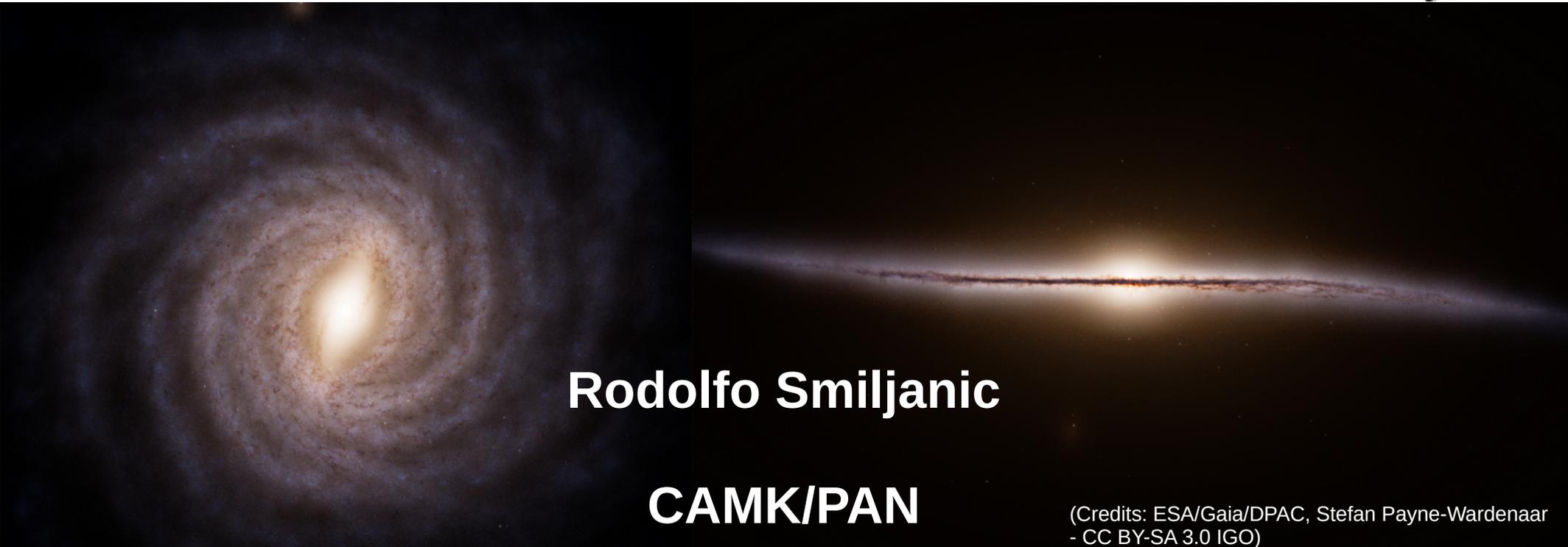
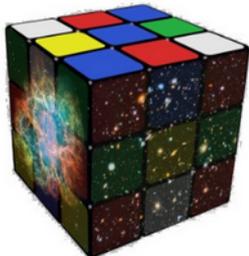




CUBES & WST



Rodolfo Smiljanic

CAMK/PAN

(Credits: ESA/Gaia/DPAC, Stefan Payne-Wardenaar - CC BY-SA 3.0 IGO)



Funded by
the European Union



CAMK Annual Meeting, 4-5 February, 2026



UK Astronomy Technology Centre



FMF

UNIVERSITY OF LJUBLJANA Faculty of Mathematics and Physics



ZENTRUM FÜR ASTRONOMIE



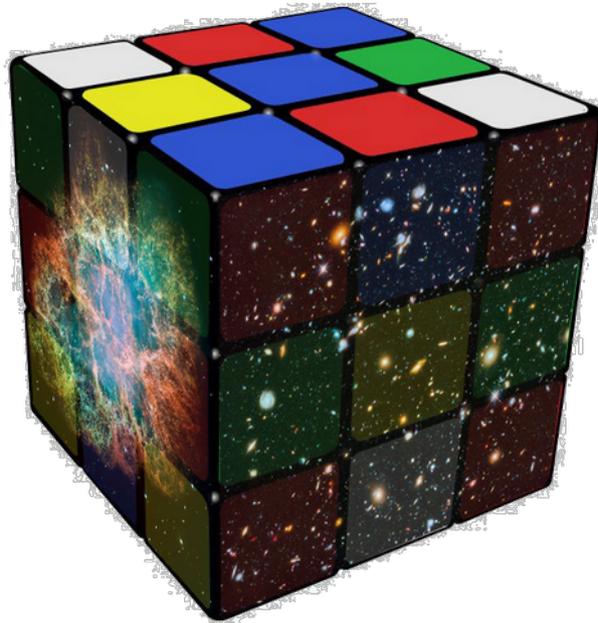
Universidade de São Paulo Instituto de Astronomia, Geofísica e Ciências Atmosféricas



Durham University



1995 - 2025 UNIVERZA V NOVI GORICI



CUBES

Cassegrain U-Band Efficient Spectrograph



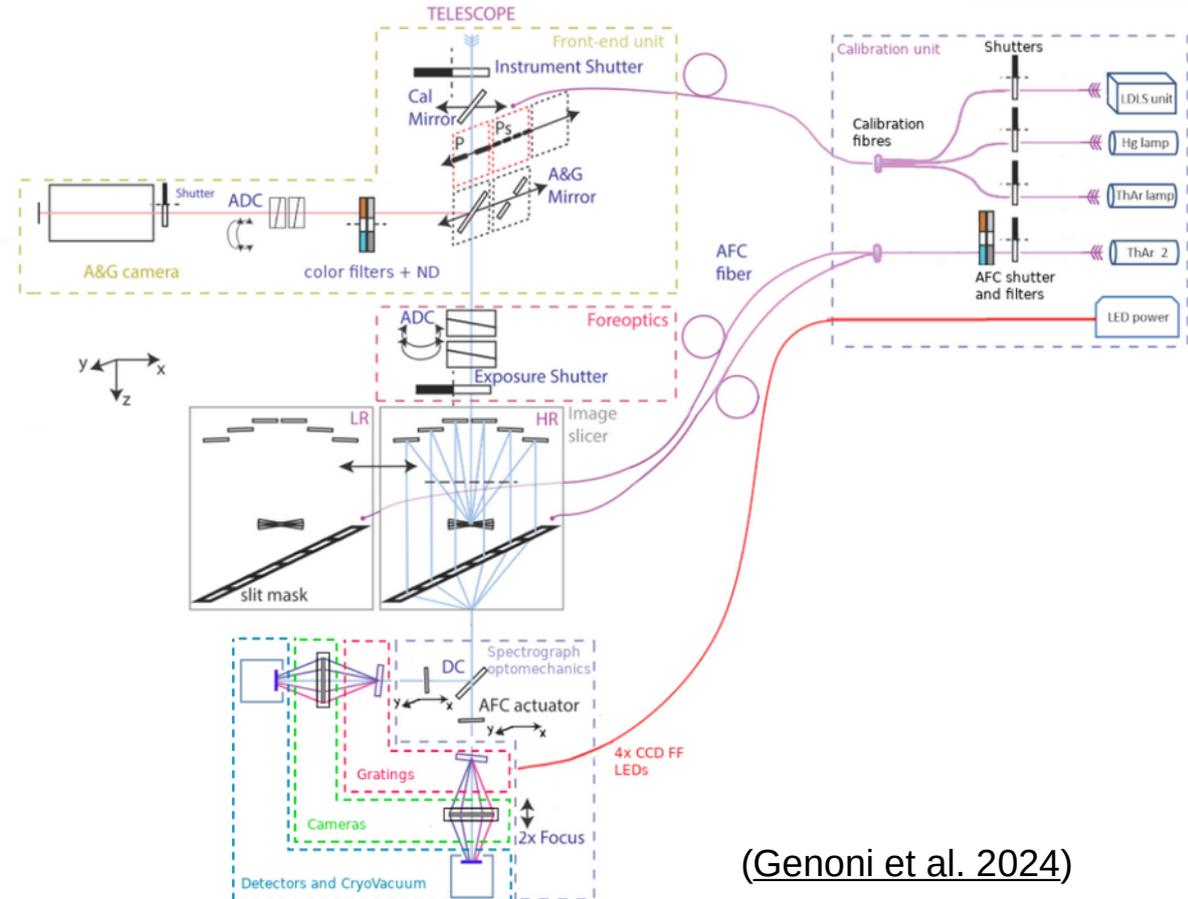


What is CUBES?

<https://cubes.inaf.it/>



- **Cassegrain U-Band Efficient Spectrograph** (Genoni et al. 2024)
- Ground near-UV (**300-405 nm**)
- High-efficiency (aim $> 37\%$ throughput)
- Two resolutions ($R \sim 6000$, $R \sim 23000$) with two image slicers
- To be installed at the 8m ESO's VLT (**by 2030**)
- **Consortium:** Italy (leader; PI S. Covino), Germany, UK, Brazil, Poland + **Slovenia (Nov. 2024)**



(Genoni et al. 2024)

(Support from NCN: [2018/31/B/ST9/01469](#) and [2022/47/I/ST9/02358](#))



Project during 2025



- Final Design Review (FDR) concluded on **July 2025**
- Instrument and software design completed
- Phase D **on-going** (MAIT - Manufacturing, Assembly, Integration, Testing)
- Major tenders started (> 2M€):
 - CCDs from E2V (engineering-grade delivered; science in Q1 2026)
 - Image slicers (H1 2027)
 - Grating (H2 2026)
 - Spectrograph optics (end-2026/early-2027)

Project schedule

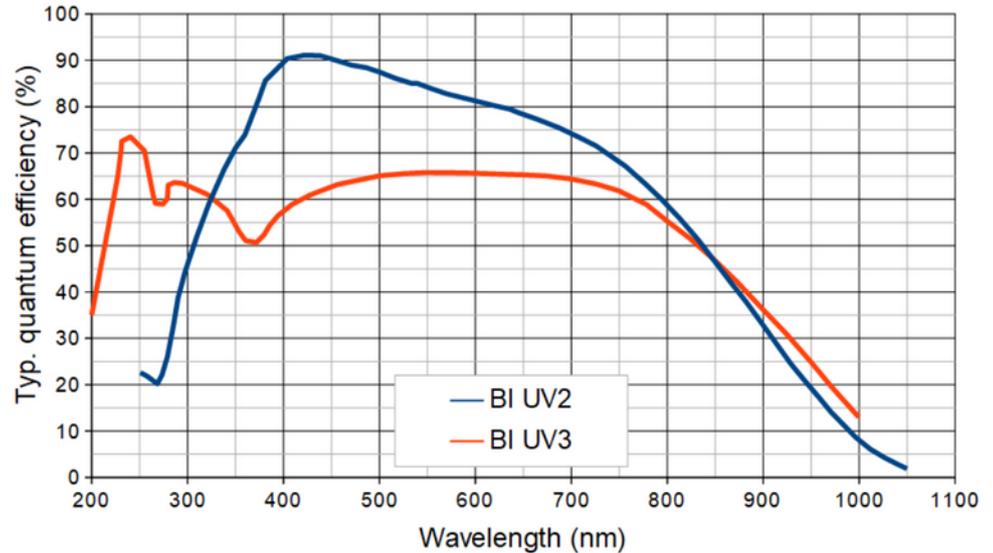
Milestone / Activity	Date
Entry into force of the CA	15 Feb. 2022
Kick-off meeting	24 Mar. 2022
PDR	30 Nov. - 1 Dec. 2022
Detector LLI Review	6 Jul. 2023
Optics LLI Review	16 Nov. 2023
FDR	24-25 Oct. 2024
FDR close out meeting	27 May 2025
Spectrograph in Heidelberg	Jul. 2027 – Feb. 2028
AIT in Merate	Mar. 2028 – Oct. 2029
ARR	~mid 2028
TRR	Jul. 2029
PAE	Jan. 2030
PAC	Apr. 2031



Acquisition & Guiding camera



- Within **OPUS/LAP NCN grant (2024-2028)**:
 - **2025**: Purchase of A&G camera (ELSE-I 1k x 1k BI UV3; Axiom Optics)
 - **2026**: Characterization of the A&G (with Italy)
 - **2026**: Development of imaging mode simulator & imaging mode data reduction SW



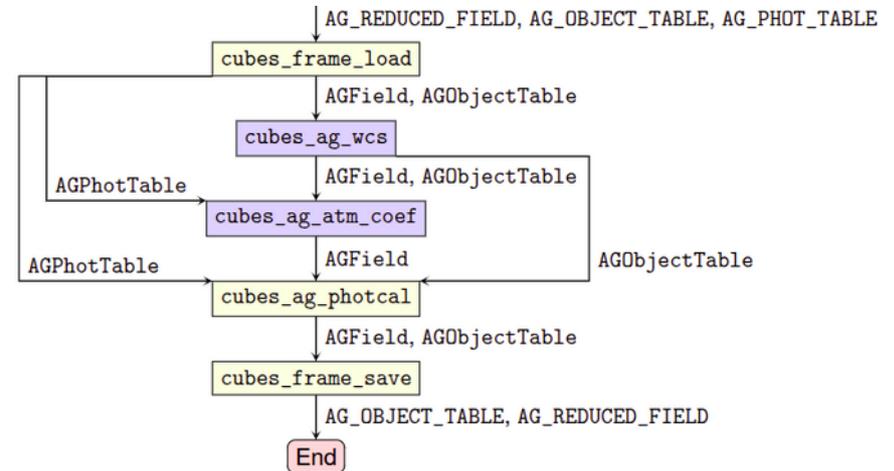
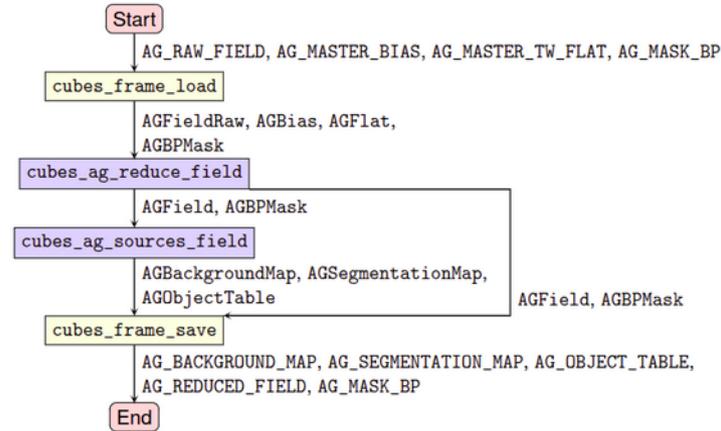
- Imaging mode:
 - *u, g, r* SDSS-like filters
 - Photometric images of the science target + standard after the spectroscopic observation
 - Use photometry for flux calibration



Imaging mode DRS

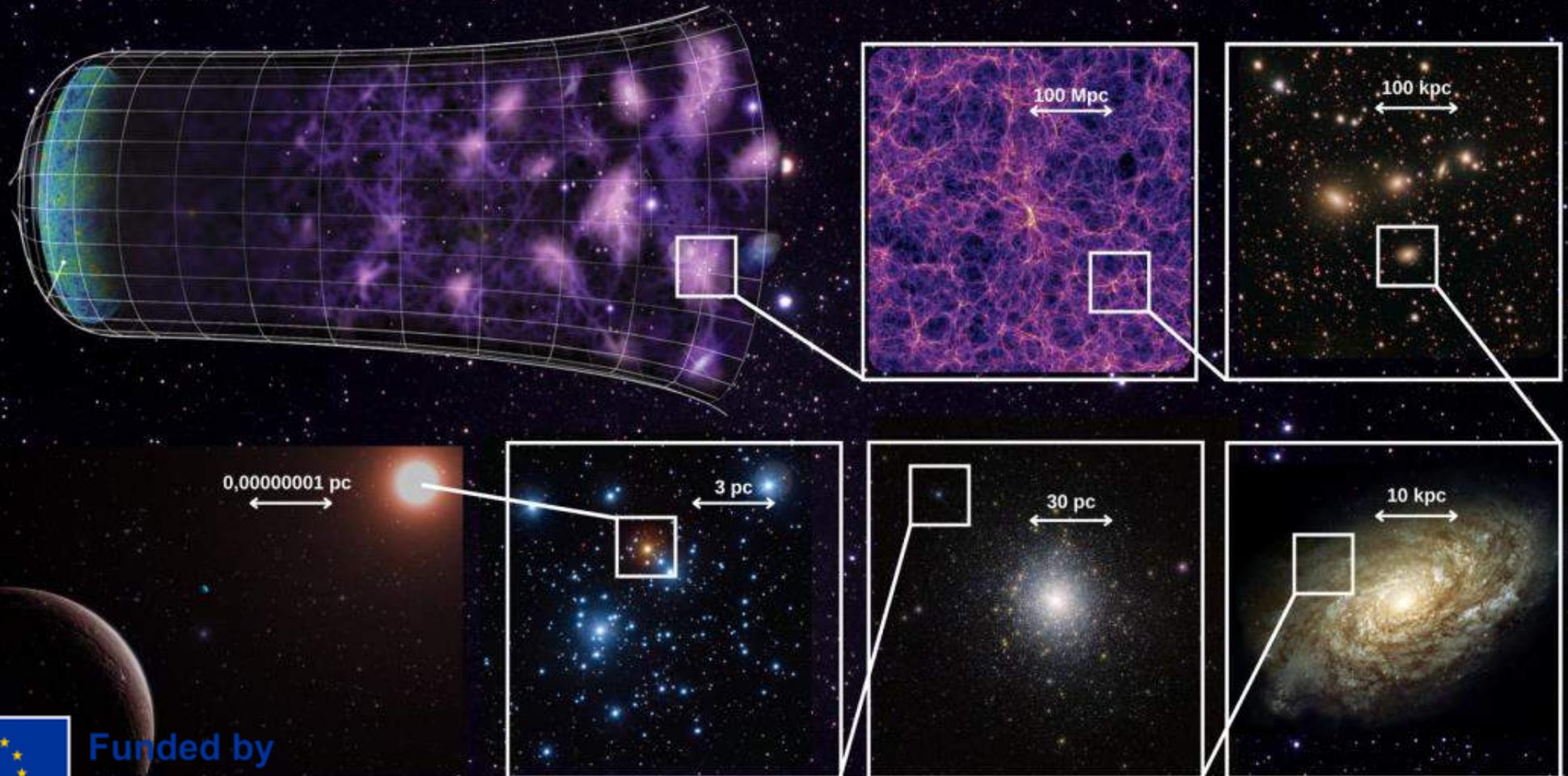


- **2025:** Software contributions:
 - Design data reduction pipeline for the imaging mode
 - Design specifications for the observation preparation software
- **2026-2027:** Build the imaging mode DRS
 - Bias correction; flat-field correction; source identification; atmospheric extinction; photometric calibration
- Imaging mode main user case: flux calibration of the spectra of transients
 - Possible application to analysis of metal-poor stars (OPUS/LAP - [see talk by Deepak](#))



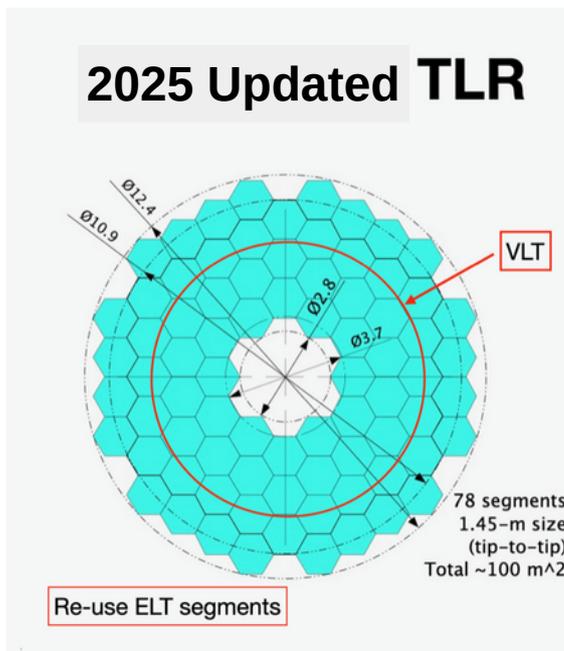
(Data Reduction Library Specifications)

Wide-field Spectroscopic Telescope



Funded by
the European Union

- **Wide-field Spectroscopic Telescope** (Bacon et al. 2024)
- 12-m ground-based telescope dedicated to multi-object spectroscopy
- Consortium formed in 2021 (23 institutes in Europe + Australia)
- Extended Science Team with > 500 astronomers worldwide
- **Horizon Europe proposal approved in 2024 (~ 3M €):**
 - 3-year conceptual design study (Grant agreement ID: 101183153; since Feb. 2025)
 - One postdoc at CAMK (see talk by **Thibault Boulet**)



Telescope Aperture	12 m, seeing limited
Telescope FoV	3.1 deg ²
Tel. Spec Range	0.35–1.6 μm
MOS LR Multiplex	30,000
MOS LR Resolution	3,000–4,000
MOS LR Spec Range	370–970 nm (simultaneous)
MOS HR Multiplex	2,000
MOS HR Resolution	40,000
MOS HR Spec Range	350–970 nm (3–4 regions)
IFS FoV	3 × 3 arcmin ²
IFS Resolution	3,500
IFS Spec Range	370–970 nm (simultaneous)
IFS Patrol Field	13 arcmin diameter
MOS & IFS parallel operations	
ToO implemented at telescope and fibre level	

- ESO started the planning for the next big facility, after the ELT
- Call for White Papers (**Dec. 2025**): “Science questions in the 2040s?”
 - ➔ Review by a “Senior science committee”
 - ➔ Expanding horizons workshop in H1 2026
- Rumours say ~ 210 white papers
 - ➔ **The WST Science Team organized 66 submissions**
 - ➔ A few other relevant to WST appeared in arXiv
- **End 2026:** Letter of Intent



- WST Science White Paper: Manieri et al. 2024, [arXiv:2403.05398](https://arxiv.org/abs/2403.05398)
 - **Time domain** (Richard I. Anderson, Cyrielle Opitom, Paula Sanchez Saez)
 - **Galactic and stellar** (Vanessa Hill, Rodolfo Smiljanic, Eline Tolstoy)
 - **Resolved stellar populations** (Martin M. Roth and Anna McLeod)
 - **Extragalactic** (Francesco Belfiore, Richard Ellis, Mark Sargent)
 - **Cosmology** (Michele Moresco, Jean-Paul Kneib, Sofia Contarini)
- **2027:** White Paper v2

In the first 5 years of operation, WST will provide:

MOS-LR

300 millions galaxies (to AB 24.5), over 14,000 deg²
50 millions stars (to AB 23.0), over the entire Galaxy and local group

MOS-HR

10 million stars (to AB 17.0), over most of the Galaxy

IFS

4 billions spectra, over 30 deg² in diverse environments (low-density fields, galaxy and stars clusters, galactic fields, ...)

- 2025:** SOC of Special Session (SS7) at the European Astronomical Society meeting in Cork (Ireland):
 - “WST: the Wide-field spectroscopic facility”
 - 17 talks: facility + science
 - Discussion with a panel of experts (Anja Anderson, Sarah Bosman, Cristina Chiappini, Laurent Eyer, Kyle Dawson, Silvia Piranomonte)
- 2026:** SOC of SS24 at the EAS meeting in Lausanne (Switzerland):
 - “WST in the 2040s landscape: the power of synergies”
 - **Focus on synergies** (SKA, Einstein Telescope, Roman Telescope, Gaia & GaiaNIR, ELT, LSST)
 - **Abstract by early March**

EUROPEAN ASTRONOMICAL SOCIETY ANNUAL MEETING

29 JUNE - 03 JULY

SWISSTECH CONVENTION CENTRE
LAUSANNE SWITZERLAND



Expand All | Collapse All

EAS 2026

Welcome & News

Organisers

Contact



Organiser

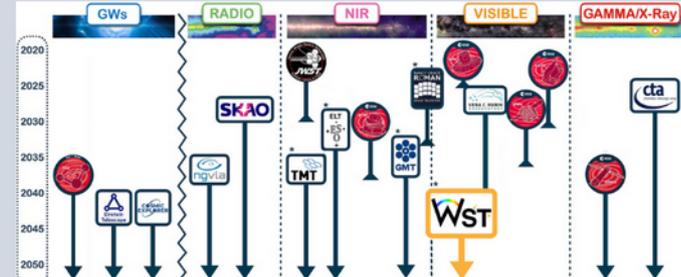


Partner



Special Session SS24

WST in the 2040s landscape: the power of synergies.



Aims and scope

The main goal of this special session is to highlight and discuss with the astronomical community the strong synergies that the Wide-field Spectroscopic Telescope (WST) will have with other major observatories in the 2040s.



WST Chronicle



Issue 3 - January 2026

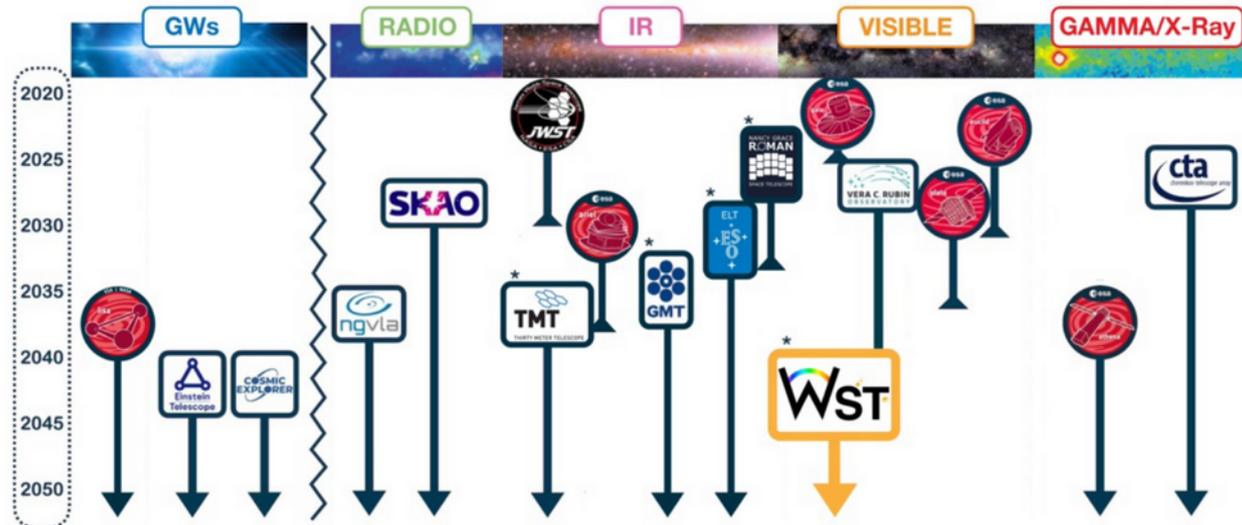
THE WST CHRONICLE

Pushing the Boundaries of Spectroscopic Surveys

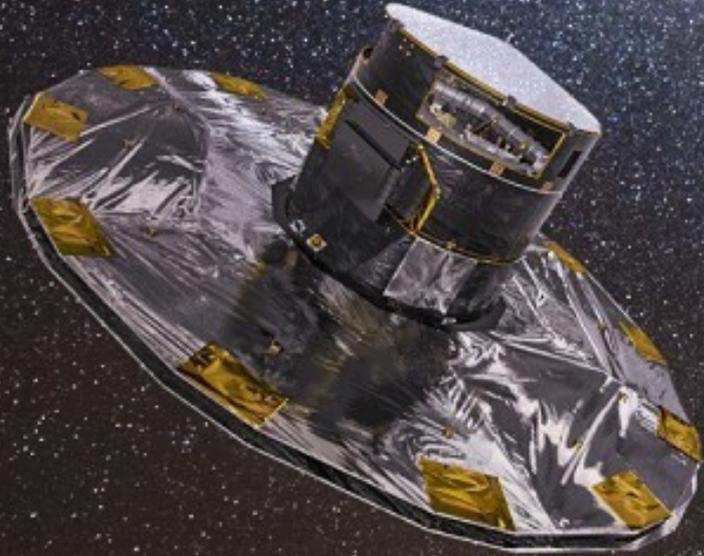


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- “A trimonthly magazine that provides both a platform to communicate progress within the WST large Consortium and a bridge to the wider community.”



Thank you for your attention

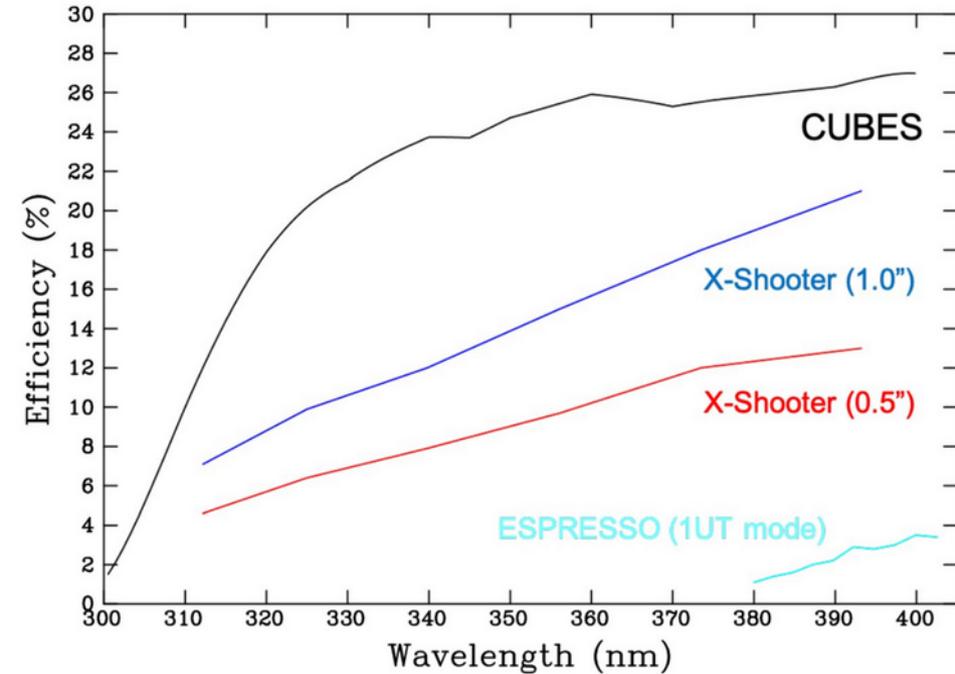




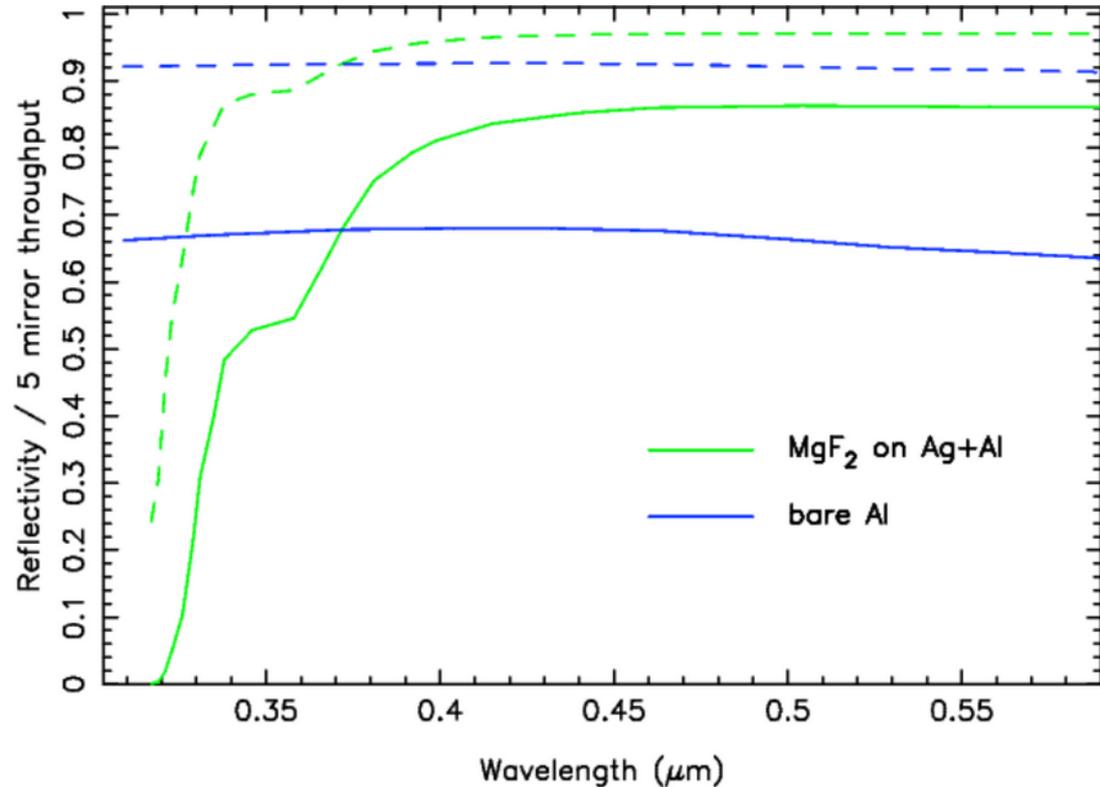
CUBES efficiency



- Sky + telescope + instrument:



(Evans et al. 2023, ExA, 55, 1)



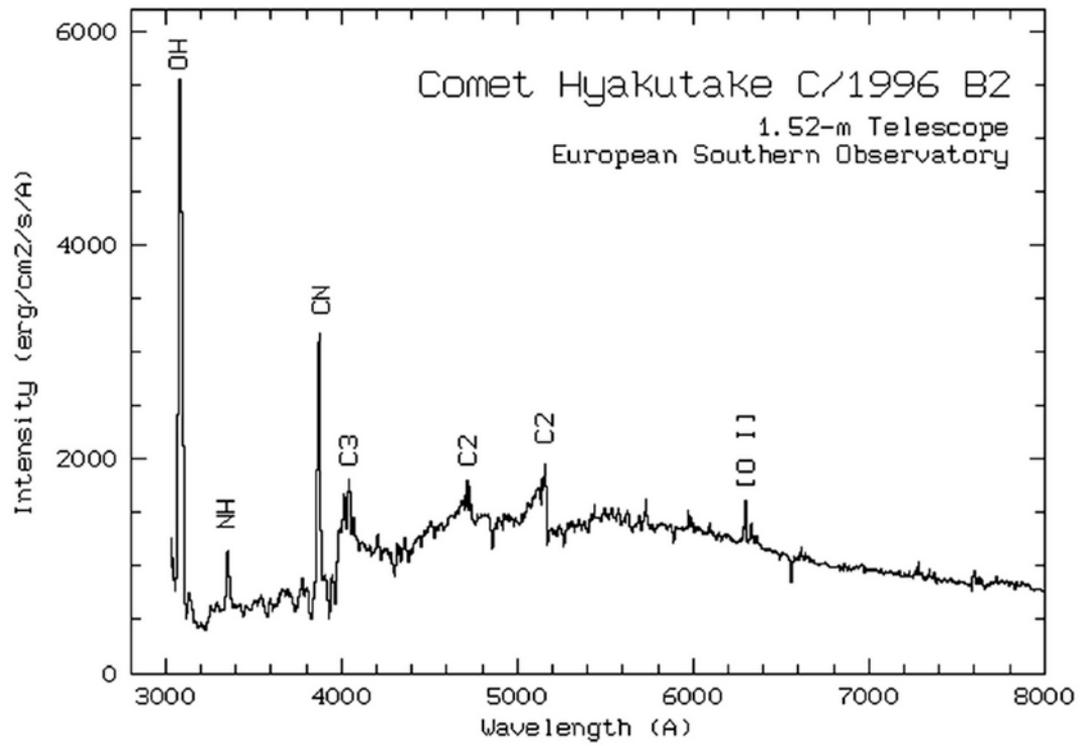
(ELT mirror coating)



Science with CUBES

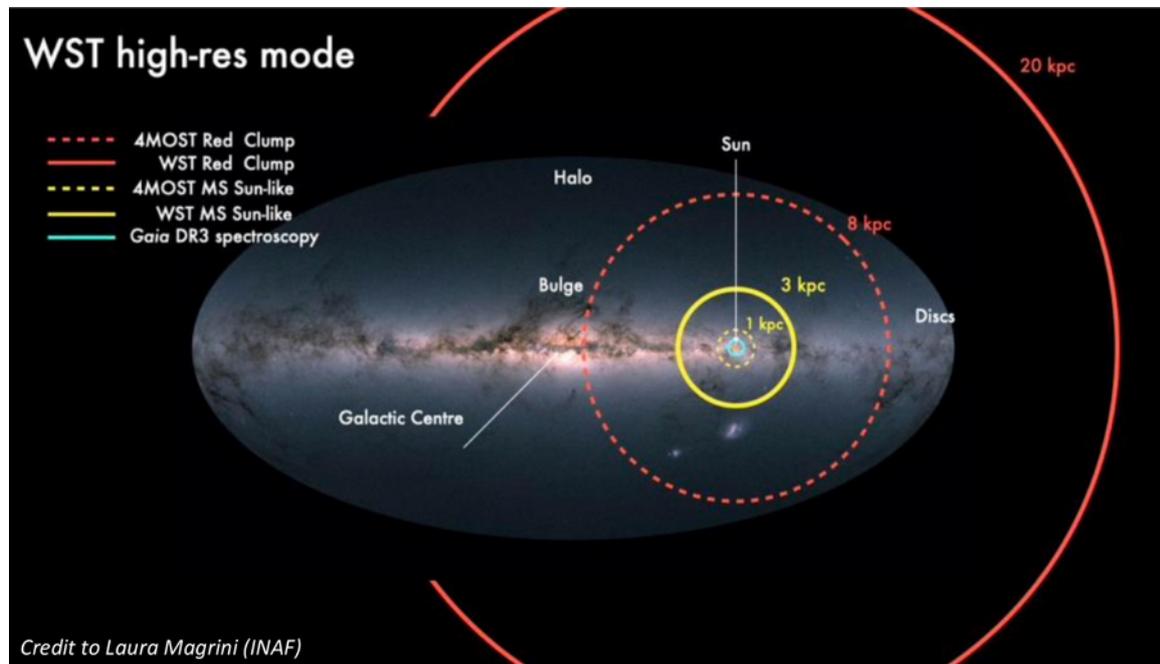


Field	Science case
Solar System	S1: Cometary Science S2: Icy Satellites
Galactic	G1: Accretion, winds & outflows in YSOs G2: Exo-planet composition G3: Stellar astrophysics & exoplanets G4: Beryllium in metal-poor stars and stellar clusters G5: Lithium production in novae G6: Metal-poor stars & light elements G7: Neutron-capture elements G8: Precise metallicities of metal-poor pulsators G9: Horizontal branch stars in Galactic GCs G10: Early-type companions in binary Cepheids G11: Extragalactic massive stars
Extragalactic	E1: Primordial deuterium abundance E2: Missing baryonic mass in the high- z CGM E3: Cold gas at high redshift E4: Reionisation
Transients	T1: GRBs T2: Kilonovae T3: Superluminous supernovae

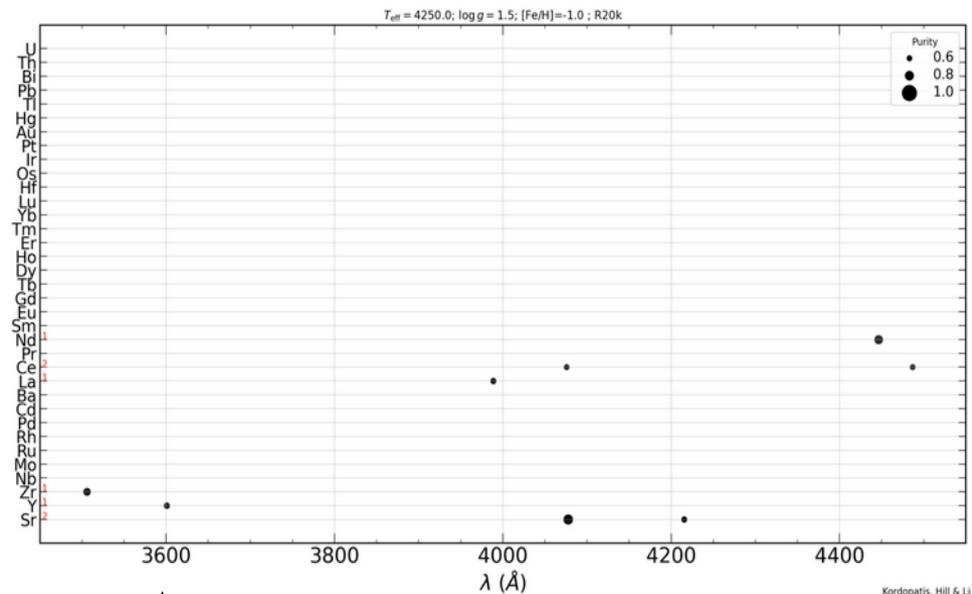


(Evans et al. 2023, ExA, 55, 1)

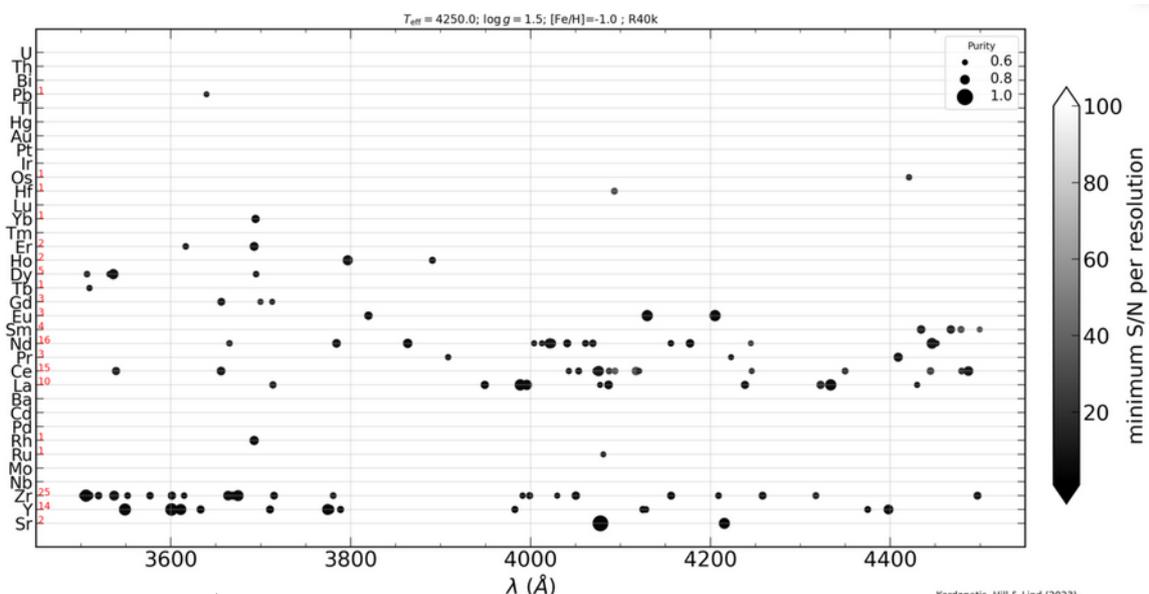
- **Science case v2** → three main topics:
 - Origins of the elements
 - Origins of the Milky Way system
 - Origins of stars and planets
- Except for Gaia-ESO and PFS @ Subaru, all surveys use < 4m telescopes
- Except for Gaia-ESO (~7000 stars) and (~1 M stars) GALAH, surveys with $R < 20k$
- **Reach fainter and more distant sources**
- **Explore chemical elements missed by other surveys**
- **Reach higher precision in the abundances**



- **2025:** Four spectral windows for the HR mode ($R = 40\,000$; 2000 fibers)
 - centered at 422, 476, 571, 640 nm



↑ High resolution of 4MOST ($R = 20\,000$)



↑ High resolution of WST ($R = 40\,000$)