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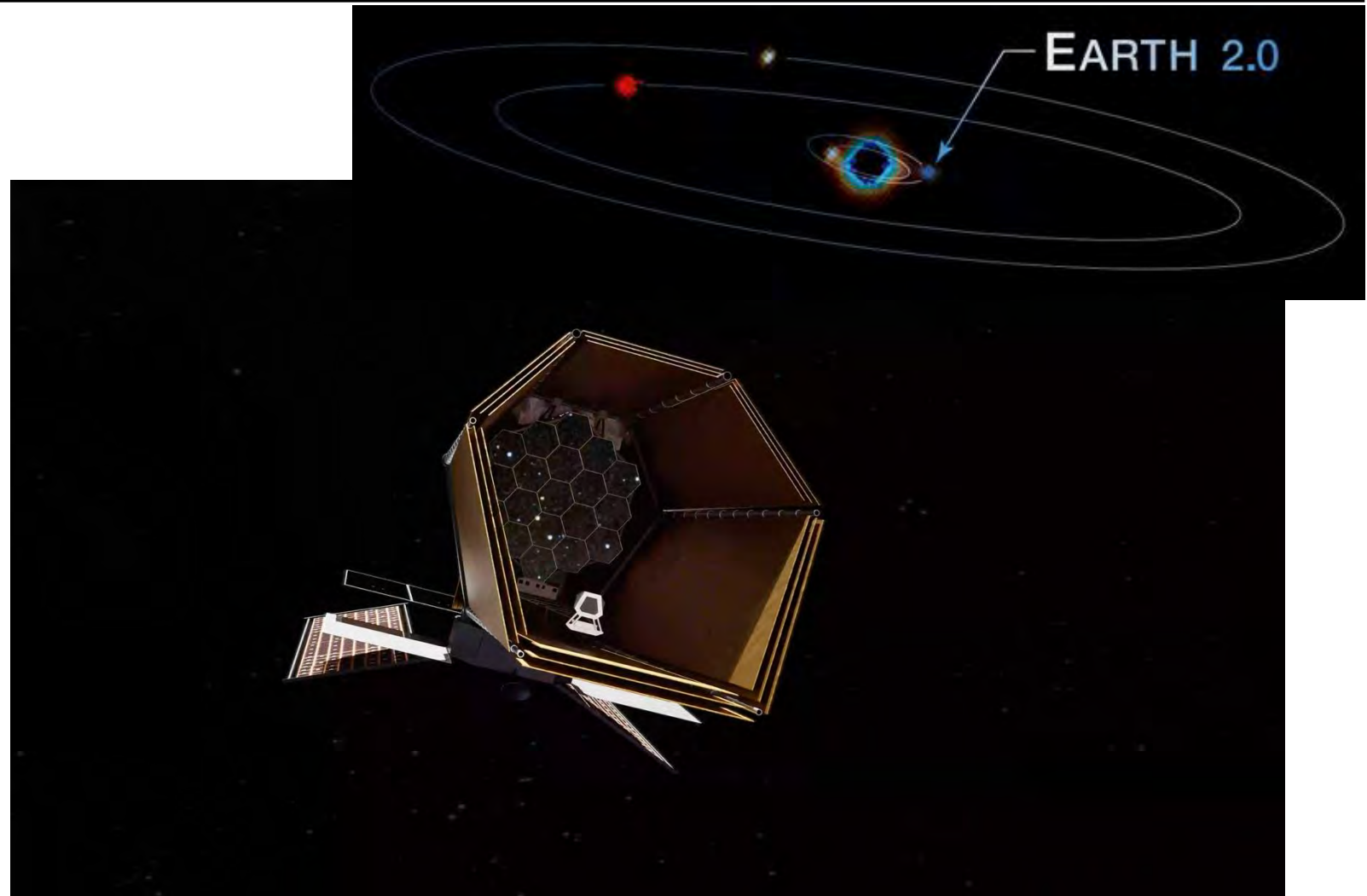
Planning for a UK-led Instrument Contribution to HWO

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The Habitable Worlds Observatory (HWO)

- Aperture $> 6.5\text{m}$
- Serviceable & upgradable
- 5-year prime mission, 10 years of consumables
- 25-year lifetime goal, non-serviceable components
- International collaboration
- Instrument contributions
> opportunity for UK

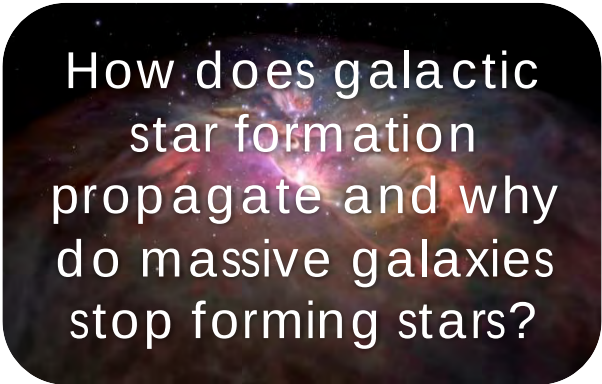




What is the nature of dark matter?



How does our solar system fit in among other planetary systems?



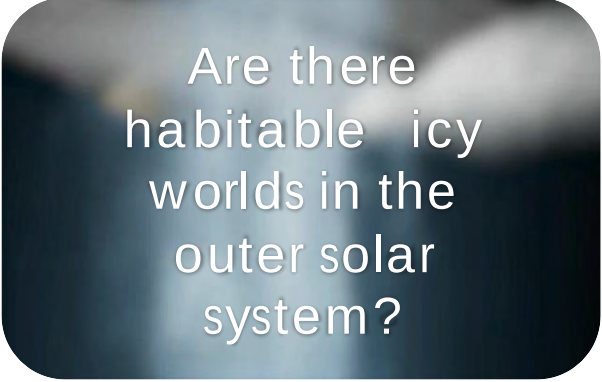
How does galactic star formation propagate and why do massive galaxies stop forming stars?

How are heavy elements recycled by galaxies?

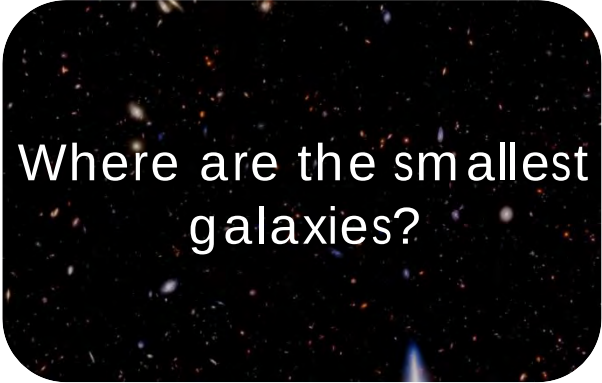


How many black holes are in the Milky Way?

H A B I T A B L E
W O R L D S
O B S E R V A T O R Y



Are there habitable icy worlds in the outer solar system?



Where are the smallest galaxies?

How do the most chemically primitive stars live and die?



Is there life on exoplanets?

How do the most massive black holes form?

Context

- Strong UK science & technical interest
- UKSA and STFC fully engaged
 - STFC grants for travel/meetings
 - UKSA funding for instrument studies
- Potential UK instrument contribution
 - Modelled on MIRI approach
 - Sensor contributions
 - Other key technologies?
- Maximising UK community involvement



UK instrument studies

- Call for proposals issued mid-2025 (£300k funding limit)
 - Funding for 6-month period – October 2025 to March 2026
- Two programmes selected
 - Leicester, Open University, Durham, Cambridge, RALSpace, Astronomy Technology Centre – studying HRI and MOS, awarded £300k
 - MSSL/UCL, Durham, with RALSpace, ATC support – studying HRI
 - Reports delivered March/April 2025



UK instrument studies

- Studies based on LUVVOIR baseline specifications
- Additional requirements drawn from GOMAP case studies
- Additional science input from UK community
 - E.g. Imaging of planetary aurorae

High-Resolution Imager		Multi-Object Spectrograph	
FUV, NUV, Vis and NIR imaging		UV, Vis multi-object spectroscopy and FUV integral field spectroscopy	
Bandpass	~ 90 - 2500 nm	Bandpass	~ 90 - 700 nm
Field-of-View	~ 2.5'×5'	Field-of-View	~ 5'×5'
Resolution	~ 16 mas	Resolution (IFU)	~ 10 mas
Astrometry precision	~ 0.5 μas	R (λ/Δλ)	~ 5000 - 20,000
60+ science filters & grisms			
			



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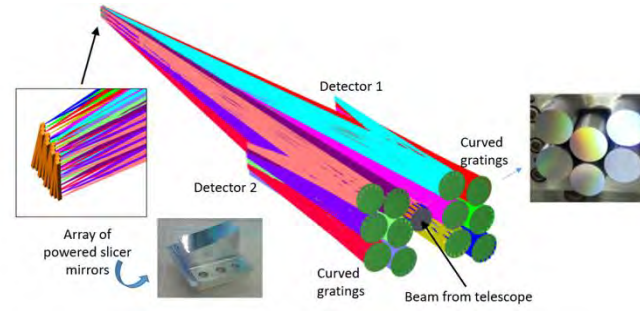
The diagram illustrates the instrument architecture, showing the flow of light from the Observation Target through the Optical Telescope Assembly (OTA) and Fine Steering Mirror. The light path is divided into two channels, OW1 and OW2, which pass through various filters (FUV, NUV, NIR, VIS) and detectors (Delta diopod CMOS, CS3000, H-488). The system is controlled by the Instrument Control Unit (ICU) and the Observatory Main Computer, which is connected to the Observatory Radiator Array and Heat Sink Interface.

HRI Functional Block Diagram

MOS



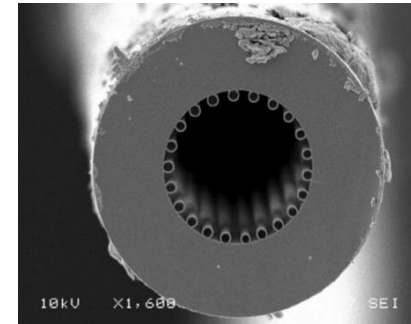
- Fibre-fed system for MOS
 - Need hollow core fibres for NUV
 - Flexure-based fibre positioners
- Integral Field Unit
 - Image slicer mirrors
 - Curved focusing gratings
- Detectors
 - Silicon-based for NUV and Vis
 - Delta-doped CMOS and MCPs considered for FUV
- Technology challenges
 - Performance of hollow core fibres
 - Performance of positioners
 - Manufacturability of freeform optics
 - FUV detector QE performance



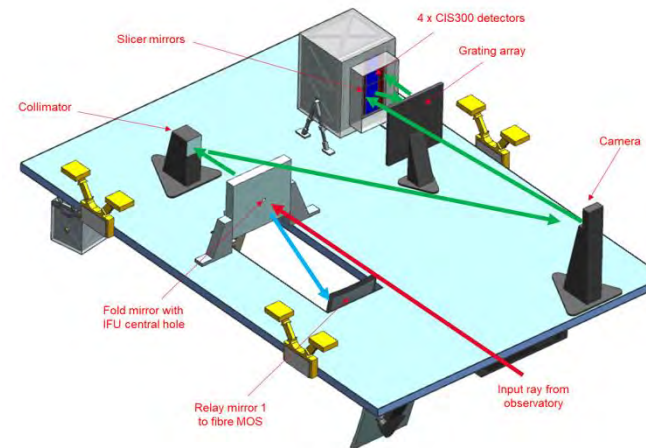
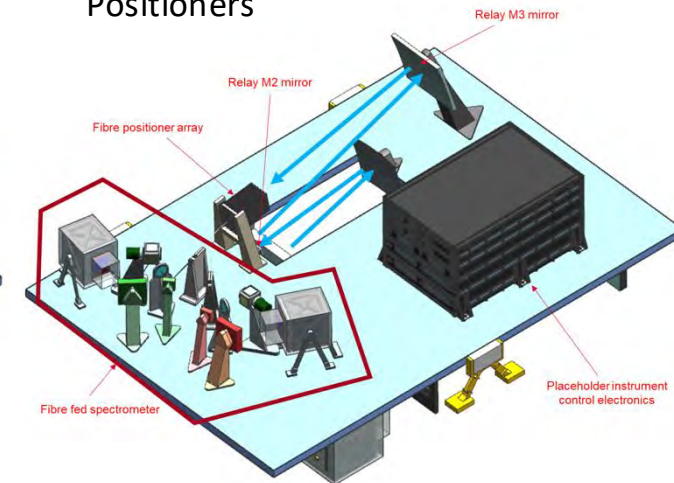
FUV Integral Field Unit design



Positioners

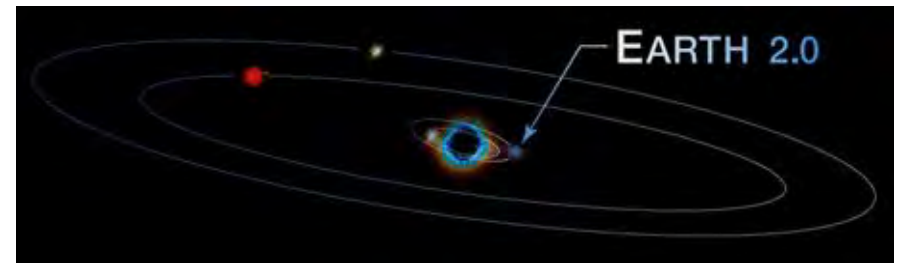


Hollow core fibres for NUV



MOS Concept Instrument Design,
IFU (left) and Fibre-MOS (right) on either sides of the optical bench

What Next?

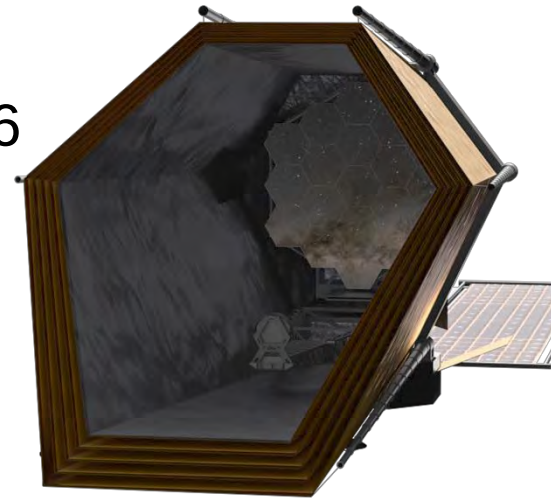


- UKSA awarded £3M for continued studies in a single consortium (01/08/26 to 31/03/27)
 - There is further work flowing from new telescope architectures
 - Earlier studies have identified key TRL development needs
 - Demonstrations that raise TRL – free-form mirrors, space qual. of fibre positioners/image slicers, hollow-core fibres, dichroics, FUV detectors
 - Doing these now when, we have higher funding than we might later, banks some wins for the UK
- Seek international partners



Current international activities

- European HWO Programme Coordination Group running since early 2025
 - Informal group to allow exchange of views & build collaborations
 - Only UK and France (Pollux) interested in leading instrument
 - Strong interest in participating from others
 - Note European HWO Conference – Paris, Nov 30th to Dec 4th 2026
- ESA now developing HWO activity following Nov 25 ministerial
 - Expected call for expressions of interest was expected in summer
 - Seems to have been paused
- NASA continuing work on telescope configurations
- NASA call for instrument studies currently underway
- Other known interests
 - Japan - IFU, Canada - MOS, Colorado - UV spectrograph, Ames – Coronagraph, France – Astrometry, Texas – HRI



Future...many moving pieces

- What will happen with NASA studies
 - Who?
 - What?
- What will ESA do?
- UK choice of instrument
 - When? What input is needed?
 - Input from reports
 - Views from community
 - Develop robust costs for the various elements
 - Need insight of likely funding
- Instrument provision is a ticket to the party
 - HWO will do all our science with its wide instrument complement



UK community

