**Euclid**

Mission Overview

The Euclid mission is planned for launch in 2020, at an estimated total cost of 800million Euros, and will work in the optical and near infrared. http://www.bbc.co.uk/news/science-environment-18503703. Its primary goal is to conduct a wide survey – some 15000 degrees of sky is planned to be covered – in order to map the geometry of the dark universe. It will look at galaxies and galaxy clusters to work out their redshifts and shapes, back to z= 2. There is also to be a deep survey which is expected to cover around 40 degrees of sky to a depth 2 magnitudes deeper than the wide survey. This deep survey will allow astronomers to see even further back in time, up to redshifts of 8 and potentially even higher. The primary mission objectives are expected to be completed within 7 years.

One of Euclid’s main scientific objectives with the deep survey is to study high redshift galaxies at z =6+ over a very wide survey area. This will give astronomers the opportunity to spectroscopically confirm hundreds of galaxies for use in the study of the EoR. It will help constrain the bright end of the luminosity function at high z. Euclid claims that it will ‘detect hundreds of z=7 galaxies brighter than an apparent magnitude J=26 and tens at z greater than 8.’reference red handbook

Capabilities

* Visual Imaging/ Photometry, 550 – 900nm
* Spectroscopy, 1100 – 2000nm
* NIR Imaging/ Photometry, 920 – 2000nm (Y, J,H bands)

Euclid will have two instruments in order to do the above; a wide-band imaging system in the visible (VIS), and an instrument capable of both slitless spectroscopy as well as NIR imaging. These instruments will be able to operate simultaneously when required.

Method of conducting the deep survey

The Euclid deep survey will be carried out by re-visiting particular areas in the wide survey over an extended period of time. Over this time, the image depth will be built up by combining the series of images taken of the same piece of sky. The telescope operates a 4 step dithering mode.

Uses and Limitations for use in studying high redshift galaxies

The limitation of using Euclid for this study is its filter range: Since the drop out technique requires two filters above the drop and one below, the redshift of the galaxy must be such that the filters available with Euclid are able to achieve this. Euclid’s longest wavelength filter is centred at 1.63 microns (J-band filter). IF the drop is at too long a wavelength, only one band will observe flux. Without two bands observing flux, no colour-colour diagrams can be plotted, and one measurement of flux and another of no flux is not enough to have confidence that the object even is a Lyman break galaxy. Table ? shows the IR filters of Euclid, along with their central wavelength and their bandwidth.

|  |  |  |
| --- | --- | --- |
| filter | Central wavelength | bandwidth |
| Y (920 – 1146) | 1020 | 226 |
| H (1146 – 1372) | 1220 | 226 |
| J (1372 – 2000) | 1630 | 628 |

From this, it can be concluded that the survey will be unhelpful in determining galaxies past a redshift of 10.5 (corresponding to the drop being observed at 1.40microns): The object would be detected in the J band, but not in either H or Y. The end of the H filter and start of the J filter is at 1.37 microns. To get significant flux in the Y band, ideally the galaxy would need to be at a redshift of 10 or lower.

A weak lensing survey is planned with Euclid, which will help find gravitational lenses for use in magnifying very faint Lyman break galaxies at high redshift. These can be investigated more closely with larger telescopes.

Transmission of data back to earth – telemetry rate

Euclid will use K band communications to relay data back to Earth. Only four hours a day operational due to amount of data that can be sent back.

Key technical data:

|  |  |
| --- | --- |
| Primary mirror | 1.2m |
| FoV | 0.763x0.763 degrees2 |
| Pixel size | 0.3 arcsec X 0.3 arcsec |
| Detector Array | 2kx2k pixels |
| Resolution | 0.3 -> 0.6 arcsecs (in J band) |
| Plate Scale (infrared) | 0.3arcsec per pix |

The data is quoted for the deep survey NIR photometry. Some data is subject to slight change as the planning stages progress.