Ultracool Neighbors from 2MASS

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Abstract. We present initial results of an all-sky search for cool, low-mass stars and brown dwarfs within 20 pc. We have used the near-infrared photometry provided by the 2-Micron All Sky Survey (2MASS) Second Incremental Data Release to create a target list of 1793 candidates with $6 < J < 17$ and $J - K > 1$. Follow-up observations and existing data have enabled over 85% of the sample to be classified. Spectral types and distances have been derived for over 250 nearby dwarfs, including 39 newly discovered L dwarfs. In this poster[1], we discuss our selection methods and present preliminary results.

1. Introduction

The Galactic Disk contains a great multitude of low-mass stars and brown dwarfs. Despite many discoveries from DENIS, 2MASS, and SDSS, there has not been a large-scale, systematic effort to study this new regime. In particular, late-M and early-L dwarfs have received relatively little attention while the emphasis has been on pushing detections to lower and lower luminosities and temperatures. We have undertaken a project to compile an all-sky, volume-limited sample (20 pc) of nearby objects with spectral types from M8 to L8. Candidate nearby dwarfs are found using 2MASS infrared photometry and are followed-up with moderate-resolution, far-red optical spectroscopy. Several methods are used to determine spectral type, absolute magnitude, and distance.

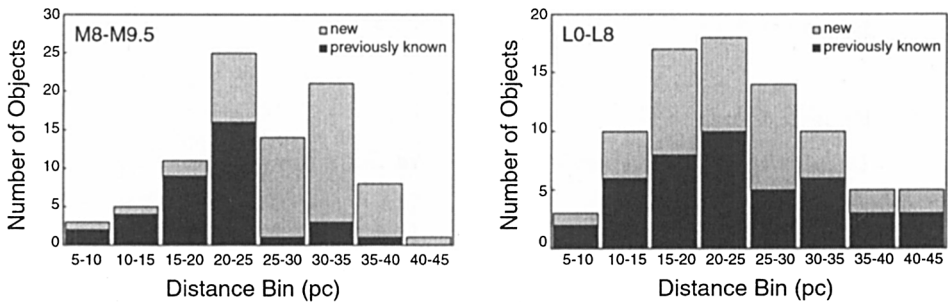[1]The original poster can be obtained from http://www.hep.upenn.edu/~kelle/BDposter.pdf

Figure 1.   Distance distribution of M8-M9.5 dwarfs (left panel) and of L0-L8 dwarfs (right panel) found in the sample.

2.   The Sample

We culled the 2MASS Second Release (47% sky coverage) using several methods to select all of the M and L dwarfs cooler than M8 within 20 pc. The primary selection criteria required sources to have $|b| > 10°$ and to meet the following color cuts:

$$(J - K) > 1 \text{ and } J < 1.5(J - K) + 10.5,$$

$$(H - K) > 0.35 \text{ and } 1.75(H - K) - 0.475 < (J - H) < 1.75(H - K) + 0.175.$$

3.   Results

We obtained moderate-resolution, far-red follow-up spectroscopy of 347 targets from September 2000 through January 2002 using NOAO facilities. Appropriate spectral indices were measured for all dwarfs. Spectral types were determined by comparison with standard spectra and spectral index relations found by Kirkpatrick et al. (1999) and Cruz & Reid (2002). Absolute magnitudes were determined using spectral index and spectral type relations found by Kirkpatrick et al. (2000) and Cruz & Reid (2002). A linear interpolation of spectral type vs. M_K was used for M7-M8.5 dwarfs.

Out of the 347 targets observed, 262 are found to be disk dwarfs. We identified 38 objects within 25 pc with spectral types M4-M8.5. The distance distributions of the objects later than M8 are shown in Figure 1. Based on sky coverage, we estimate 33% completeness for L0-L3 dwarfs, and therefore expect a total of 45 within 20 pc, or a space density of 0.0013 pc^{-3}.

References

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