WISH: Wide-field Imaging Surveyor for High-redshift
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http://wishmission.org

WISH Overview

WISH is a newly proposed Japanese space mission aiming at revealing the first-generation galaxies in the early universe. With a cooled 1.5m primary mirror and ~1000 arcmin² wide-field camera, WISH will conduct very deep and wide sky survey which have not been achieved by any ground-based telescopes. WISH should be a unique facility not only for the finding first-generation galaxies but also for various subjects including cosmological issues such as dark energy. Currently the development of the mission concept is being proceeded by the JAXA/ISAS WISH working group (PI: T. Yamada).

Scientific Goals

* Finding First Generation Galaxies (up to z~15) via Extremely Wide and Deep Near-IR Surveys
* Study of the expansion history of the universe and the properties of dark energy by using Type-Ia Supernovae luminosity in rest-frame near-IR
* Explore formation and evolution of galaxies via wide-field near-IR survey (stellar mass assembly, star formation history etc.)
* Finding afterglow of very distant Gamma-ray bursts

Wide-field NIR Survey is complementary to very deep (but narrow) observations by JWST / NIRCam, and WISH has a great synergy with Next-gen Extremely Large Telescopes as a target provider (feeding rare objects bright enough for spectroscopy with ELTs).

Why 1.5m Mirror?

In order to constrain the number density evolution of galaxies in the very early stage, statistically significant number of galaxies is required = need wide-field, and we need to reach ~28 AB magnitudes (~ 15000 stars per shot is ~840 sq.arcmin. We have verified that with this configuration uniform survey depth can be achieved by dithering telescope pointings.

Why 1-5μm?

We need to cover >2μm to detect redshifted UV emission from galaxies at z>12. Capability of observing at 2-5μm is essential to high-z galaxy studies.

Survey Plan

<table>
<thead>
<tr>
<th># of Filters</th>
<th>Limiting Mag.</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra Deep Survey</td>
<td>3</td>
<td>28 AB</td>
</tr>
<tr>
<td>Multi-Band Survey</td>
<td>5</td>
<td>27-28 AB</td>
</tr>
<tr>
<td>Ultra Wide Survey</td>
<td>2-3</td>
<td>24-25 AB</td>
</tr>
</tbody>
</table>

Current Development Status

Optics

Light-weight ULE glass mirror as a heritage of Hinode (Solar-B) will be used.

Current optical design by Dr. Y. Iikeda (photocoding) achieves Strehl ratio of ~1.0 all over the field of view.

Telescope Structure

WISH is a very simple, single-purpose space telescope mission. The total weight of the telescope is estimated to be about 1.3t, and it can be fitted to the ‘dual-launch’ with the Japanese HII-A rocket.

Filter Exchanger

More than 4 broad-band filters (and possibly narrow-band filters) will be installed for each cluster of detectors. Current design of the filter exchanger and placement plan of exchangers are shown above.

Thermal Design

The entire telescope system will be cooled down passively (i.e., without cryocoolers) with radiators and Sun shields. The absence of cryocoolers has a large benefit to suppress the vibration of the telescope, and to achieve this cooling we require thermally stable environment of the Sun-Earth L2 orbit. Preliminary analyses of thermal design are underway.

WISH Development Team

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