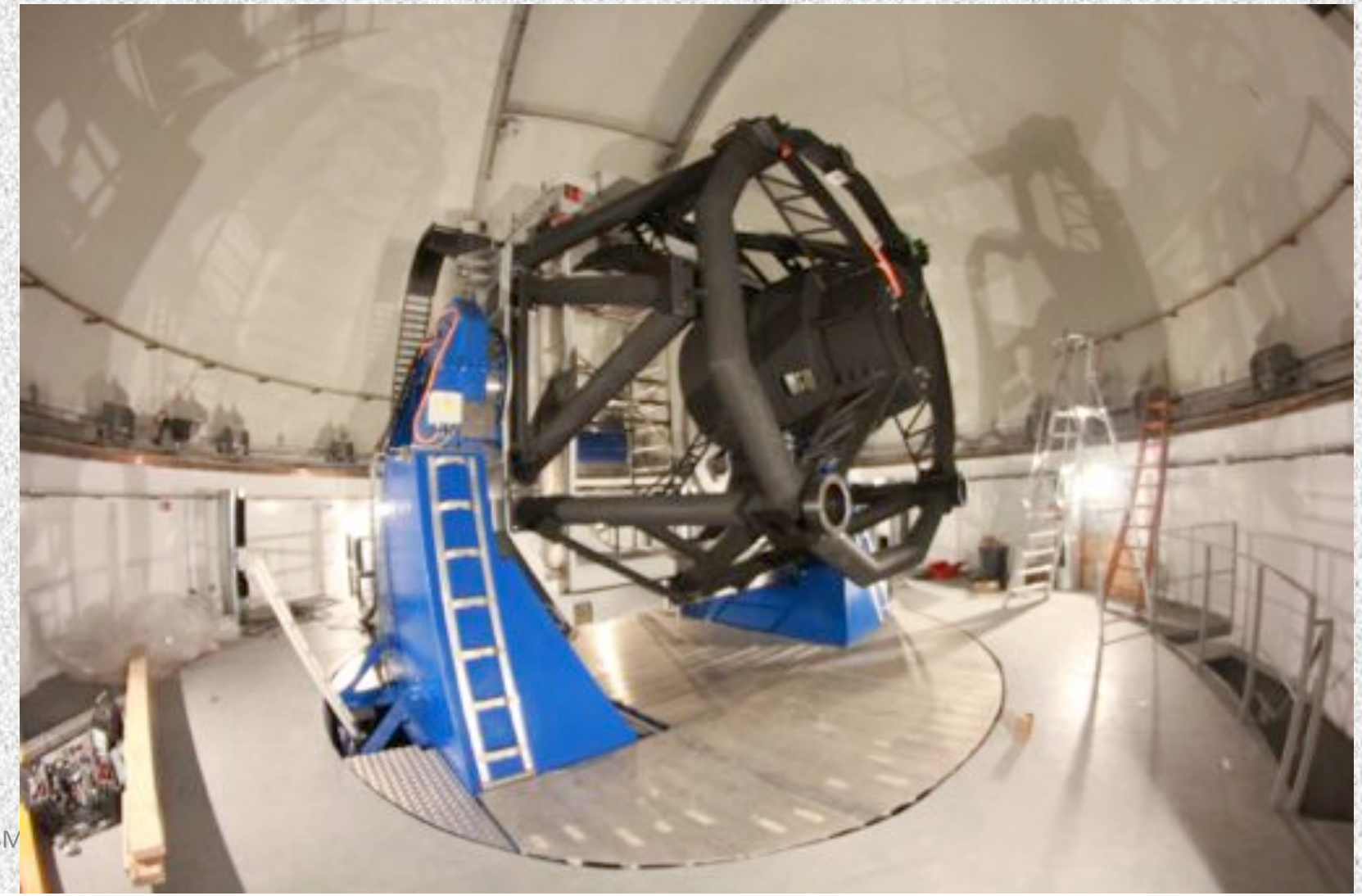
- M1 (∅) = 2.55 m
- FoV (∅) = 3 deg = 476 mm at FP
- Effective collecting area = 3.89 m^2
- Etendue = 27.5 m^2deg^2
- Plate scale = 22.67 arcsec/mm
  = 0.22 arcsec/pix
- Focal length = 9098mm → F#3.5
- IQ EE50 (∅) < 12μm = 0.27 arcsec
- IQ EE80 (∅) < 20μm = 0.45 arcsec

- Mount = Alt-azimuthal
- Config. = Ritchey Chrétien-like
- Focus = Cassegrain
- Field corrector of 3 lenses
- Mass ~45.000 kg
- 1st Eigenfrequencies > 10 Hz

- Manufacturer: AMOS (Belgium)

November 2013

T250/JST



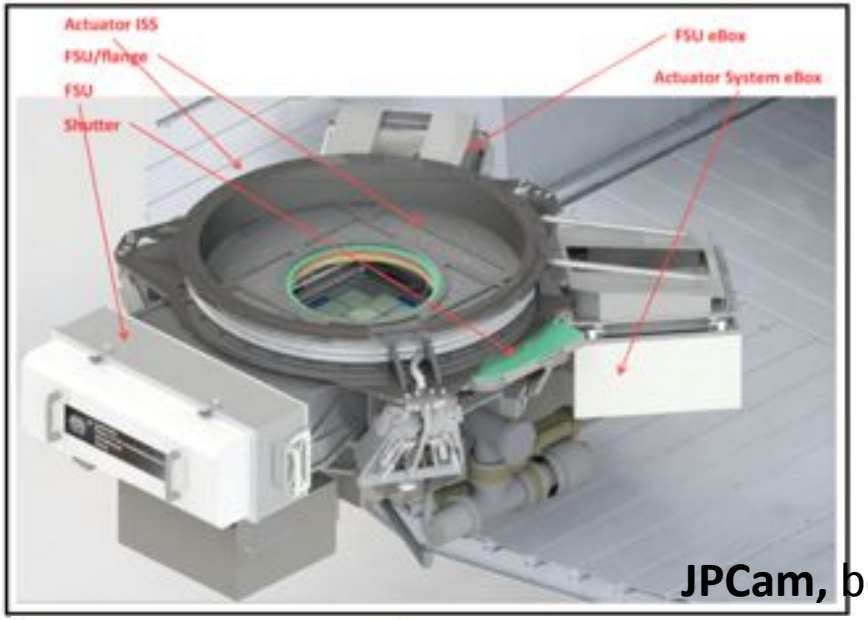
June 3rd 2014

- M2 is alluminized in France, arrived yesterday to OAJ. M1 being alluminized this week in Calar Alto, will arrive to OAJ this Friday
- Optics fully integrated in JST by the end of June 2014

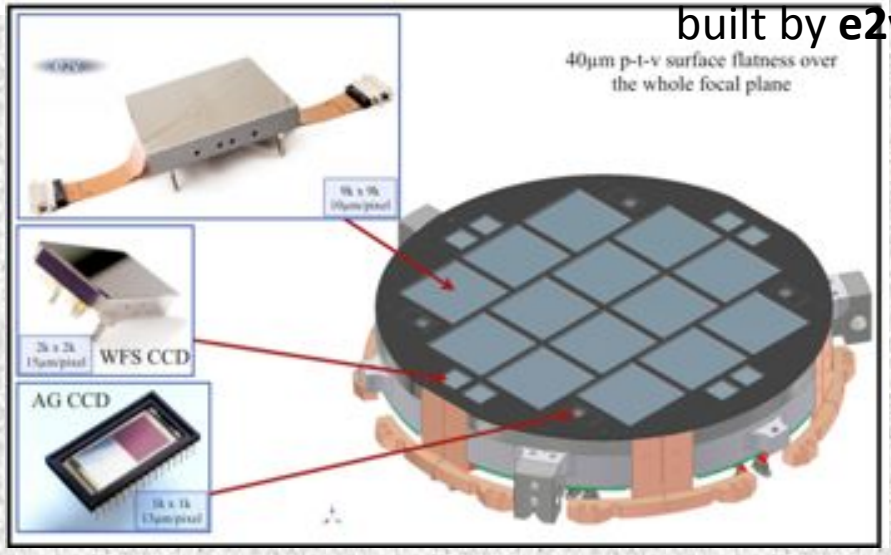
- Engineering operations to last for the entire Summer 2014
- Scientific operations to start in Autumn 2014 with camera **Pathfinder – start of systematic tests with multifilter camera**

- **JPCam** to arrive in Summer 2015
- **J-PAS survey to start in during the end of 2015**

T250/JST



JPCam, being built by **e2v**



1.2 Gpixels

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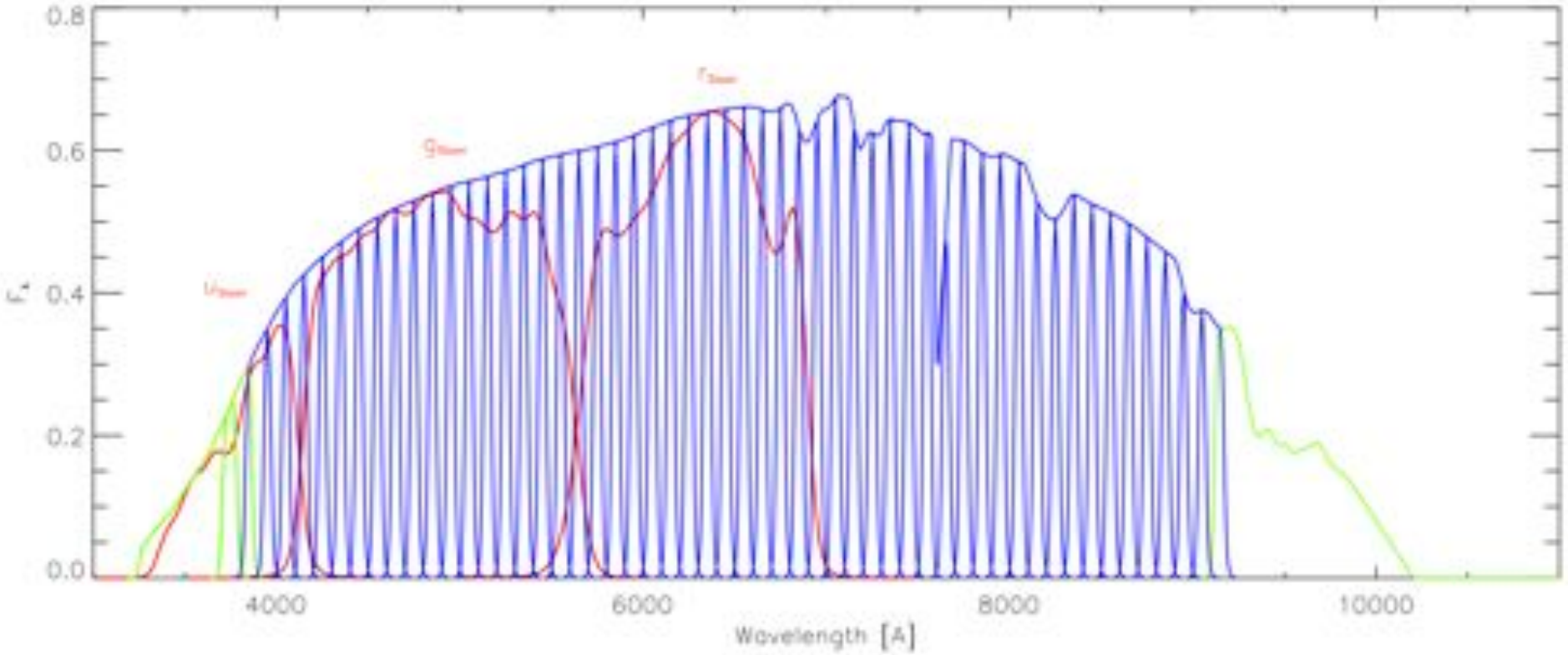
JPCam filter system



•Resources for data "on-the-fly" analysis at OAJ and storage in both OAJ and Teruel are ready to operate.

•Radio link between OAJ and Teruel has been tested

•Larger set of racks for J-PAS have been bought, but wait for habilitation of host building in Teruel (starting in August 2014, hopefully finishing in October 2014)

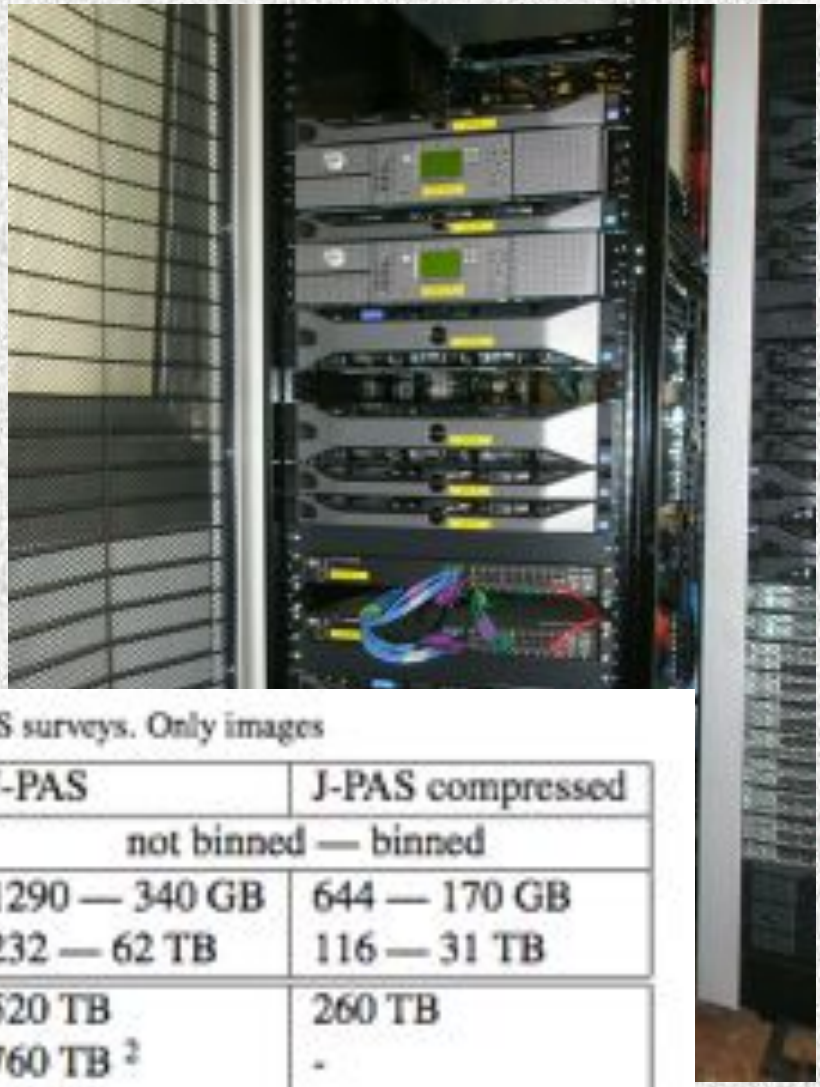


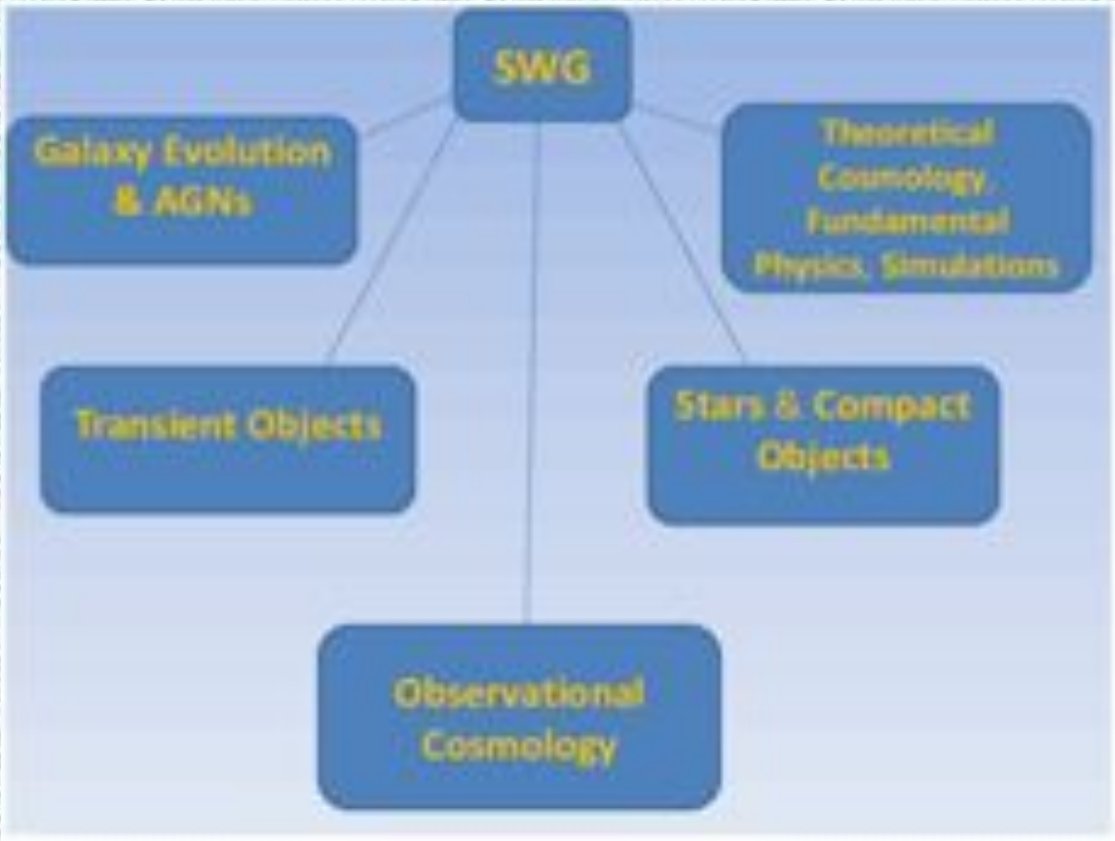
Table 19: Storage needs for the J-PLUS and J-PAS surveys. Only images

	J-PLUS	J-PLUS compressed	J-PAS	J-PAS compressed
			not binned — binned	
Night 10h	158 GB	79 GB	1290 — 340 GB	644 — 170 GB
Year raw data [1]	31.6 TB	15.8 TB	232 — 62 TB	116 — 31 TB
Total raw data [1]	42.8 TB	21.4 TB	520 TB	260 TB
Coadded data (1DR)	32.2 TB	-	760 TB [2]	-
Coadded calibration	204 GB	-	2.4 TB	-

[1] Include calibration frames
[2] The weight map stored in 2 bytes.

Science

J-PAS should have a significant output in very different fields of Astrophysics**:**



Science

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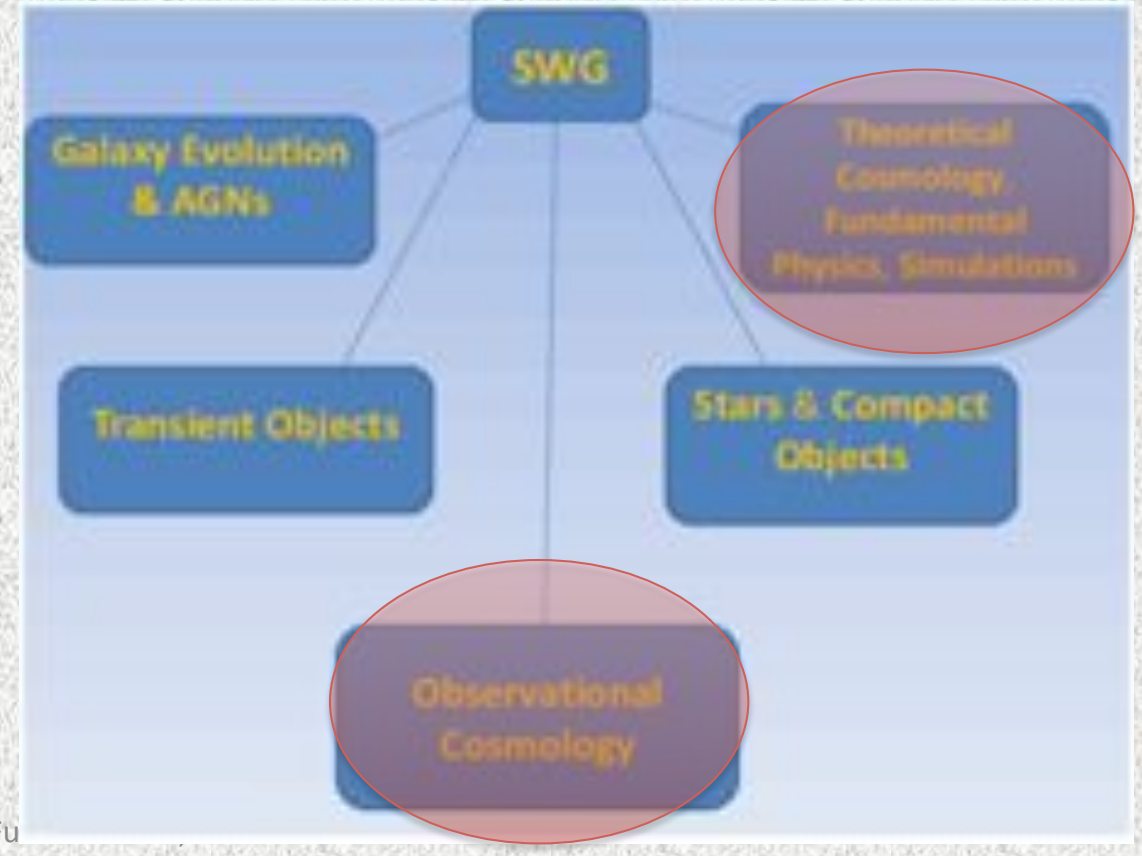


Science

The **Observational Cosmology** group is divided in**:**

- **Photo-z's & LSS** (Abramo, Benítez & Hernández-Monteagudo)
- **Galaxy clusters** (Ascaso & Dupke)
- **SNa** (Masao Sako & Abramo)
- **Gravitational lensing** (Broadhurst & TBD)

Science

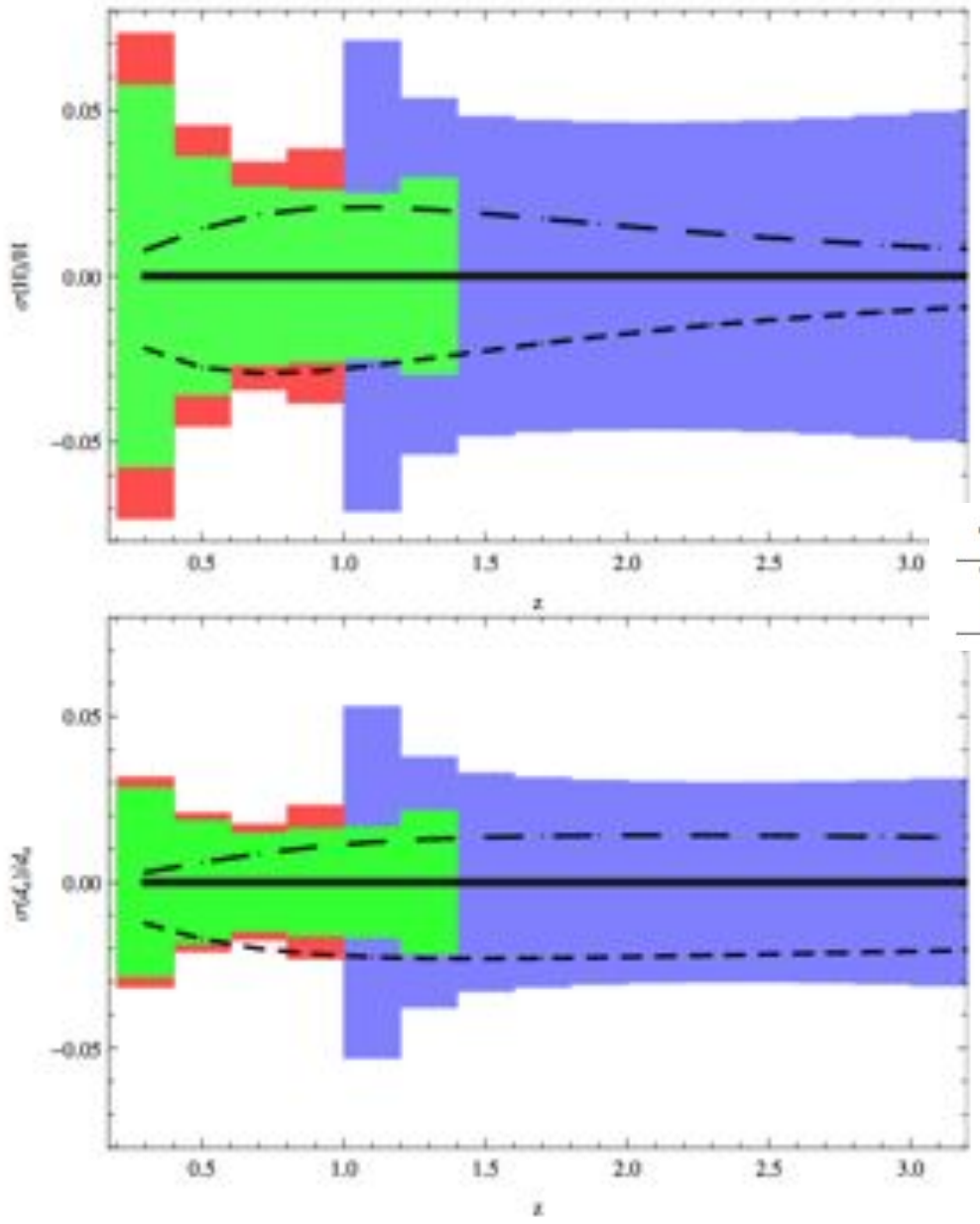
The **Theory Cosmology, Fundamental Physics and Simulations (== Theory)** working group is divided in**:**

- **Fundamental tests of Cosmology** (Alcaniz)
- **J-PAS x CMB joint analysis** (Hernández-Monteagudo & Vielva)
- **Inflation** (E.Martínez-González & TBD)
- **Alternative Cosmologies & Theories of Gravity** (Tsukikawa & Alcaniz)
- **Statistical Tools** (Kitaura & Abramo)

Science

The **main drivers** of J-PAS cosmological analysis are

- The possibility of mapping the Large Scale Structure with **different probes** (LRGs, ELGs & QSOs), with very **high** redshift accuracy ($\Delta z/(1+z) < 0.003$) in a **wide redshift** range (**z€[0,3]**), with the implications this has on BAO and RSD measurements,



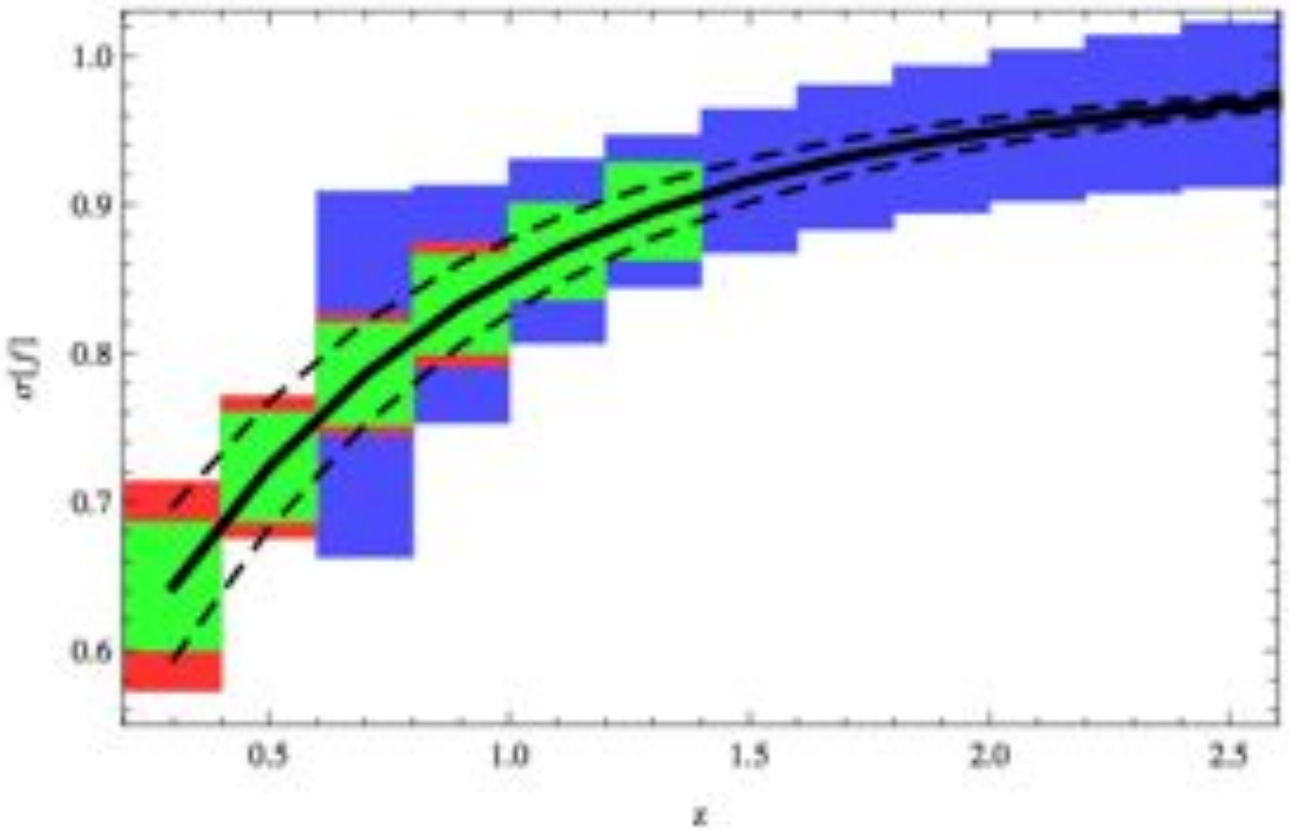
Constraints on **Hubble parameter**

x 10^6

Trays	Date	N_{RG}	N_{ELG}	V_{eff}	$N_{RG}^{z>0.7}$	$N_{ELG}^{z>0.7}$	$V_{eff}^{z>0.7}$
T543	Y3	4.6	33.9	9.5	0.7	9.4	5.8
All	Y6	17.6	73.1	13.9	3.7	19.7	9.9

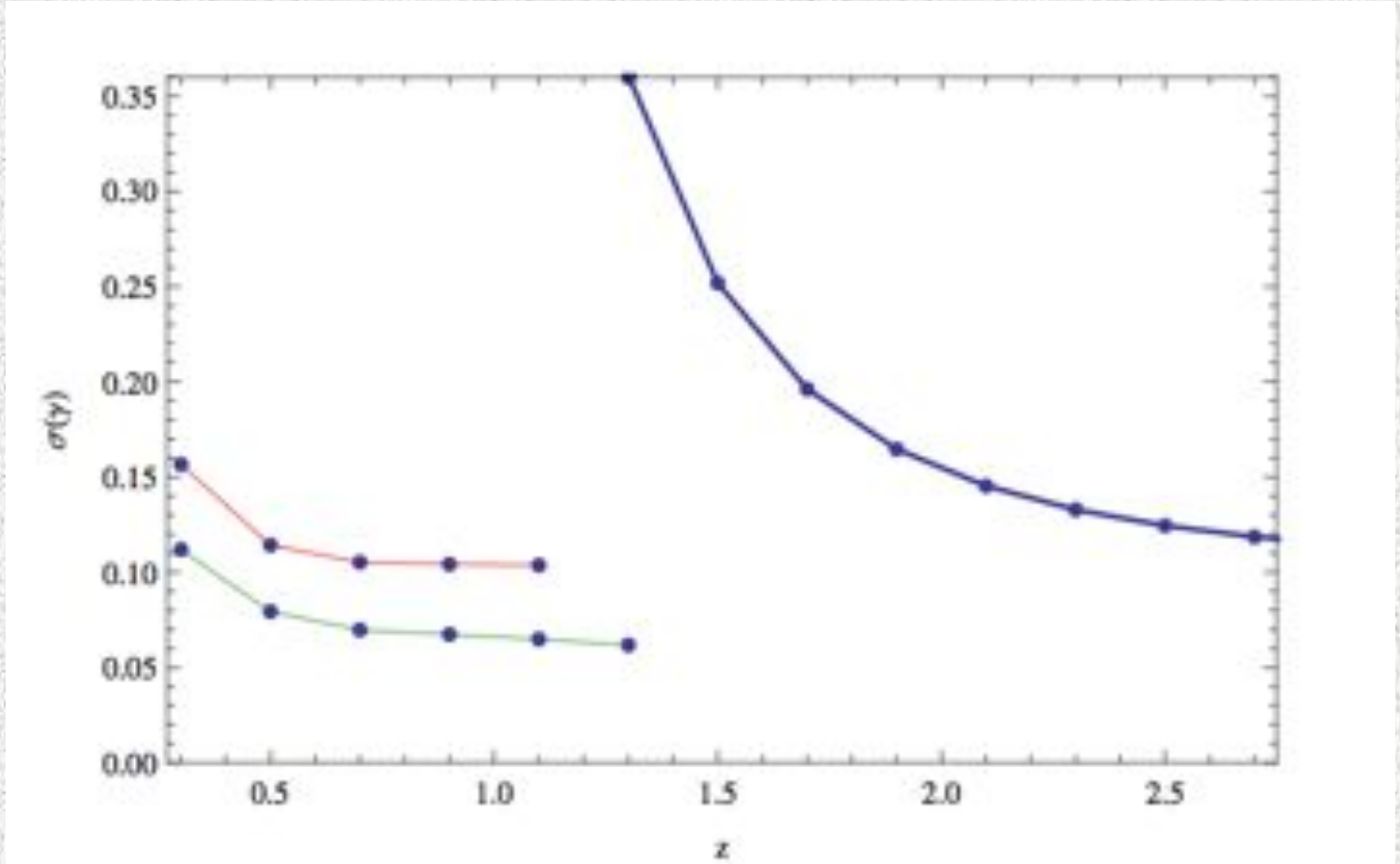
Constraints on **angular distance**

J-PAS Red book, Benítez et al., astro.ph 1403.5237



Constraints on **RSD parameter f=dlnD/dlna**, with strong implications for **Dark Energy models** and **alternative theories of Gravity** ….

J-PAS Red book, Benítez et al., astro.ph 1403.5237



Constraints on **gamma γ parameter f=Omega_m$^{\gamma}$**, with strong implications for **Dark Energy models** and **alternative theories of Gravity** ….

J-PAS Red book, Benítez et al., astro.ph 1403.5237

Science

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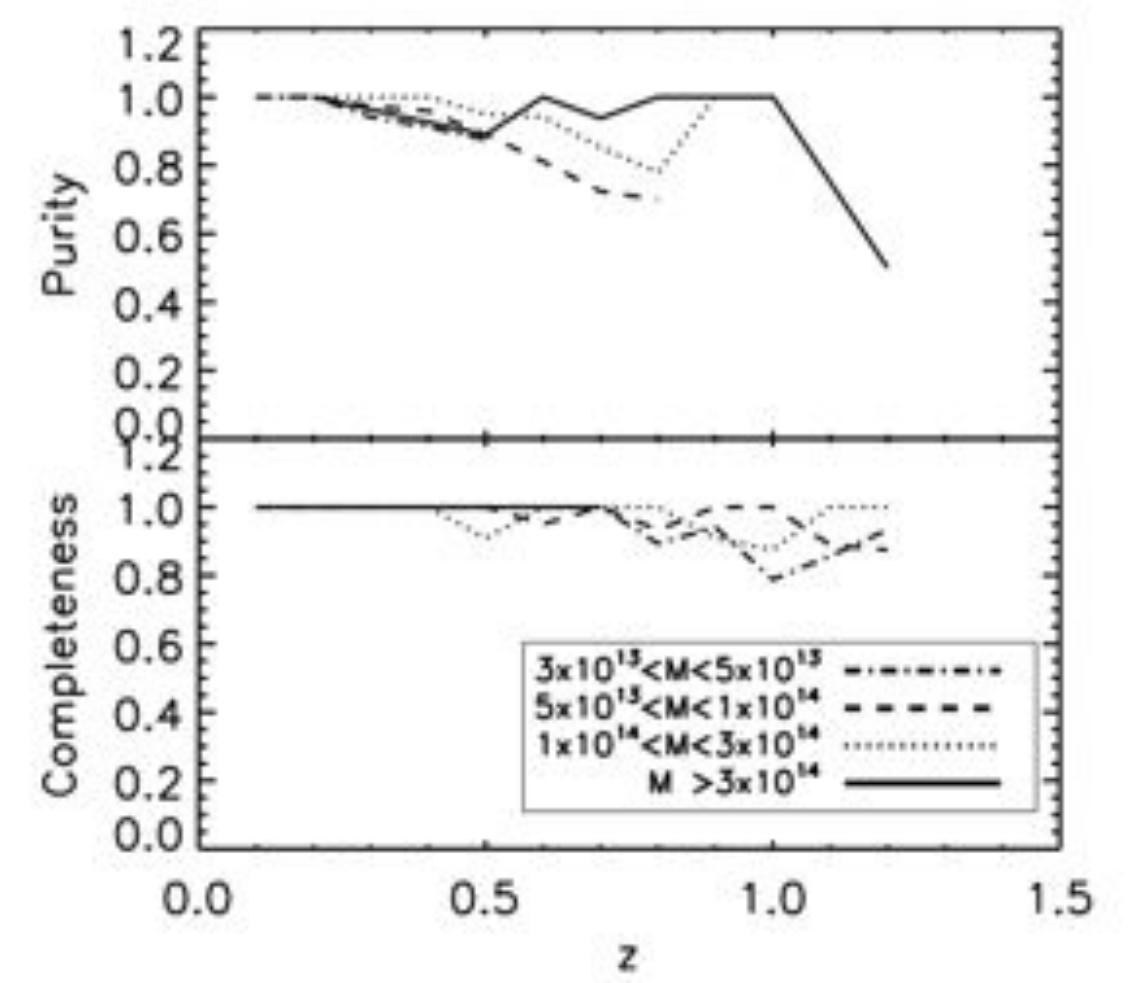
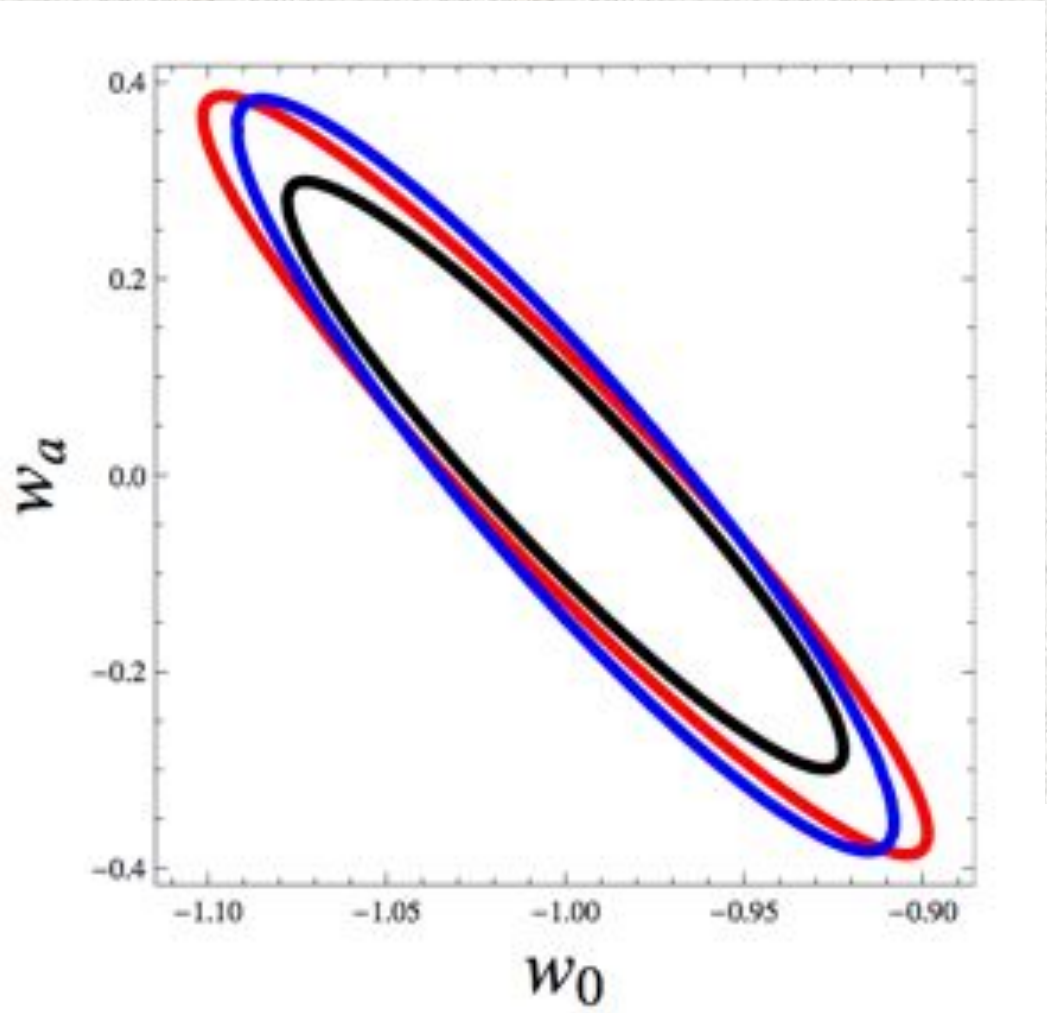
- The production of a **galaxy cluster catalogue** (with ~6e5 members), presumably the **deepest** until the arrival of *Euclid,* **up to z~1.3**,



- We expect **~650e3 clusters** of masses above **3e13 Msolar** up to z~1.3 …
- These should have exquisite redshift information & even membership information
- Mass estimates based upon richness and lensing from the *r*-band

J-PAS Red book, Benítez et al., astro.ph 1403.5237



Constraints from BAOs (blue), from clusters (red) and joint (black)

J-PAS Red book, Benítez et al., astro.ph 1403.5237

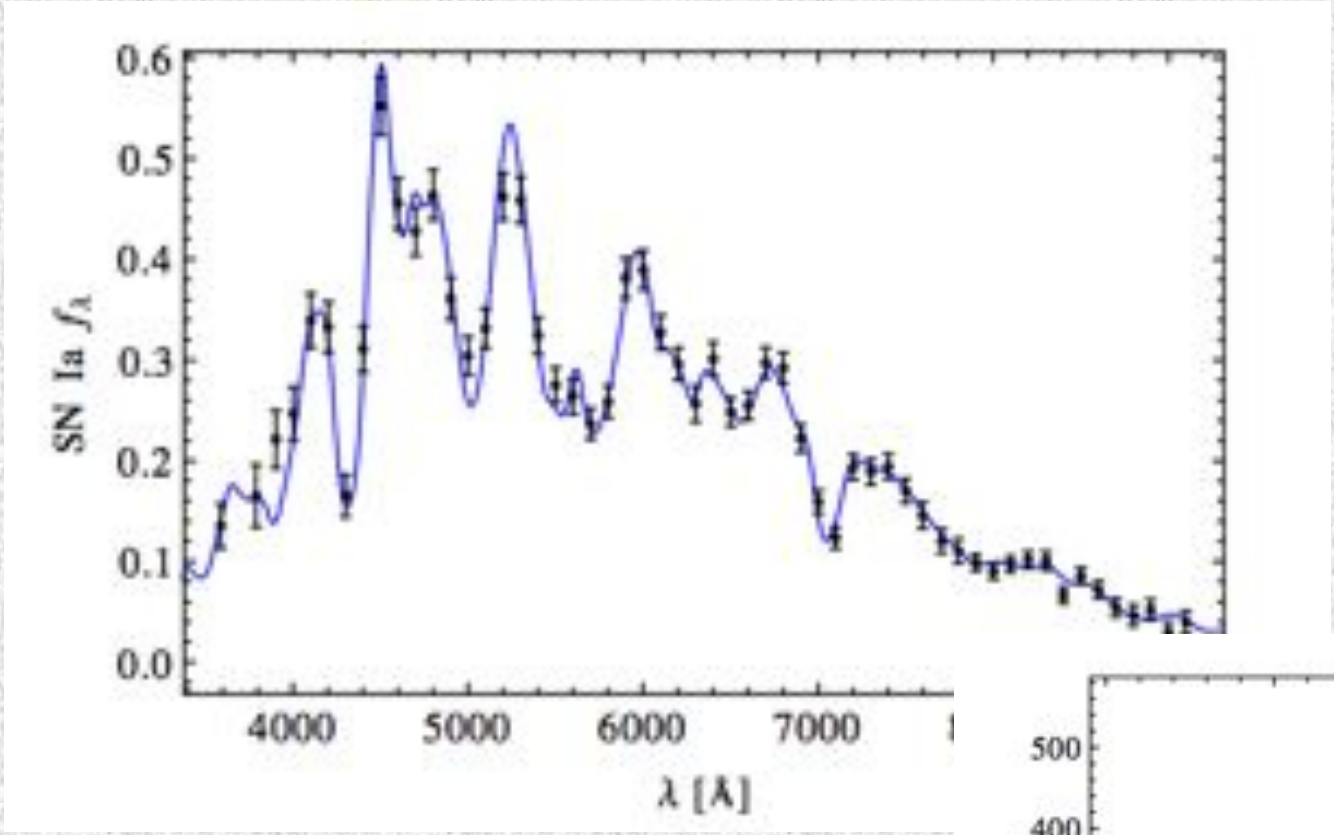
Table 12: Figure of merit.

Test	LRGs	ELGs	QSOs	All
BAOs + *Planck*+ Stage II	87	121	100	163
BAOs + Clusters + *Planck*+ Stage II	195	222	201	256

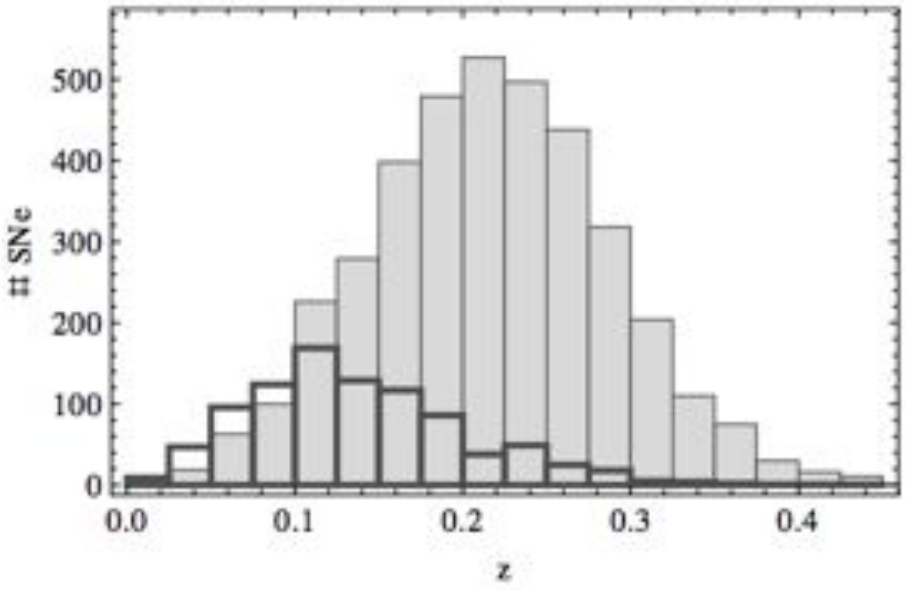
Science

The **main drivers** of J-PAS cosmological analysis are

- The possibility of mapping the Large Scale Structure with **different probes** (LRGs, ELGs & QSOs), with very **high** redshift accuracy ($\Delta z/(1+z) < 0.003$) in a **wide redshift** range (**z€[0,3]**), with the implications this has on BAO and RSDs measurements,
- The production of a **galaxy cluster catalogue** (with ~1e5 members), presumably the **deepest** until the arrival of *Euclid,* **up to z~1.3**,
- The production of a **SNIa catalogue**, and



- Around 3,800 SNIa and 900 CCSNe expected
- Accurate photo-z information + characterization of host galaxy



J-PAS Red book, Benítez et al., astro.ph 1403.5237

Science

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- The production of a **galaxy cluster catalogue** (with ~1e5 members), presumably the **deepest** until the arrival of *Euclid,* **up to z~1.3**,
- The production of a **SNIa catalogue**, and
- The study of **gravitational lensing**, providing **shear measurements** by its own, but also contributing to other Science, like **cluster mass estimates**

Summary

I would be happy if you remembered that …

- Both **main telescopes** at the OAJ are **practically operative**: fully equipped (with early cameras) by end of June 2014, **JAST/T80 should start the J-PLUS survey in Autumn 2014**, while around that time JST/T250 should finish its scientific commissioning and incorporate the Pathfinder camera
- **JPCam** should arrive **mid-2015**, and **J-PAS** should start at the **end of 2015** …
- Loads of data along the way! Stay tuned!

Javalambre
Physics of the Accelerating Universe
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Summer Grant

We are searching for 3 **undegraduate students** willing to spend **July, August and half September at CEFCA** on a 700€/month basis, if you know of anyone, **please let us know**, deadline is this Friday (***today***)!!

https://www.cefca.es/becas-verano