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SNO4 JWST EXTRAGALACTIC DEEP LEGACY FIELDS

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Abstract. I will present the role and activities of the *Service National d'Observation* JWST Extragalactic Deep Legacy Surveys (EDLS) dedicated on blank fields and on massive galaxy clusters both with HST coverage in which the PNCG community is involved for GTO, ERS, GO Cy1 JWST observational programs. These fields are the cornerstone of future extragalactic programs with the JWST for the study of the formation and evolution of galaxies as well as the epoch of reionization. The dedicated web site is `http://www.iap.fr/jwst-edls/`.

Keywords: galaxies, surveys

1 Introduction

A *Service national d'observation* (SNO) is a long-term service towards the community, making the results/tools available to all, it is implemented under the responsibility of the Observatoires des Sciences de l'Univers (OSU, components of the Universities), and it is labelled and reviewed by our institute INSU/CNRS. An *Action nationale d'observation* (ANO) is composed of several labelled SNO. The *Action Nationale d'Observation 4: Grands relevés, sondages profonds et suivi à long terme* is managing the following: surveys link to an instrument, homogeneous re-analysis of a mission, regular data releases - definition: targets selection, planning, input catalogues, simulations, data reduction pipelines - implementation: steering and monitoring of observations - Production of data catalogues with scientific validation and quality control - Standardised online publication of documented data until their final distribution. The SNO4 JWST EDLS was labelled in 2016 (at that time launch of JWST is foreseen in October 2018), reviewed in 2018, then in 2022. JWST has been successfully launched on December, 25^{th} 2021, with the first images delivered in July 2022.

2 The idea to create a SNO

2.1 The assessment

We wanted to propose a SNO around extragalactic deep fields which produce large datasets, and that no science can be made without a good knowledge of other processed datasets with added value. Added values can be, e.g., magnitudes, morphologies, sizes, zspec, spectral signatures, zphot, star formation rates, stellar masses, dust, B/T, radius, velocities, environment, age, completeness, selections, etc. All those large datasets are published and mostly public, after a huge effort to release them. The used data can be 10-15 years old. Nevertheless, catalogs were/are often exchanged from person to person, done by instrumentation/observation, sometimes with no cross-matching, sometimes with no added-value, or released very late, etc. same operations are repeated each time by new users; checking the catalogues, cross-matching, re-discovering the problems, re-extracting/calibrating, etc. lack of proper documentation of the distributed files, data without context, etc. Furthermore nowadays FAIRisation of the data implies open data to access, share, interrogate and re-use. Let's say that in AA we are already well advanced compared to other disciplines thanks to, e.g. ESO, NASA, CDS archives, etc.

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2.2 An example case: the HST-COSMOS field

There has been a strong French implication in this deep field defined in 2000. Datasets are from: VLT, VISTA, CFHT, Subaru, VLA, GALEX, HERSCHEL, SPITZER, XMM-Newton, Chandra, Laboca, ALMA, and still to be acquired with new facilities. The COSMOS catalogs represent 2 million sources over 2 sq. deg., in 30 photometric bands from UV to IR. The last releases are COSMOS2015 (Laigle et al. 2016) and COSMOS2020 (Weaver et al. 2022), that is 20 years afterward.

The achieved work in France is impressive, with the following non exhaustive work: zCosmos-VIMOS and FORS2 catalogues (LAM),Mosaics from MegaCam (u+VIS), WIRCam (HK), UltraVISTA (Terapix-IAP), Photometric multi-lambda catalogs (CFHT, Subaru, VISTA) (IAP), GALEX UV catalogs with Emphot (LAM), Morphologies catalog (LAM, OBSPM), Flux and EW catalogs (IRAP), magnitude and stellar masses (LAM), HEDAM database for Herchel-Cosmos (LAM), photometric redshifts with LePhare (LAM), Empirical simulated catalog for Euclid (LAM), etc.

In 2022, about 1.4K papers are using COSMOS sources, with the top first most cited including strong French involment which are the following. COSMOS overview: Scoville, Aussel et al. with 1400 citations (Scoville et al. 2007); COSMOS zphot: Ilbert, Capak et al. with 1000 citations (Ilbert et al. 2009); zCOSMOS: Lilly, Le Fèvre et al. with 800 citations; COSMOS2015: Laigle, McCracken, Ilbert et al. with 700 citations; COSMOS 1^{st} release: Capak, Aussel et al. with 800 citations (Capak et al. 2007); S-COSMOS: Ilbert, Salvato, Le Floc'h et al (2010) with 600 citations (Ilbert et al. 2010); UltraVISTA-COSMOS:, McCracken et al. with 522 citations (McCracken et al. 2012).

Even though we have a large impact in the field, we cannot compete with, for instance, the USA fundings for postdoctoral and PhD positions, and our visibility and return towards our national or local funding/supporting agencies is not enough present.

2.3 The objectives of SNO4 JWST ELDS

They are to strengthen our French community and to gather our expertise and tools on deep fields. Our service covers all technical aspects of the preparation, implementation, operation and follow-up of deep surveys with JWST. That is to carry out simulations to optimize the observation strategy, to characterize the analysis biases, to organize follow-up observations with other instruments, to generate catalogues of physical parameters with their uncertainties, to release to the community all the simulated and observed data, tools and high-level science catalogues via national databases, to produce detailed documentation, and To support the community (surveys, master class/ESA, dedicated workshop, etc.) It is a very long-term lasting goal to establish comprehensive datasets on deep fields for future facilities like, e.g., ELT, SKA.

The French context for the extragalactic view is a contribution to JWST instrumentation in NIRSpec (CRAL) and MIRI (CNES & CEA-Sap, OBSPM-LESIA, IAS, LAM). Furthermore we have a long standing experience and know-how in large campaigns of multi-wavelength galaxy deep fields, and have developed several tools and mock catalogues. The OSU responsible is Pythéas/LAM, with the partners OSUL/CRAL and IAP, and since 2022 OSUPS/AIM.

3 The JWST programs in deep extragalactic fields

The landscape for blank and cluster fields is 2 Early Release Science (ERS), 9 Guaranteed Time Observations (GTO) and 5 General Observation (GO) Cycle 1 programs.

Several of us are part of JWST Large Programs, totalling more than 400 hrs in deep fields in our PNCG community. Large Programs ($> 75hrs$) have no exclusive access period and represent 1000 hrs in Cycle 1: GO, Treasury 1837 Cycle 1: PRIMER, 187.2 hrs (Dunlop et al. 2021) (Elbaz, ILbert, Magnelli, McCracken, Tresse et al.) and GO, Treasury 1727 Cycle 1: COSMOS-Web 207.8 hrs (Kartaltepe et al. 2021) (Ilbert, Laigle, McCracken, Shuntov et al.). Medium Program ($25 - 75hrs$) have an exclusive access period of 12 months and represent 1500 hrs in Cycle 1: GO, Treasury 2561 Cycle 1: UNCOVER 71 hrs (Labbe et al. 2021) (Atek et al.). And the CEERS CANDELS fields 66.4 hrs (Finkelstein et al. 2017)(Buat, Burgarella, Elbaz, Magnelli et al.). In addition, we are part of the GTO-MIRI (O. Le Fèvre, then O. Ilbert and T. Moutard) and GTO-NIRSpec - JADES (S. Charlot).

4 Organisation of the SNO

Figure 1 shows the organisation of the SNO. Within the SNO, we have several tools in hands, like Le Phare, Cigale, Beagle, T-Phot, synthetic observations using zoom-in from numerical simulations and producing mock catalogues (RAMSES-RT/Sphinx-reionization, Obelix-massive galaxies), post-treatment tool: RASCASm Empirical Galaxy Generator EGG Sextractor, Sextractor++, Tractor and databases (ASPIC, CDS,...). These tools are used for instance to extract fondamental physical parameters, to analyse bias, to interpret the data, etc.

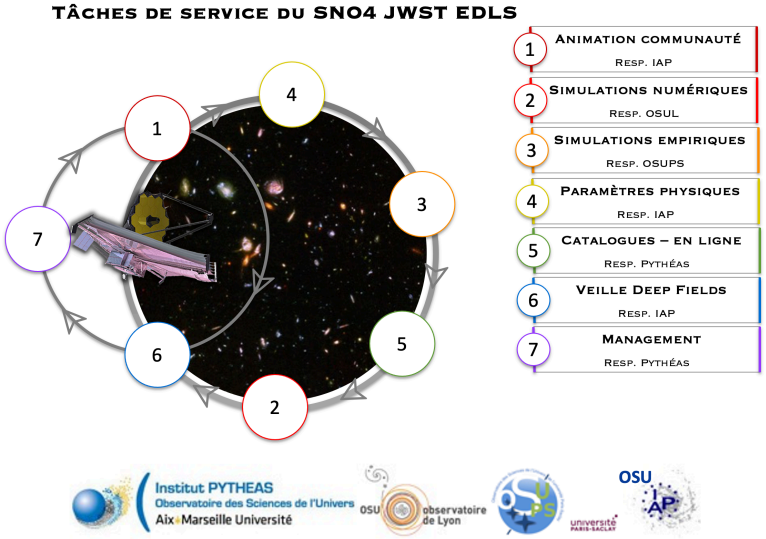

Fig. 1. Service tasks of SNO4 JWST EDLS.

5 Conclusions

Our SNO4 JWST EDLS supports a fantastic French potentiel contribution towards deep fields is part of a long path preparing the next phases in galaxy evolution and first galaxies with ELT, SKA future facilities. It also requires active forces, recruitments and backing for PhDs, postdocs.

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