Multi-Wavelength Photometric Catalogs of Star Forming Galaxies at z~2
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Abstract
We present first results of a study aiming on the characterization of star forming galaxies at 1<z<3. This is the epoch in which the global star formation rate peaks and complex morphological features like galaxy disks and bulges are formed, making this an important time frame for the understanding of the formation and evolution of Milky Way like disk galaxies. The project presented here is based on publicly available multi-frequency data of the COSMOS and AEGIS deep survey fields. We demonstrate the power of large, multi-frequency surveys and present Mc3, a new publicly available Python package. We developed Mc3 to efficiently produce a master catalog of unique, position correlated objects from a number of single filter-band SEextractor searches. Our first results include photometric redshifts and a discussion of their accuracies as well as the color-color based selection of 1<z<3 star forming galaxies.

Photometric Redshifts
We use HyperZ (Bolzonella et al. 2000) to estimate the redshifts of roughly 300k objects in each of the COSMOS and AEGIS fields and compare these results to the spectroscopic redshifts (>95% accuracy for objects shown here) produced by the DEEP2 team (Lilly et al. 2007) with redshifts up to z~1.5. We demonstrate the importance of deep data with wide wavelength coverage to accurately estimate redshifts for large samples of objects.

Introduction to the Data
We make use of the publicly available multi-wavelength data from the COSMOS (Scoville et al. 2007) and AEGIS (Davis et al. 2007) surveys, roughly 1-2 sq. degree regions on the sky with extensive observational data from ground and space based telescopes. These data, which span from the far-ultraviolet to mid-infrared, allow for the study of faint and distant galaxies across large cosmological time scales. These data are essential to the characterization of galaxies during various epochs of their evolution.

The Master Catalog and Mc3
Photometric catalogs are produced via the well known software SExtractor (Bertin & Arnouts 1996). In order to understand the properties of an object across all filters, however, an object must be identified in all independent SExtractor searches. We have developed a Python package, Mc3, which takes any number of such catalogs as input, identifies all unique objects in the entire catalog set, and produces a master catalog in the form of a multi-extension FITS cube.

Figure 1: The GALEX, CFHT, UVISTA, and SPIZTER filter transmission curves superimposed by a SWIRE Sb-type Galaxy (Polletta et al. 2007) redshifted at z=0 and z=1.5.

Figure 2: The limiting magnitudes of the COSMOS (top) and AEGIS (bottom) fields.

Figure 3: Stamps produced by Mc3 of a correlated master catalog object in the COSMOS field.

The Mc3 Python Package
Mc3.PySex - Module for batch SExtractor searches.
Mc3.correlation - Function for nearest neighbor position correlation used by Mc3.
Mc3.combine - Function which combines SExtractor catalogs of multiple images of a filter into one catalog.
Mc3.creator - Function which creates the FITS Master Catalog Cube from a set of catalogs. Mc3.coverage - Function which determines if non-matched objects are covered in the data.
Mc3.Cube - Class which gives easy access to the FITS cube in a Python shell.

All of the functionality described is accessible via a Python shell or through the terminal command, mc3, and simple configuration files.

Figure 4: The overall process of creating a FITS Master Catalog Cube with the Mc3 Python package from a set of FITS images.

Figure 5: The errors in the photometric redshift estimations for the COSMOS and AEGIS fields in relation to the DEEP2 spectroscopic redshifts. The results show the significance in the UV data in the accuracy of the photometric redshift estimation and number of catastrophic outliers (red).

Using HyperZ, we achieved a photometric redshift accuracy of σ=0.14 (COSMOS) and σ=0.11 (AEGIS), as well as minimum offsets of Δz=0.04 (COSMOS) and Δz=-0.02 (AEGIS). We estimated the redshifts for ~258k objects in COSMOS and ~251k in the AEGIS.

Color-Color Selection of SFGs
We have begun the selection of Lyman Break Galaxies (LBG) using the FUV, NUV and u band dropout technique adopted from Adelberger et al. (2004). We also use color selection criteria derived from PEGASE galaxy templates modeled with exponentially decreasing star formation rates with decay times of τ=100Myr and τ=5000Myr. We have selected roughly 100k LBG candidates in each of the COSMOS and AEGIS fields.

Figure 6: The distribution of redshifts for the COSMOS (left) and AEGIS (right) fields.

Figure 7: Color-Color distributions for the COSMOS field superimposed with PEGASE (Fio & Rocca-Volmerange et al. 2007) galaxy templates with colors produced by HyperZ at redshifts ranging from z=1 to z=3 (bottom to top, large symbols represent steps of dz=0.2). LBG candidates are shown in red.

References
- Davis et al. 2007, ApJS 660, 1
- Lilly et al. 2007, ApJS 172, 70
- Scoville et al. 2007, ApJS 172, 150

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