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# PROBING MILKY WAY'S BROWN DWARFS USING CFHTLS

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**Abstract.** We present the results of our ongoing search for field Brown Dwarfs in CFHTLS data. The aim of this survey is the identification of a large sample of cool brown dwarfs to find and study the coolest brown dwarfs. This will also allow to determine the statistics of the brown dwarfs galactic population. To achieve this goal we create optimised object catalogs, using a new version of Sextractor to perform PSF-fitting photometry in dual image mode between the i' and z' images. We then select Brown Dwarf candidates using their extremely red i'-z' color, and obtain follow-up J-band photometry to discriminate them from z=6 quasars. After analysing 235 square degrees of CFHTLS Very Wide and Deep images, we found over 500 new early L to early T dwarfs and several late T dwarfs, as well as the first $z > 6$ quasars outside the SDSS survey. We have obtained spectra of the most interesting candidates.

## 1 Introduction

Brown dwarfs are key to two of the most important stellar astrophysics topics: (1) the determination of luminosity and mass function, which gives strong constraint to stellar formation models (see Chabrier et al. 2003 for a review) and (2) spectroscopy of extremely cool objects which provides unmatched insight into the atmospheric physics in this temperature range, also populated by many of the currently known extrasolar planets. The CFHTLS legacy survey is a powerful tool to study these elusive objects. Its three components (see http://www.cfht.hawaii.edu/Science/CFHLS/ for details), complemented with PI programs of our own, cover a much larger and deeper volume than previous surveys, such as 2MASS or DENIS (Fig. 1). A full analysis of these data will identify many more brown dwarfs than currently known.

| | Very Wide | Wide | Deep |
|---|---|---|---|
| MID-L | 190 | 300 | 480 |
| MID-T | 60 | 95 | 150 |
| Early Y | 12 | 20 | 30 |
| Surface | ~1000□ | 170□ | 4□ |
| Volume | 225 | 265 | 15 |

**Fig. 1.** Detection distances in parsecs for various spectral types for each CFHTLS surveys. Volume=1 for DENIS survey.

## 2 Analysis methods

We modified Sextractor (Bertin & Arnouts 1995) to perform a multiple PSF fitting image analysis in dual image mode. The multiple PSF fitting allows allows an accurate description of binaries, while the dual image mode produces accurate i-band photometry of brown dwarfs by forcing the position to coincide with their much brighter z-band detection. This produces accurate point source photometry for the millions of objects visible on CFHTLS data.

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## 3 Ongoing results

We found over 500 hundred candidates with $i-z>1.7$ over the 235 square degrees analysed so far. Only brown dwarfs and high redshift quasars have such red colors. Since brown dwarfs have $z-J>2$ while high redshift quasars have $1.5>z-J>0$, we use J-band photometry follow-up to discriminate them.

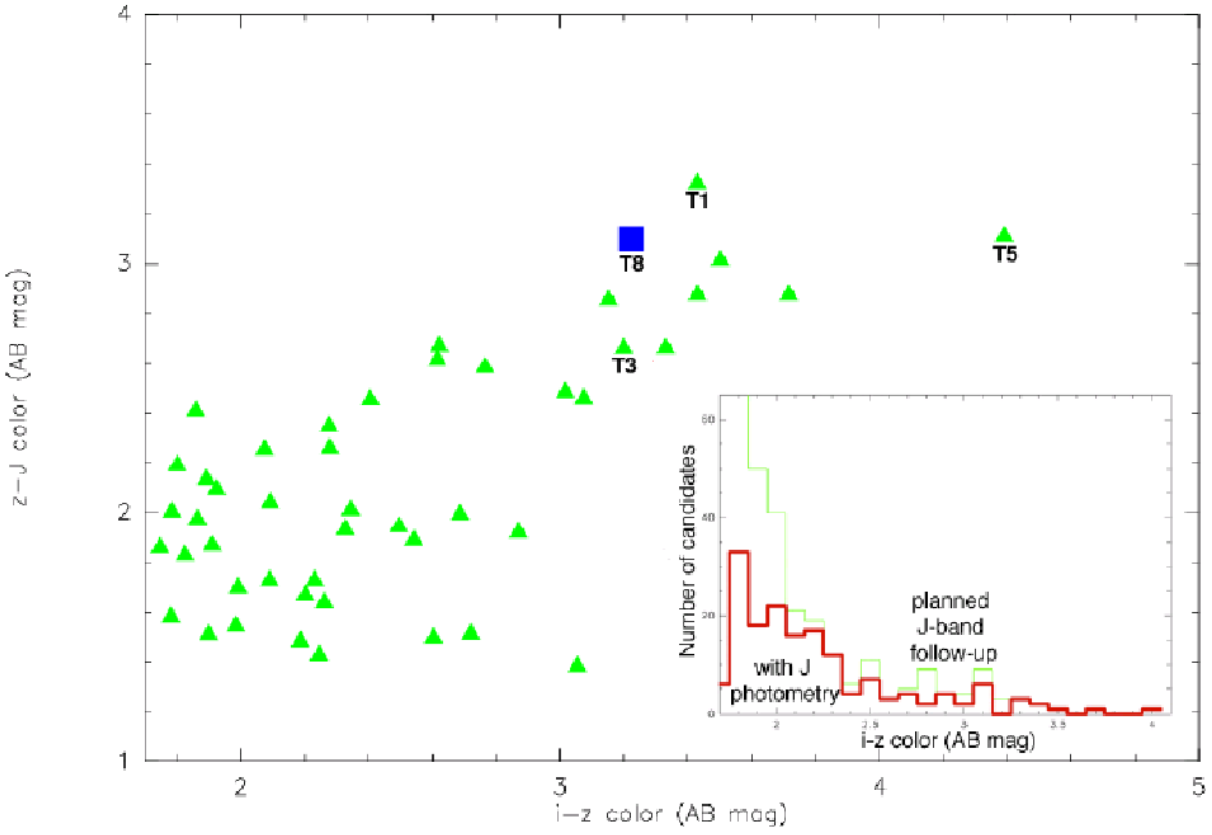


**Fig. 2.** Color-color plot of our candidates compared to the latest T-dwarf known, 2MASS J04151954-0935066 (T8, big blue square). Green triangles represent our candidates with extracted J magnitudes. All magnitudes are on the AB system. The inset is an histogram (green) of the i-z color of the the candidates identified in the in 235 square degrees of the CFHTLS analysed so far. Those with $i-z>2.4$ are promising Tdwarfs candidates, soon to be confirmed. The red histogram shows the current extent of the J band follow-up.

## 4 Conclusions

We now have efficient programs that are well matched to the the huge data volume of the CFHTLS. Since our first results (Willott et al 2005), we have found hundreds of candidates, including some late T dwarfs confirmed through NIR spectroscopy. We expect that the complete survey will have over 1000 L-to mid T dwarfs, a few dozens late T dwarfs, and hopefully a few Y dwarfs.

## References

Bertin, E., Arnouts, S., 1996, A&AS, 117, 393
Chabrier, G. et al, 2003, PASP 115, 763
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