Vera C. Rubin Observatory
Systems Engineering

Photometric redshifts for ComCam data

Melissa Graham

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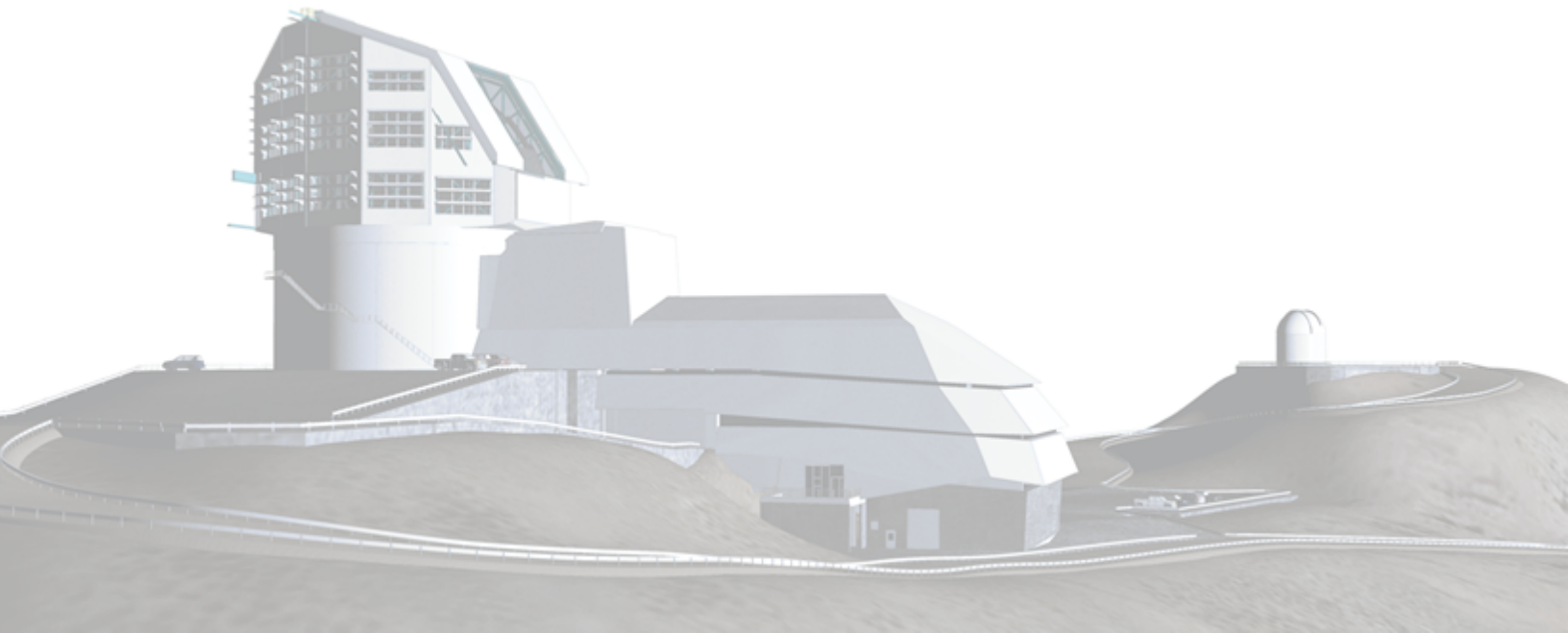
DRAFT



Abstract

This technote holds reports based on the analysis of ComCam data by the Science Unit for photometric redshifts.

Change Record

Version	Date	Description	Owner name
1	YYYY-MM-DD	Unreleased.	Melissa Graham
1	2025-04-07	Training set constructuion for ComCam Survey	Tianqing Zhang

Document source location: `https://github.com/lsst-sitcom/sitcomtn-154`

Contents

Photometric redshifts for ComCam data

1 Training Set in ECDFS

In this section, we describe how we make the photometric redshift training set in the ECDFS field of the ComCam survey.

1.1 Spectroscopic datasets in ECDFS

We compile a spectroscopic dataset in the ComCam survey's ECDFS and cross-match it to the ECDFS object catalog to build the training set and test set for the machine learning photometric redshift algorithms.

1.1.1 ESO/GOODS-S Spectroscopy master catalogue

These are spectroscopic redshifts and spectra publicly available in the Chandra Deep Field South (an area of $30' \times 30'$ centered on RA=3:32:28.0 Dec= -27:48:30) have been collected. We use the compilation v2.0, dated to Dec 13 2009, which is the result of cross-matching each published spectroscopic catalog with the GOODS HST/ACS (v1.0) catalog and WFI-R catalog. All positions are given in the World Coordinate System defined by the ACS GOODS data.

In total, there are 7336 galaxies in this catalog. [1]

1.1.2 CANDELS GOODS-S Redshift Catalog

We take the spectroscopic redshift in the CANDELS GOODS-S redshift catalog [2]. We select the spectroscopic sample by selecting the positive values in the "redshift" column. In total, there are 2350 galaxies in this catalog.

[1] For detailed reference of the sources that constituent the catalog, we refer to `https://www.stecf.org/goods/spectroscopy/CDFS_Mastercat`

[2] The catalog is accessible in `https://archive.stsci.edu/hlsp/candels/goods-n-catalogs`

1.1.3 3D-HST Grism Reshift

3D-HST is a near-infrared Grism Spectroscopic survey with the Hubble Space Telescope designed to study the physical processes that shape galaxies in the distant Universe. We take the `v4.1.5` of 3D-HST catalog[3], and apply the following the following selections:

1. `use_zgrism == True`
2. `use_phot == True`
3. `flag1 == False`
4. `flag2 == False`
5. `z_best_s != 0`
6. `z_phot_u68 - z_phot_l68 >0`.

These quality cuts follow Kodra et al. 2023 to optimize photometric redshift. In total, there are 520 galaxies from this catalog.

1.2 Object Catalog

We use the ComCam xxx release object catalog for the ComCam photometry. The tracts that contain the ECDFS field is `[5063, 4849, 4848]`. We select objects based on the following cuts:

1. `detect_isPrimary == 1` (is a primary object)
2. `refExtendedness == 1` (is indicated as an extended object)
3. `i_cModelFlux/i_cModelFluxErr > 5` (i-band signal-to-noise ratio over 5)
4. `{ugrizy}_cModelMag < 30` (Brighter than mag-30 in every band)

After these cuts, we get 131368 objects in the ComCam ECDFS field for cross-matching. Here, the ComCam CModel magnitude and magnitude error are converted by the CModel flux and flux error, assuming the zero point photometry at 31.4 magnitude.

[3] `https://archive.stsci.edu/prepds/3d-hst/`

We dereddened the galaxy magnitudes using a linear dereddening formalism,

$$m_{\text{dered}} = m_{\text{obs}} - k_\lambda E(B-V). \tag{1}$$

The k_λ for (u, g, r, i, z, y) bands are $(4.81, 3.64, 2.70, 2.06, 1.58, 1.31)$, calculated based on LSST filters. We get the $E(B-V)$ values from the Schlegel, Finkbeiner & Davis (SFD) dust map available in `dustmaps`.

1.3 Cross Matching

We cross match the spectroscopic samples and the ComCam photometry to build a training set for the photo-z algorithms. We use the `astropy` cross matching tools to find the closest spectroscopic object to every ComCam object. They are considered a match if the closest spectroscopic object is within 0.5 arcsec. In total, we find 3855 matched galaxies in the ECDFS fields.

A References

B Acronyms

Acronym	Description
DM	Data Management