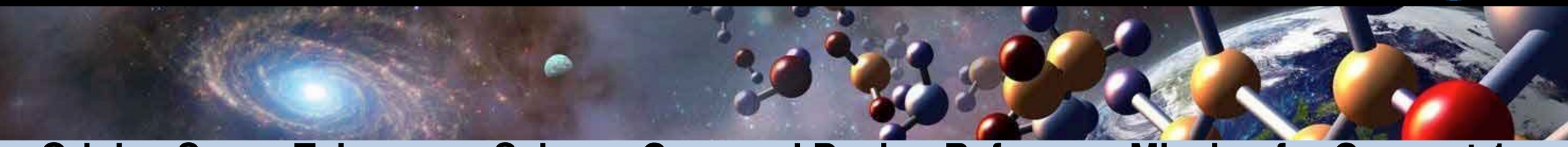
ORIGINS Space Telescope

From the first stars to life

National Aeronautics and Space Administration



Origins Space Telescope: Science Case and Design Reference Mission for Concept 1

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Summary: The Origins Space Telescope (OST) will enable flagship quality general observing programs led by the astronomical community in the 2030s. The Mission Concept 1 (Fig. 2, described in poster by Carter & OST Study team) is defined by four main science themes (Fig. 1). Here we present a few key science programs expected to be accomplished either as large programs or an accumulation of smaller programs. **The total observing time for these key programs is 1.6 years, assuming a conservative 50% overhead for the observatory (i.e. double "science time", Table). The remaining 3.4 years enable a multitude of science over a broad range of topics of interest to the astronomical community.**

Exoplanet Biosignatures:

The MISC transit channel will measure spectra of 10 exoplanet+ M star systems in transit and emission. These candidates will be carefully selected from discoveries by TESS, PLATO, SPECULOOS. This work will build upon JWST and WFIRST results. This growing field will only increase in demand in the 2030s.

Extragalactic survey, deep: Using the MRSS and the survey mode of OST, a 0.5 square degree field will be spectrally mapped in the 30 to 660 micron range. ~500 LIRGS z=5-6, ~10,000 LIRGS z=1-2 and ~0.5 million galaxies, will be measured over all redshifts. Addresses the formation of the first galaxies, rise of metals and dust in galaxies, the connection between black hole growth and star formation over cosmic time, and galaxy feedback. This work will build on JWST and WFIRST discoveries.

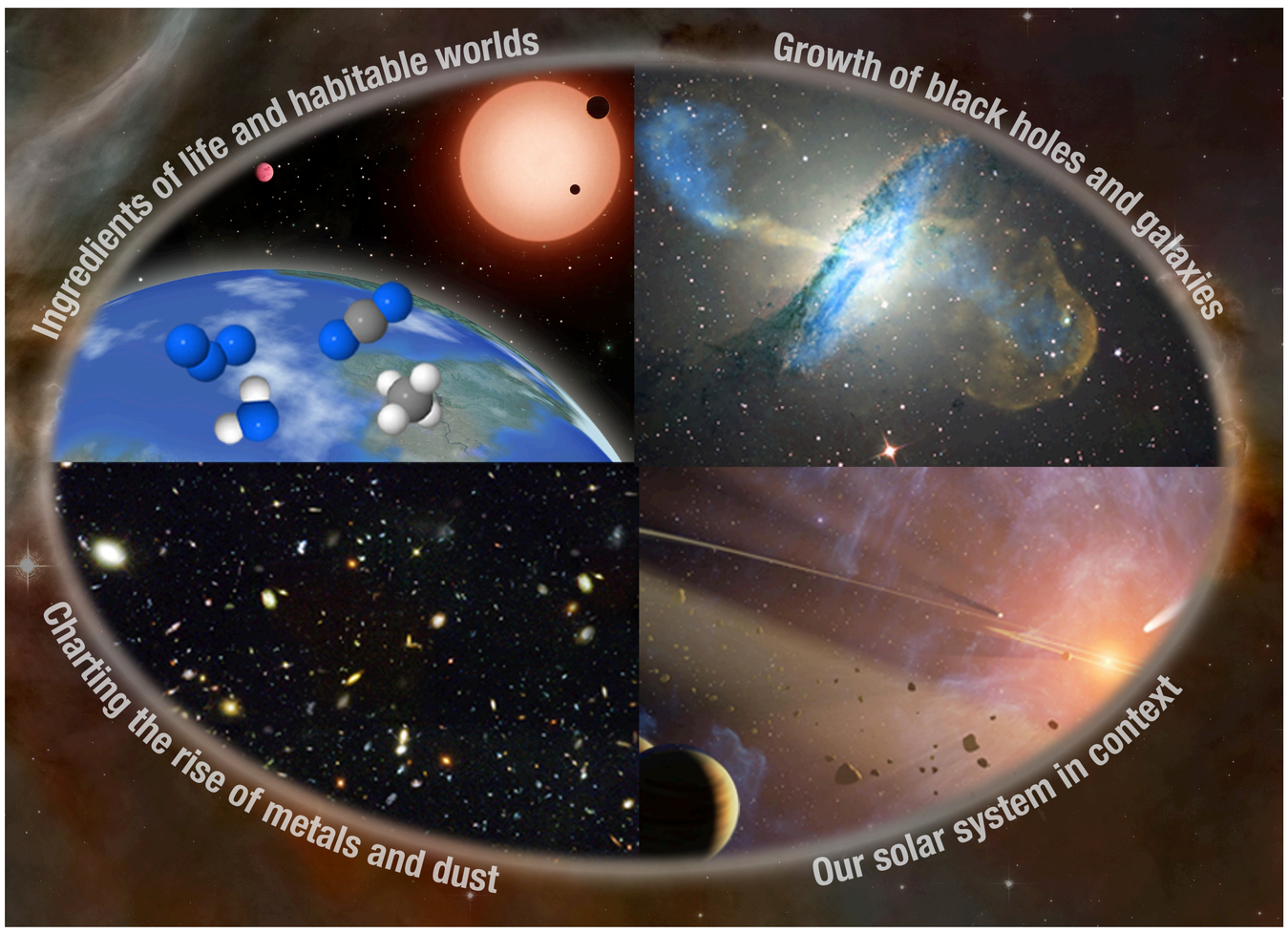

Figure 1: The science drivers for OST covers four main themes.

Extragalactic survey, wide: Using the MRSS in OST survey mode, a 5 square degree field will be spectrally mapped in the 30 to 660 micron range. ~500 ULIRGS z=5-6, ~10,000 ULIRGS z=1-2 and ~5 million galaxies, will be measured over all redshifts. Addresses the connection between black hole growth and star formation over cosmic time, rise of metals and dust in galaxies, and galaxy feedback.

Planetary system formation survey: The HRS will survey ~1000 disks with luminosities > 0.05 Lsol for the H_2O and HD lines. These disks will cover a wide range in evolutionary state and reside in well characterized star formation regions, e.g. Orion. HERO will followup on 20 targets in order to obtain the kinematic signatures of the H2O, and HD lines. **Outer solar system survey:** The FIP will survey 300 square degrees 4 times to discover and characterize thousands of outer solar system bodies (> 20 km diameter), e.g. Kuiper belt objects. This survey will put our solar system in context of nearby planet forming systems.

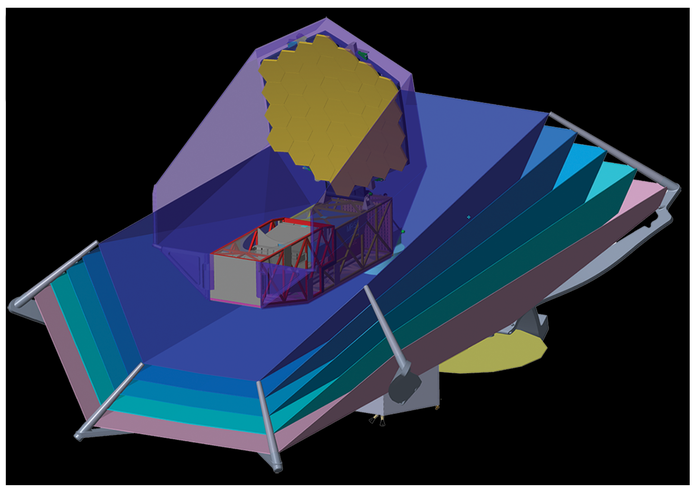

Figure 2: OST: Mission Concept 1.

Table: Design Reference Mission (DRM)

Program Title	Est. Hours: Science / total	Surveyed area or # targets	Instrument modes used
Extragalactic survey, wide	1500 / 3000	5 square degrees, e.g. Stripe82	Medium Resolution Scanning Spectrometer (MRSS), R~500
Extragalactic survey, deep	1500 / 3000	0.5 square degrees, e.g. COSMOS	Medium ResolutionScanning Spectrometer, R~500
Planetary system formation survey	2100 / 3800	1000 protoplanetary disks, 20 disks followup	High Resolution Spectrometer (HRS), R~10^5, HERO R~10^7
Exoplanet Biosignatures	2000 / 4000	10 carefully chosen exoplanets, e.g. TESS, Trappist-1 system	Mid-Infrared (MISC), transit channel, R~500, <10 ppm (goal of <5 ppm)
Outer Solar System Survey	300 / 600	300 square degree survey of outer solar system at 4 epochs	Far Infrared Imager Polarimeter (FIP), broad band imaging

The **Origins Space Telescope** is the mission concept for the **Far Infrared Surveyor**, a study in development by NASA in preparation for the *2020 Astronomy and Astrophysics Decadal Survey*.

http://origins.ipac.caltech.edu/
https://asd.gsfc.nasa.gov/firs/

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