The CLU Nearby Galaxy Catalog: Preliminary Results

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Background

The intermediate Palomar Transient Factory (iPTF) is undertaking the Census of the Local Universe (CLU) project to complete our survey of galaxies out to 200 Mpc. CLU deploys four contiguous narrow-band filters to search for extended, emission line (Hα) sources across 3n of the sky. The estimated 5σ limiting flux for a point source is $3 \times 10^{-15}$ erg s$^{-1}$ cm$^{-2}$, which corresponds to a star formation rate (SFR) of $10^{-2-3}$ M$_\odot$ yr$^{-1}$ at a distance of 50 Mpc.

The CLU galaxy catalog will help to: pinpoint future gravitational wave triggers, classify iPTF transients, and constrain the discrepancy between Hα and FUV star formation rate tracers in low-mass galaxies when CLU galaxies are cross-matched to GALEX FUV sources.

Filters & Observations

- We use 4 narrowband filters to detect emission line galaxies out to 200 Mpc.
- The observing strategy consists of 3 staggered grid patterns which overlap. Stacking all 3 grids will result in deep Hα observations for 3n of the sky. Observations are carried out with filter pairs (Ha1/ Ha2 or Ha3/Ha4) each night.

Current Status of Observations

- Hα1/Hα2 ~ 92% complete
- Hα3/Hα4 ~ 90% complete

Results

We find a total of 155 candidates in 15 preliminary pointings (out of 3600), where all have SDSS or follow-up Palomar spectra. Our galaxy candidate selection method is sensitive to galaxies with an Hα EW greater than 20 Å. Using a 5 sigma “On-Off” color excess cut, we find a 15.8% contamination rate and a 92% success rate.

In addition, out of all 137 galaxies in our fields, 37 are newly discovered galaxies. However, this is an underestimate since the SDSS galaxy catalog is relatively complete down to our detection limit. We anticipate finding 20,000 new galaxies outside the SDSS footprint.

We also have found a few dozen interesting “contaminant” sources: planetary nebulae and green peas. These objects exemplify the many broad science applications of the data set, and demonstrates the wide impact this survey will have on many areas of astrophysical research.

Galaxy Candidate ID Method

Top-Right: spectra of a confirmed galaxy zoomed into the Hα emission line. The red boxes indicate the Hα filter coverage. Bottom: SDSS color, Hα-Off grey, Hα-On grey images.

- New Galaxy at $z = 0.015$
- mag6563 - mag6630 = 1.5
- Hα EW = 865 Å

Confirmed New Galaxies

Figure: Examples of CLU galaxy candidates that have been spectroscopically confirmed.

Results & Selection Methods

- $\Sigma(z)$: total number of candidates
- $\Sigma(z)$: number of candidates with Hα EW $> 30$ Å
- $\Sigma(z)$: number of high-$z$ candidates
- $\Sigma(z)$: number of contaminants

Above: We perform an experiment to test which $\Sigma$ to use, and quantify this by the total contamination rate and the percent of known galaxies found. We find that a $\Sigma=5$ minimizes the contaminants while maximizing the success rate.

Interesting Candidates

- Green Pea Candidate
- Planetary Nebulae
- Green Peas