

EChO : The Exoplanet Characterization Observatory

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Abstract

The transit method may be used not only for planets detection, but also for the characterization of their atmosphere thanks to spectroscopy during the primary and / or the secondary transit. The EChO mission (Exoplanet Characterization Observatory) has been proposed and pre-selected by ESA for the M3 slot of its "Cosmic Vision" program in that purpose. In this presentation, we sketch the outline of the mission concept. This presentation is completed by a description of the scientific goals of the mission (see T Encrenaz / P. Drossart in this session).

1. Mission overview

The EChO mission has been selected by ESA as a candidate for the M3 mission of its Cosmic Vision program.

The EChO mission (Fig 1.) aims at studying by spectroscopy the atmospheric composition of transiting planets [1]. The observation spectral range, from 0.4 to 16 μm , should allow the identification of the major spectral features of classical atmospheric gases (CH_4 , H_2O , CO_2 , NH_3 , ...) but also bio-signatures (O_3) in the atmosphere of exoplanets. With a 1.2 m telescope cooled down to 50 K, and an associated instrumentation, EChO should allow the observation of a large set of exoplanets from hot giant ones to temperate super earths, in the vicinity of late type stars enabling comparative exo-planetology.

EChO should be put in a grand halo orbit around L2. This type of orbit is a good trade-off between thermal cooling / thermal stabilization capabilities and observability of the targets. Whatever its position on the sky any target can be observed at least 120 days per year. The lifetime of the mission is about 5 years and allows the observation of several tens of planets with the possibility of re-observing targets several times within the mission lifetime.

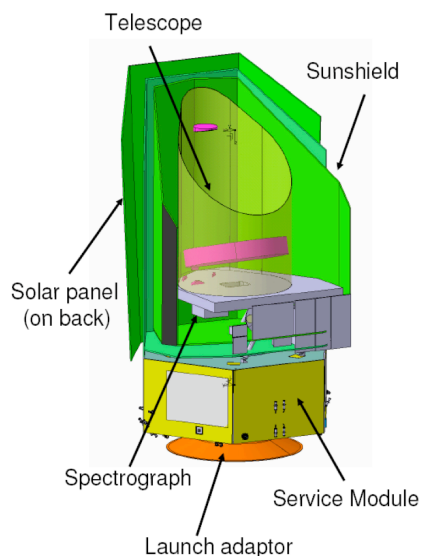


Fig.1 : view of EChO

2. Instrument Overview

The EChO instrument is under preliminary design. It should be made of several optimized infrared channels (from 3 to 5) and a visible channel. The baseline for the design is a classical prism/gratings spectrograph with a moderate spectral resolution varying from a few tens to a few hundreds depending on the spectral range allowing the identification of major spectral features. The visible channel is used to monitor the stellar activity and help for the extraction of the planetary spectrum from the stellar signal.

One of the key issues of the instrument is the choice of the detectors. Several ways are under assessment,

but the use of HgCdTe detectors cooled down to 30 K appears to be an interesting solution. Characterization of these detectors at such temperature is under consideration.

The instrument includes also a fine guiding sensor driving a tip-tilt mirror that stabilizes the line of sight during the observation at a level of 20 mas, relaxing the pointing specification of the spacecraft itself.

3. Project Status

The project is under study at ESA. A Concurrent Design Facility study has been performed in June 2011 and the project is now ready for industrial assessment. In the same time, a consortium of space laboratories will assess the instrument. All these studies should lead to a down selection by ESA of 2 projects among 4 for the M3 mission in the middle of 2013.

References

[1] Tinetti G. and the EChO Team : EChO : the Exoplanet Characterization Observatory, submitted to Experimental Astronomy

