



*Pushing the boundaries
of Spectroscopic Surveys*



Funded by
the European Union

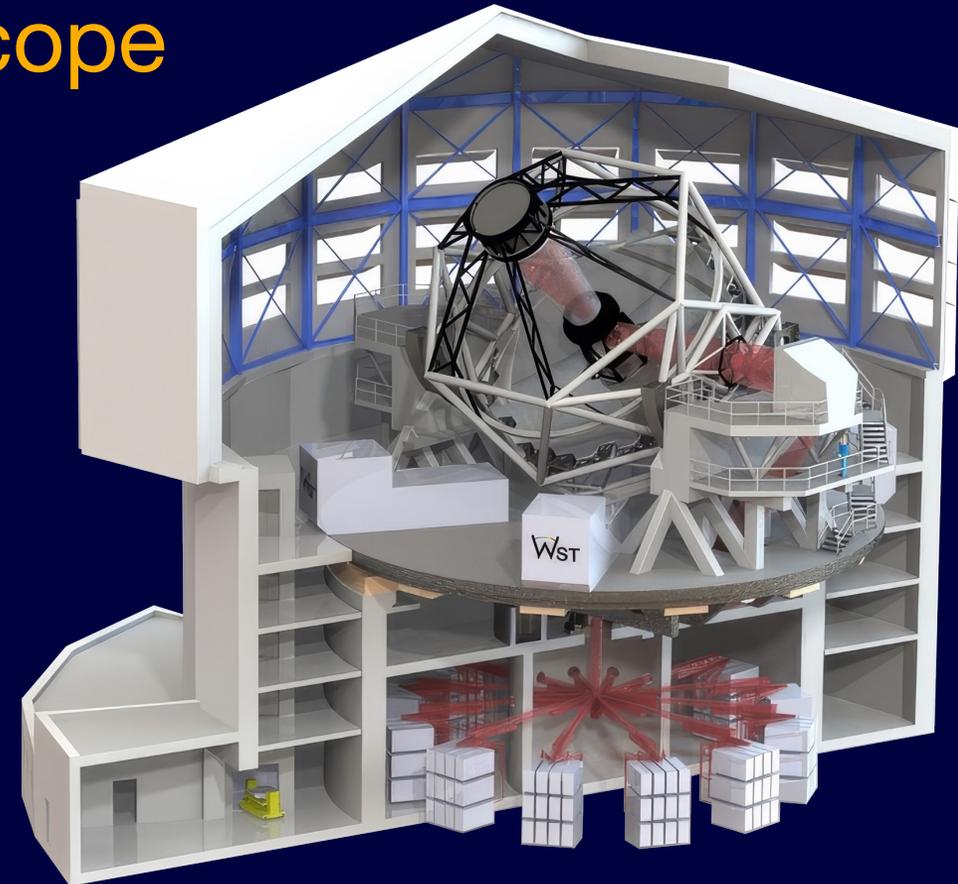


INAF
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The Wide-field Spectroscopic Telescope and the perspectives for multi-messenger astronomy

Sofia Randich

WST Deputy Coordinator





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of Spectroscopic Surveys*



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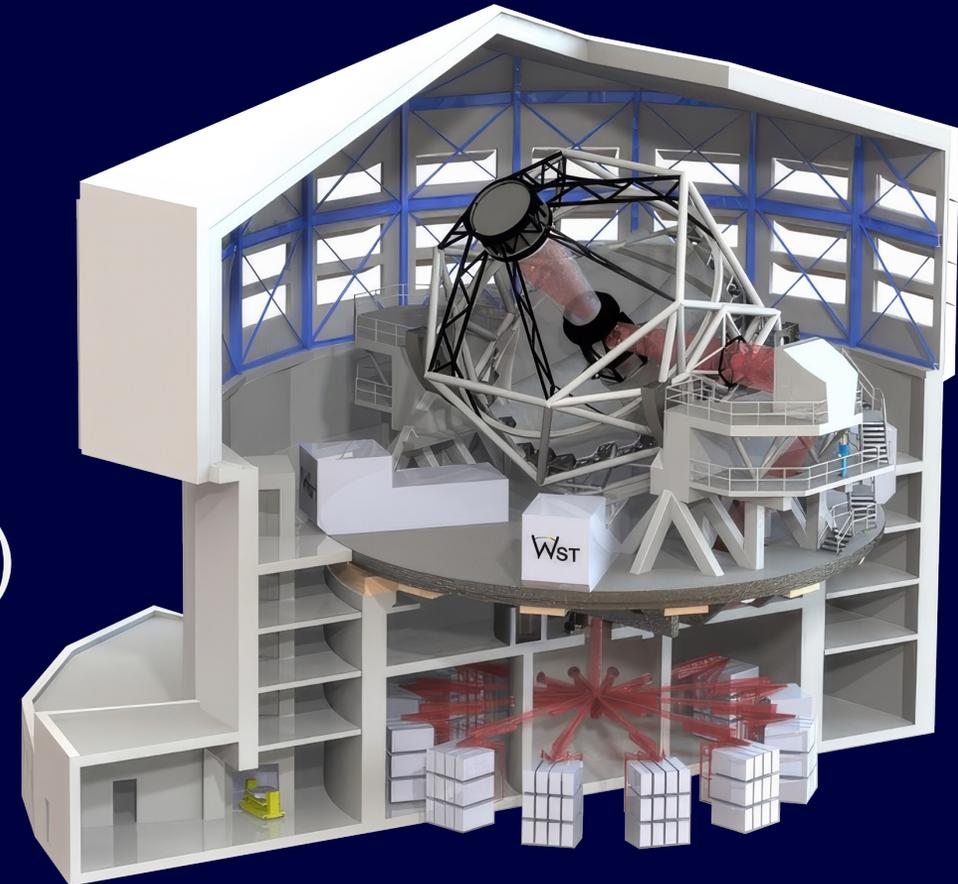


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The Wide-field Spectroscopic Telescope

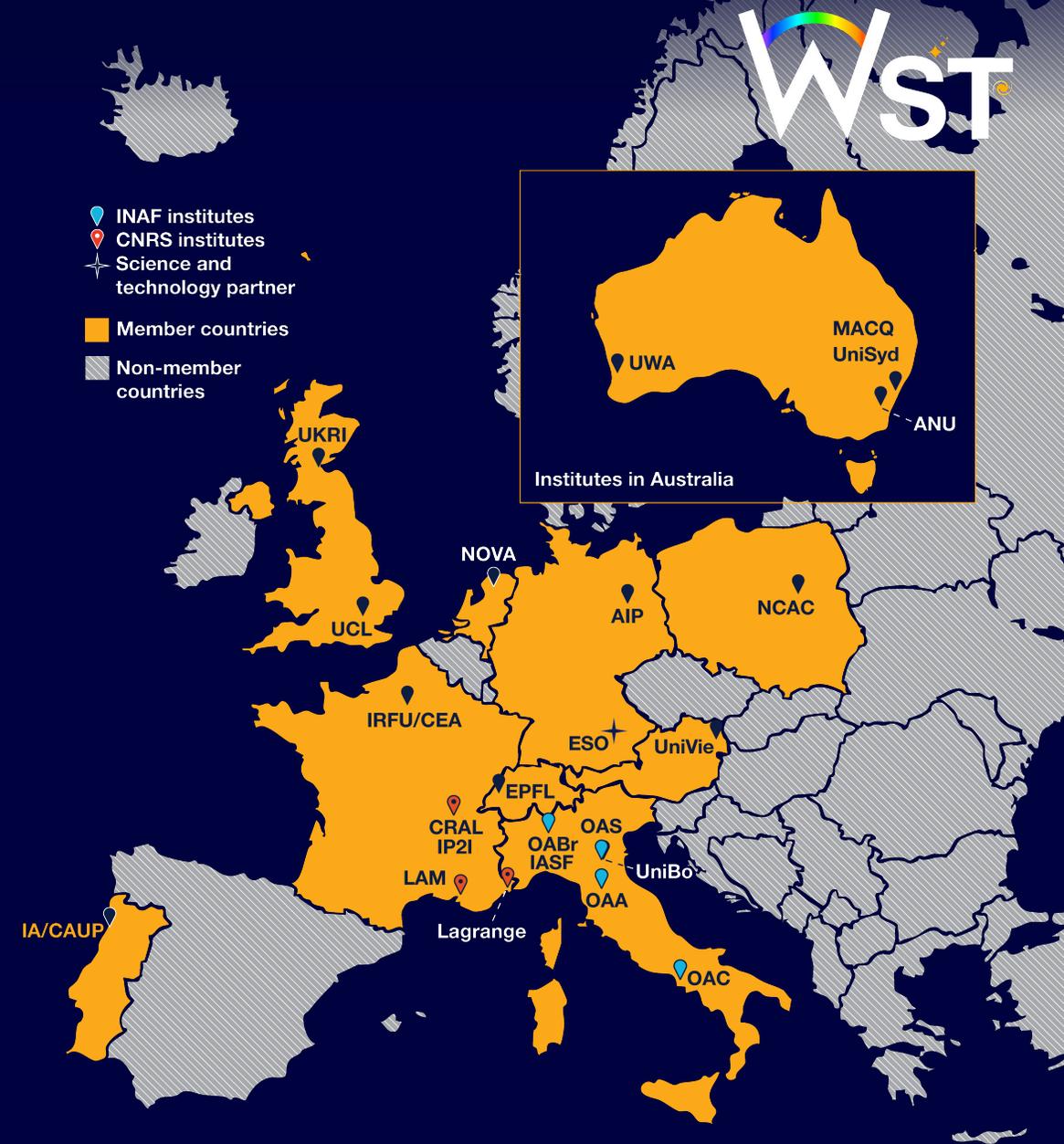
Started in 2021 Funded in 2024 (3 M€)

3-year full concept study



Consortium

- Coordinator: Roland Bacon (CRAL)
- deputy coordinator: S. Randich
- 23 research institutes or universities spread over 10 countries
- ~850 science team members from 34 countries



What and why

WST: an innovative facility dedicated to spectroscopic surveys
“born“ from strategic needs and community request.
If approved, operational in the 2040's



What and why

WST: an innovative facility dedicated to spectroscopic surveys
“born“ from strategic needs and community request
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- In the 2040+ landscape a crucial element in answering many of the pressing scientific questions will be the availability of **vast spectroscopic datasets** covering a large fraction of the sky.
- The delivery of such datasets is currently **missing in the EU research infrastructure plans for the 2040s and beyond**

The image shows the cover of a report titled 'A Strategic Plan for European Astronomy'. The background is a dark, blue-toned landscape with a winding river or path. Two overlapping circles are present: a light blue one on the left and a white one on the right. The text is white and light blue.

A STRATEGIC
PLAN FOR
EUROPEAN
ASTRONOMY

THE ASTRONET
SCIENCE VISION &
INFRASTRUCTURE
ROADMAP
2022-2035

✦ What makes WST unique

Telescope

12.1 m, seeing limited

3.1 deg²

Spectral range: 0.35 – 1.6 μm

three instruments/modes working in parallel

-low resolution MOS

-high resolution MOS

-central panoramic IFS

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MOS LR Multiplex	30,000
MOS LR Resolution	>3,000
MOS LR Spec Range	370-970 nm (simultaneous)
MOS HR Multiplex	2,000
MOS HR Resolution	40,000
MOS HR Spec Range	370-970 nm (4 regions)
IFS FoV	3x3 arcmin ²
IFS Resolution	>3,000
IFS Spec Range	370-970 nm (simultaneous)
IFS Patrol Field	13 arcmin diameter
MOS & IFS simultaneous operation	
ToO implemented at telescope and fibre level	

What makes WST unique

Telescope

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To be put in Chile – close to Paranal

-high resolution MOS

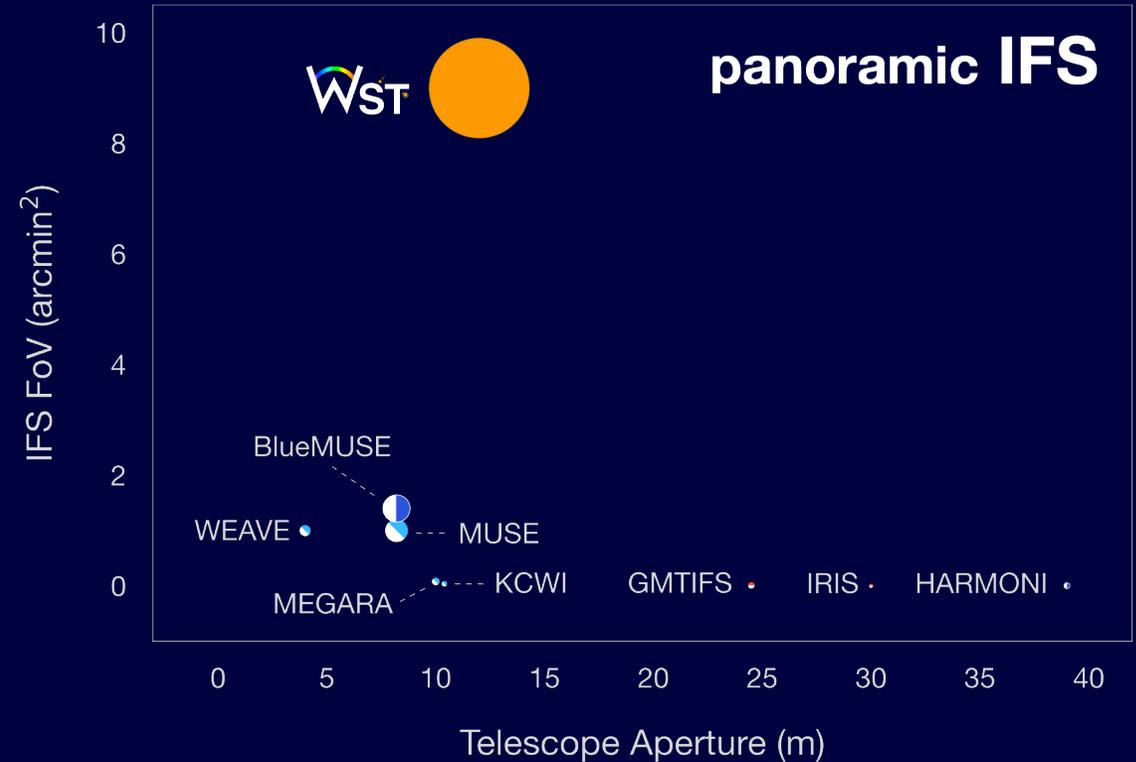
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MOS & IFS simultaneous operation	
ToO implemented at telescope and fibre level	

✦ Upgrade plan

- ✦ An IR (1-1.6 μm) extension of the MOS-LR
- ✦ A MOS mini-IFUs
- ✦ A GLAO for the IFS – very likely in the baseline
- ✦

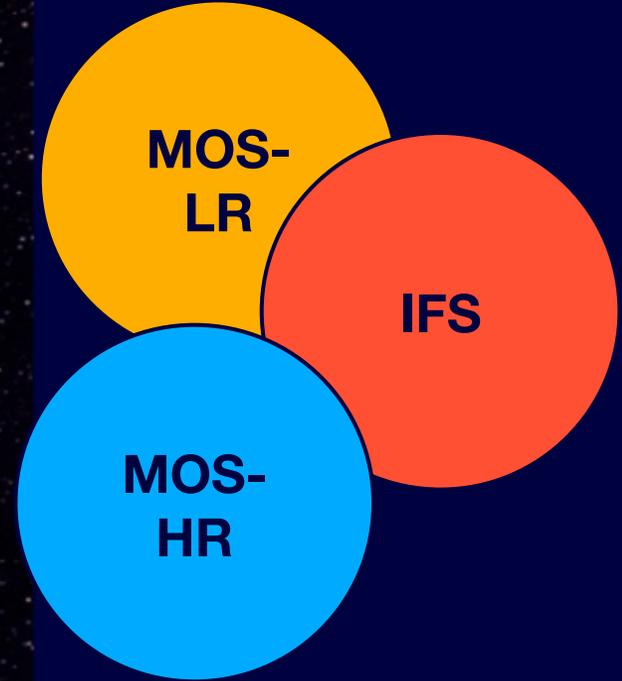
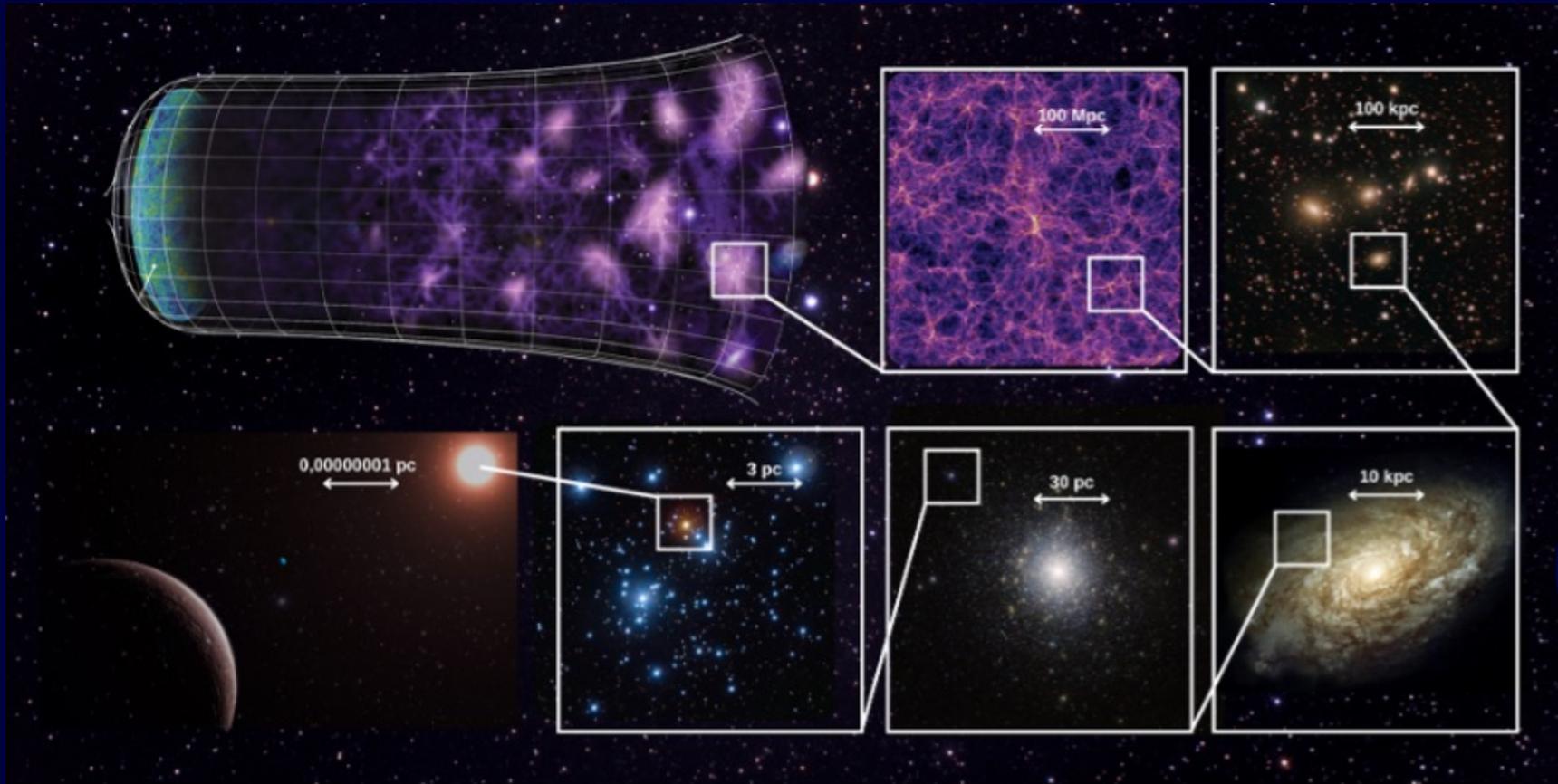
The WST in the landscape



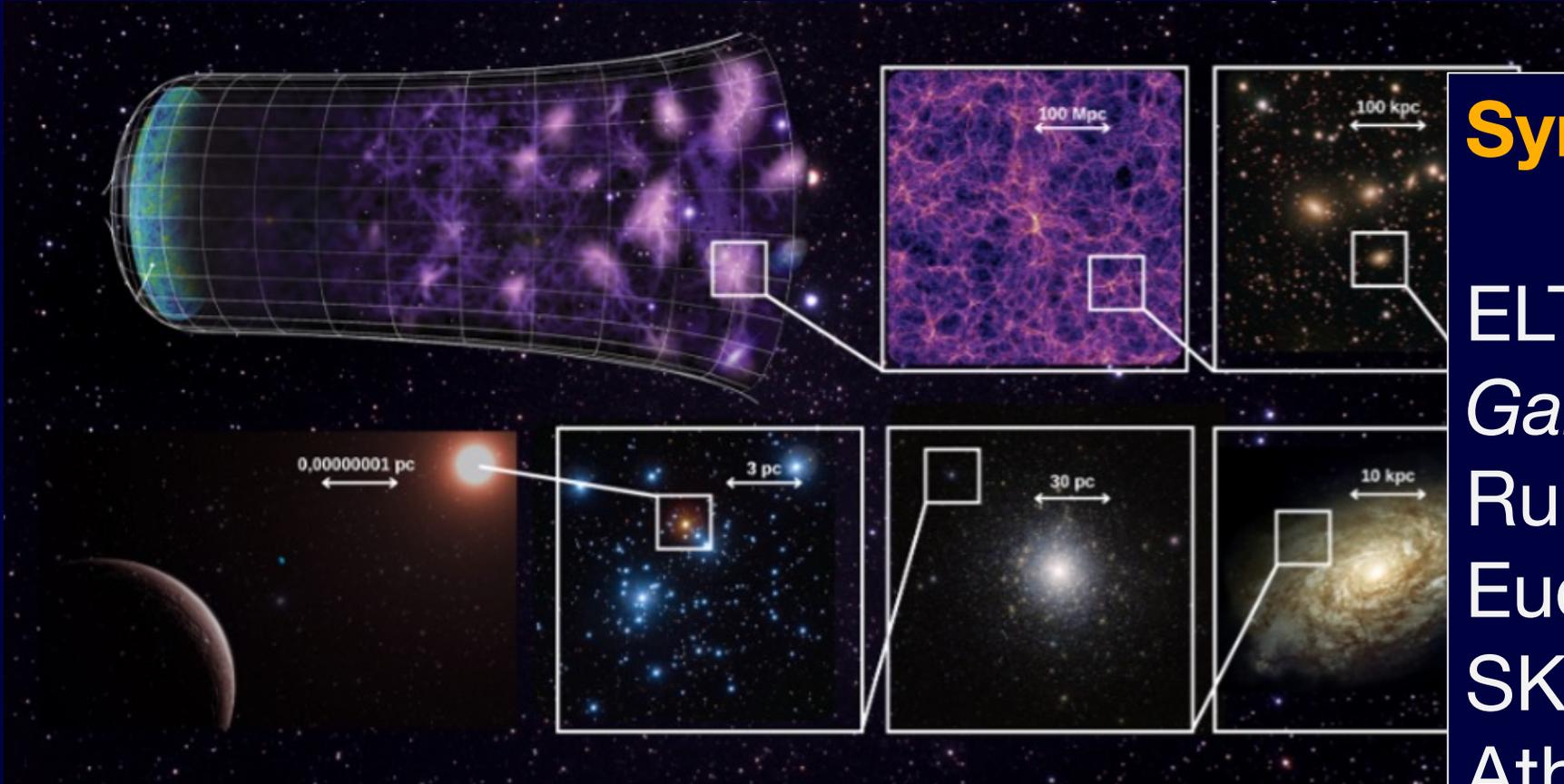
Credit: Maria Cristina Fortuna

throughput x FoV x multiplex

Science



WST: a facility to answer a wide range of cutting-edge scientific questions that cannot be addressed with current or planned MOS facilities
+ huge discovery space



Synergies

ELT

Gaia (Gaia-NIR)

Rubin/LSST

Euclid, Roman

SKAO

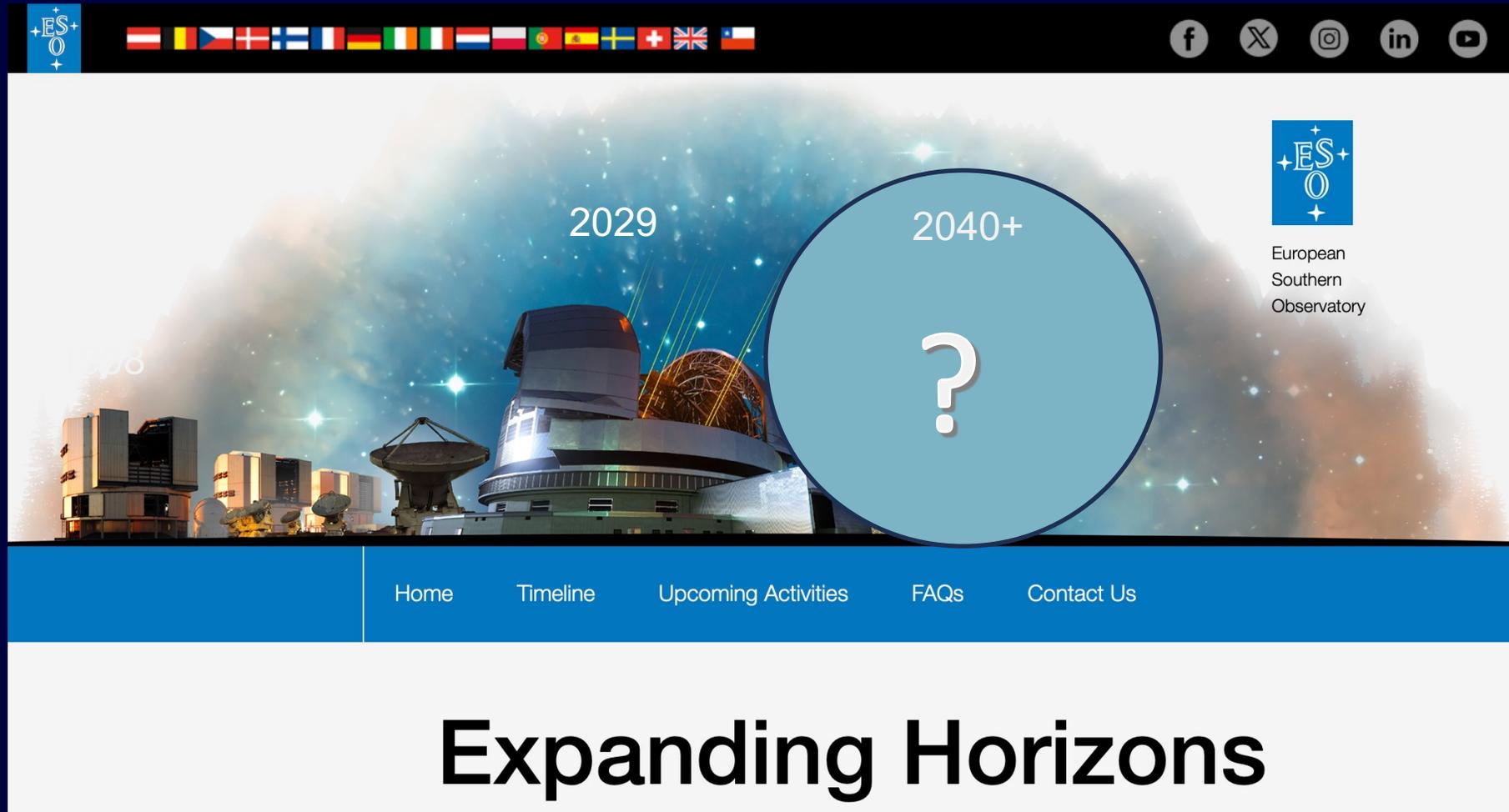
Athena

Einstein Telescope

LISA

WST: a facility to answer a wide range of cutting-edge questions in astronomy and astrophysics that cannot be addressed with current or planned facilities
+ huge discovery space

ESO future plans



2029

2040+

European Southern Observatory

Home Timeline Upcoming Activities FAQs Contact Us

Expanding Horizons

ESO future plans

A screenshot of the ESO website's 'Future Plans' page. The page features a dark blue header with the ESO logo and a row of national flags. Below the header is a large, vibrant image of a futuristic telescope facility at night, with a large circular graphic overlaid in the center. The graphic is divided into two sections: '2029' on the left and '2040+' on the right. The '2040+' section contains the WST logo. To the right of the main image is the ESO logo and the text 'European Southern Observatory'. At the bottom of the page is a blue navigation bar with links for 'Home', 'Timeline', 'Upcoming Activities', 'FAQs', and 'Contact Us'. Below the navigation bar is a white section with the text 'Expanding Horizons' in a large, bold, black font.

2029

2040+

WST

European Southern Observatory

Home Timeline Upcoming Activities FAQs Contact Us

Expanding Horizons

Science Team (850 people)



Cosmology

Michele Moresco
Jean-Paul Kneib
Sofia Contarini



Galaxy evolution

Francesco Belfiore
Richard Ellis
Mark Sargent



Res Populations

Anna McLeod
Martin Roth
Sebastian Kamann



Galactic

Rodolfo Smiljanic
Eline Tolstoy
Vanessa Hill



Time domain

Richard Anderson
Paula Sanchez Saez
Cyrielle Opitom



White paper
(v1), Mainieri
et al, 2024

Including
Multi-Messenger

✦ The WST: a game changer

- ✦ GW detection rates will explode
- ✦ Transition to population-level MM science
- ✦ Spectroscopy is the limiting factor
- ✦ Sky localization uncertainties
- ✦ Large number of galaxies within the GW error volume
- ✦ Need for rapid, scalable response

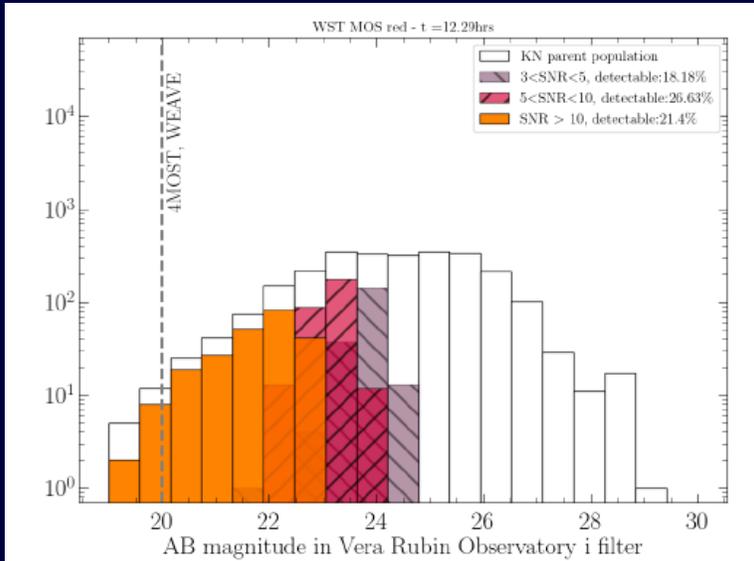
✦ The WST: a game changer

- ✦ GW detection rates will explode
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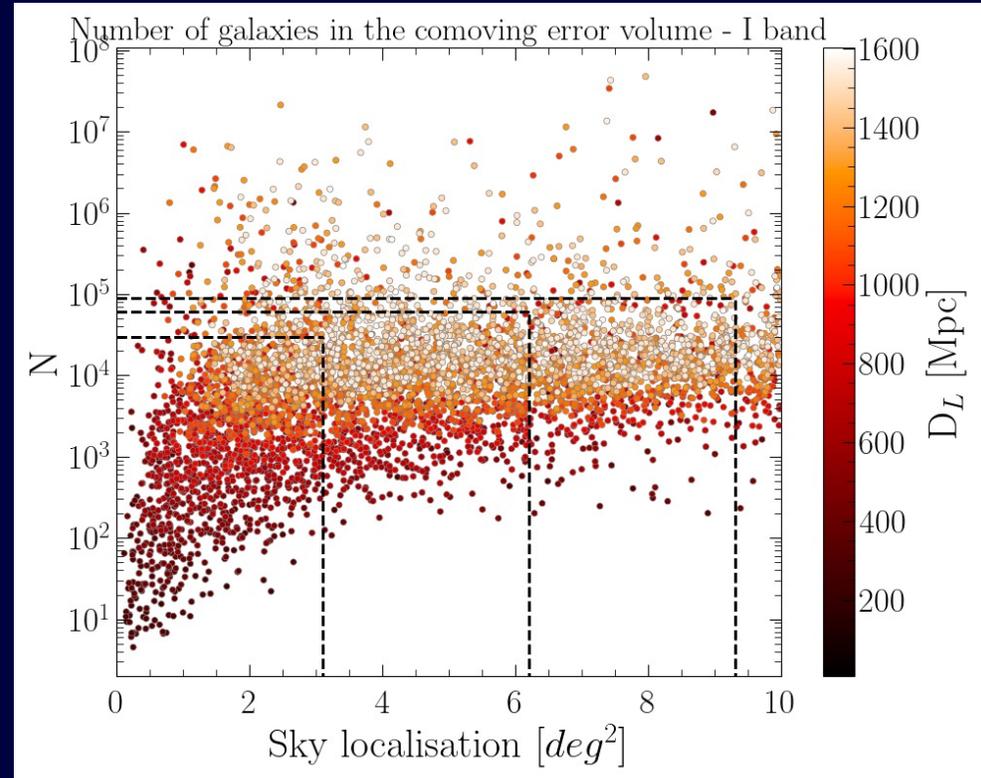
WST uniquely addresses these issues

- Faint magnitudes
- Orders-of-magnitude gain in spectra/hour
- Thousands of targets observed simultaneously
- Optimized for homogeneous, repeatable observations
- Rapid (12-24 h) telescope ToO implementation

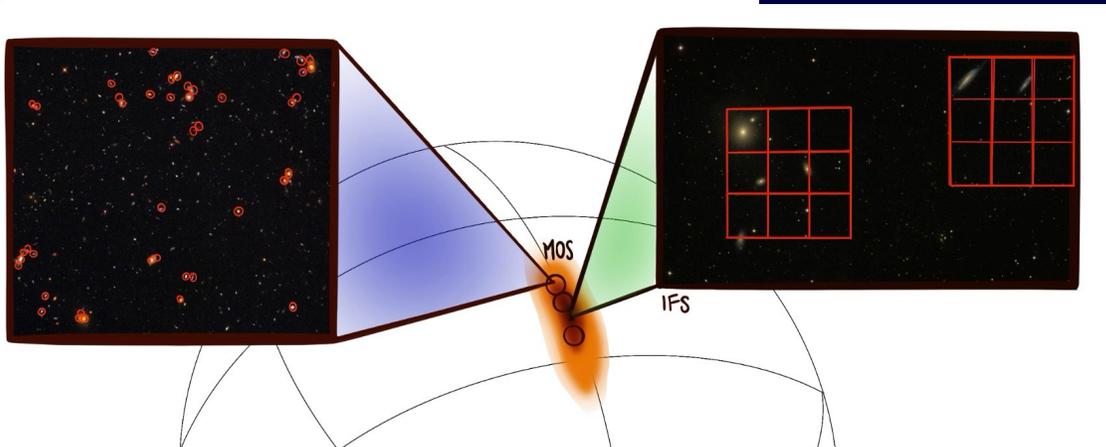
First simulations of WST – ET synergy



Magnitude distribution in i filter of ET BNS detected over 10 years and their corresponding theoretical KN at 12 hours after the merger.



The golden case: Number of galaxies in the comoving error volume of ET + CE BNS at $z < 0.3$ with $< 10 \text{ deg}^2$ (in 10 years more than 100 events ET alone)



✦ Take home

- ✦ The **WST** is conceived as a transformational facility for **large-scale spectroscopy**, enabling a qualitative leap in how we explore the Universe.
- ✦ Simulations by Bisero et al. show that the WST is a “*powerful tool in addressing the challenges of the research of EM counterparts of next-generation GW-detected BNS mergers*”
- ✦ Several **challenges** are identified – e.g., ET+Rubin, prioritization of events, observational strategy complex, quasi-real time data reduction and analysis is key, etc.
- ✦ **GRAWITA is welcome to contribute**, to further develop simulations, and to shape observing strategies
- ✦ **Extensions** to BBH environments and other MM sources/detectors (see e.g., Dotti et al. 2025 for LISA)



Not yet registered to
WST science team ?

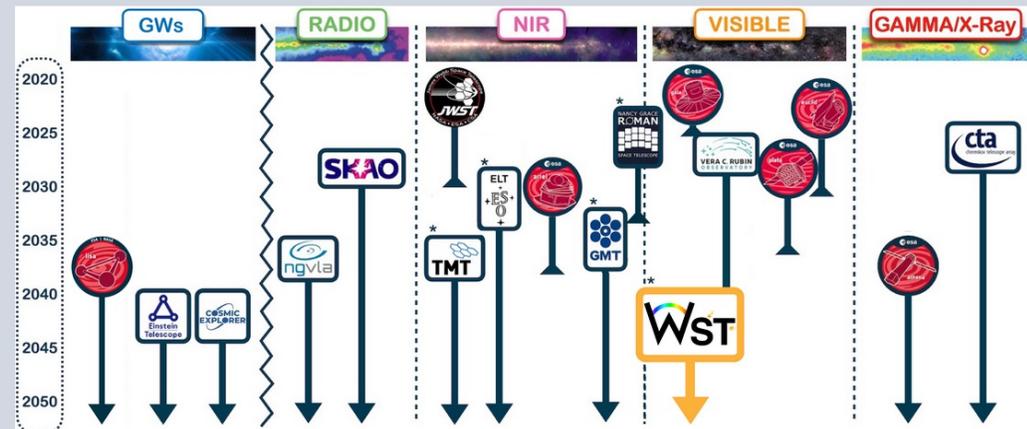
Register now at
wstelescope.com



Special Session SS24

2 Jul 2026

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.