Science with J-PAS and other large astronomical surveys from OAJ

Carlos López-Sanjuan
on behalf of J-PAS / J-PLUS / J-VAR collaborations

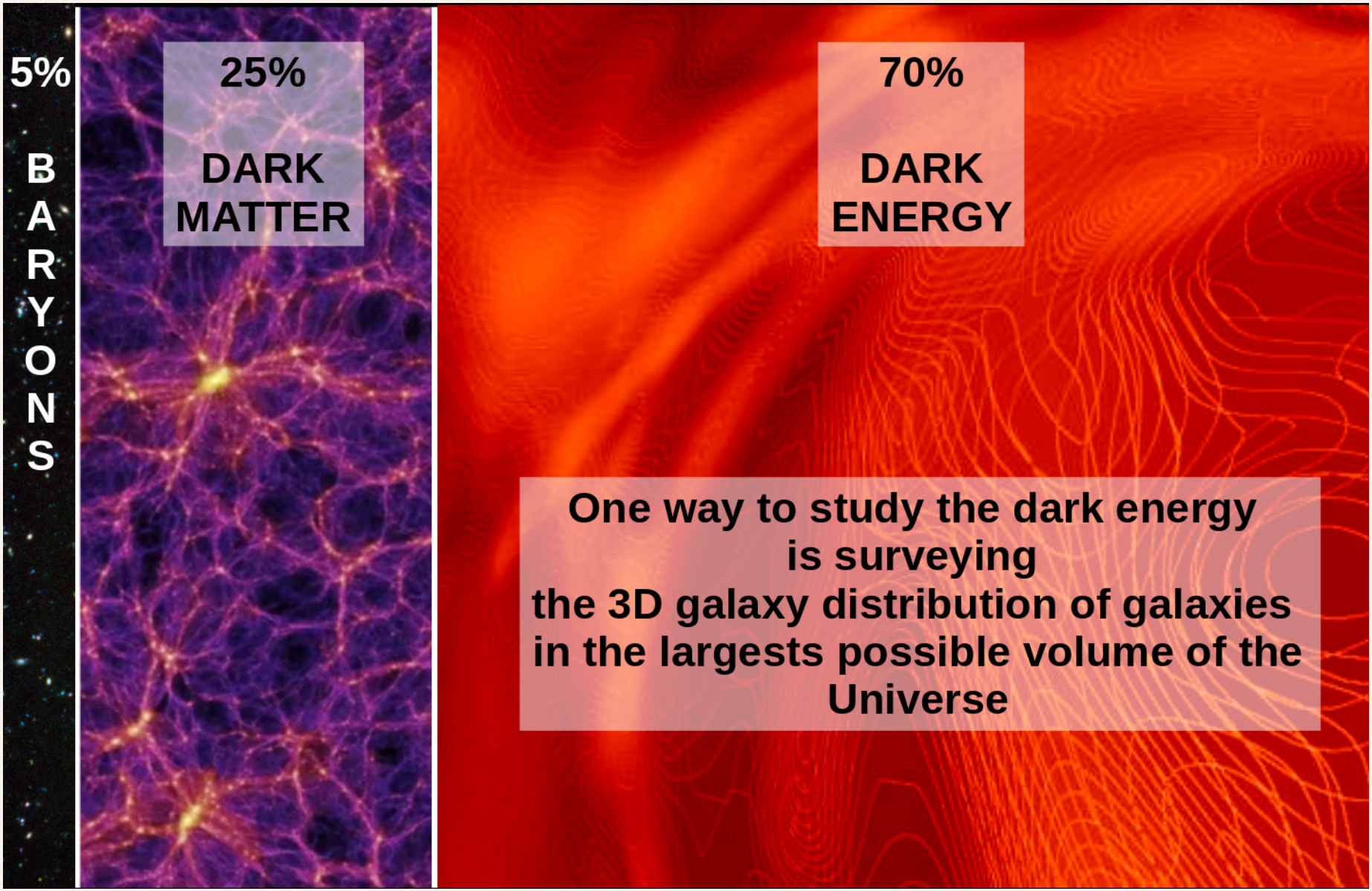
Astrofisica y física de altas energías

Centro de Estudios de Física del Cosmos de Aragón
CEFCA

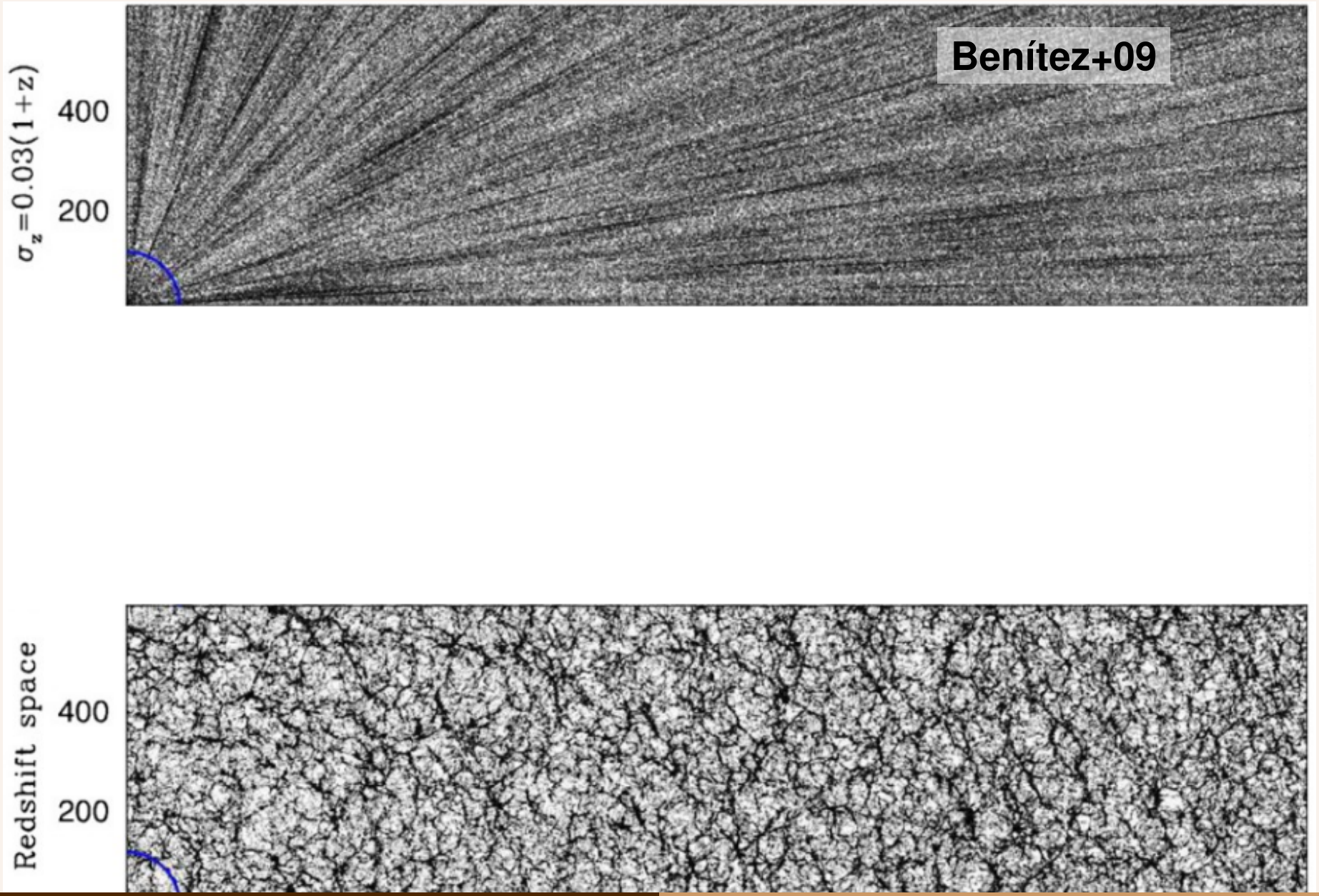
6 de junio de 2024
I Reunión nacional del Plan Complementario de Astrofísica y Física de Altas Energías

CEFCA GOBIERNO DE ARAGON MINISTERIO DE CIENCIA E INNOVACIÓN Plan de Recuperación, Transformación y Resiliencia Financiado por la Unión Europea NextGenerationEU FONDO DE INVERSIONES DE TERUEL

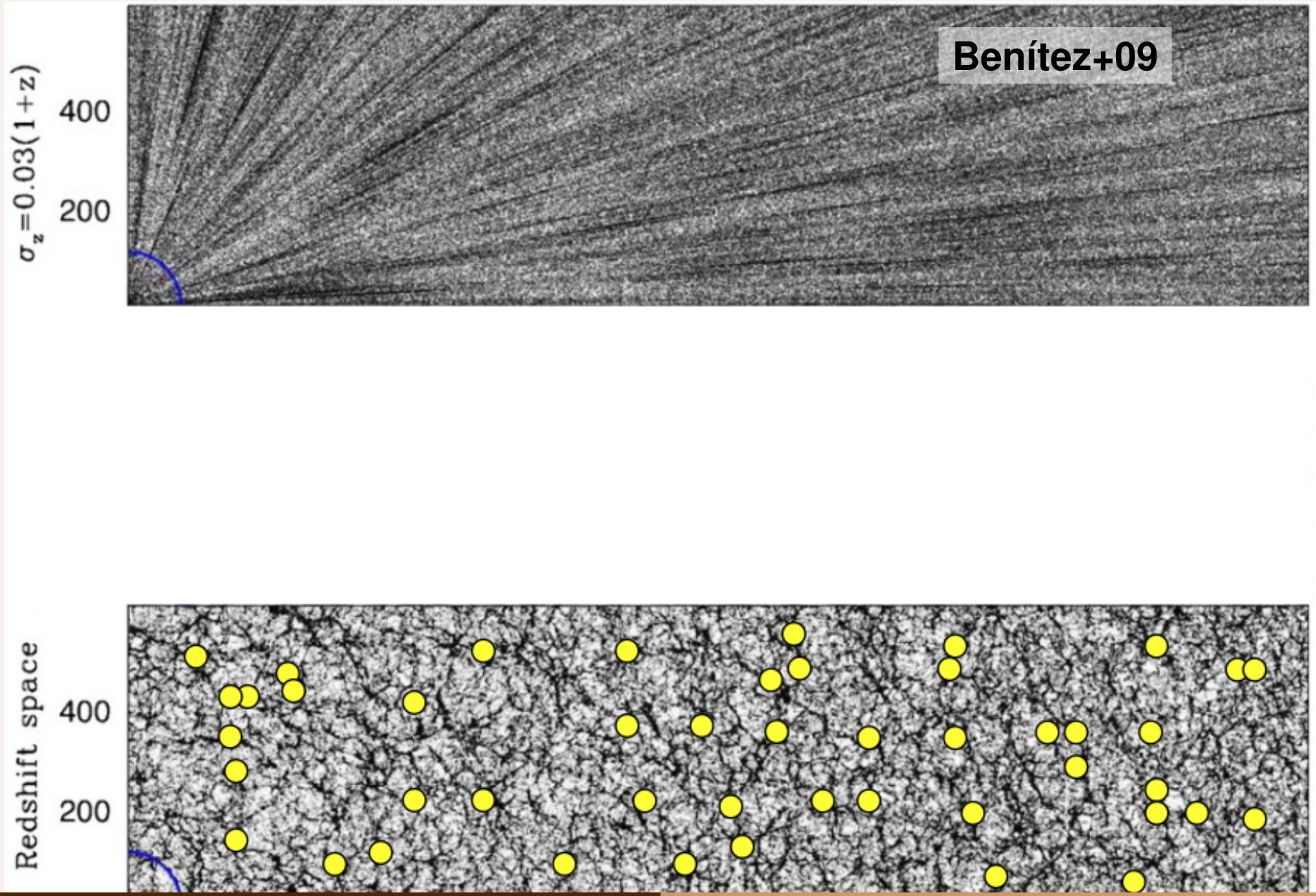
The accelerating Universe



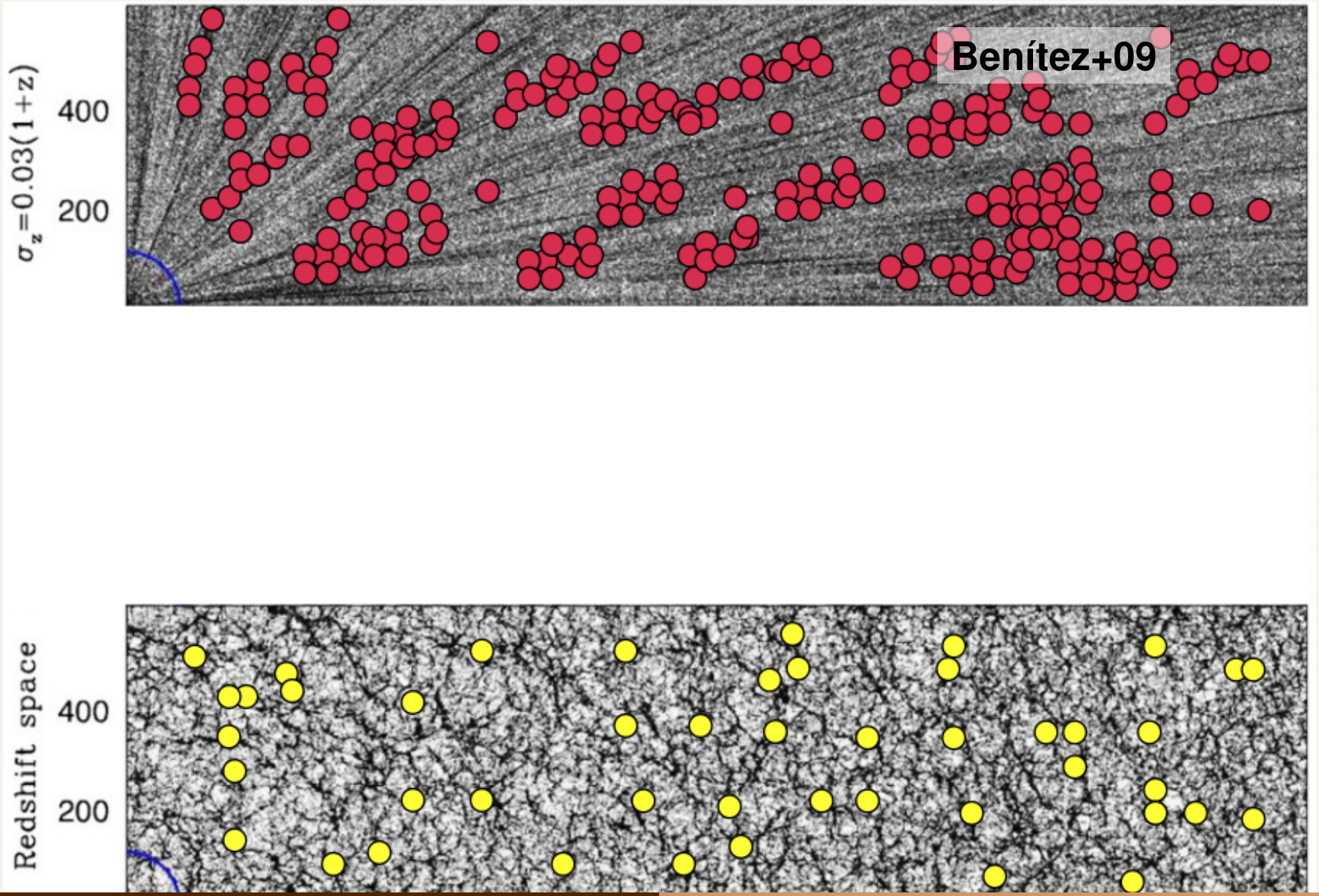
Iluminating the dark sector



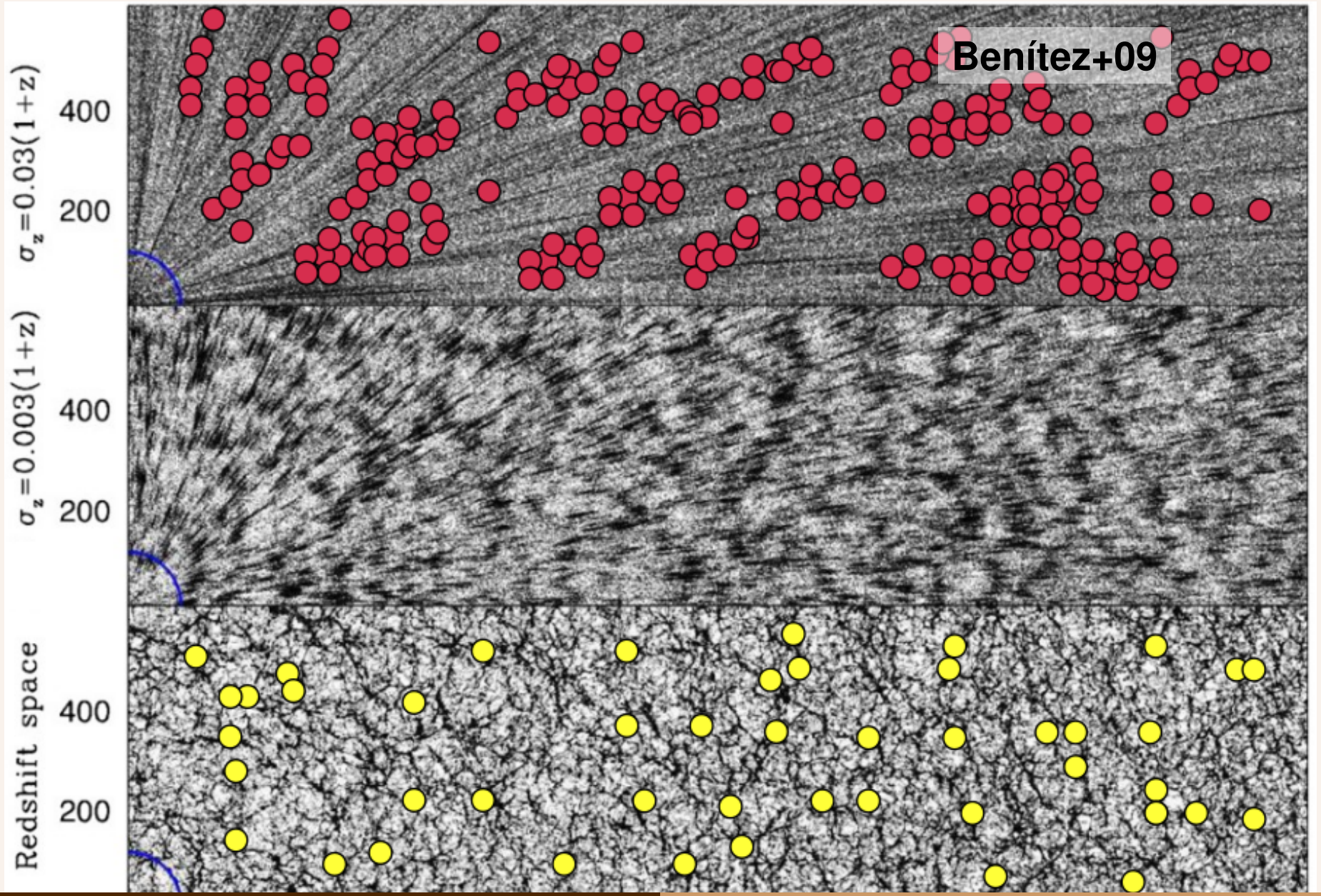
Iluminating the dark sector



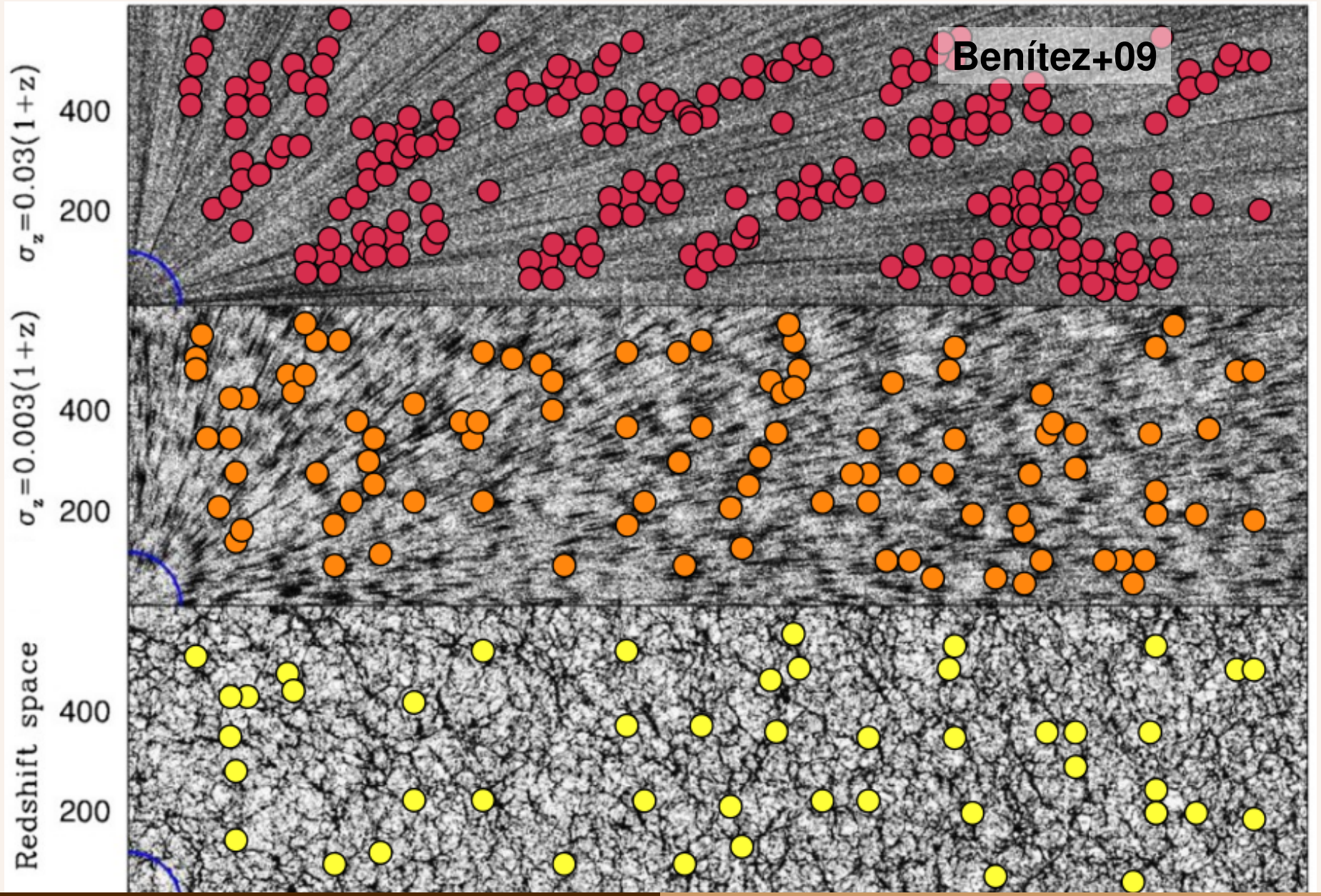
Iluminating the dark sector



Iluminating the dark sector



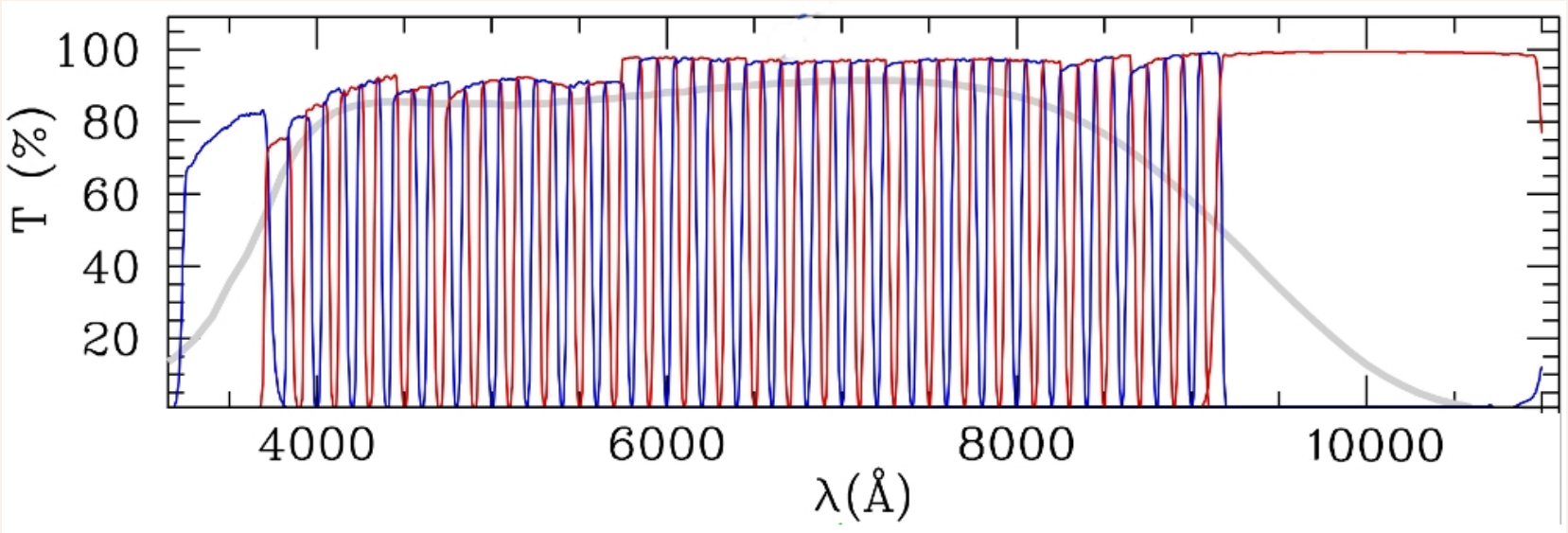
Iluminating the dark sector



J-PAS

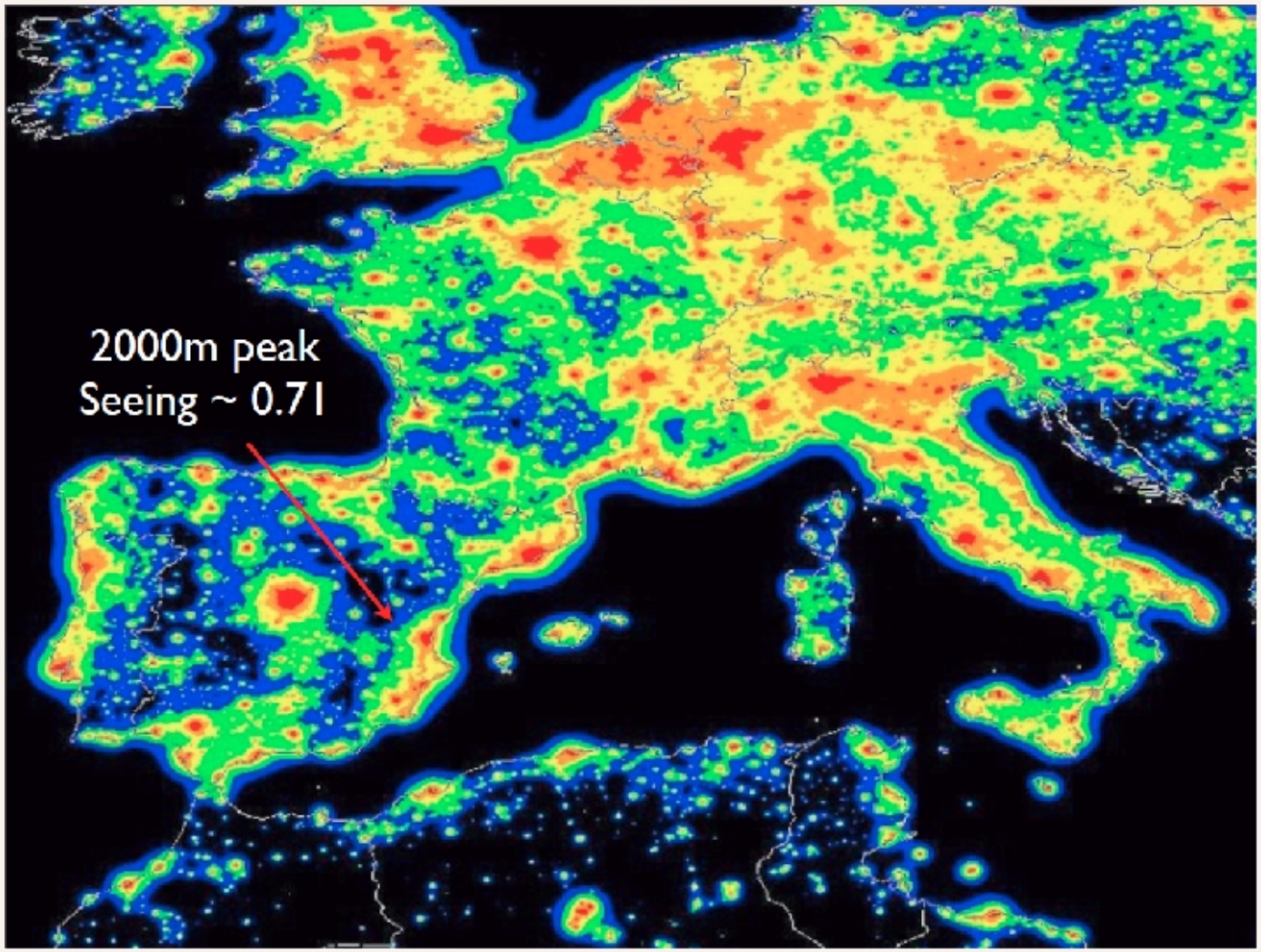
Javalambre **P**hysics of the accelerating Universe **A**strophysical **S**urvey

(Benítez+14, Bonoli+21; `j-pas.org`)



54 filters of 140 Å separated by 100 Å to get $\sigma_z = 0.3\%$
To ensure volume and source density: 8 000 deg^2 down to $m = 22.5$ mag.

Observatorio Astrofísico de Javalambre (OAJ)



Dark site (no light pollution) with a competitive seeing (median of 0.71″; Moles et al. 2008).

Observatorio Astrofísico de Javalambre (OAJ)

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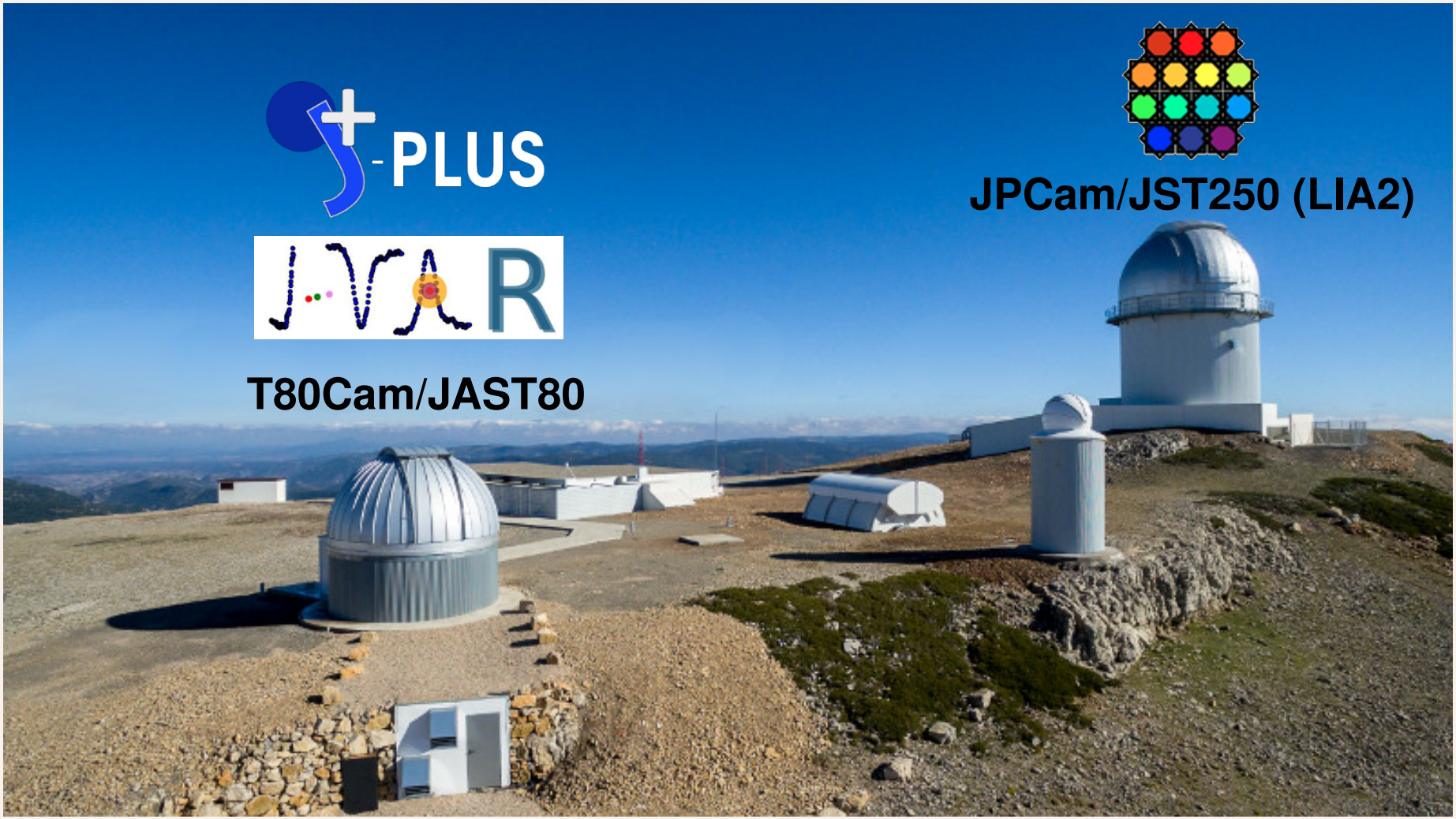
Observatorio Astrofísico de Javalambre (OAJ)



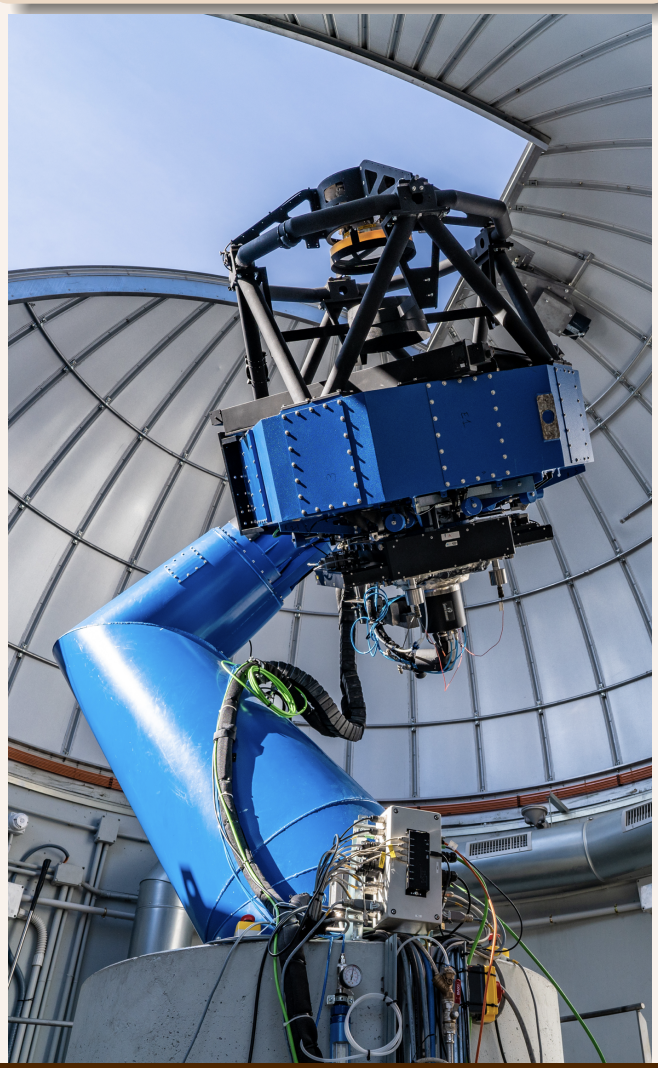
Observatorio Astrofísico de Javalambre (OAJ)

UPAD (Unidad de Procesado y Archivo de Datos; LIA8)

Javalambre Auxiliary Survey Telescope

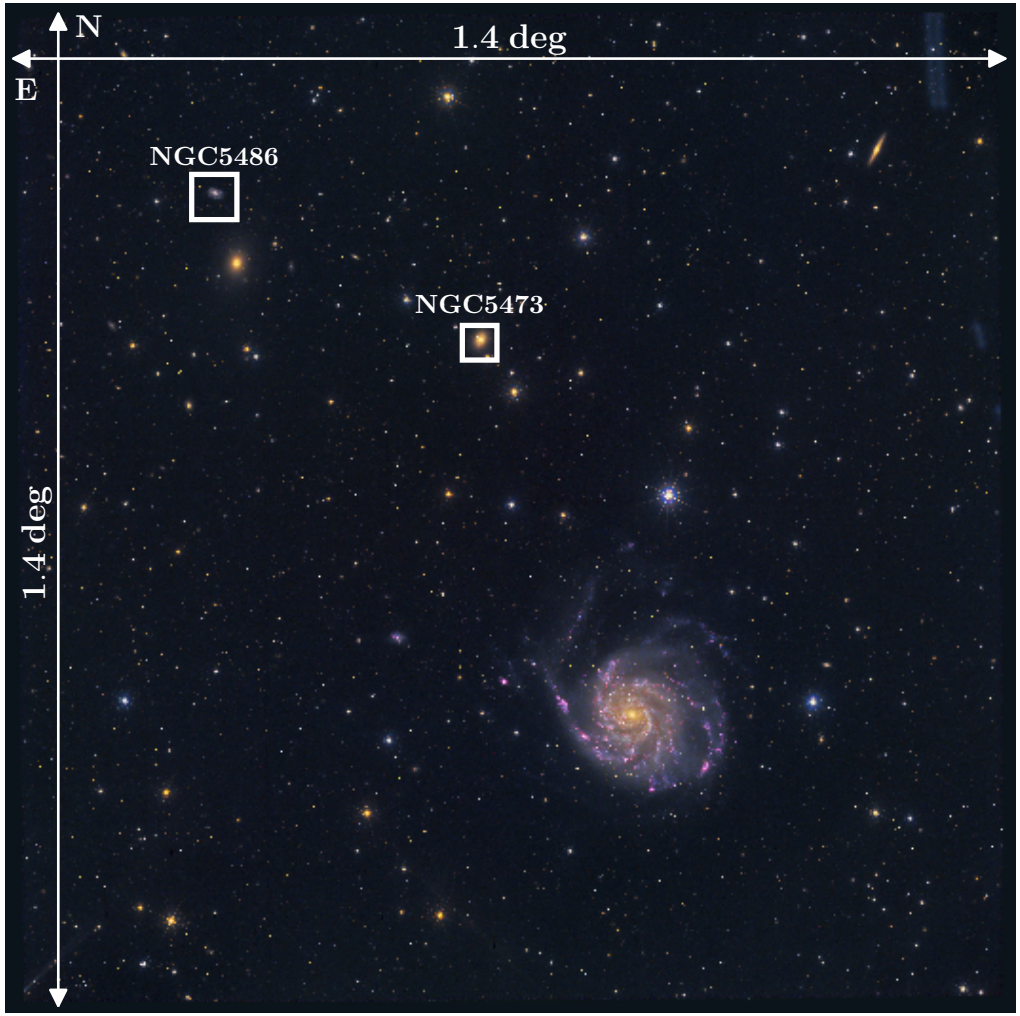
JAST80

M1 (⌀) = 0.83 m

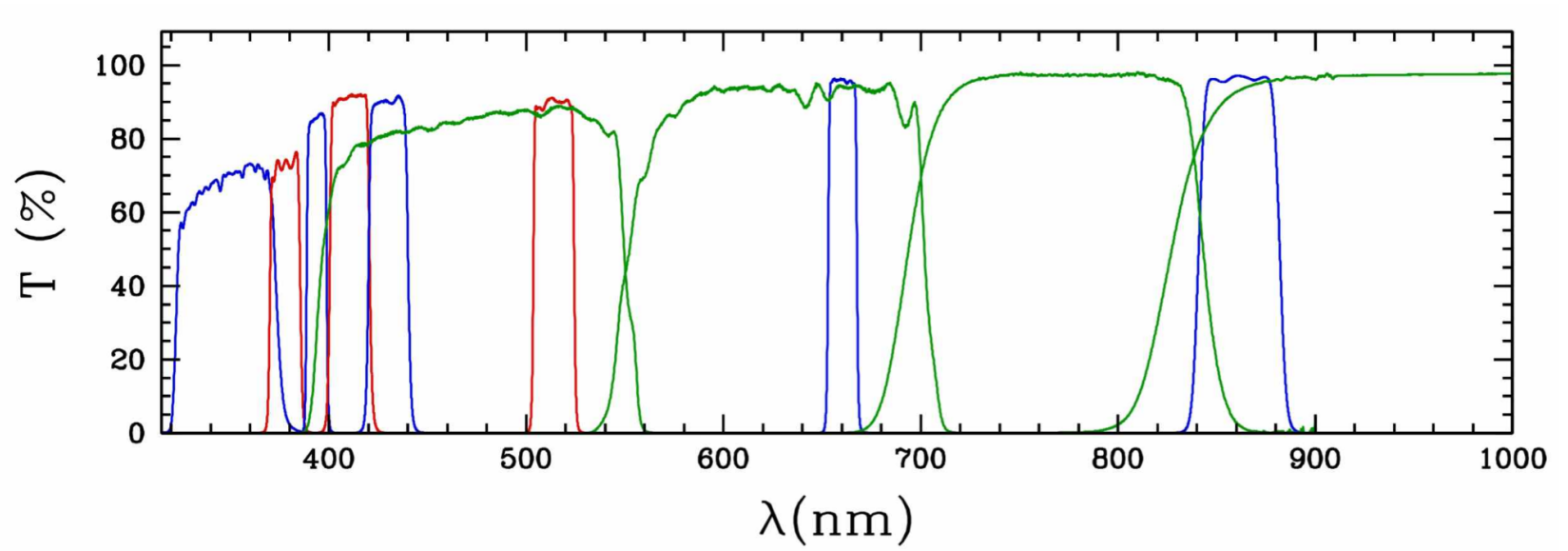


T80Cam

CCD = 9200 × 9200 pixels and FoV = 2 deg^2



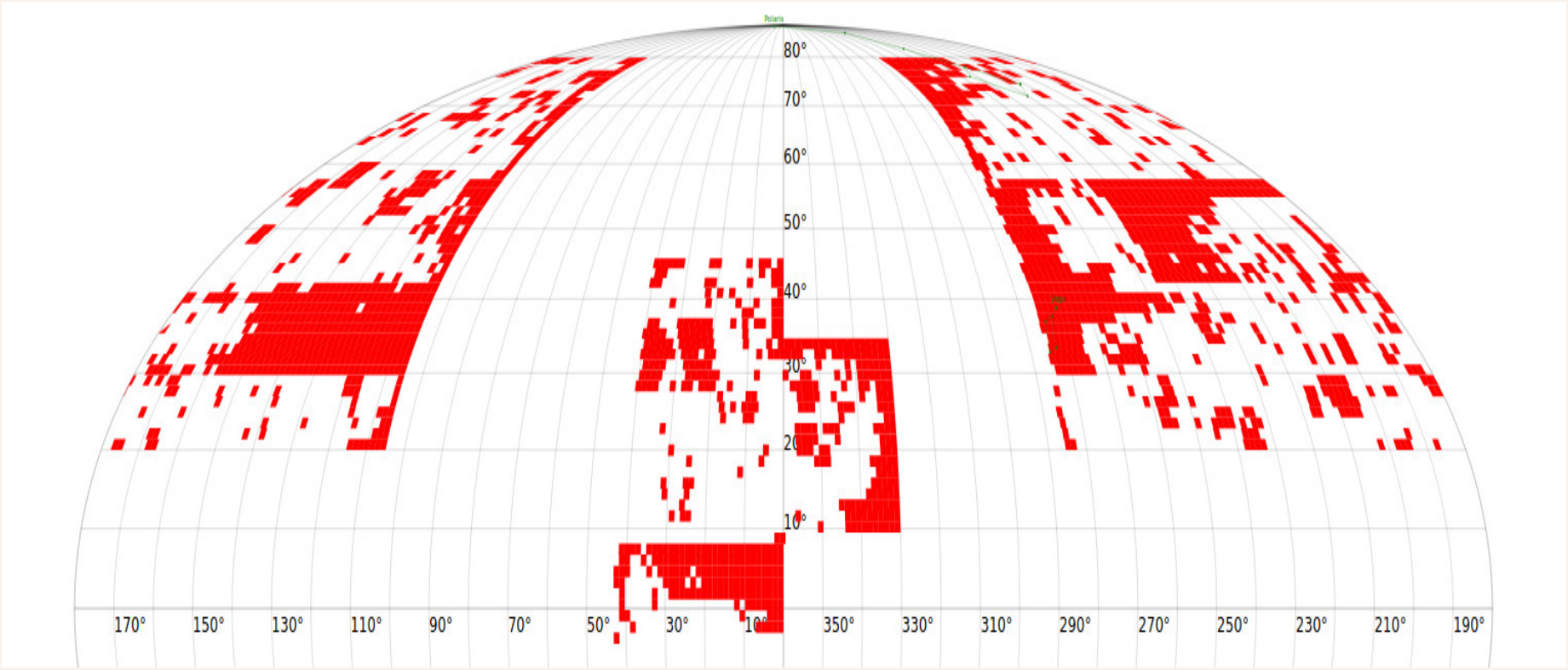
Filter System



Filter	λ (nm)	$\Delta\lambda$ (nm)	J-PLUS/ J-VAR
u	348.5	50.8	X /
g	483.0	140.9	X / X
r	625.4	138.8	X / X
i	766.8	153.5	X / X
z	911.4	140.9	X /

Filter	λ (nm)	$\Delta\lambda$ (nm)	Note	J-PLUS/ J-VAR
*J*0378	378.5	16.8	[OII]	X /
*J*0395	395.0	10.0	Ca H+K	X / X
*J*0410	410.0	20.0	Hδ	X /
*J*0430	430.0	20.0	G-band	X /
*J*0515	515.0	20.0	Mbg Triplet	X / X
*J*0660	660.0	14.5	Hα	X / X
*J*0861	861.0	40.0	Ca Triplet	X / X

J-PLUS sky coverage



J-PLUS

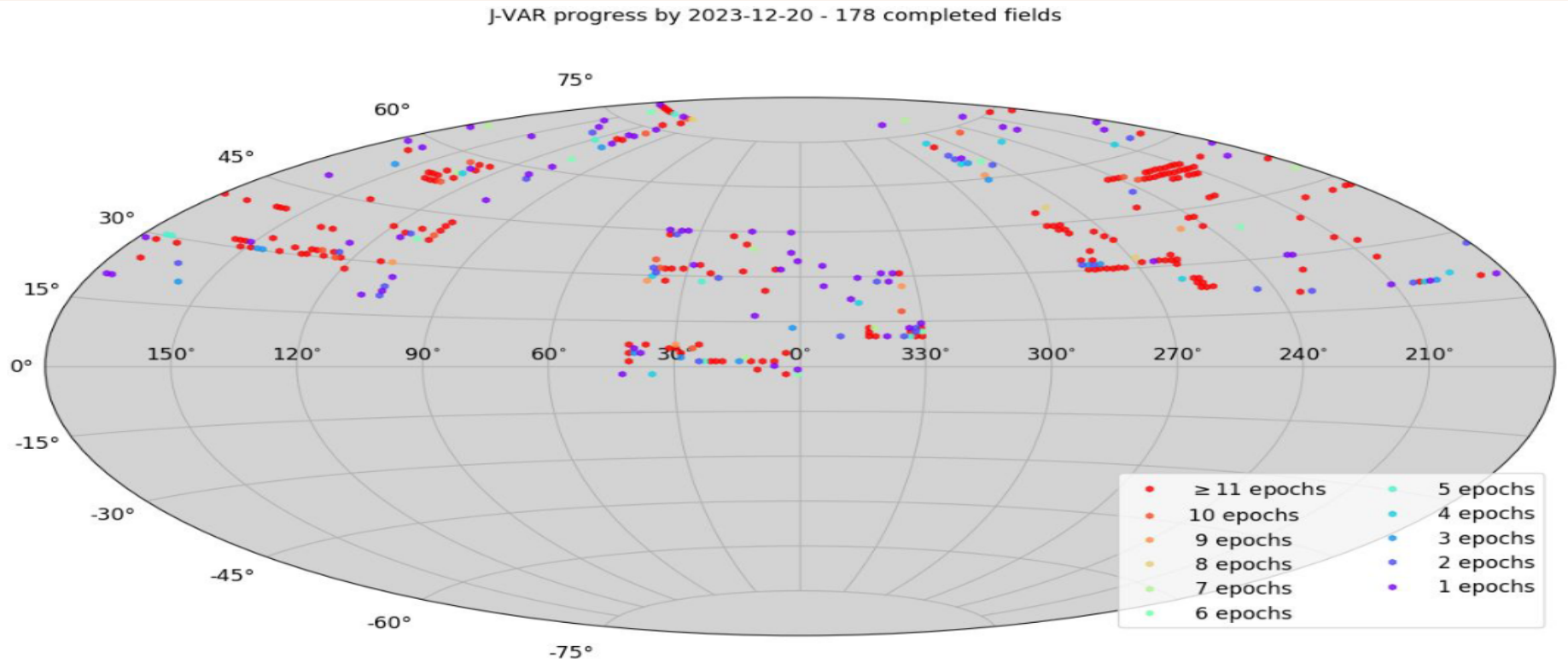
Cenarro+19

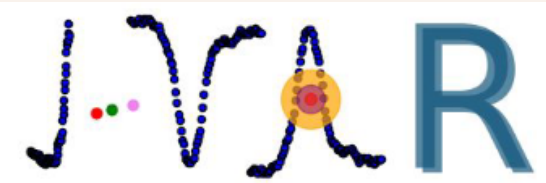
DR3 : 3 284 deg^2 in December 2022

Today : $\sim$ 4 800 deg^2

35 papers at international journals.

J-VAR sky coverage





Ederoclite at al., in prep.

Observations in cloudy / large seeing / bright nights.
At least 33 epochs in 7 filters.

DR1 : $\sim$ 202 **deg^2 in July 2024**.

Several papers in preparation.

Javalambre Survey Telescope

JST250

M1 ($\varnothing$) = 2.55 m

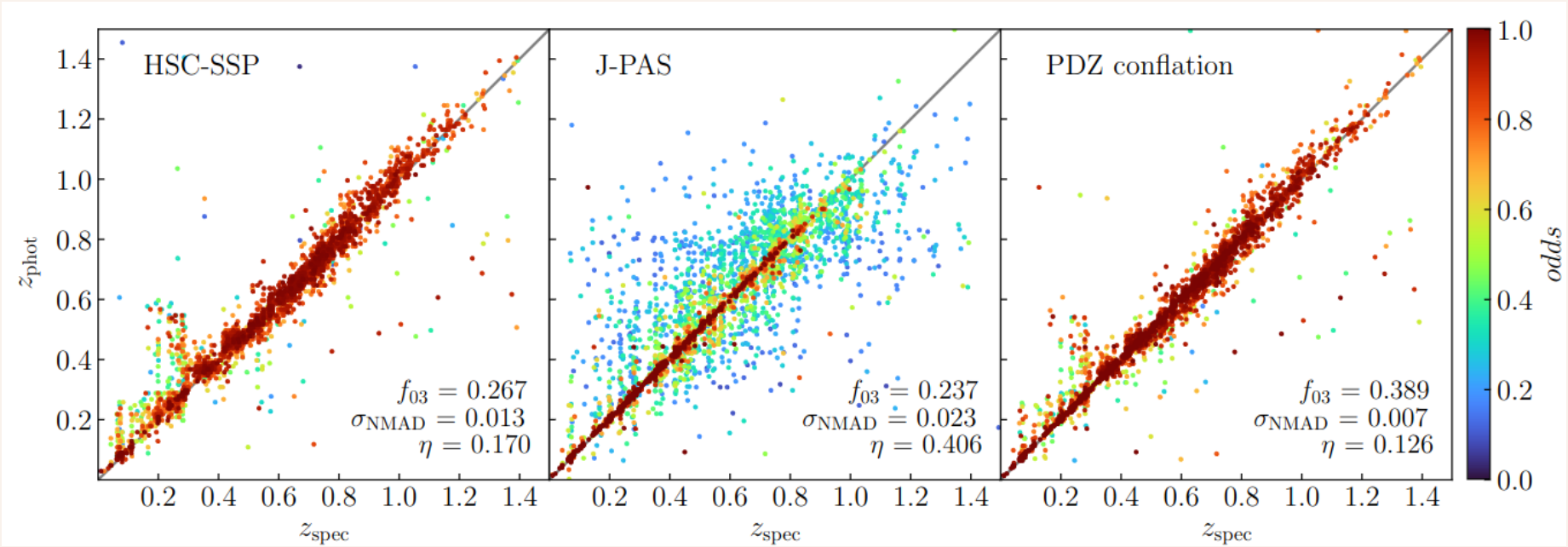
JPAS Pathfinder

Interim camera in 2018-2019

CCD = 9200 $\times$ 9200 pixels
FoV = 0.25 deg^2

J-PAS

MiniJPAS (1 deg^2, Bonoli+21)
J-NEP (0.25 deg^2, Hernán-Caballero+23)



J-PAS validation: 40% galaxies with $\sigma_z = 0.3\%$ at $i < 22.5$ mag.
(Hernán-Caballero+21,23,24; Laur+22).
32 papers at international peer-reviewed journals.

Javalambre Survey Telescope

JST250

M1 ($\varnothing$) = 2.55 m

JPAS Pathfinder

Interim camera in 2018-2019

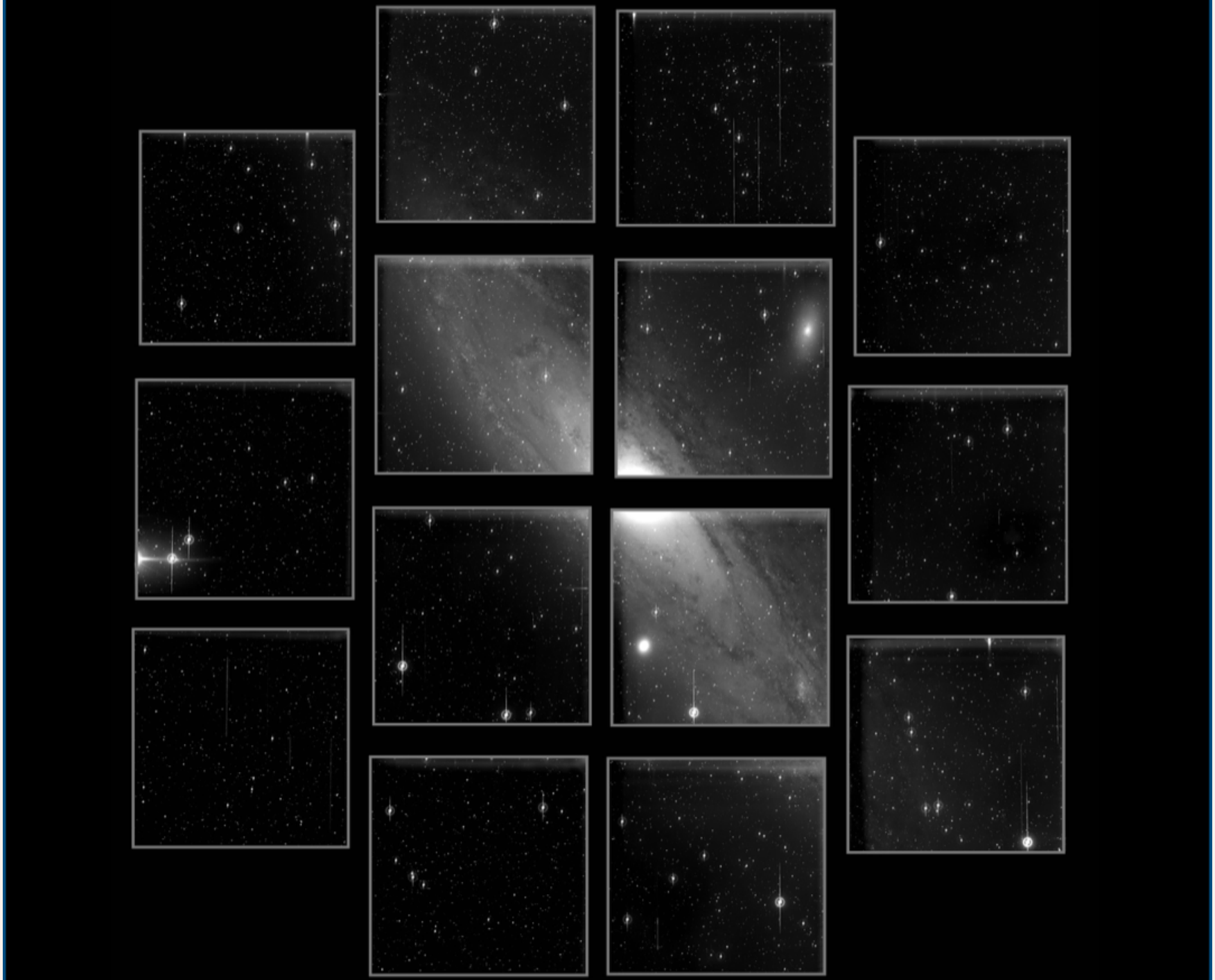
CCD = 9200 $\times$ 9200 pixels
FoV = 0.25 deg^2

JPCam

Final camera installed in 2020

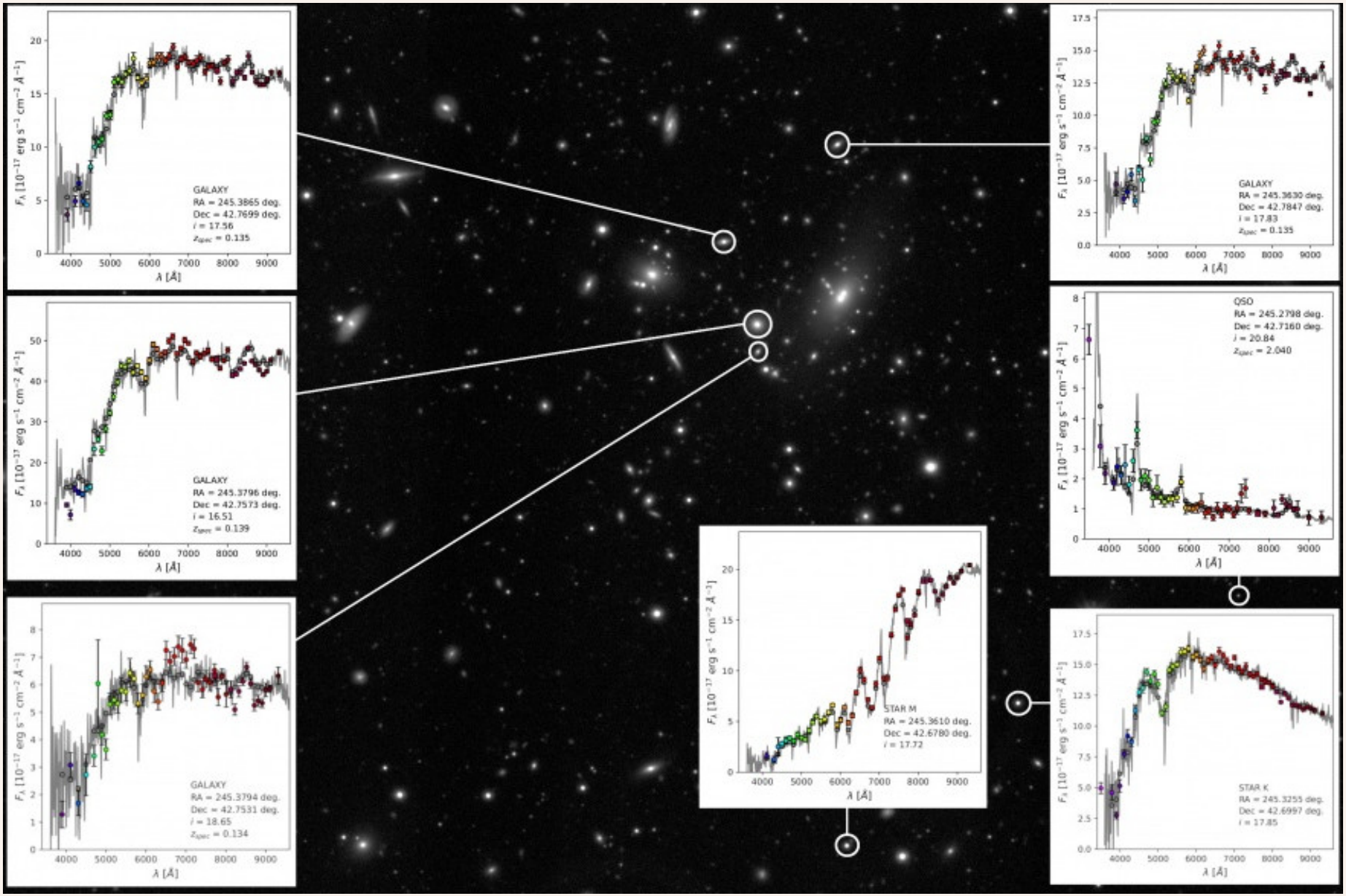
CCD = (14$\times$) 9200 $\times$ 9200 pixels
FoV = 3.4 deg^2 = 14 $\times$ 0.24 deg^2

A. Marín-Franch's talk [15:00]

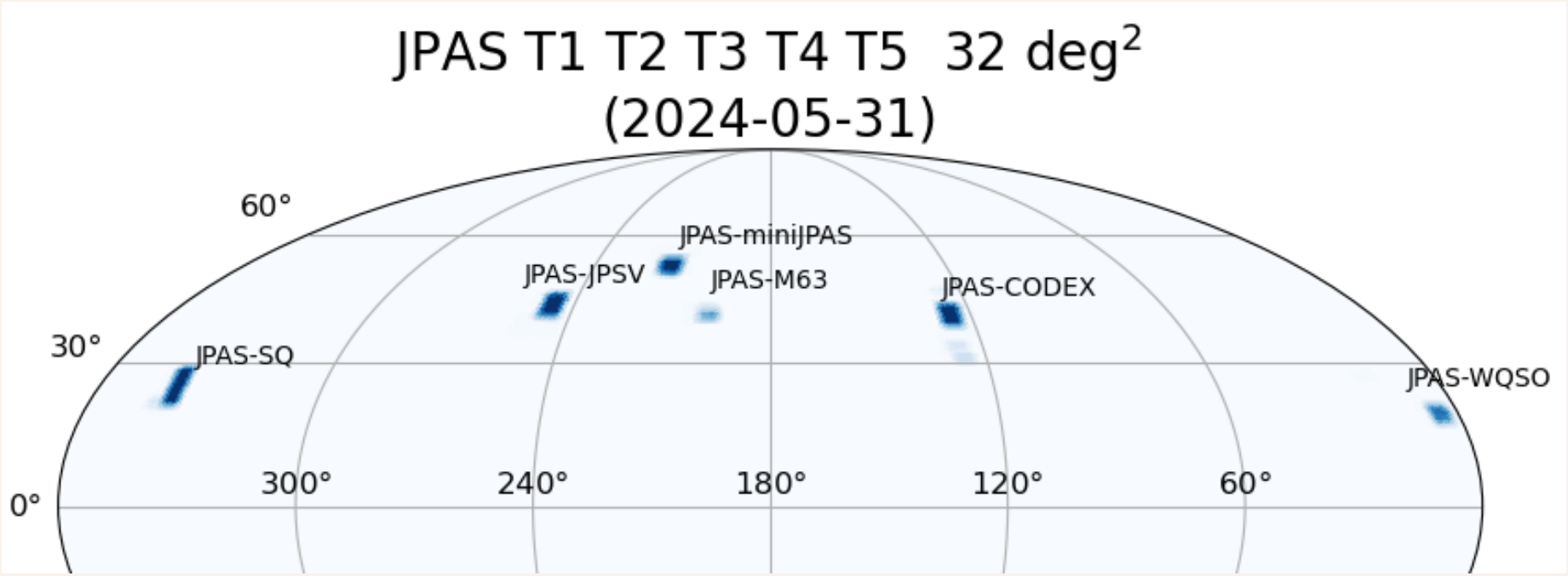


Andromeda Galaxy (M31). Technical First Light Image 29/06/2020. JPCam@JST/T250 - Observatorio Astrofísico de Javalambre (OAJ)

The J-PAS awakening



J-PAS sky coverage



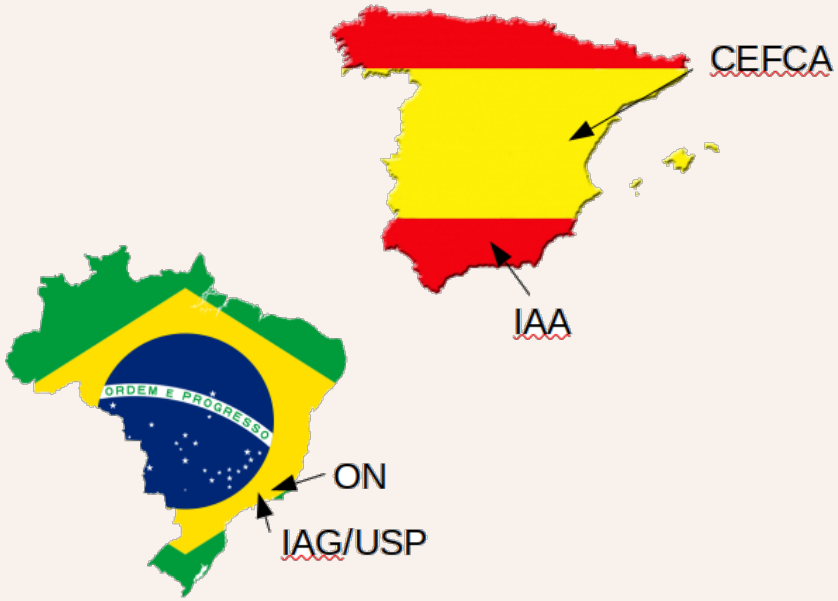
All the filters : 32 deg^2.
Each filter : 110 – 160 deg^2.

J-PAS DR1 is expected in November 2024.

J-PAS meets PPCC

J-PAS collaboration

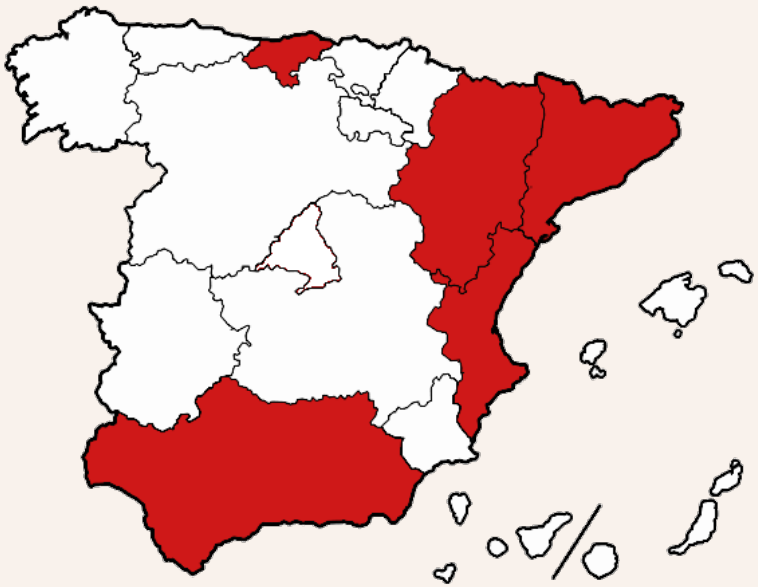
More than 150 researchers from **Spain, Brazil**, Estonia, China, etc.



J-PAS meets PPCC

Linea de Actuacion: LIA4 - Large astronomical surveys

Andalucía, Aragón, Cantabria, Cataluña, C. Valenciana.

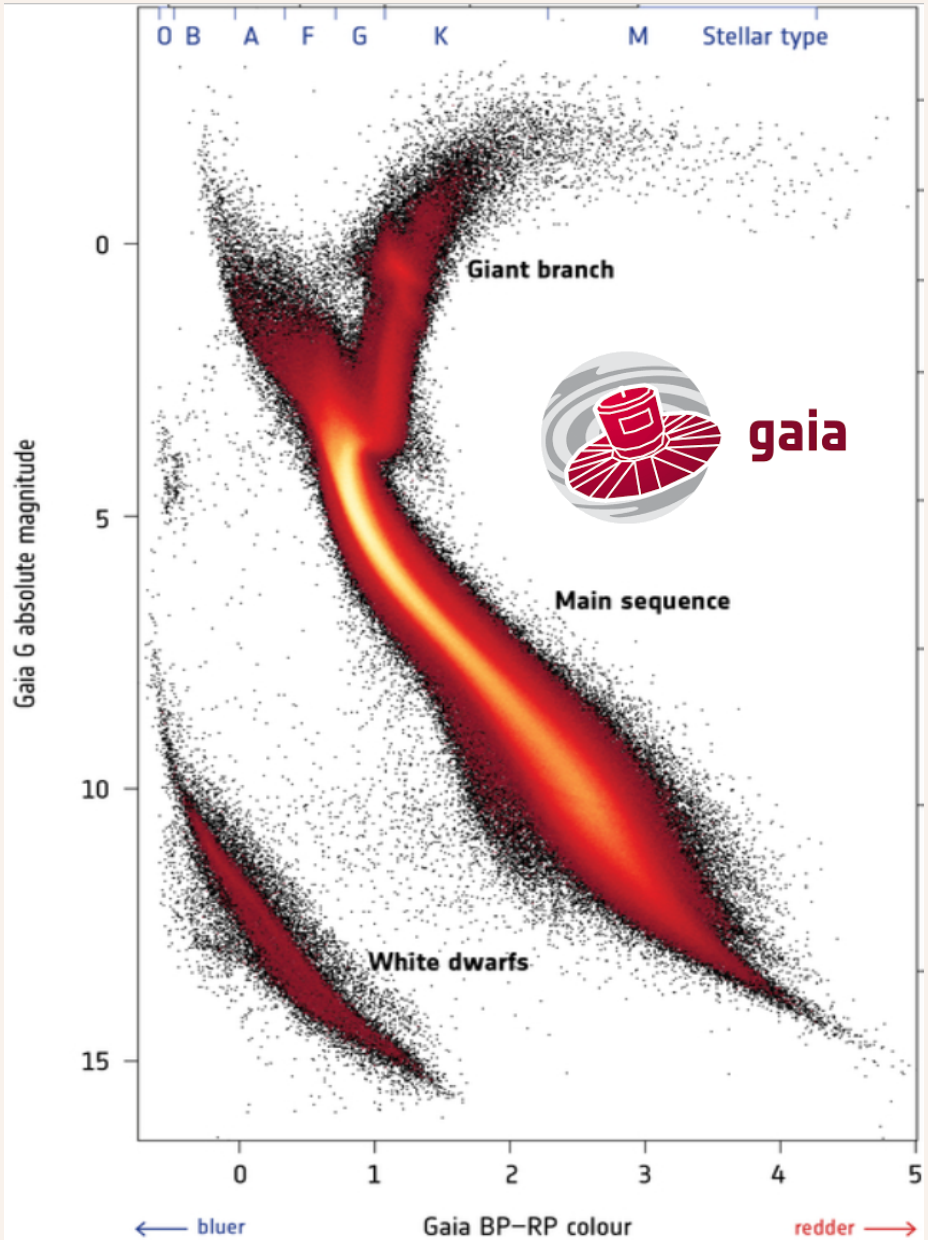


Minor bodies of the Solar System

Asteroids appear as moving objects in J-PLUS and J-VAR images.
Detection, taxonomy (Morate+21), and rotation curves.

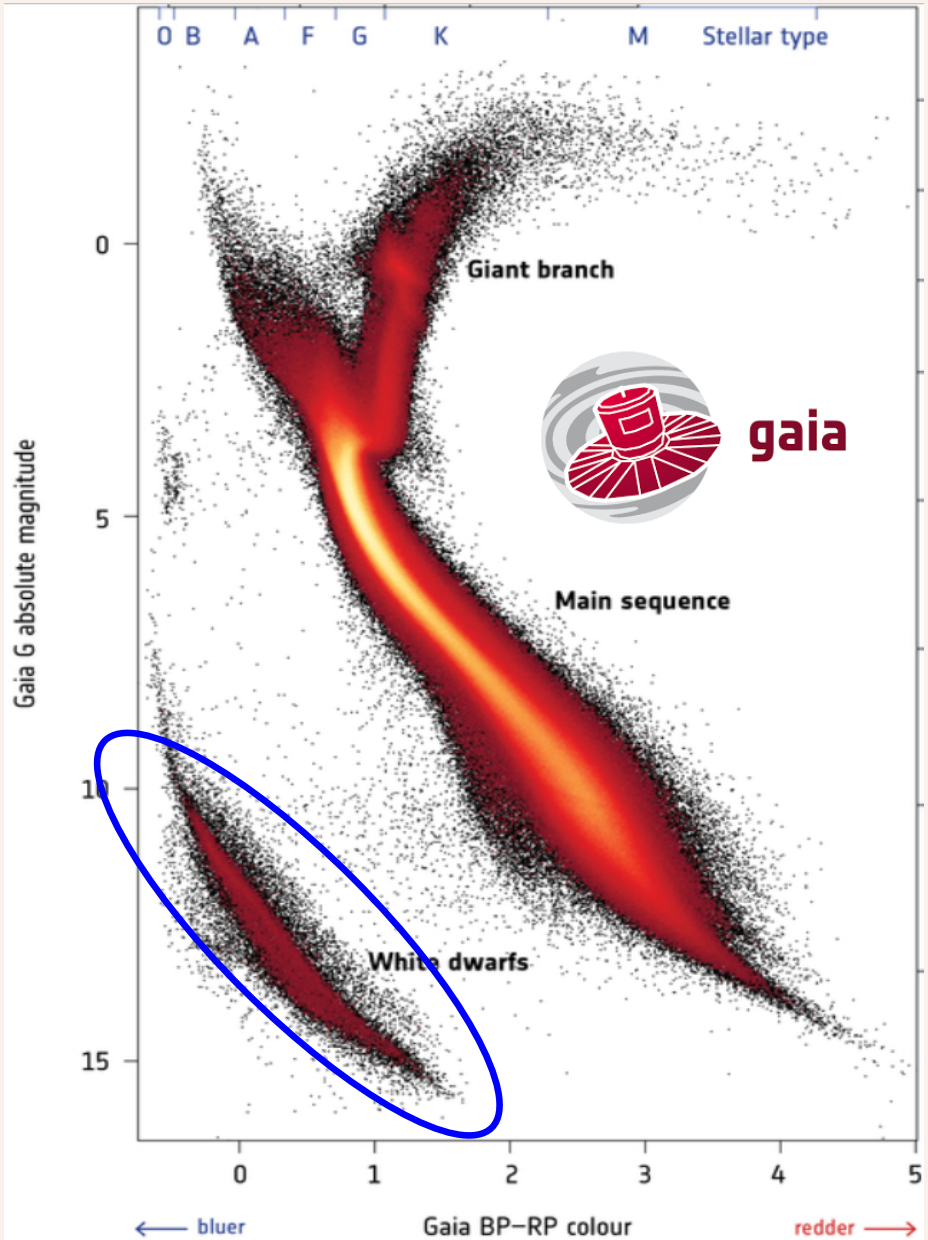
D. Morate (CEFCA, postdoc), PPCC funding. Talk at 17:30.

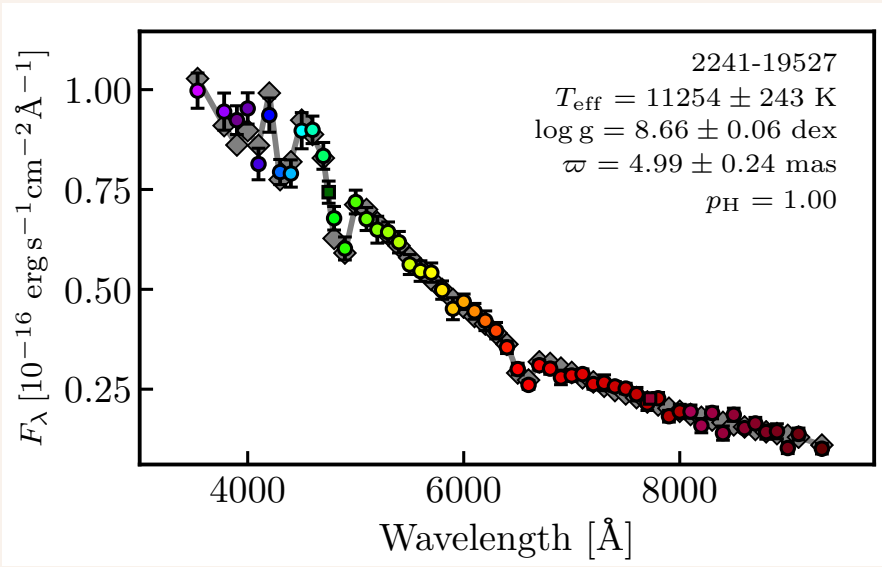
Milky Way stars



Sinergies with Gaia satellite.
Creation of a Gaia + J-PLUS merged catalog (PPCC funding).

Milky Way stars



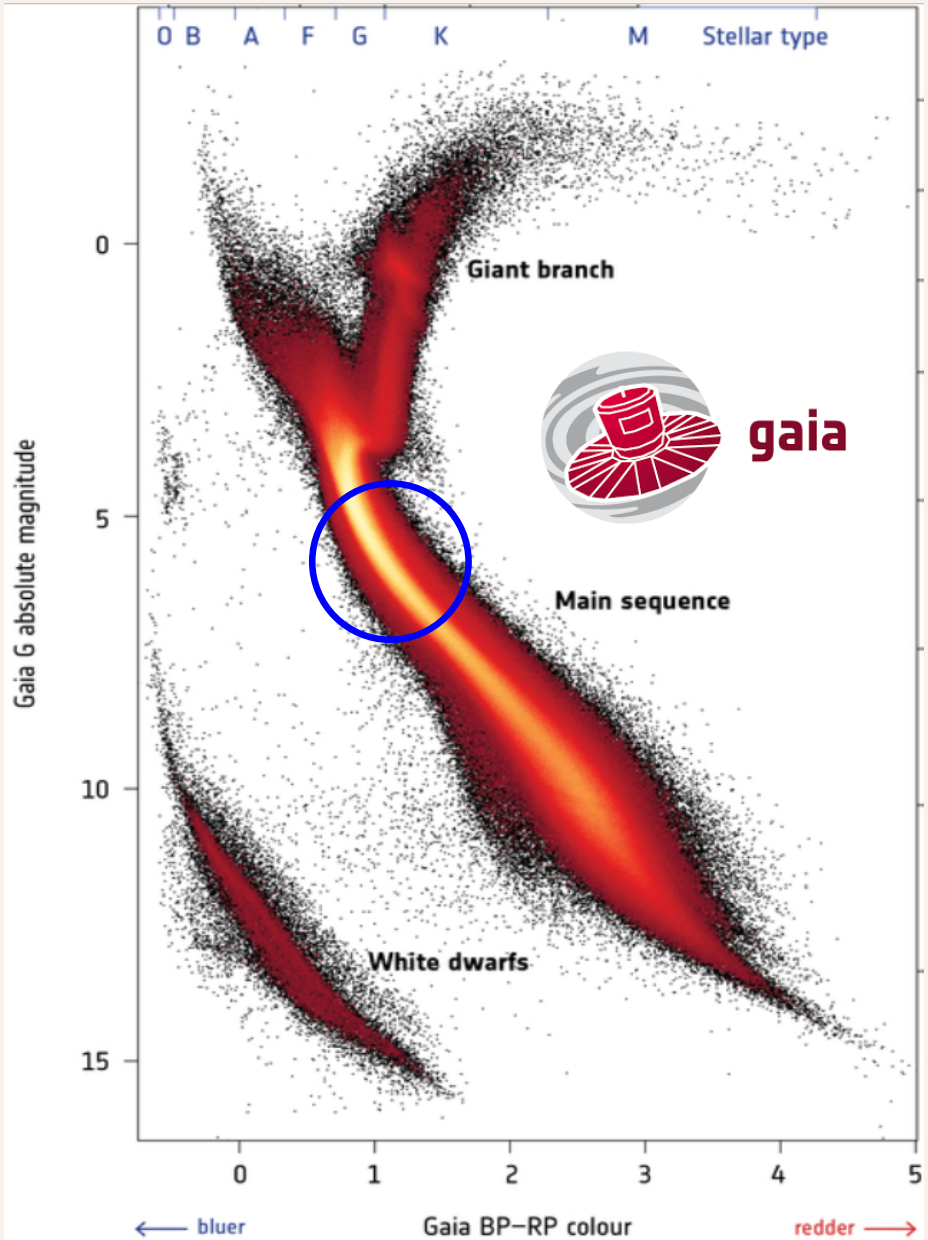


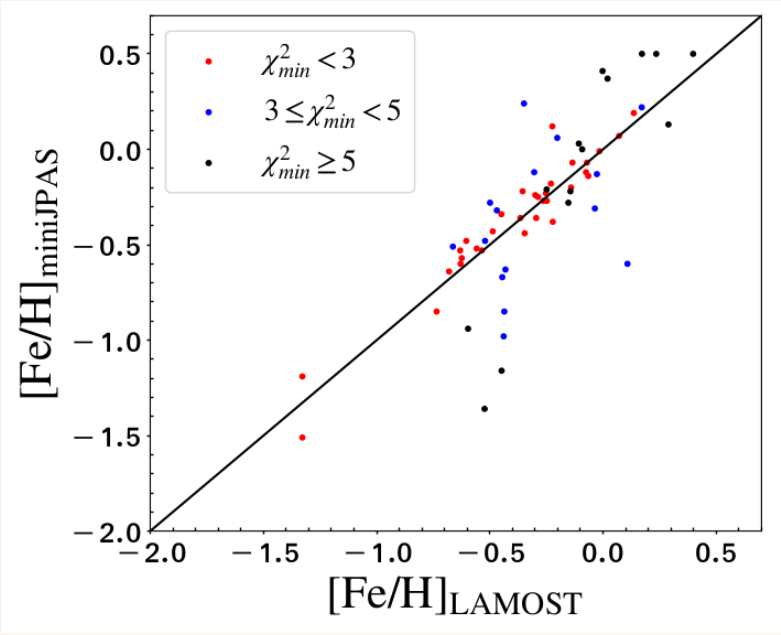
López-Sanjuan+22b (CEFCA)

Analysis of the white dwarf population in J-PLUS and miniJPAS. (López-Sanjuan+22ab).

White dwarfs are used in the photometric calibration. (López-Sanjuan+19,21,24).

Milky Way stars





Yuan+23

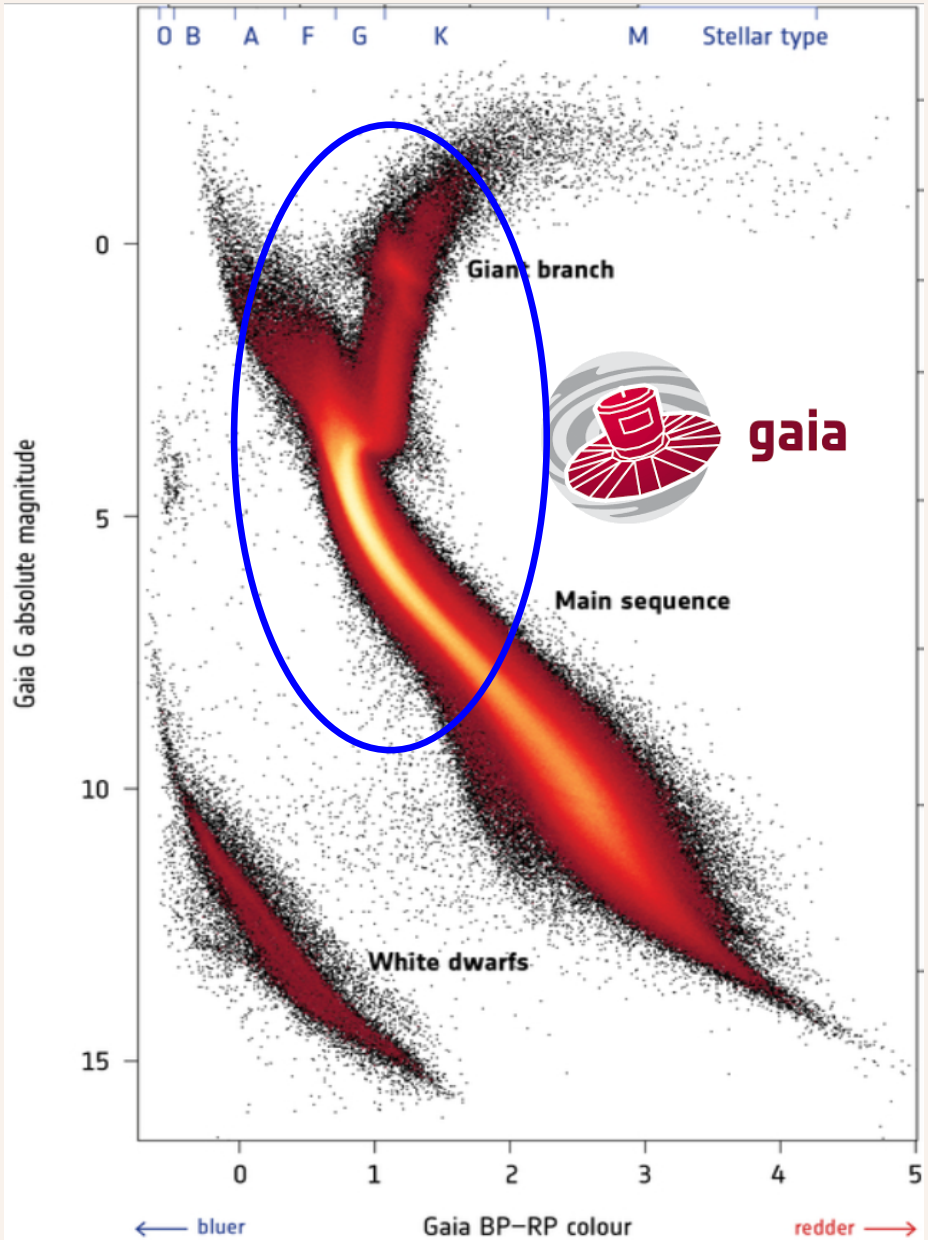
Stellar parameters with machine learning and SED fitting:

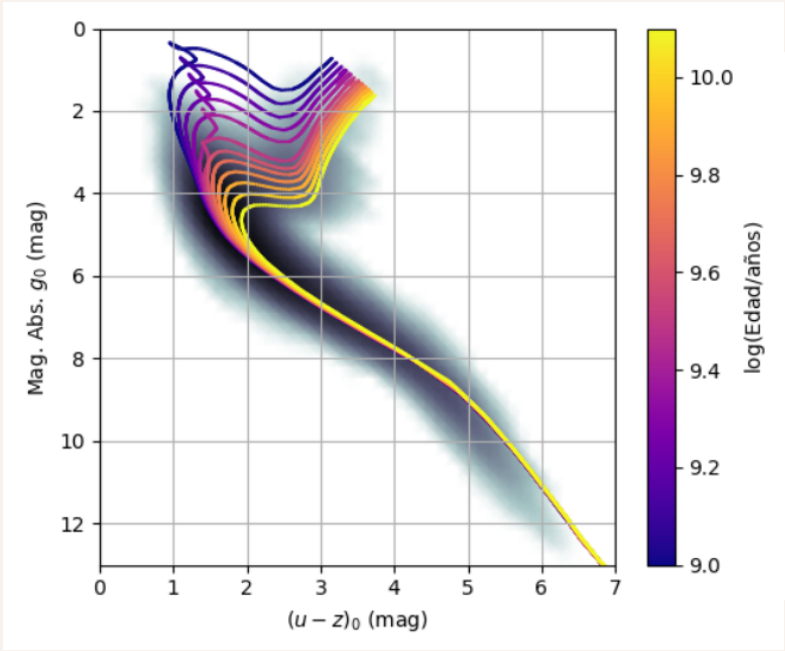
$\sigma_{T_{\rm eff}} \sim 50$ K

$\sigma_{\rm [Fe/H]} \sim 0.1$ dex

(Whitten+19, Galarza+22, Yang+22, Wang+22, Yuan+23).

Milky Way stars



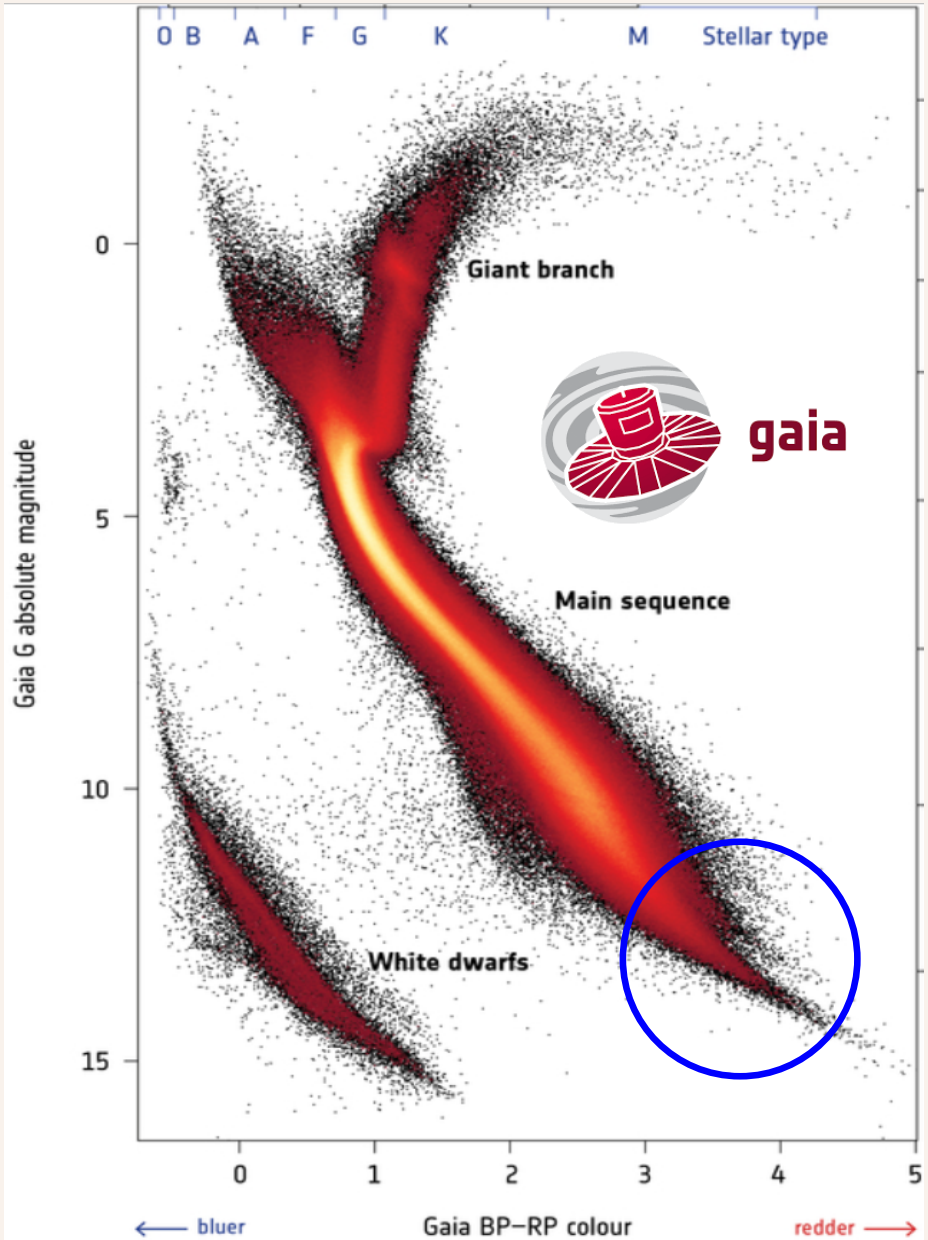


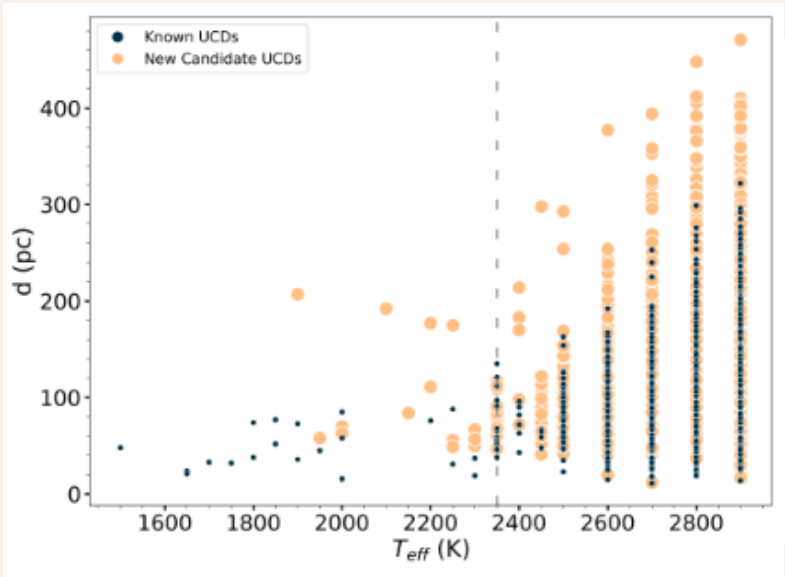
Alzate+, in prep. (CEFCA)

Star formation history of the Galaxy by isochrone fitting.

J. Alzate (CEFCA, postdoc)
PPCC funding
Talk at 17:15.

Milky Way stars



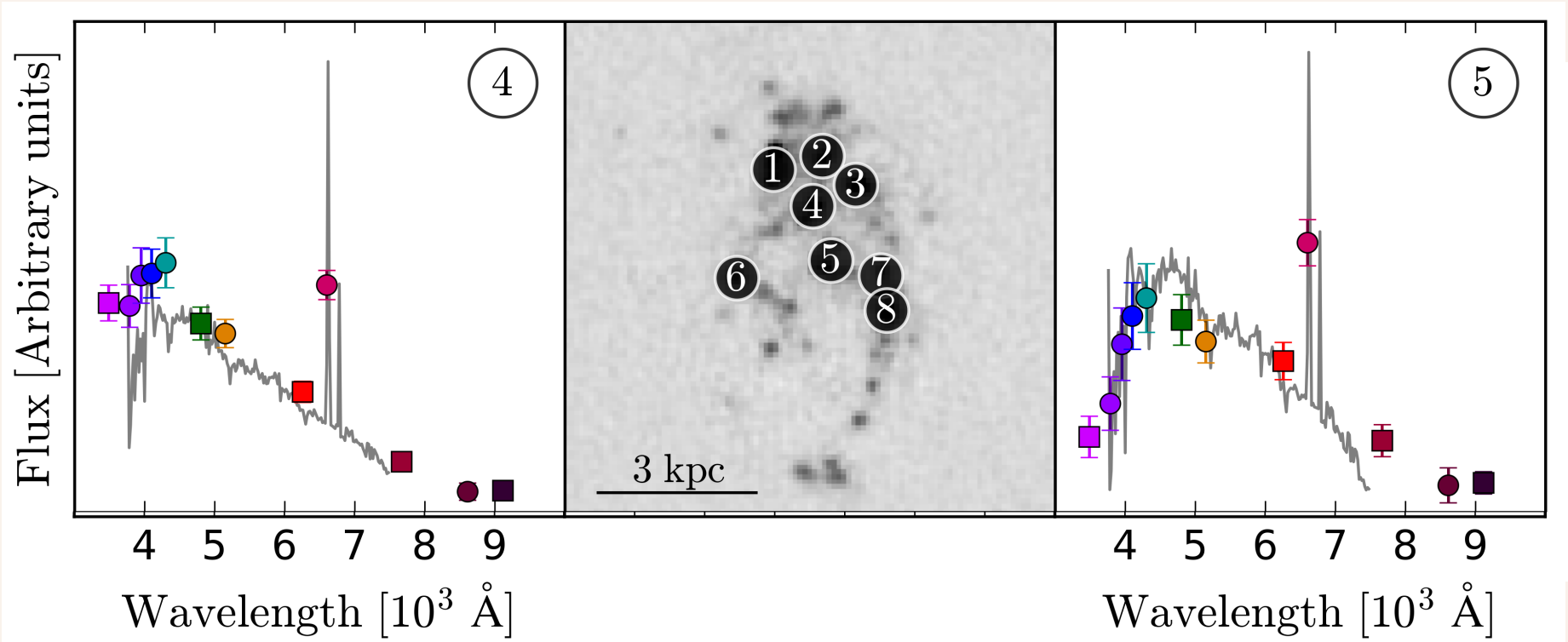


Mas-Buitrago+22 (CAB)

Analysis of ultracool dwarfs, including activity from J0660 and J0395.

(Solano+19, Mas-Buitrago+22).

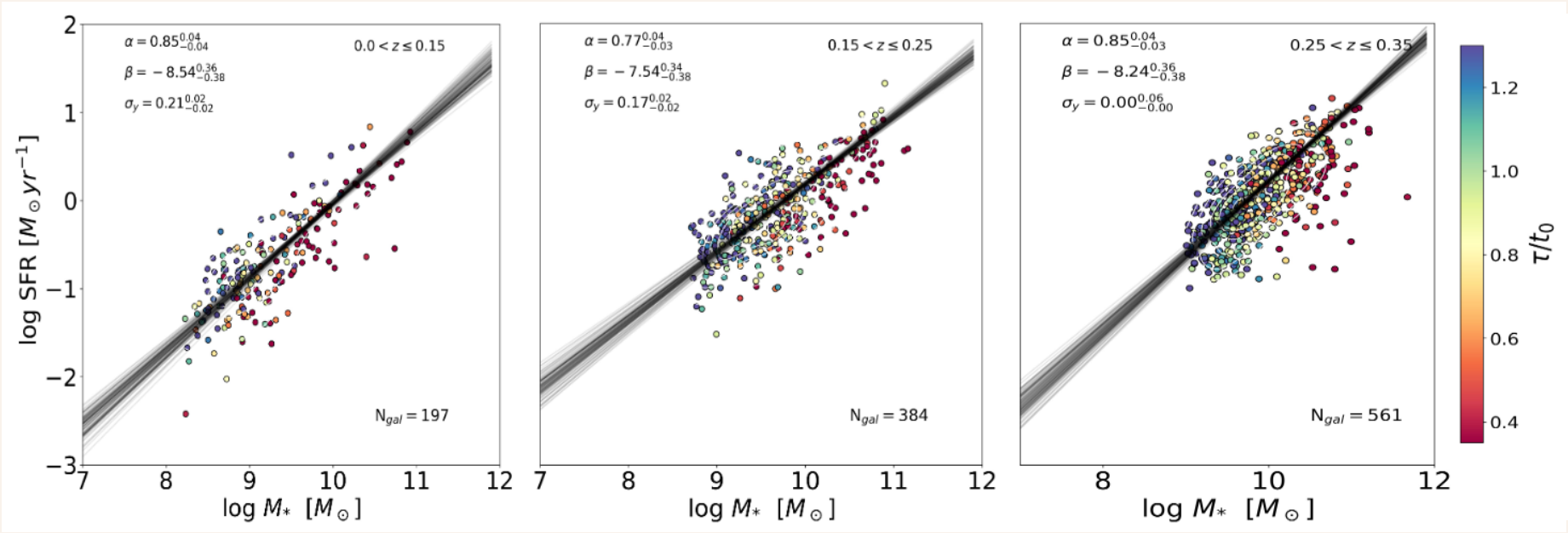
Galaxies in 3D



Spatially resolved studies of star formation and stellar populations.
(Logroño-García+19, San Román+19, González-Díaz+24, Acharya+24).

R. Payyasseri (CEFCA, postdoc), PPCC funding.
2D star formation in J-PLUS DR3.

Star forming galaxies across cosmic time

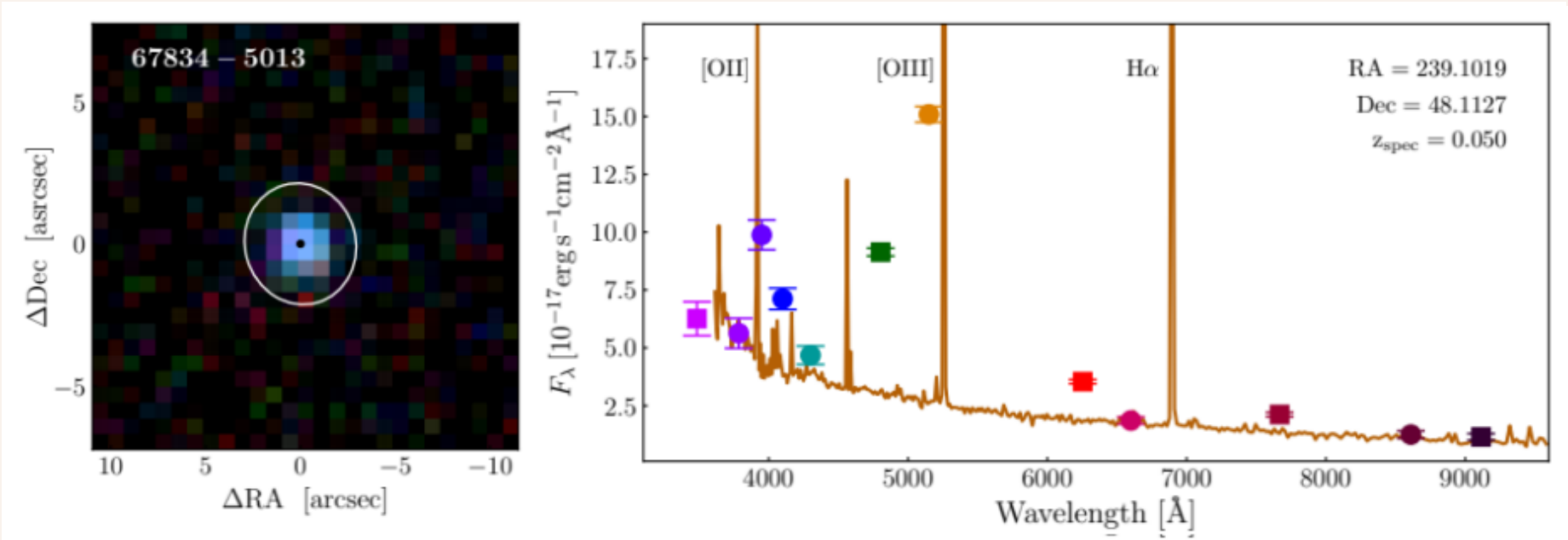


Martínez-Solaeche+22 (IAA)

The star formation main sequence up to z = 0.35
using J-PLUS and miniJPAS.
(Vilella-Rojo+21, Martínez-Solaeche+21,22).

M. Martínez-Solaeche (IAA, postdoc), PPCC funding.
Star formation with machine learning techniques.

Extreme emission line galaxies

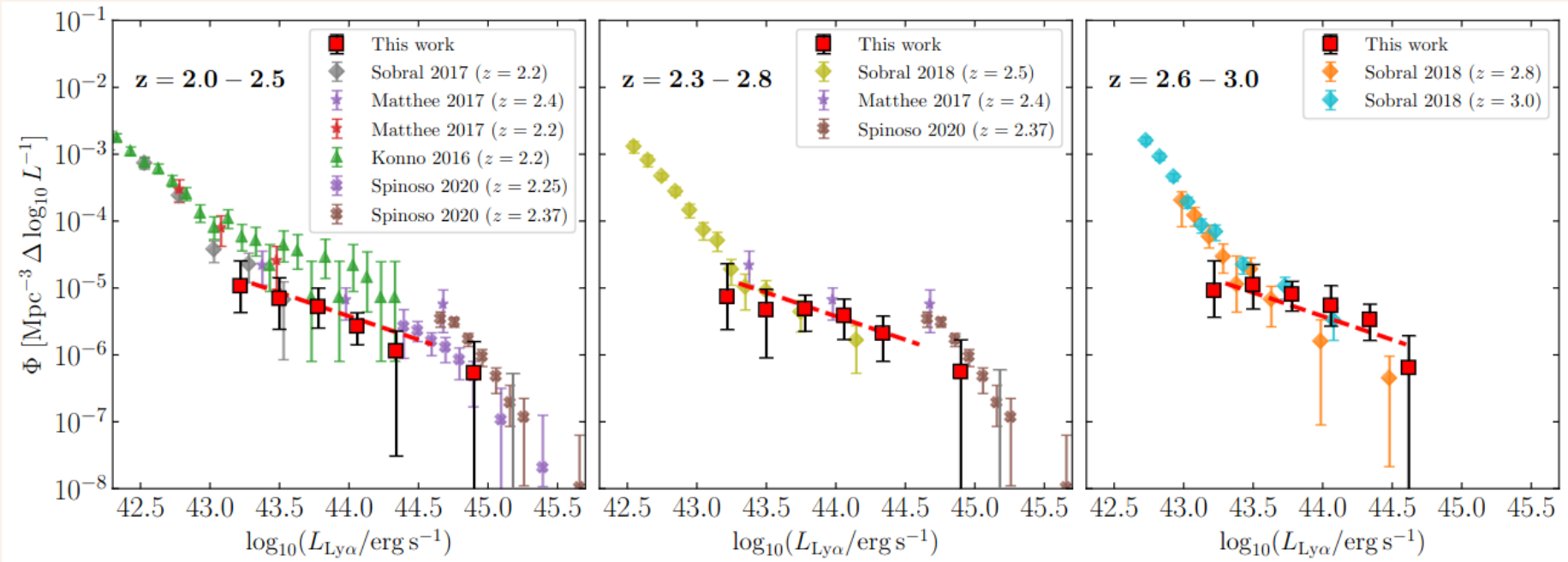


Lumbreras-Calle+22 (CEFCA)

More than 2 000 extreme emission line galaxies at z < 1 (analogues of z > 8 galaxies) using J-PLUS and miniJPAS. (Lumbreras-Calle+22, Iglésias-Páramo+22, Breda+24).

A. Lumbreras-Calle (CEFCA, postdoc), PPCC funding. Talk 16:00.
A. Giménez Alcázar (IAA, predoc), PPCC funding.

Lyα emitters at $z > 2$



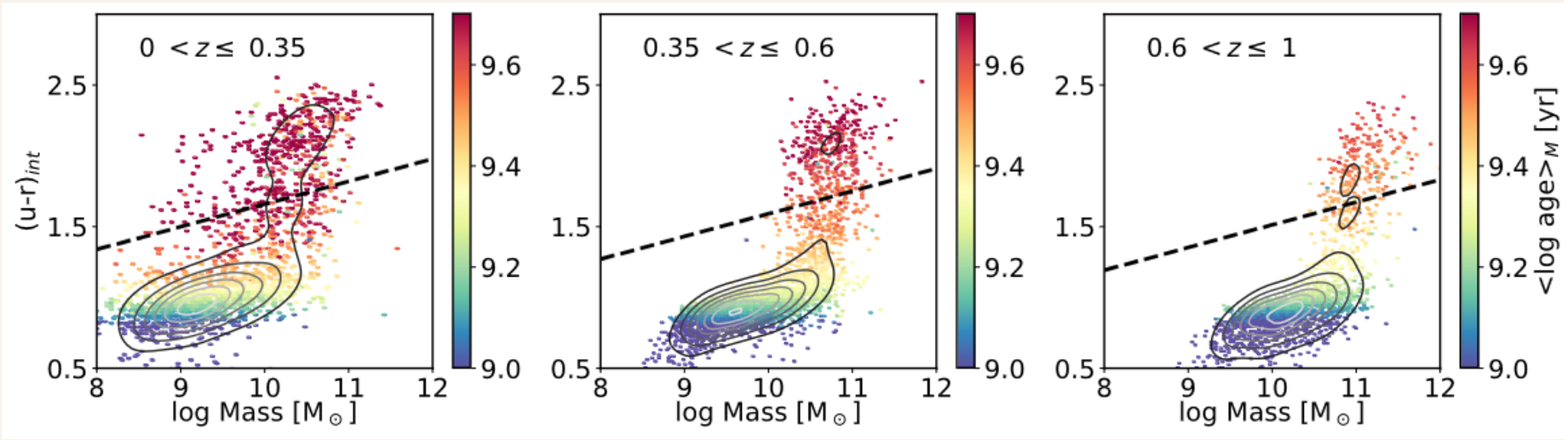
Torralba-Torregrosa+23 (UV)

Detection of Lyα emitters at $z > 2$ and their luminosity function.
(Spinoso+20, Torralba-Torregrosa+23).

Selection of QSOs for WEAVE.
(Queiroz+23, Rodrigues+23, Martínez-Solaeche+23, Pérez-Ràfols+23).

A. Torralba-Torregrosa (UV, predoc), PPCC funding.
S. Gurung-López (UV, postdoc), PPCC funding. Talk 15:30.

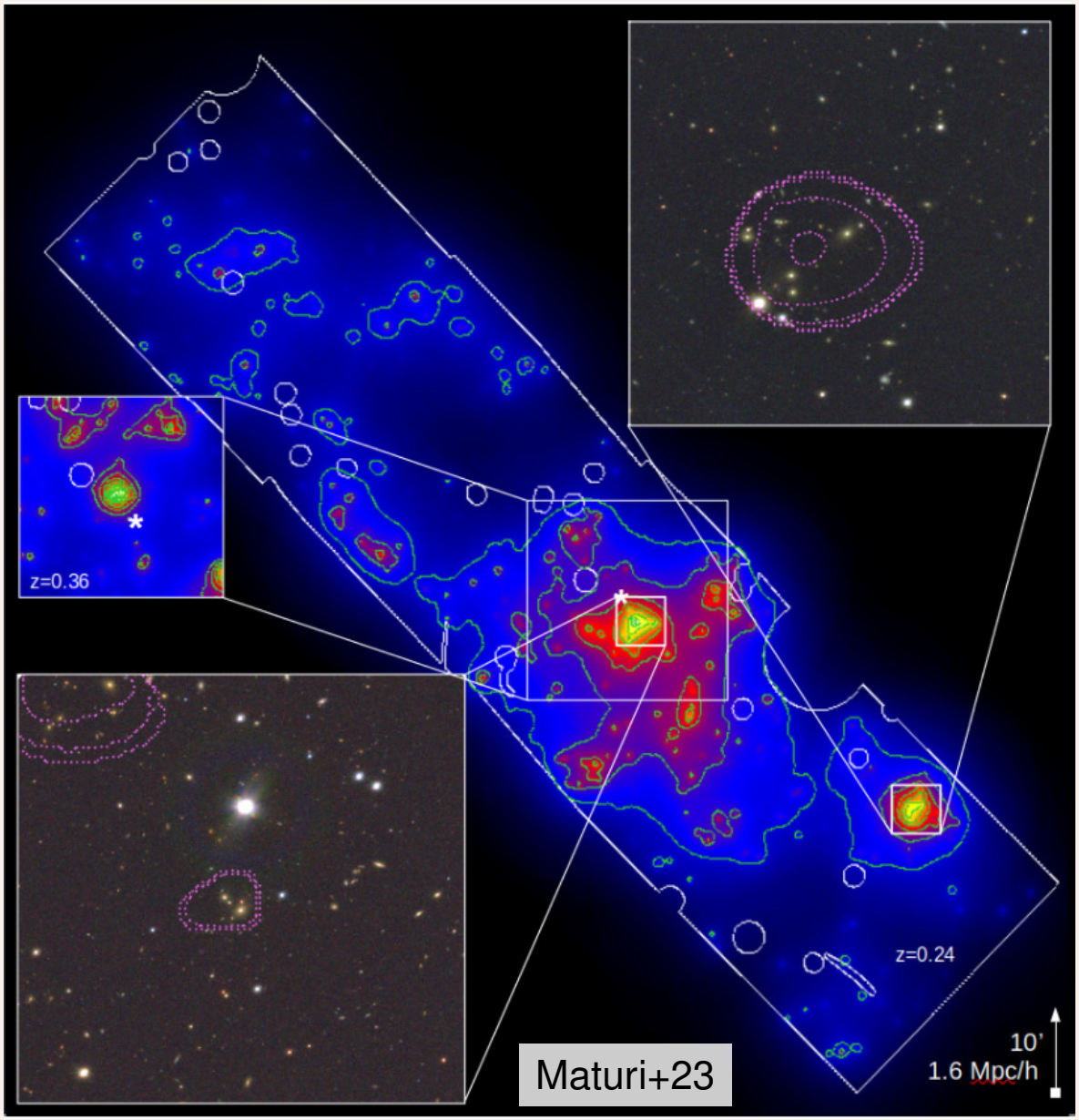
Stellar populations across cosmic times



González Delgado+21 (IAA)

Study of the stellar populations (mass, age, metallicity, extinction, etc.), including luminosity and mass functions, up to $z = 1$.
(González Delgado+21, Díaz-García+24).

Galaxy clusters and groups

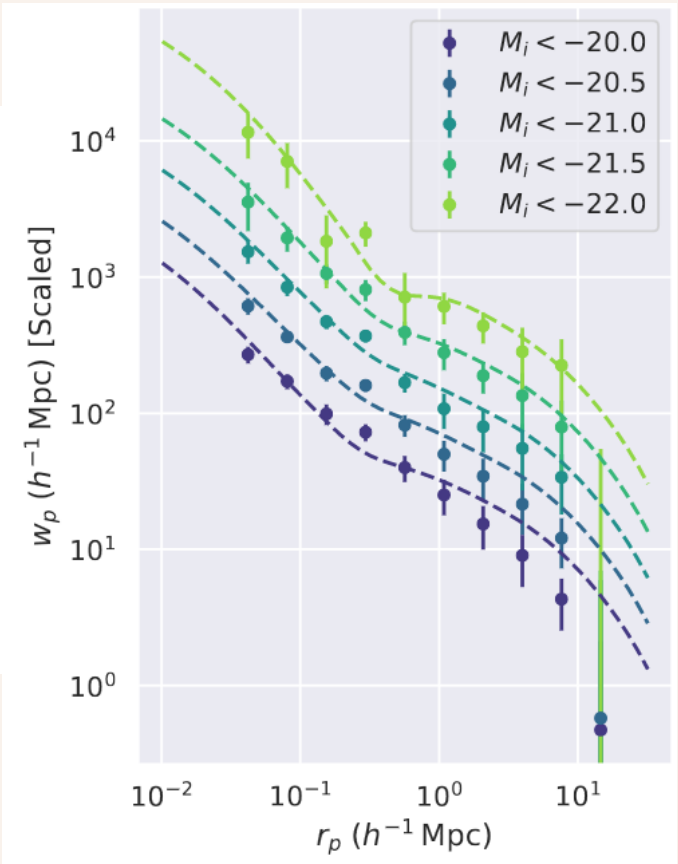


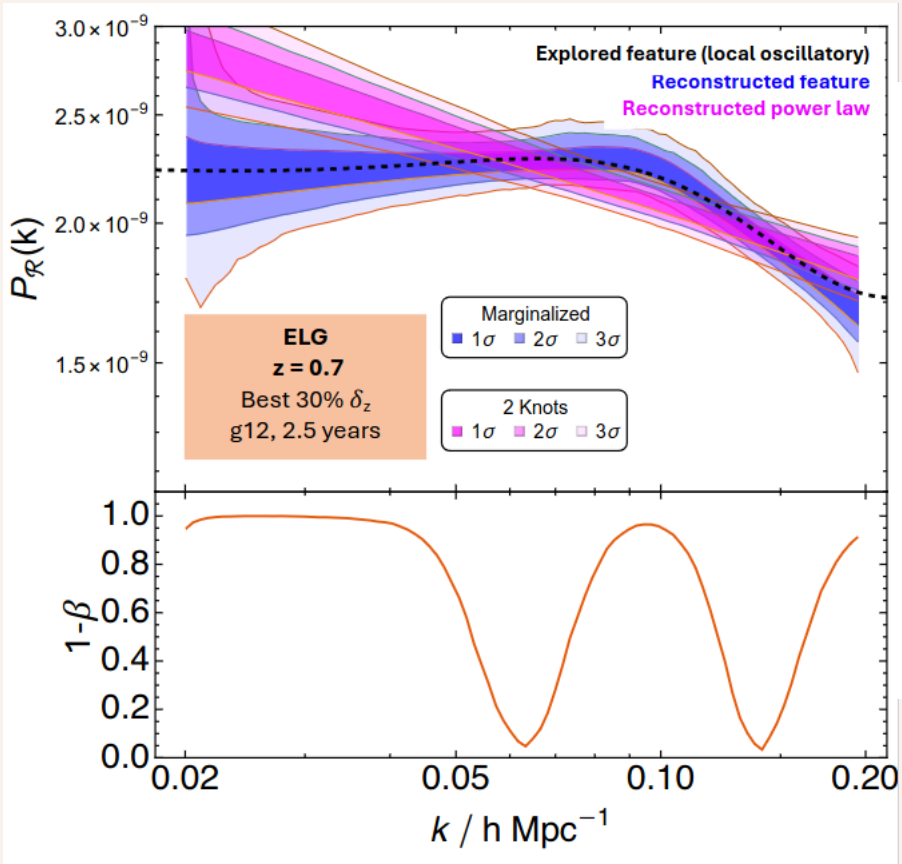
Accurate detection of galaxy clusters and groups. (Ascaso+16, Maturi+23, Doubrawa+24).

Study of galaxy properties as a function of environment. (González Delgado+22, Rodríguez-Martín+22).

Cosmological expectations for J-PAS

Arnalte-Mur+, in prep. (UV)





Martínez-Somonte+23 (IFCA)

Theoretical predictions and mocks for correlation function (left) and power spectrum (right) of galaxies and quasars.
(Aparicio Resco+20, Figueruelo+21, Salzano+21, Martínez-Somonte+23).

Summary

Linea de Actuación: LIA4 - Large astronomical surveys

Astrofisica y física de altas energías

Scientific exploitation of J-PAS, J-PLUS, J-VAR.
Synergies with Gaia, WEAVE, and SKA.
6 posdocs + 2 predocs funded by PPCC.

Data is public! `https://archive.cefca.es`