

INTRODUCTION AND MOTIVATION

Ultracool dwarfs (UCDs) are very cool, low-mass objects, ranging from spectral type M7 and later. Although they are common in the Galaxy, comprising almost 1/6 of the local population, their detection at larger distances is challenging due to their low luminosities. Consequently, the census of UCDs is still heterogeneous and shallow.

The main goal of this project was to create a large census of L and T dwarfs using only photometry, to subsequently study structural Milky Way (MW) parameters to constrain the properties and formation history of this population.

ULTRACOOL DWARF CANDIDATES

The data used is a combination of the Dark Energy Survey (DES), VHS and AllWISE comprising objects brighter than $z \leq 23$ and covering $\sim 4,800 \text{ deg}^2$ in the Southern Hemisphere. The steps adopted to select our sample are:

1. Pre-select L and T dwarfs based on their (i-z), (z-Y), and (Y-J) colors
2. Classify using a method that compares their optical, near-infrared and mid-infrared colors to templates of M, L and T dwarfs
3. Remove extragalactic contamination using LEPHARE code

Fig. 1 shows the distribution of the 19,583 UCD candidates discovered with the full six years of DES observations. More details in Carnero Rosell et al. (2019) and dal Ponte et al. (2023).

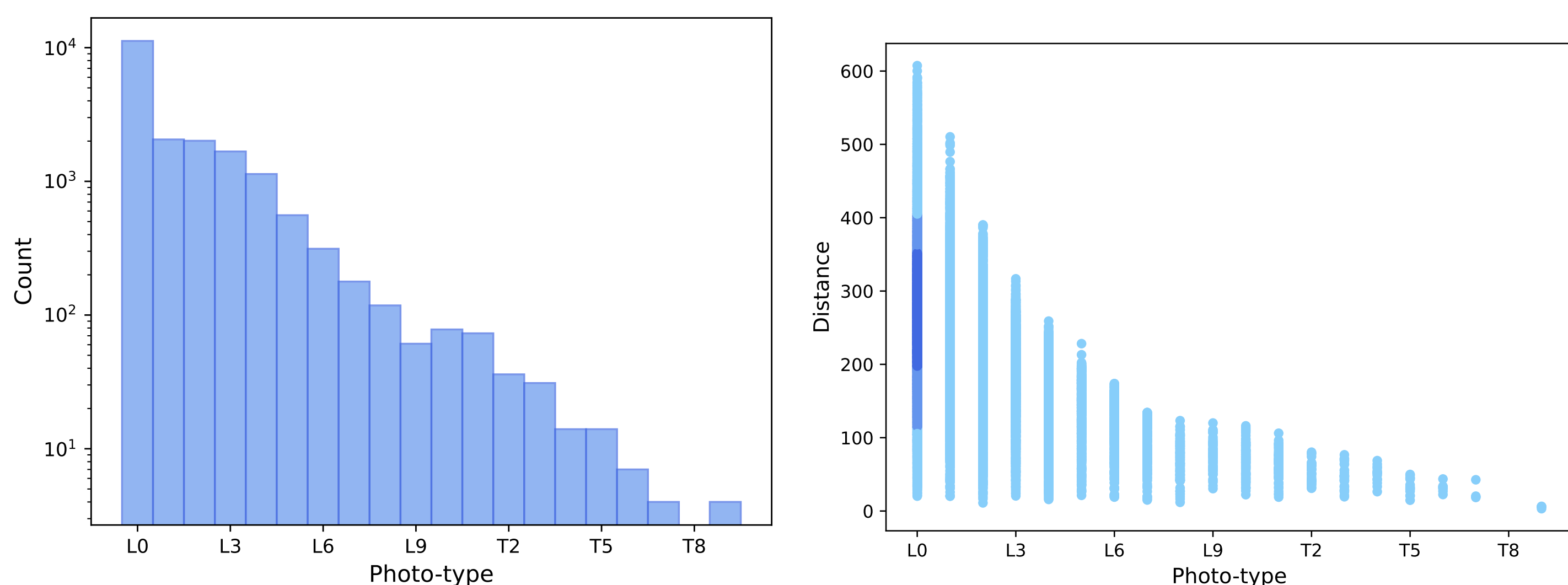


Fig 1. Left panel: Distribution of photo-types for the UCD candidates. The majority of candidates in the sample are early-L. **Right panel:** Distances as a function of photo-type. The distances reach ~ 600 pc.

SEARCH FOR BINARIES AND YMG MEMBERS

Wide binary candidates

We searched for UCD with stellar companions and also systems composed by two UCDs. Our search relied in a common distance and proper motion (when available). We calculated the probability of chance alignments and removed systems with probabilities $> 5\%$. As a result, we identified 255 wide binary candidates and 13 UCD+UCD candidates. More details in dal Ponte et al. (2020).

Young moving group candidate members

We used BANYAN Σ (Gagné et al., 2018) to search for potential ultracool dwarf members of young moving groups (YMGs). We were able to identify 20 new candidate members within young associations, each with $> 90\%$ membership probability. More details in dal Ponte et al. (2023).

MW STRUCTURAL PARAMETERS AND SPECTROSCOPY

Thin disk scale height

We measured the scale height of the disk for the L dwarfs, the majority in our sample. The scale height was estimated with the aid of GalmodBD code, by comparing the observed and simulated number counts for a grid of models with different spatial distributions. The estimate of scale height was $h_{z,thin} \sim 450$ pc, in agreement with previous findings. More details are available in Carnero Rosell et al. (2019).

Spectroscopic confirmation of 12 ultracool dwarfs

We obtained spectra for 12 UCD candidates from our sample using Gemini/GMOS. All observed objects were confirmed as UCDs. These spectroscopically confirmed objects are a sanity check of our selection and photometric classification method. Fig 2 shows six observed objects confirmed as ultracool dwarfs. More details in dal Ponte et al. (2023).

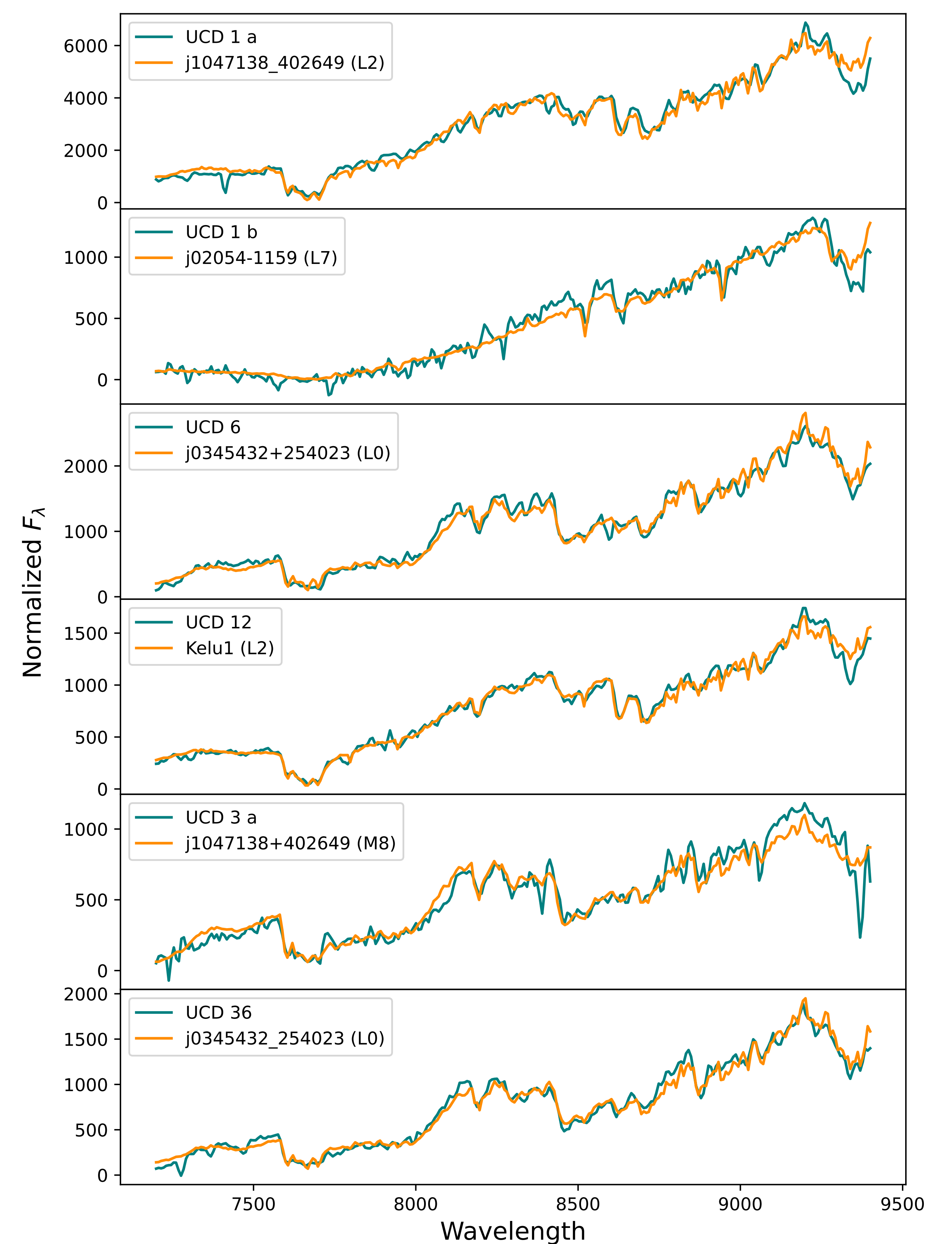


Fig 2. UCD spectra (blue) and the best-fitting template (orange). The fluxes shown are relative F_λ in arbitrary units. The flux of the templates was multiplied by a normalization factor.

AFFILIATIONS AND REFERENCES

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