JWST is an international partnership between NASA, ESA and the CSA.



JWST status, capabilities and scientific timeline

Pierre Ferruit (ESA JWST project scientist)

"Preparing JWST era" – S21 EWASS 2017 – Prague – Czech Republic

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Introduction.

Mission status.

JWST observing modes (quick overview) and capabilities.

Scientific timeline.

Getting ready for JWST (beyond this session).

Conclusion.

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All along this presentation you will see results from work conducted by a large number of teams in Europe, USA and Canada.

Many elements of this presentation are based on existing presentations prepared by other members of the JWST project, the instrument teams and STScI.

A lot of material used in this presentation is coming from from STScI's JWST web sites (main resources for getting information):

https://jwst.stsci.edu/ (main site)

https://jwst-docs.stsci.edu/ (documentation site, work in progress)

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JWST will be one of the "great observatories" of the next decade.

Joint mission between NASA, ESA and CSA.

• High-priority endeavor for the associated astrophysical communities.

Setup similar to the HST one.

- Over the duration of the mission, at least 15% of the total JWST observing time goes to ESA member states applicants.
- To be launched in October 2018 for a minimum mission duration of 5 years (10-year goal).











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JWST's payload module (telescope + instruments = OTIS) is getting ready for a major cryogenic test campaign.





Credits: NASA/Chris Gunn

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In parallel, the integration of the spacecraft and the sunshield continues at Northrop-Grumman's premises in California.



Forward Sunshield Unitized Pallet Structure Attached to the Spacecraft Bus (Northrop Grumman)

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JWST has made tremendous progress and the launch is now in sight but we still have a lot of work in front of us.

JWST is on track for a launch in October 2018.

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JWST observing modes







NIRCam = Near-InfraRed Camera - PI: M. Rieke

Developed under the responsibility of the University of Arizona.









NIRISS = Near-infrared Imager and Slit-less Spectrograph FGS = Fine Guidance Sensor - PIs: R. Doyon & C. Willott

Provided by the Canadian Space Agency.



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NIRSpec = Near-infrared Spectrograph

Provided by the European Space Agency. Built for ESA by an industrial consortium led by Airbus Defence and Space.

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JWST observing modes



Each instrument has its dedicated section in the documentation. This is the primary source of documentation on the capabilities and observing modes of each instrument

https://jwst-docs.stsci.edu/display/HOM/JWST+User+Documentation+Home

JWST Observatory and Instrumentation Search Expand all Collapse all > Mid-Infrared Instrument, MIRI Near Infrared Camera, NIRCAM Near Infrared Imager and Slitless Spectrograph. NIRISS Near Infrared Spectrograph, NIRSpec * Fine Guidance Sensor, FGS > JWST Observatory James Webb Space Telescope User Documentation DATA * INSTRUMENTS ' PLANNING 1 CALL FOR PROPOSALS * POLICIES * Search

JWST Observation Planning Documentation

JWST Observing Modes and Strategies

https://jwst-docs.stsci.edu/display/JPP/JWST+Observing+Modes+and+Strategies

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Work on the area dedicated to the observing modes is in progress Will be ready for the GO call for proposals



JWST observing modes





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🗅 image image+grism coronagraph IFU 74" 🗖 slit MSA 24' 30" 113" 20" 24'' . 37" V3 MIRI 64" V2 ← 132" 3x3" 1' 1.5 5" NIRCam NIRSpec 133" FGS NIRISS







JWST observing modes (imaging)



Instrument	Wavelength (in microns)	Pixel scale (in mas/pixel)	Field of view (arcmin x arcmin)
NIRCam	0.6-2.3	32	2.2' x 4.4'
NIRCam	2.4-5.0	65	2.2' x 4.4'
NIRISS	0.9-5.0	65	2.2' x 2.2'
MIRI	5.0-28	110	1.3' x 1.7'
NIRCam	0.6-2.3	32	Single object, time series
NIRCam	2.4-5.0	65	Single object, time series

NIRCam: Simultaneous imaging of the same field of view in the short and long wavelength channels.

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jwst JWST observing modes (spectroscopy, 1/2)



Instrument	Туре	Wavelength	Spectral resolution	Field of view
NIRISS	SLITLESS	1.0-2.5 μm	~150	2.2′ x 2.2′
NIRCam	SLITLESS	2.4-5.0 μm	~2000	2.2′ x 2.2′
NIRSpec	MOS	0.6-5.3 μm	100/1000/[2700]	9 square arcminutes
NIRSpec	IFS	0.6-5.3 μm	100/1000/2700	3" x 3"
MIRI	IFS (MRS)	5.0-28.8 μm	2000-3500	>3" x >3.9"
NIRSpec	SLIT	0.6-5.0 μm	100/1000/2700	Single object
MIRI	SLIT (LRS)	5.0-12.0 μm	40-160	Single object

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JWST observing modes (spectroscopy 2/2)



Instrument	Туре	Wavelength	Spectral resolution	Field of view
MIRI	SLITLESS (LRS)	5.0-12.0 μm	40-160	Single object, time series
NIRSpec	APERTURE	0.6-5.3 μm	100/1000/2700	Single object, time series
NIRCam	SLITLESS	2.4-5.0 μm	~1500-1700	Single object, time series
NIRISS	SLITLESS	0.6-2.5 μm	700	Single object, time series

NIRCam: short-wavelength imaging can be conducted simultaneously to the long-wavelength, time series spectroscopy.

Take-home message: in JWST, spectroscopy comes in many different flavors!

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jwst JWST observing modes (coronagraphy & AMI) CeSa

	Туре	Field of view	Pixel scale	Wavelength	Instrument
Lyot	20″	20" x 20"	32 mas/pixel	0.6-2.3 μm	NIRCam
Lyot	20″	20" x 20"	65 mas/pixel	2.4-5.0 μm	NIRCam
Aperture Masking Interferometry	.5″	0.1-0.5″	65 mas/pixel	3.8-4.8 μm	NIRISS
4QPM	24″	24" x 24"	110 mas/pixel	10.65 μm	MIRI
4QPM	24″	24" x 24"	110 mas/pixel	11.4 μm	MIRI
4QPM	24″	24" x 24"	110 mas/pixel	15.5 μm	MIRI
Lyot	30″	30" x 30"	110 mas/pixel	23 µm	MIRI

Direct imaging capabilities spread over the complete wavelength range of JWST.

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The cycle-1 calls for proposals will all include the possibility to request for parallel observations.

Two types of parallel observations:

- Coordinated parallels Parallel observations part of a single proposal and serving a common scientific goal.
- Pure parallels The parallel observations are independent from the main observations (separate proposal) and are using unused parallel exposure "slots" opened by the existence of the main observations.







Coordinated parallels

• 5 different instrument combinations will be offered in cycle 1.

- 1. NIRCam imaging and MIRI imaging,
- 2. NIRCam imaging and NIRISS Wide-Field Slitless Spectroscopy (WFSS),
- 3. NIRCam imaging and NIRISS imaging (NIRCam must be the prime instrument),
- 4. NIRCam imaging and NIRSpec MOS (NIRSpec must be the prime instrument),
- 5. MIRI imaging and NIRISS WFSS.

Pure parallels

• A larger set of combinations of 2 instruments will be offered to the GOs for cycle 1 (only GOs).







JWST can observe moving targets.

• Up to 30 mas/s. Covers a lot of the potential Solar System targets.

Same cycle NIRCam/MIRI imaging and NIRSpec MOS spectroscopy is possible in cycle 1 (GTOs and GOs only).

- Pure pre-imaging primarily used to refine the position of known sources and make them suitable for an accurate positioning in the MOS micro-shutter "min-slits".
- Scientific imaging observations used to create the catalog(s) of sources from which the MOS spectroscopy target list(s) will be drawn.







JWST launch in October 2018

After launch, JWST will deploy (duration ~2-3 weeks) as it cruises toward the Lagrange 2 (L2) point.

It will take it ~1 months to reach the vicinity of the L2 point around which it will orbit (halo orbit).

The commissioning should be completed 6 months after launch, i.e. in April-May 2019.

Cycle 1 is scheduled to start in April-May 2019.

- Scientific observations will start as soon as possible, mode per mode.
- Full calibration will be achieved progressively during cycle 1.

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Scientific timeline



Happening now!

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Even if the first scientific observations will only take place in 2019, 2017 is a pivotal year if you want to observe with JWST during its cycle 1.

From a

presentation by N.

Lewis (STScI)

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Second JWST ESAC workshop "Mastering the science instruments and the observing modes of JWST [get set]" at ESAC (4-6 October 2017).

• Following the successful [on your mark] 2016 edition.



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Workshop web site: https://www.cosmos.esa.int/web/jwst-2017-esac/

Take a look at the previous edition:

https://www.cosmos.esa.int/web/jwst-2016-esac/



Also: list of events in the USA, Europe and Canada maintained by STScI:

https://jwst.stsci.edu/news-events/events

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Workshop "Planning Solar System Observations with JWST" in ESTEC (13-15 December 2017).

• Mirroring a similar US workshop planned for November.

We will be proposing for a JWST symposium at the EWASS 2018 meeting in Liverpool (3-6 April 2018).

• More science oriented than this session.

List of events in the USA, Europe and Canada maintained by STScI:

https://jwst.stsci.edu/news-events/events







Launch in October 2018 (stable) and start of scientific observations in the first half of 2019!

A powerful observatory that will provide plenty of opportunities for excellent science!

Apply for time!

I hope you will enjoy this special session on JWST

Thanks for your attention

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