WST

Pushing the boundaries of Spectroscopic Surveys

Funded by the European Union

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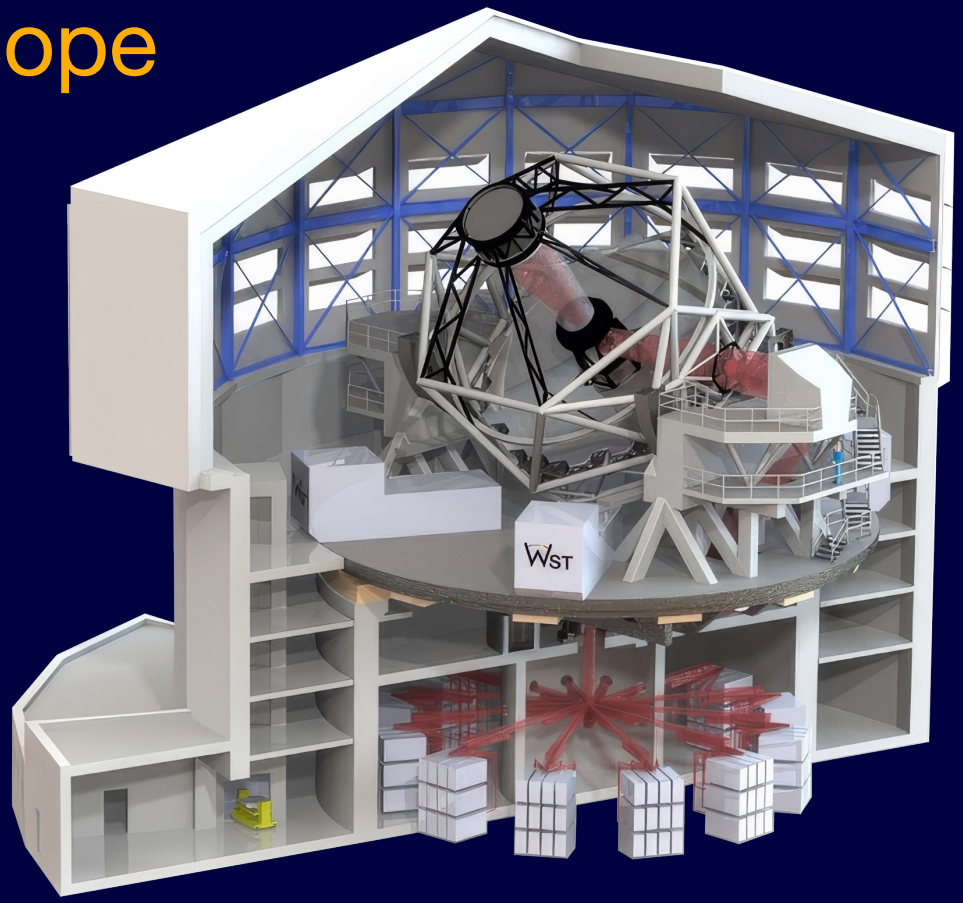
The Wide-field Spectroscopic Telescope and the perspectives for multi-messenger astronomy

Sofia Randich

WST Deputy Coordinator



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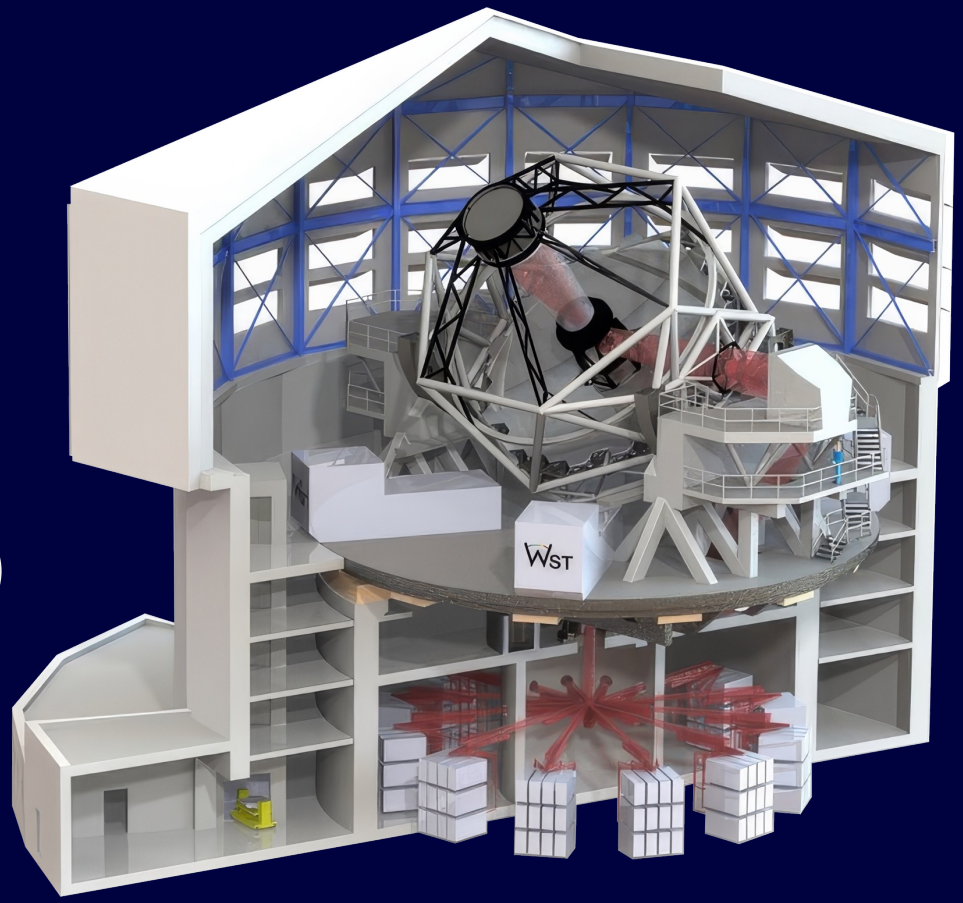
The Wide-field Spectroscopic Telescope

Started in 2021 Funded in 2024 (3 M€)

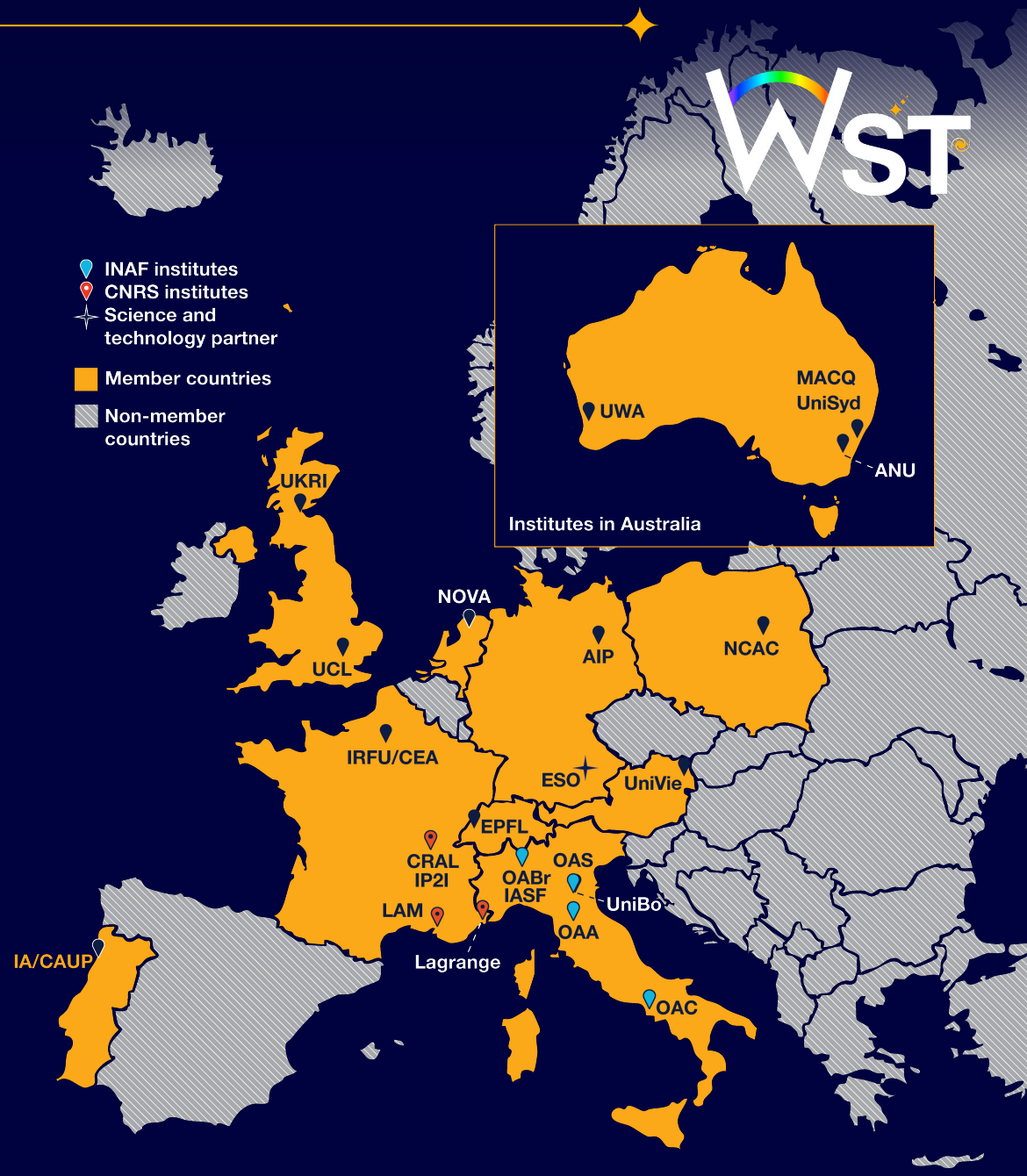
3-year full concept study



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**

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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**

What makes WST unique

Telescope
12.1 m, seeing limited
3.1 deg^2
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
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IFS Patrol Field	13 arcmin diameter
MOS & IFS simultaneous operation	
ToO implemented at telescope and fibre level	

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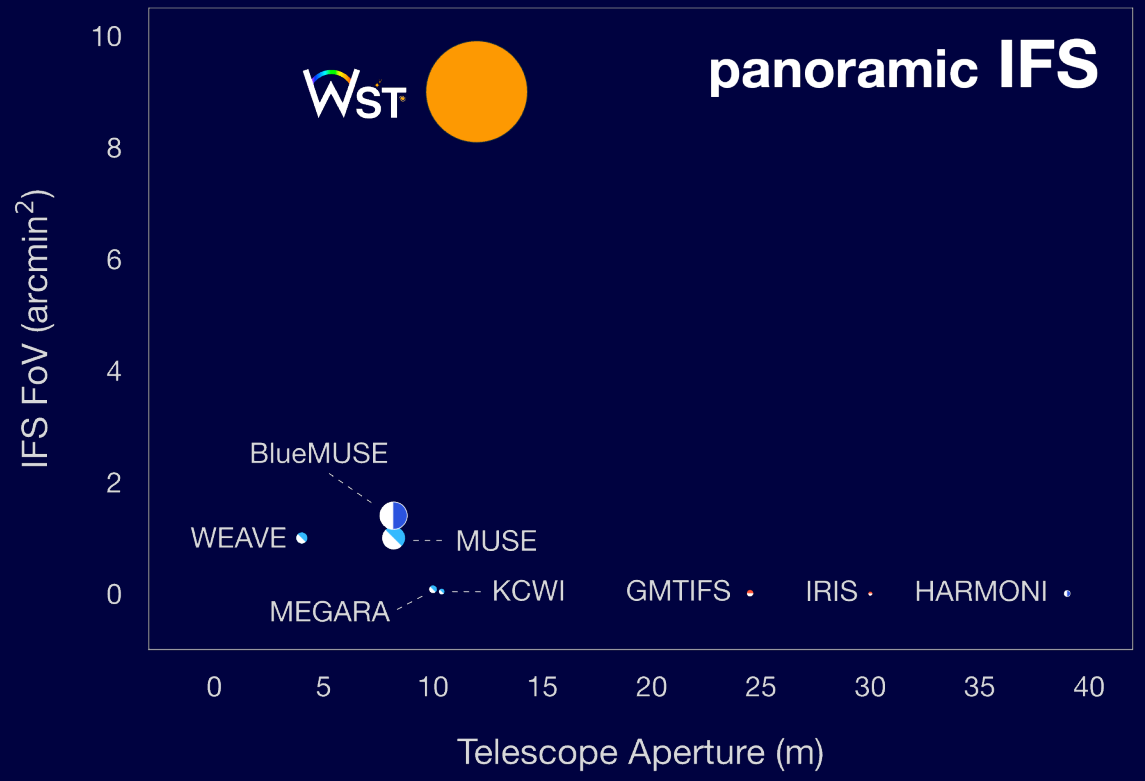
IFS Patrol Field	13 arcmin diameter
MOS & IFS simultaneous operation	
ToO implemented at telescope and fibre level	

To be put in Chile – close to Paranal

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

MOS-LR

IFS

MOS-HR

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

Science

Synergies

ELT
Gaia (Gaia-NIR)
Rubin/LSST
Euclid, Roman
SKAO
Athena
Einstein Telescope
LISA

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that cannot be addressed with current or planned
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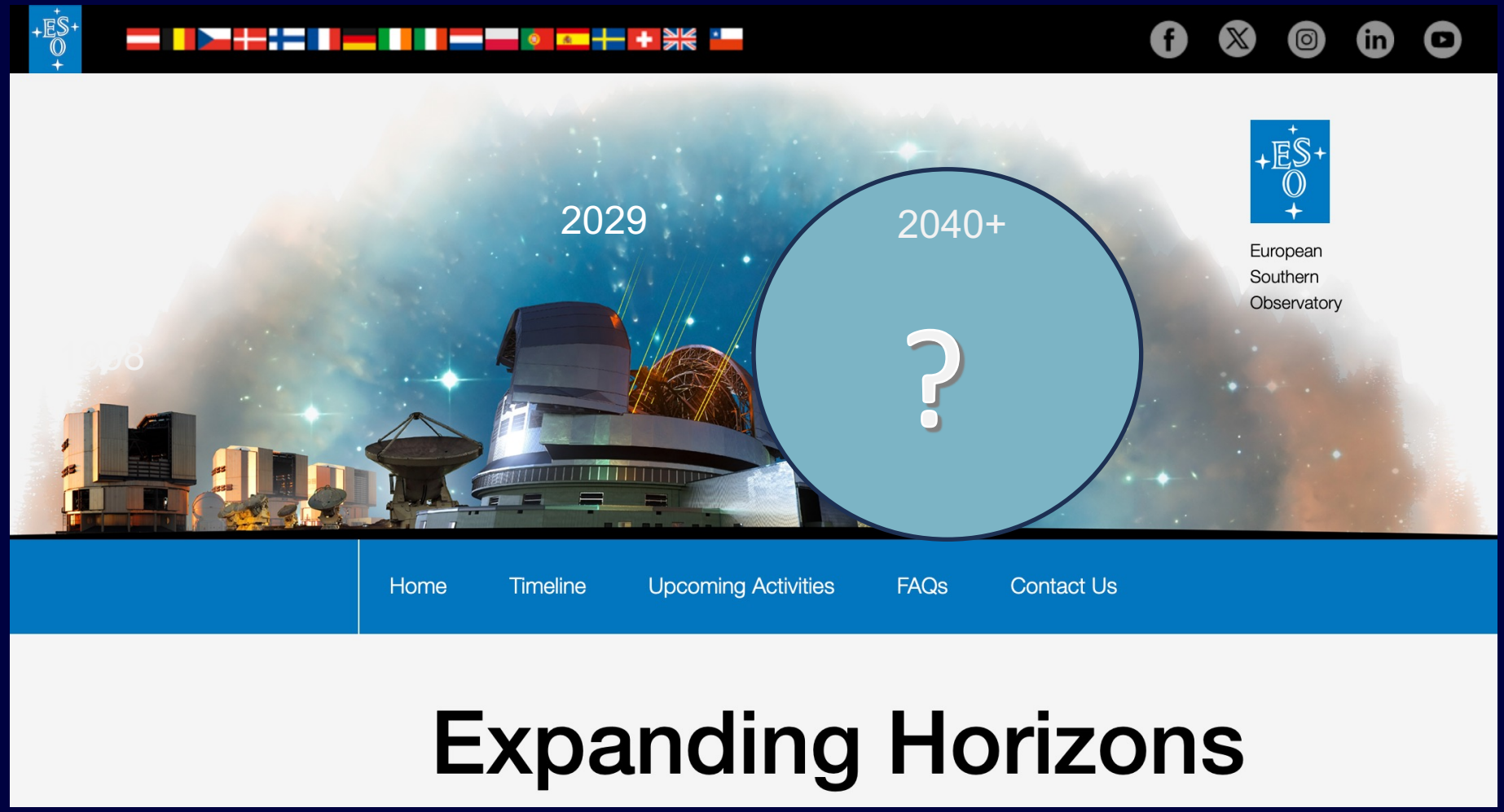
ESO future plans



ESO future plans

Science Team (850 people)

Michele Moresco
Jean-Paul Kneib
Sofia Contarini

Francesco Belfiore
Richard Ellis
Mark Sargent

Anna McLeod
Martin Roth
Sebastian Kamann

Rodolfo Smiljanic
Eline Tolstoy
Vanessa Hill

Richard Anderson
Paula Sanchez Saez
Cyrielle Opitom

Including Multi-Messenger

White paper (v1), Mainieri et al, 2024

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

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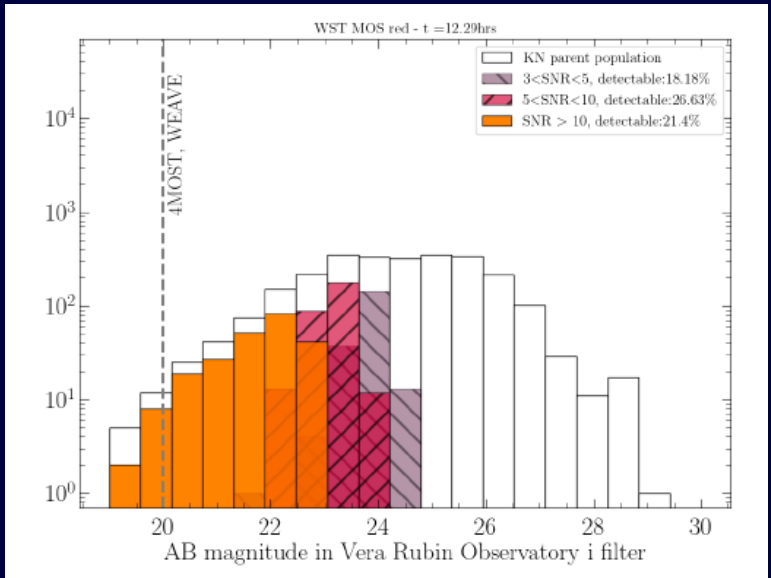
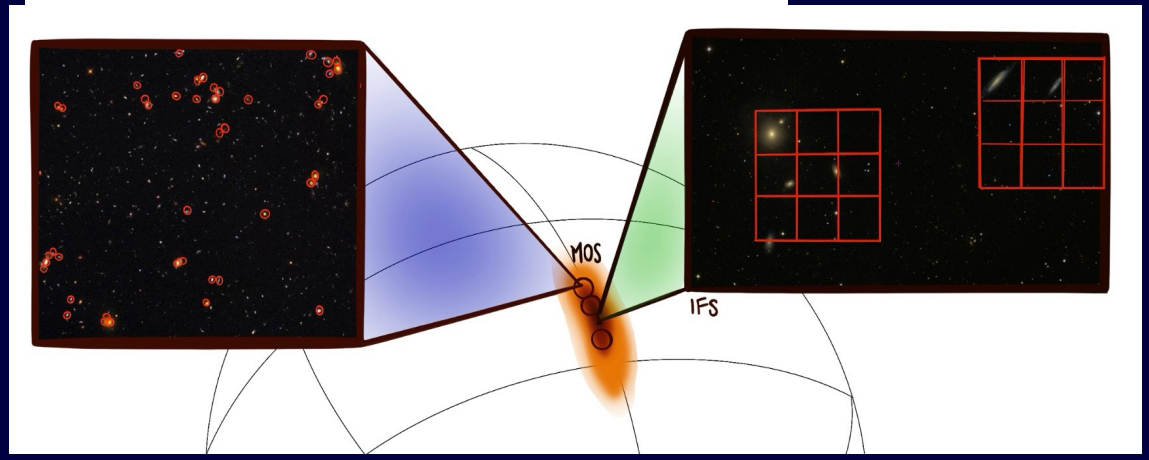
WST uniquely addresses these issues

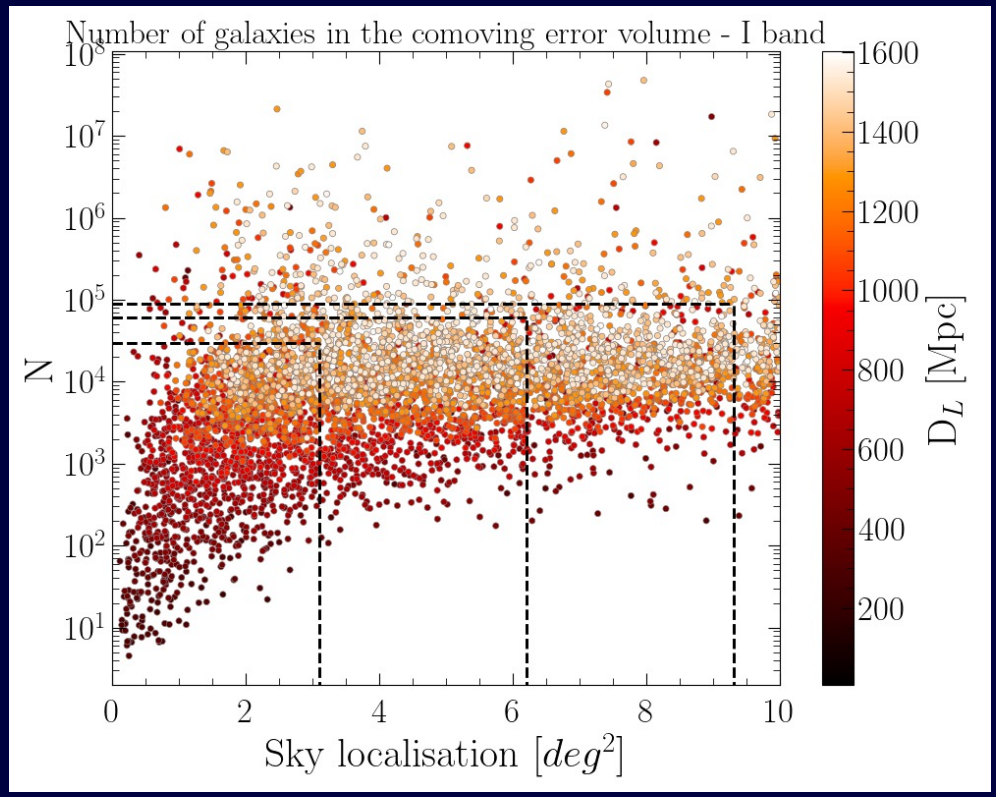
- Faint magnitudes
- Orders-of-magnitude gain in spectra/hour
- Thousands of targets observed simultaneously
- Optimized for homogeneous, repeatable observations
- Rapid (12-24 h) telescope ToO implementation

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 deg²*
(in 10 years more than 100 events ET alone)

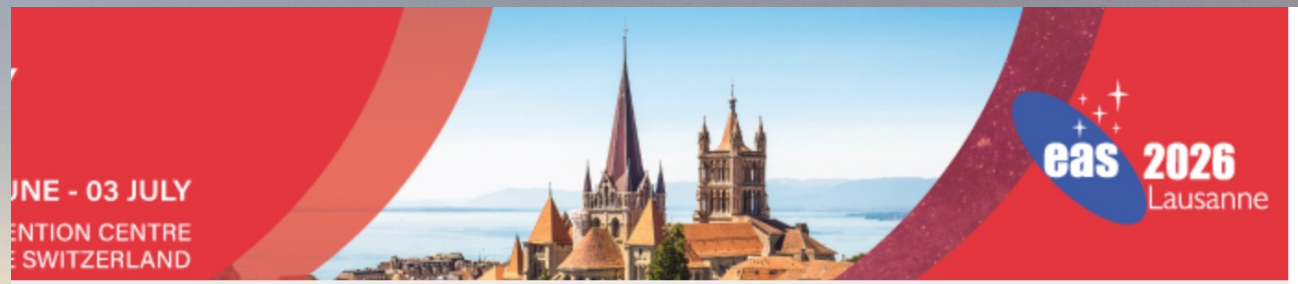
Bisero et al. (2026); see also ET Blue book

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)

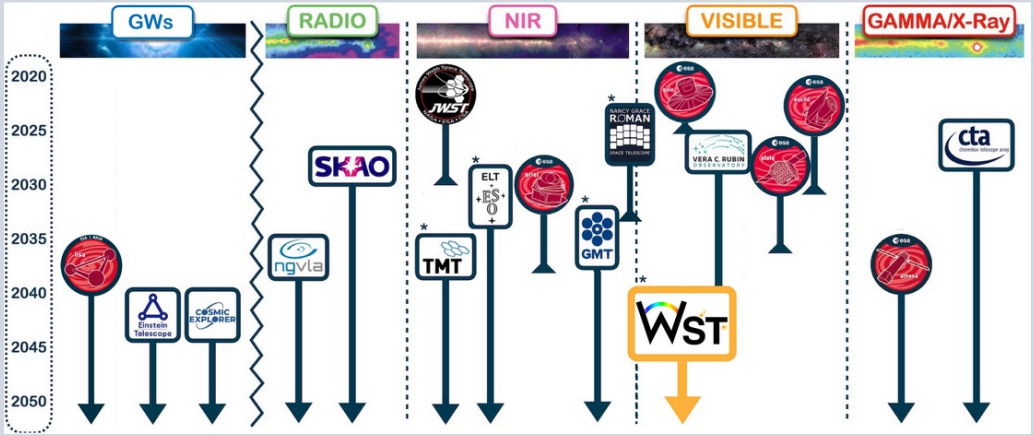
Not yet registered to WST science team ?

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.