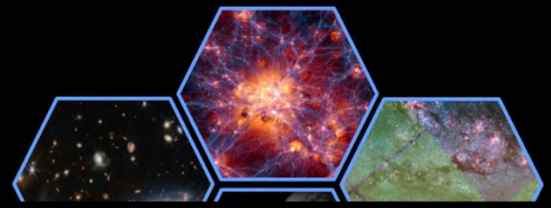
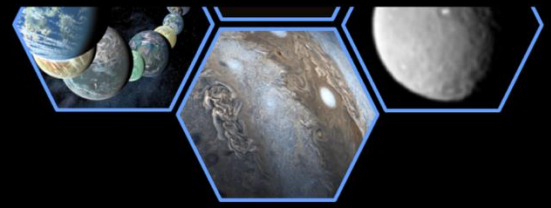
Studying the intergalactic medium with a future space telescope



SHAPING THE ITALIAN CONTRIBUTION TO THE HABITABLE WORLDS OBSERVATORY



Valentina D'Odorico

INAF – Osservatorio Astronomico di Trieste

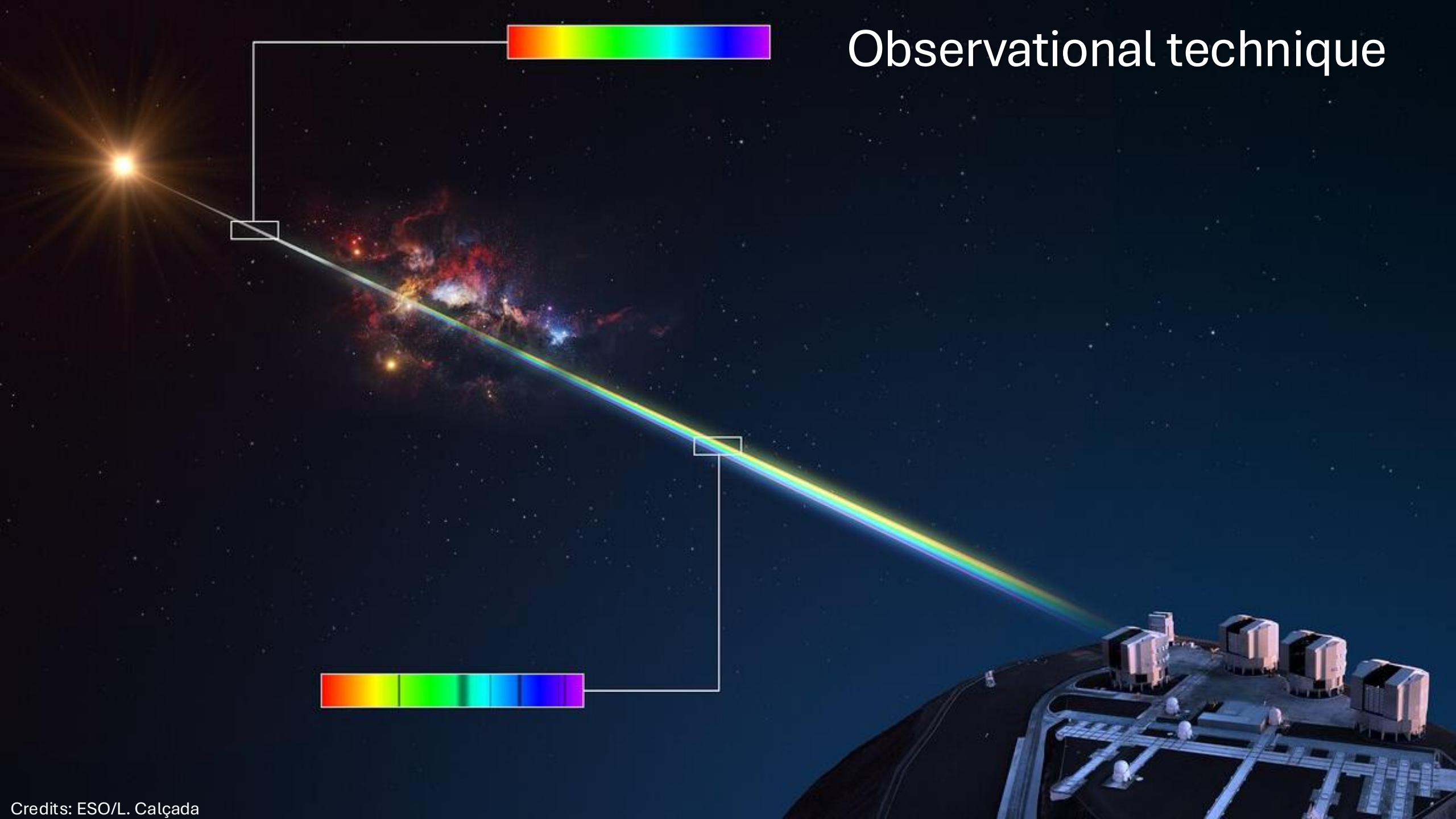
RECAP
erc synergy grant

Funded by the European Union

European Research Council
Established by the European Commission

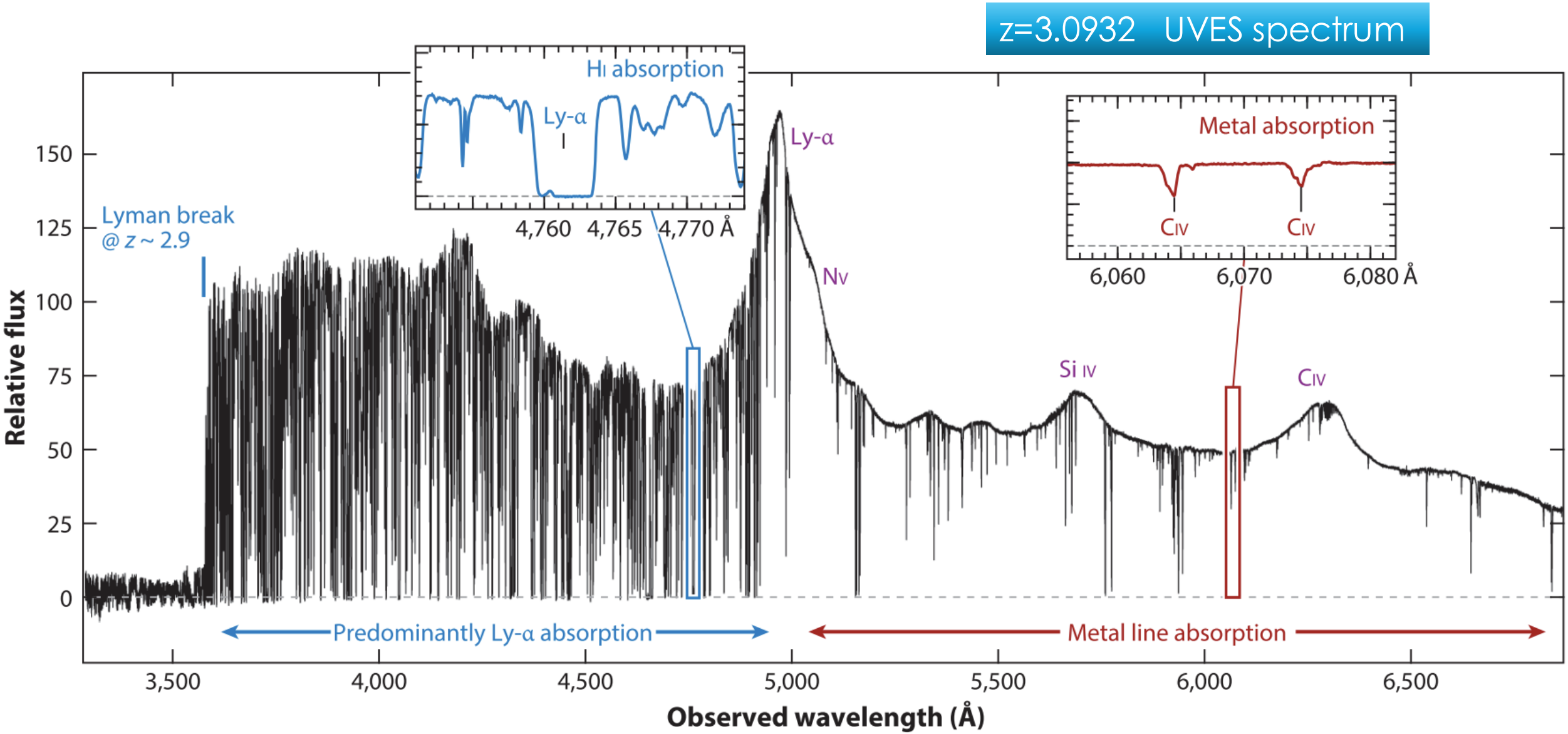
OSSERVATORIO ASTRONOMICO DI TRIESTE
INAF ISTITUTO NAZIONALE DI ASTROFISICA

Observational technique



Credits: ESO/L. Calçada

Observational technique



Péroux & Howk 2020

Science cases

Cosmology and fundamental physics

- Big Bang Nucleosynthesis: primordial abundance of Deuterium (UV, VIS);
- Redshift drift;
- Variation of fundamental constants;
- Thermal history of the Universe;
- Final phases of the HI Reionization process (NIR);
- HeII reionization (UV);
- Baryonic acoustic oscillations;
- Mass of warm DM;
- …

Astrophysics and galaxy formation and evolution

- Nature of the first stars (VIS, NIR);
- Chemical enrichment history (VIS, NIR);
- Circulation of baryons to and from galaxies;
- Escape fraction of ionizing photons from AGNs;
- Feedback mechanisms;
- …

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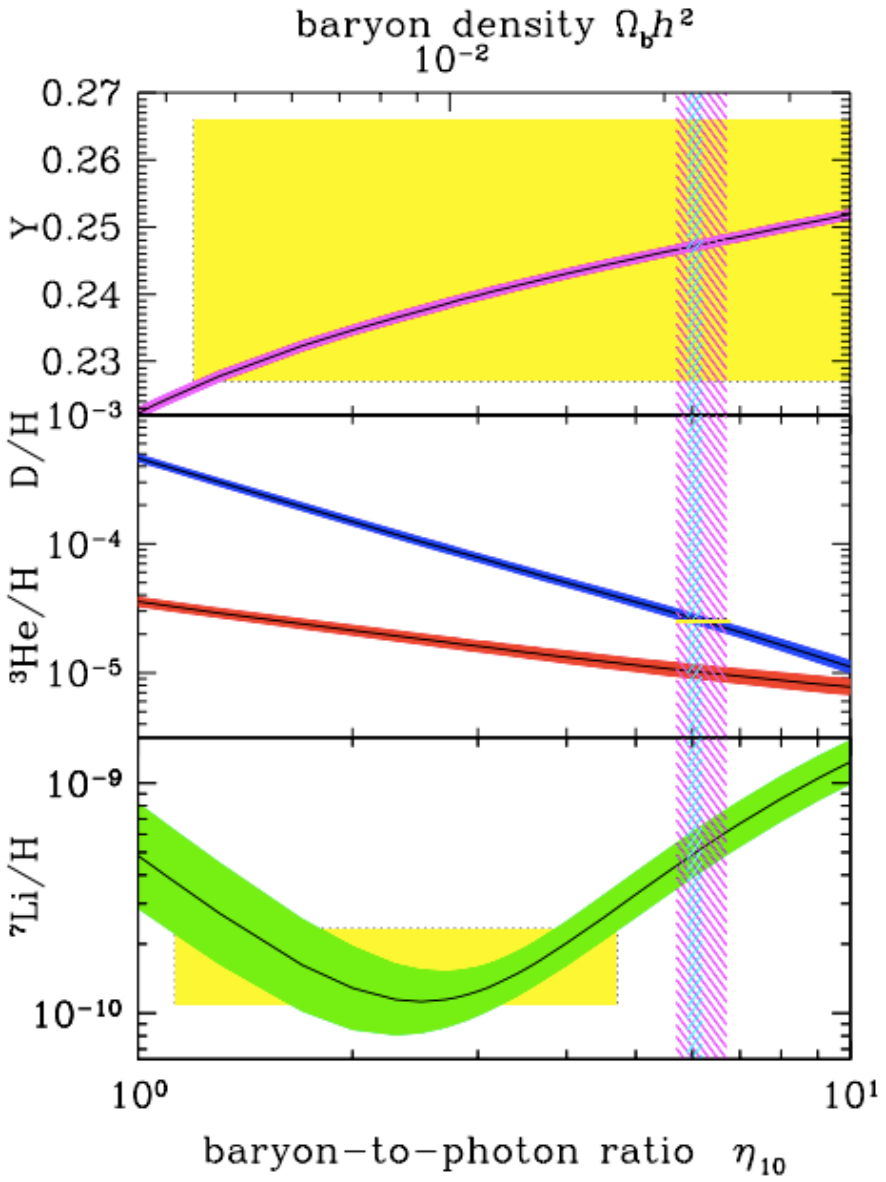
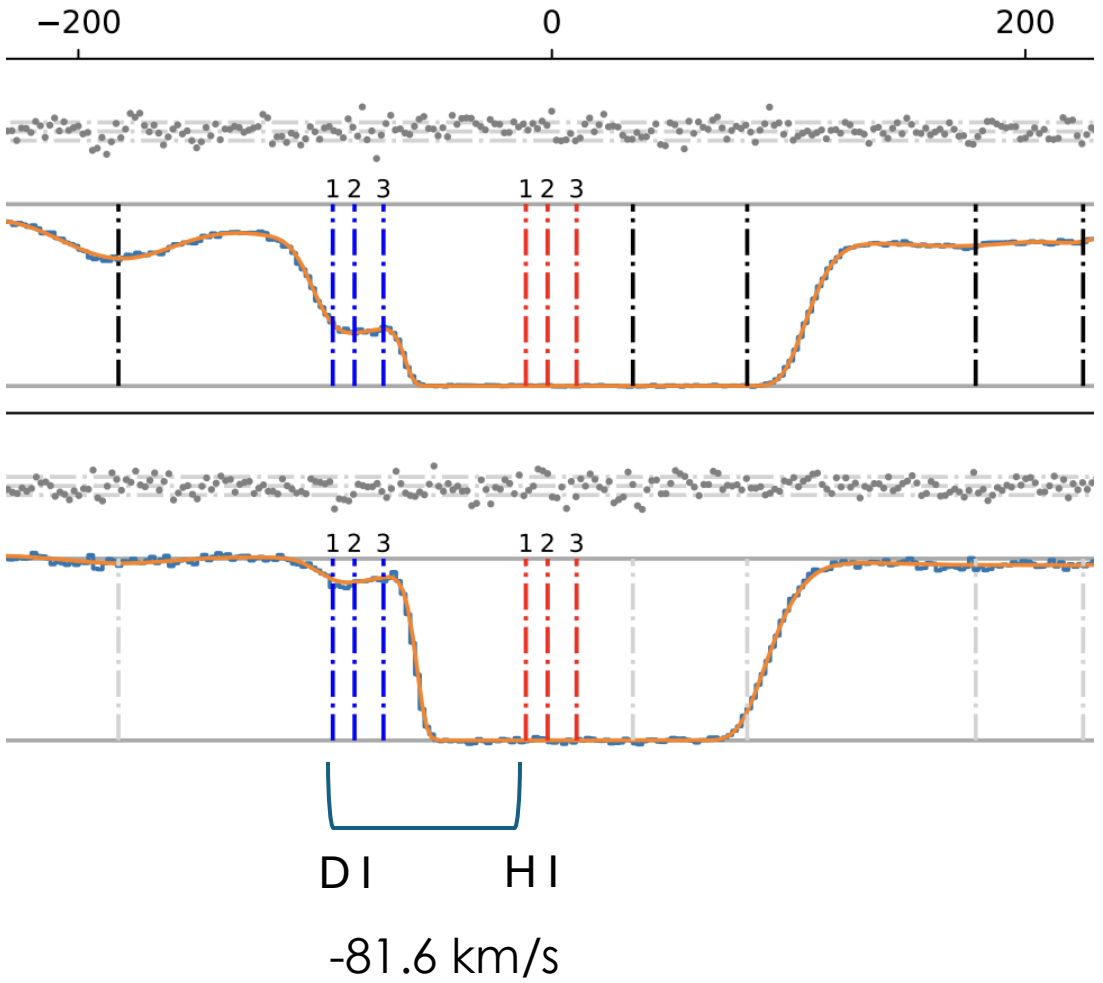
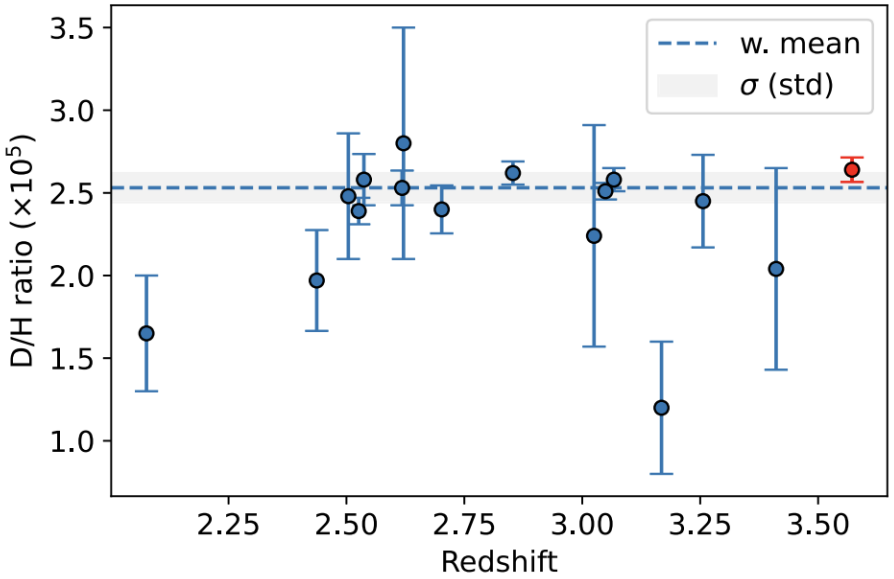
Primordial Deuterium

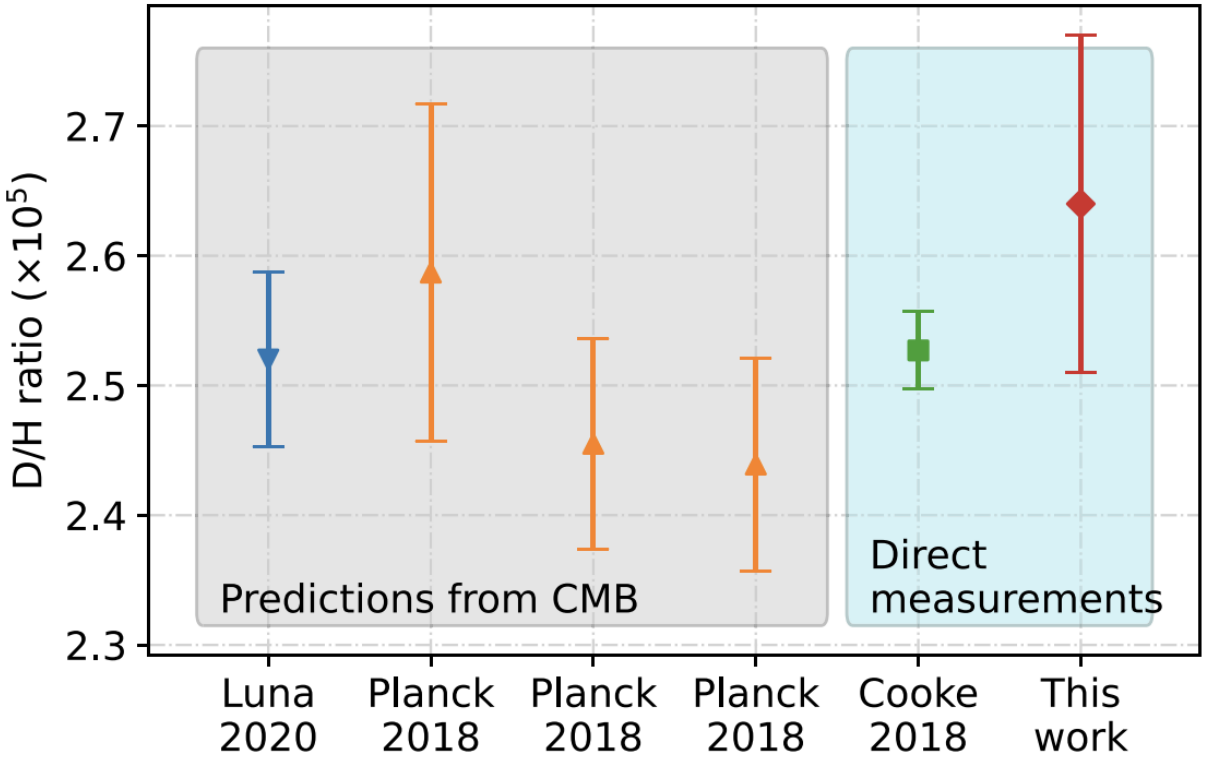




Guarneri+ 2024

Primordial Deuterium





This is also a science case for the CUBES spectrograph
(see talk by P. Di Marcantonio)

Guarneri+ 2024

Science cases

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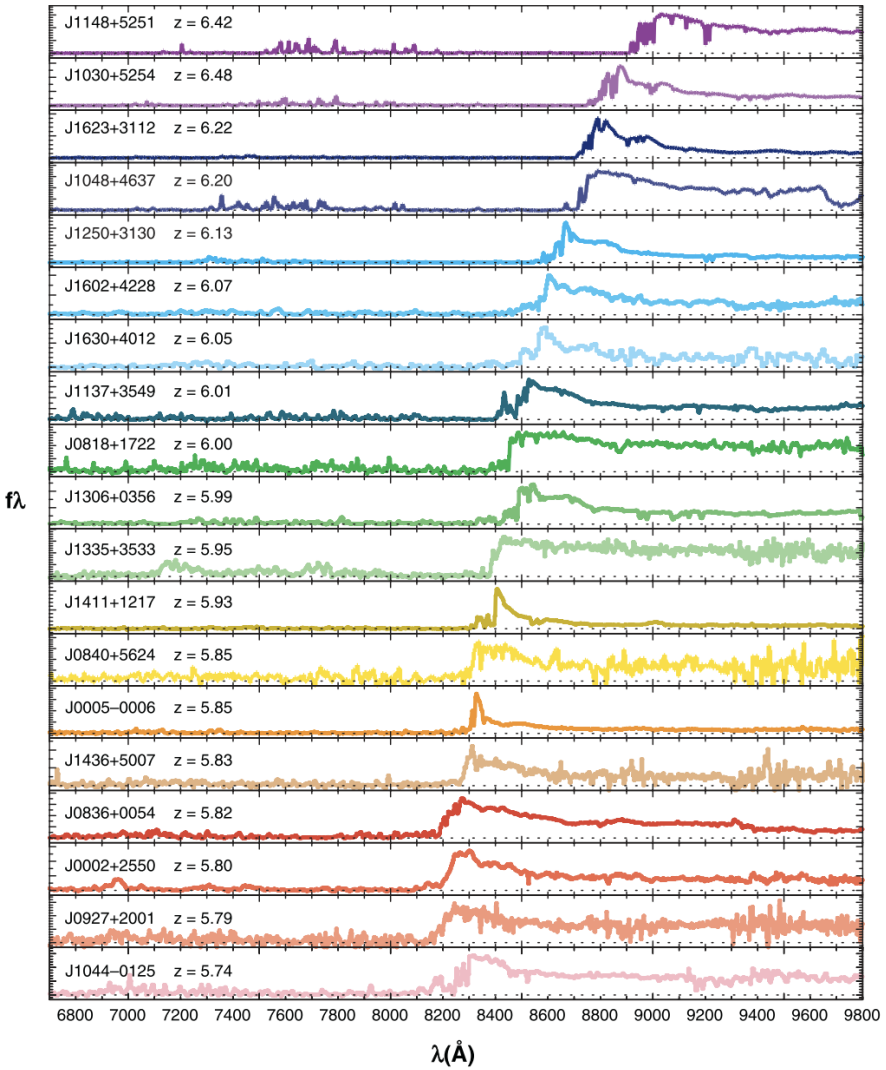
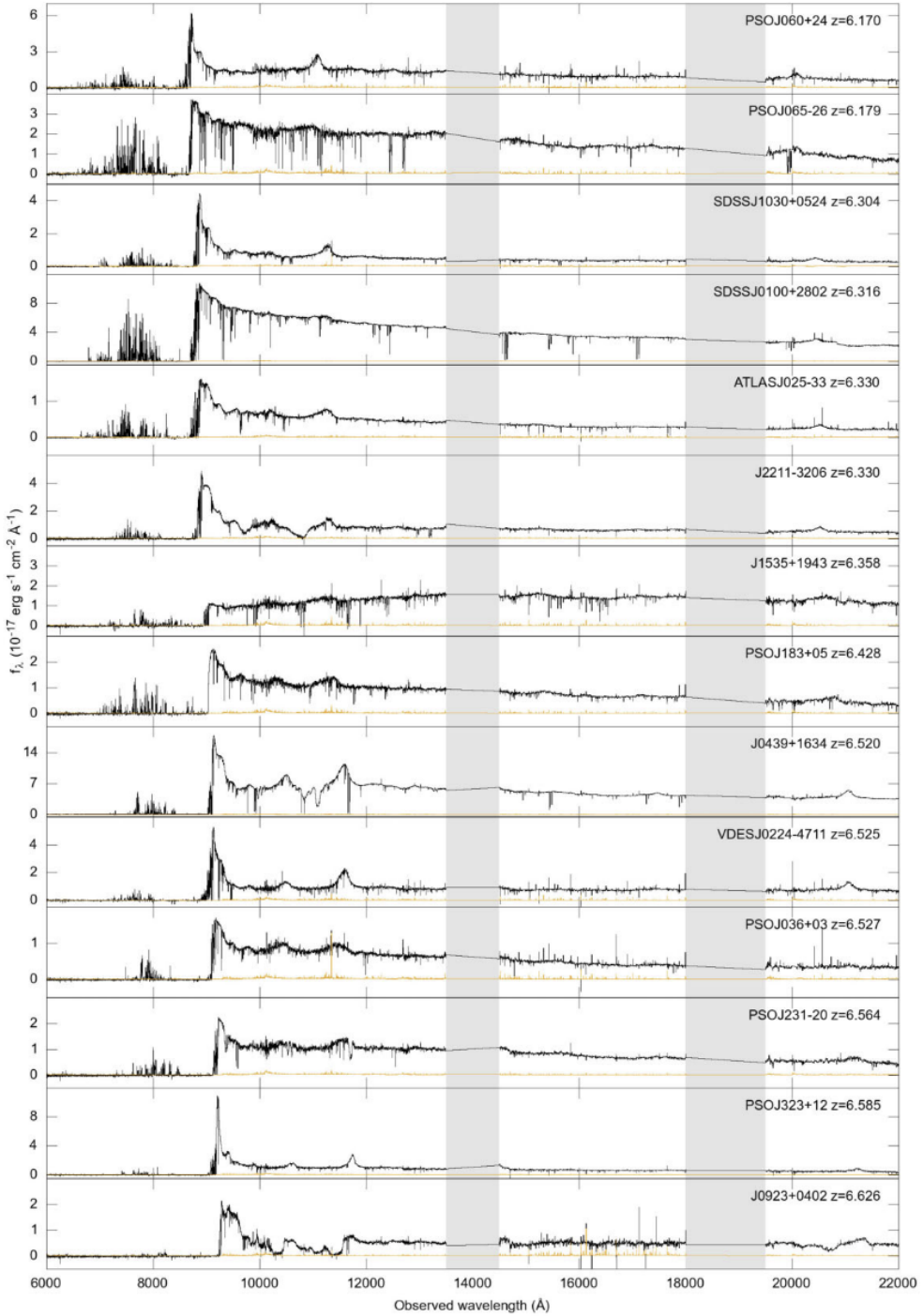
QSO spectroscopic samples at z>5.7

Fan+ 2006 SDSS



XQR-30

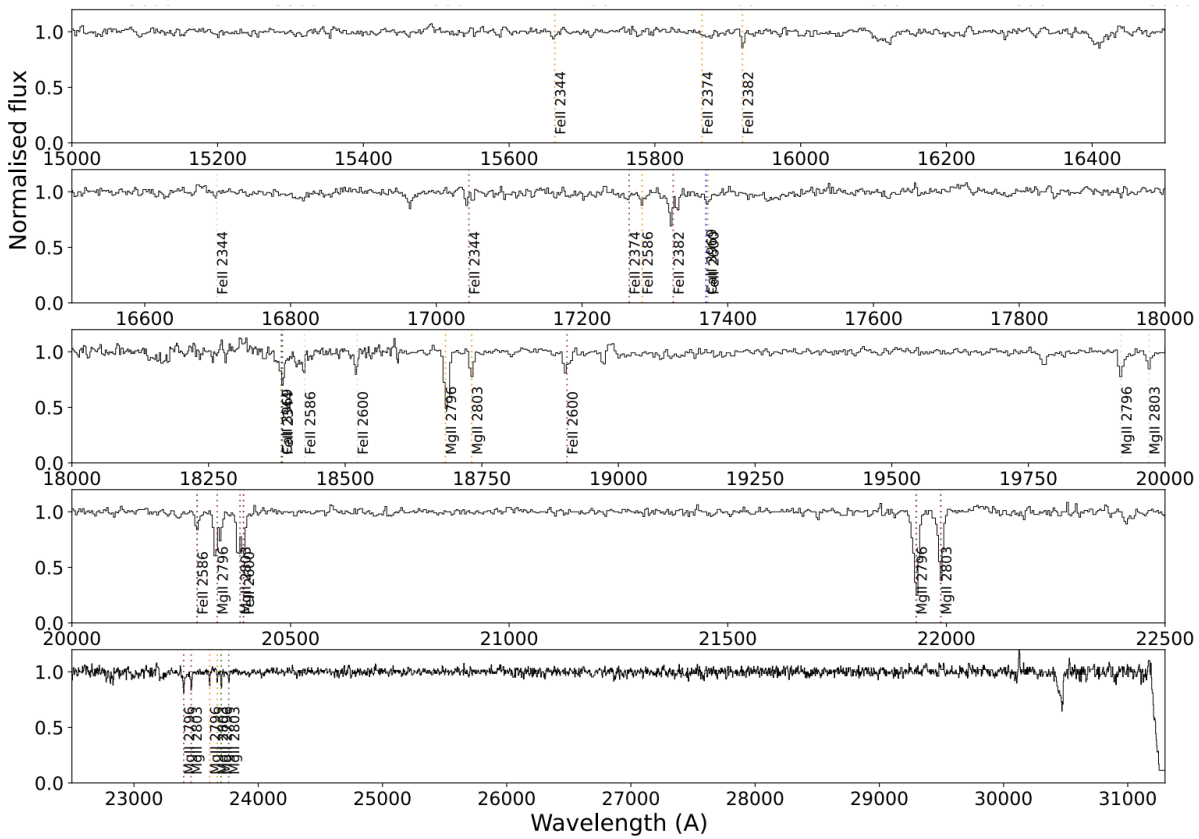
D'Odorico+ 2023
30 + 12
X-Shooter spectra



QSO spectroscopy with JWST

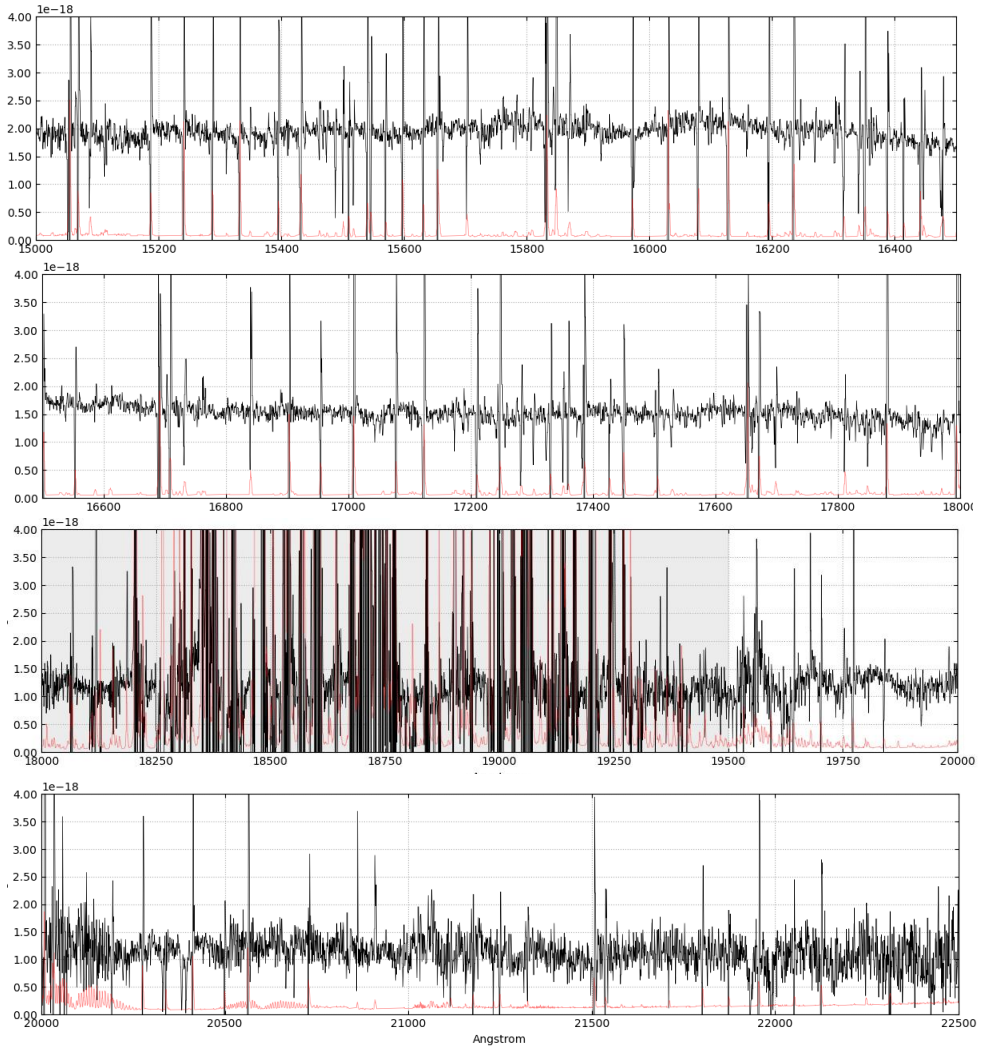
Clear advantages in the NIR: no telluric absorptions and sky emissions!

JWST R~2700, 3h



Christensen+ 2023

X-Shooter R~10,000, 23h



Vanni+ 2024

ULAS J1342+0928 z=7.54

Detailed chemical abundances

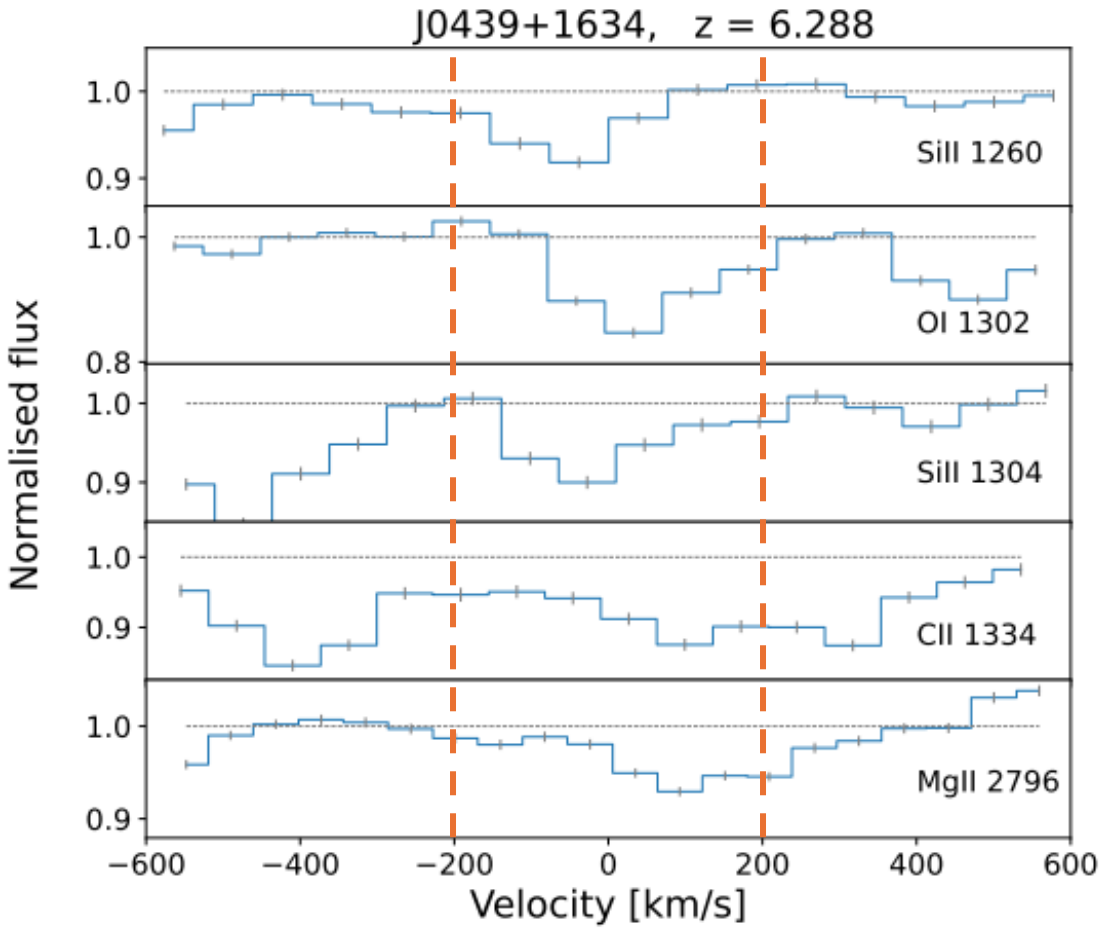
XQR-30

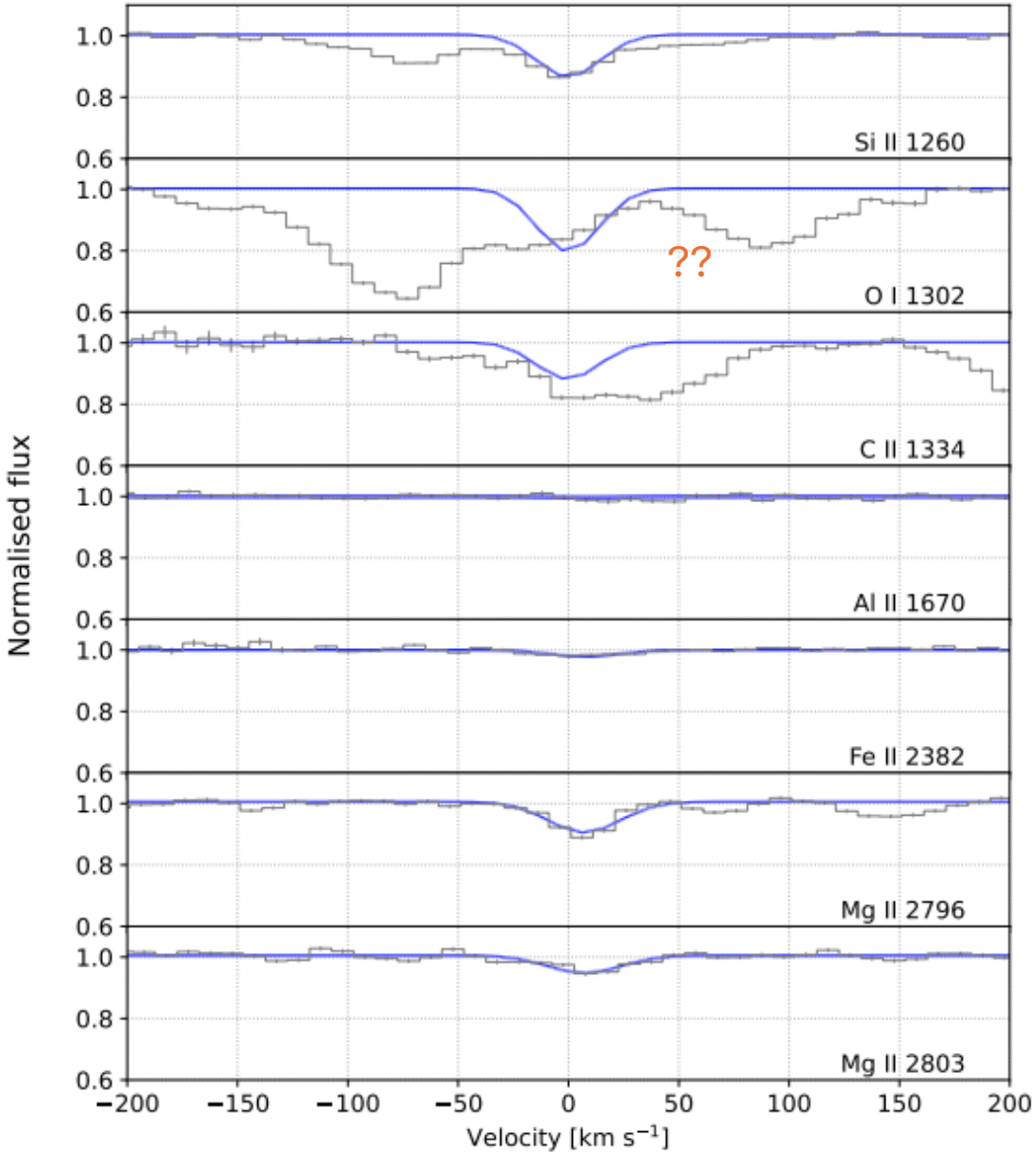
Vanni, Salvadori, VD et al. 2024

JWST/NIRSpec
R~2700
SNR~90-200 per ~2.36 A
(70km/s at 9650 A)

vs.

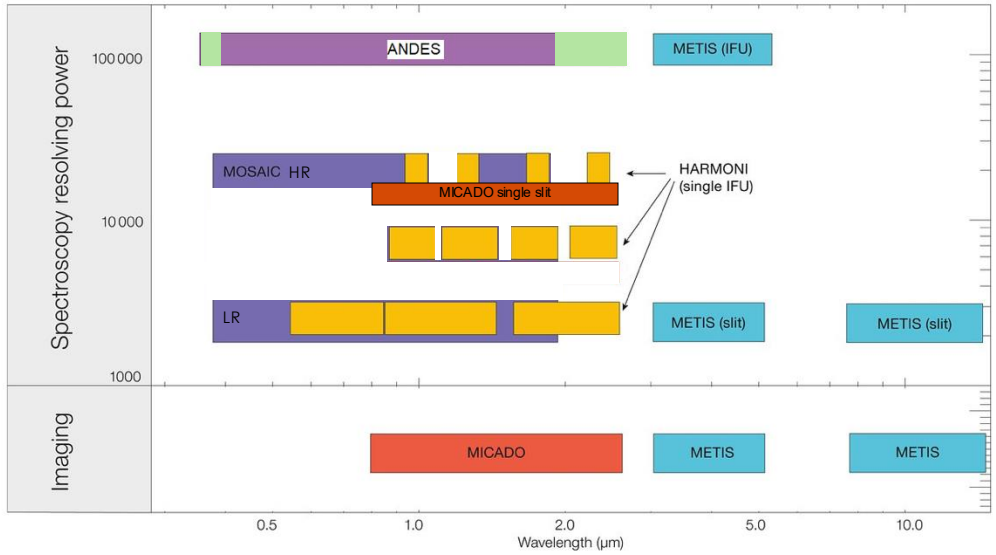
VLT/XSHOOTER
R~9500
SNR~300 per 70km/s
at 9650 A



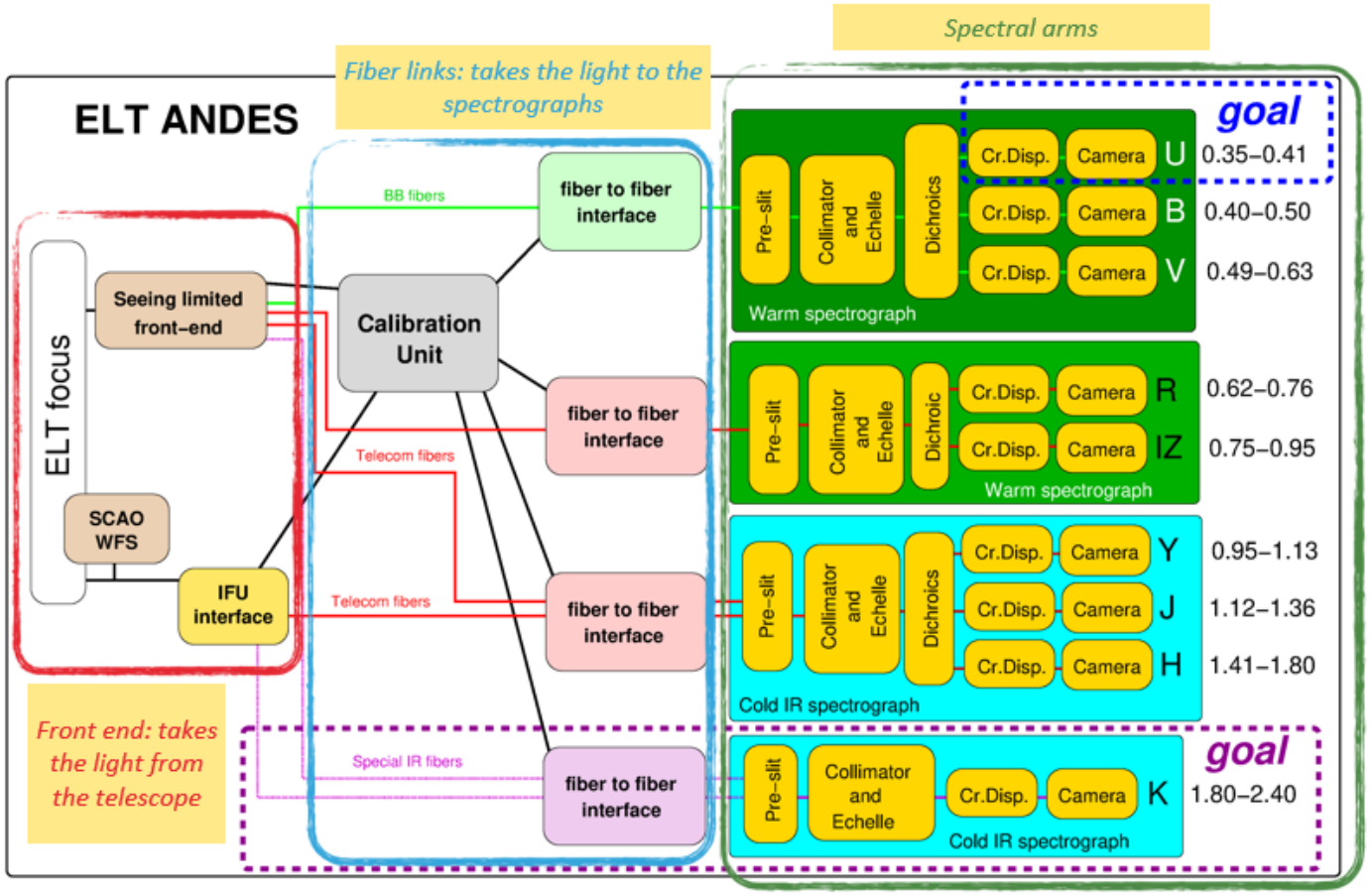


Christensen+ 2023

ANDES - ArmazoNes high Dispersion Echelle Spectrograph



- Modular instrument: the U and K spectrograph can be added in a second moment;
- Simultaneous coverage in the range 0.4-1.8 mum

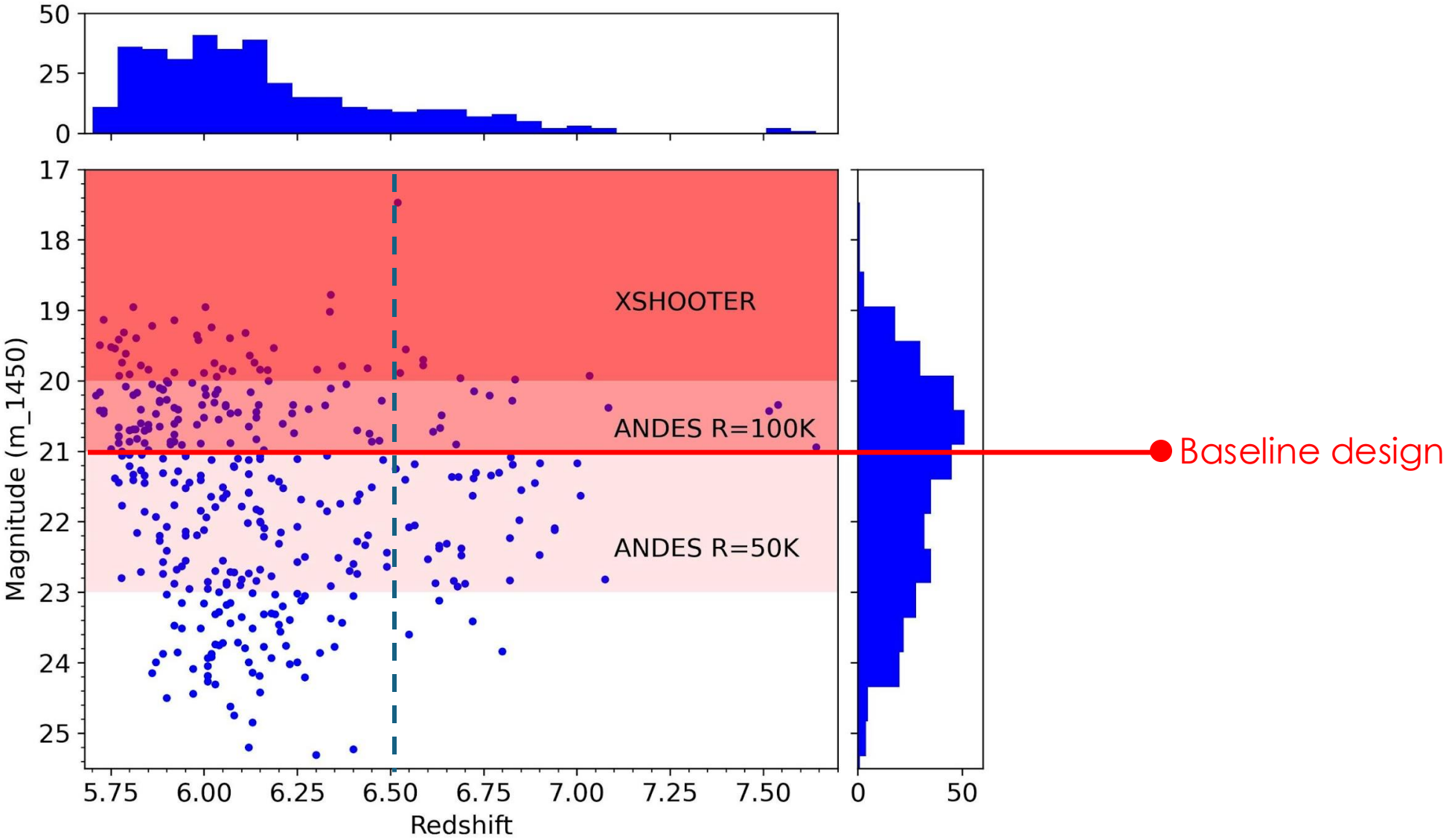


Extragalactic science

Detailed studies of the H I distribution, the metal content and chemical abundances in the IGM/CGM at the epoch of Reionisation

D'Odorico+ 2024 ANDES White Paper 3

ANDES - QSO spectroscopy at z>5.7



D'Odorico+ 2024

A step forward with HWO?

A large space telescope with…

- a UV spectrograph (λ ~ 100-300 nm) at high resolution (R~20,000-40,000)

  to study primordial Deuterium and H_2 at z~1-2

A step forward with HWO?

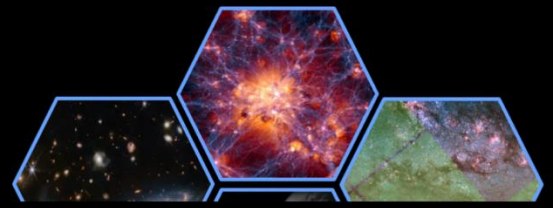
A large space telescope with…

- a UV spectrograph (λ ~ 100-300 nm) at high resolution (R~20,000-40,000)

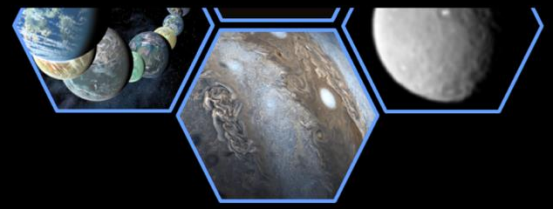
  to study primordial Deuterium and H_2 at z~1-2

- an infra-red spectrograph (λ > 1 μm) at high resolution (R~20,000-40,000)

  to study metal absorption systems in the spectra of the highest redshift quasars



SHAPING THE ITALIAN CONTRIBUTION TO THE HABITABLE WORLDS OBSERVATORY



Thanks